МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

КАЗАНСКИЙ ГОСУДАРСТВЕННЫЙ АРХИТЕКТУРНО-СТРОИТЕЛЬНЫЙ УНИВЕРСИТЕТ

Д.К. Вахитова

BUILDING ELEMENTS

Учебное пособие

Казань
2022

УДК
ББК

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Учебное пособие предназначено для студентов-бакалавров 1 курса направления подготовки 08.03.01 «Строительство» по профилю «Промышленное и гражданское строительство», 08.05.01 «Строительство уникальных зданий и сооружений».

Основная цель учебного пособия – развитие и совершенствование навыков устной коммуникации и письменной речи в рамках предложенной тематики.

Рецензенты
Кандидат технических наук, доцент кафедры «Металлические конструкции и испытание сооружений» КГАСУ
Л.Р. Гимранов

Кандидат педагогических наук, доцент кафедры «Иностранные языки» КГЭУ
Ж.И. Айтуганова

УДК

ББК

MAP OF THE BOOK

INTRODUCTION

Учебное пособие “Building Elements” предназначено для студентов первого курса, обучающихся по направлению подготовки 08.03.01 «Строительство» по профилю «Промышленное и гражданское строительство», 08.05.01 «Строительство уникальных зданий и сооружений». Цель данного учебного пособия – формирование профессионально ориентированной лингвистической компетентности студентов. Учебное пособие направлено на развитие разных видов речевой деятельности: чтения, диалогической и монологической речи в деловой и общепрофессиональной коммуникации, навыков письменного и устного перевода.

Структура учебного пособия состоит из семнадцати разделов (Units). Деление на разделы осуществляется в соответствии с тематикой. Первый раздел знакомит студентов с основной информацией о конструктивных элементах здания, их типах. Следующие разделы посвящены вертикальным и горизонтальным несущим элементам конструкции. Во втором разделе раскрывается информация о стенах, их функциях и типах. В третьем разделе подробно рассматриваются фундаменты, в особенности фундаменты глубокого и мелкого заложения. Четвертый раздел посвящен колоннам и их типам. В пятом и шестом разделах детально описываются балки и фермы, а также их использование в строительстве. Седьмой и восьмой разделы посвящены каркасным конструкциям и опалубке. В последующих разделах рассматриваются полы, крыша, потолки, своды и арки. Завершающие разделы посвящены изучению окон, дверей, лестниц и их основных элементов.

Каждый раздел включает в себя тексты для ознакомительного, изучающего и просмотрового чтения, которые содержат актуальную информацию из аутентичных источников.

Строительная терминология, представленная перед каждым текстом, закрепляется и активизируется в послетекстовых упражнениях. Каждый раздел включает в себя лексические упражнения, направленные на расширение словарного запаса по специальности. Профессиональная лексика изучается и запоминается также с помощью использования визуального компонента – цветных иллюстраций (рисунков, схем, фотографий).

В учебном пособии предусмотрены задания для индивидуальной, парной и групповой работы, в которых студенты создают и участвуют в коммуникативных ситуациях профессиональной направленности. Таким образом, каждый текстовый материал сопровождается упражнениями, имеющими коммуникативную направленность и позволяющими активизировать приобретенные навыки в речи.

Представленные задания помогут студентам научиться вести беседы на темы вышеуказанных сфер деятельности на английском языке, тем самым формируя общее представление о конструктивных элементах здания. Таким образом, изучив представленные в учебном пособии материалы, студенты смогут на базовом уровне участвовать в процессе коммуникации на профессиональные темы.

Разделы содержит контрольные задания (Review), направленные на контроль усвоения пройденного материала.

В конце учебного пособия представлены итоговые задания (Final Tasks) для оценки общего уровня усвоения всех изученных строительных элементов.

Учебное пособие “Building Elements” содержит дополнительные тексты для чтения (Supplementary Texts for Reading), содержащие более подробную информацию об отдельных конструктивных элементах. Эти тексты предназначены как для переводов, так и для использования в процессе подготовки докладов и презентаций.

Учебное пособие может быть использовано как для работы в аудитории, так и для самостоятельной работы.

UNIT 1. BUILDING ELEMENTS. GENERAL INFORMATION

1. Read the words and learn them by heart.

load – нагрузка
deck – настил, платформа
beam – балка
covering – покрытие, перекрытие, облицовка, покрывающий слой
ceiling – потолок
to enclose – огораживать, окружать
truss – ферма
vault – свод
post – стойка, столб

2. Starting off. Answer the questions.

1. What are building elements?
2. What building elements do you know?
3. What are the most popular building elements in your country?

3. Read and translate the text about building elements and check your ideas.

Building Elements. General Information.

The elements of a building which carry loads are called load bearing elements. There are vertical load bearing elements (walls, supports, columns and foundations) and horizontal load bearing elements (trusses, panels, decks and beams).

The elements of a building enclosing it or its parts are called enclosing elements. They are external and internal walls, floors, roofs, etc.

Some elements can be both load bearing and enclosing at the same time (e.g. walls).

The two basic problems of structure are those of support and covering. Walls, pillars, columns, and posts are supports. The principal kinds of covering are ceilings, vaults and roofs.

Source: Ивянская И.С. Английский язык для архитекторов: учебник / И.С. Ивянская. – 2-е изд., перераб. и доп. – М.: КУРС: ИНФРА-М, 2014. – С. 61.

4. The sentences below all contain mistakes. Find and correct the mistakes.

1. The principal kinds of supports are ceilings, vaults and roofs.

_____

2. Wall is a typical horizontal load bearing element.

_____

3. There are no elements that can be both load bearing and enclosing at the same time.

_____

4. Posts and columns are the principal kinds of covering.

_____

5. Decks are vertical load bearing elements.

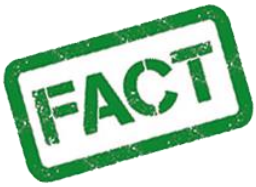
_____

5. Match the words to the definitions.

1. load	**a.** relating to the outside of something
2. pillar	**b.** to surround something, especially with a fence or wall, in order to make it separate
3. vault	**c.** the amount of weight carried, especially by a vehicle or a structure such as a bridge
4. beam	**d.** the structure that covers or forms the top of a building, vehicle, tent, etc.
5. element	**e.** a tall structure made of stone, wood, etc. that supports something above it
6. ceiling	**f.** a long heavy piece of wood or metal used in building houses, bridges, etc.
7. to enclose	**g.** one part or feature of a whole system, plan, etc, especially one that is basic or important
8. building	**h.** a type of arch that supports a roof or ceiling, especially in a church or public building, or a ceiling or roof supported by several of these arches
9. roof	**i.** a structure such as a house, church, or factory, that has a roof and walls
10. external	**j.** the inner surface of the top part of a room

6. Give English equivalents to the following words and word combinations and make up sentences.

1. Несущий элемент (конструкции)
2. Фундаменты
3. В то же время (одновременно)
4. Своды
5. Фермы
6. Нести (выдерживать) нагрузку
7. Потолки
8. Основные виды
9. Внутренний
10. Балки



7. Translate some facts about building elements.

Конструктивные элементы здания.

Здание – это многофункциональный объект, возводимый для обеспечения комфортного проживания и деятельности человека.

Сооружением является объемная материальная строительная единица, состоящая из соответствующих конструкций. Сооружения могут использоваться для хранения оборудования, материалов, разного рода изделий, для временного пребывания людей и пр. Сооружениями могут быть такие объекты как: аэродромы, трубопроводы, башни, тоннели и т.д.

Здания и сооружения подразделяются на жилые, общественные и производственные, и имеют определенные конструктивные элементы.

Конструктивные элементы зданий разделяют на ограждающие, которые отделяют помещения от внешней среды или друг от друга; несущие, принимающих нагрузки, действующие в здании; и элементы, которые совмещают ограждающие и несущие функции. Основными конструктивными элементами зданий являются фундаменты, стены, отдельные опоры, перегородки, лестницы, крыши.

Source: http://gk-drawing.ru

UNIT 2. WALLS

1. Read the words and learn them by heart.

span – пролет
breadthwise – в ширину
lengthwise – в длину
course – ряд (кирпичной кладки)
header – тычок
stretcher – ложок
stonework – каменная кладка
storey – этаж
layer – слой
solid wall – сплошная стена
moisture – влага, влажность
log – бревно
to evaporate – испаряться, выпариваться
intrusion – вторжение
joist – опорная балка, несущая балка (перекрытия, настила, пола, крыши)
insulation – изоляция, теплоизоляция
superstructure – надземная часть (здания, сооружения)
bed – ряд, слой
joint – шов кирпичной кладки, соединение, стык
self-bearing – самонесущий
curtain wall – навесная стена
glazed brick – глазурованный кирпич
sun-dried brick – сырец, саман, необожженный кирпич
lining boards – вагонка
metal tie – металлическая стяжка, анкер
cavity wall – пустотелая (полая) стена, стена с воздушной прослойкой

2. Starting off. Answer the questions.

1. What is a wall?
2. What functions does a wall perform?

3. Read and translate the text about a wall and check your ideas.

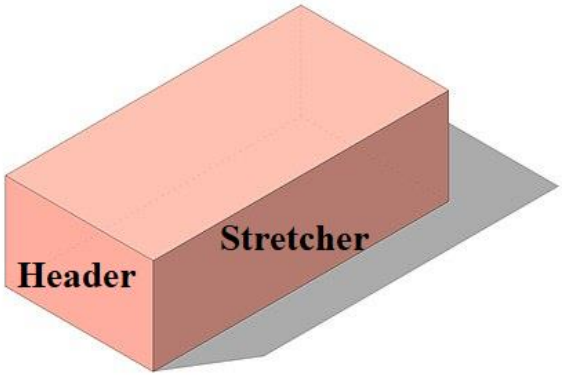
Walls.

Walls support the superstructures of building (roofs and ceilings), separate space and give protection against intrusion and the weather. They usually have three separate components: structural elements, insulation, finish elements or surface.

Walls can be load bearing or non-load bearing depending on their providing structural support to the building or not. Exterior load bearing walls carry ceiling, roof or upper floor loads to the foundation. Some bearing walls are inside buildings: they support joists at mid span and transfer loads down to the foundation. There are also self-bearing walls and curtain walls. Self-bearing walls support themselves only, they are one storey high, and curtain walls require intermediate supports within a storey height.

Walls can be made either of a single type of material (stone, brick or wood), or of a combination of different materials.

Stone walls. The stones are laid in courses. The points of contact between two stones are called joints. The construction in stones is called the stonework.



Brick.

Brick walls. Bricks can be put breadthwise or lengthwise, e.g. one course lengthwise, another breadthwise, or, in the same course, two bricks lengthwise, one behind the other, plus one breadthwise; many other combinations are possible. As bricks can be laid in the masonry in different ways, they are called headers and stretchers. A header is a brick laid so that only the end is seen on the face of the wall. A stretcher is a brick laid so that only the side is seen on the face of the wall. The brick courses are separated by thick beds of mortar. There are many different kinds of bricks: glazed brick, coloured brick, sun-dried brick, etc.

Nowadays the outer walls of buildings often consist of an outer and inner wall with a space of about 5 centimetres between them, the two layers being held together at intervals by small metal ties. These cavity walls, as they are called, help moisture evaporate better than solid walls. A layer of insulating material is often put in the space between the walls to prevent heat escaping from the building. This is known as cavity wall insulation.

Wooden walls. The external walls can be built e.g. of logs, panels, and internal walls – of boards. Walls are often painted, wallpapered or faced with lining boards.

Sources: Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 24.

Гарагуля С.И. Английский язык для студентов строительных специальностей. Learning Building Construction in English: учебное пособие / С. И. Гарагуля. – Ростов н/Д: Феникс, 2011. – С. 245.

Ивянская И.С. Английский язык для архитекторов: учебник / И.С. Ивянская. – 2-е изд., перераб. и доп. – М.: КУРС: ИНФРА-М, 2014. – С.62-63.

4. Answer the questions.

1. What are the basic functions of walls?
2. What components do walls have?
3. What is the function of self-bearing walls?
4. What materials can the walls be made of?
5. How are the stones and bricks laid in walls?
6. What is stonework?
7. What kinds of brick do you know?
8. What are headers and stretchers?
9. How can walls be finished?
10. What is the function of cavity walls?

5. Match the words to the definitions.

1. span	**a.** a hard, natural substance that is found in the ground
2. wood	**b.** a place where two things or parts of an object are joined together
3. joint	**c.** the part (of a building) above the ground
4. stone	**d.** an occasion when someone goes into a place where they are not wanted or expected to be
5. brick	**e.** an upright flat structure made of stone or brick, that divides one area from another or surrounds an area
6. intrusion	**f.** the material that trees are made of
7. superstructure	**g.** paper that you stick onto the walls of a room in order to decorate it
8. layer	**h.** the length of something from one end to the other
9. wallpaper	**i.** an amount or piece of a material or substance that covers a surface or that is between two other things
10. wall	**j.** a hard block of baked clay used for building walls, houses etc.

6. Give English equivalents to the following words and word combinations and make up sentences.

1. Изолирующий (утеплительный) материал
2. Предотвратить

3. Нагрузки верхних этажей

4. Обеспечивать защиту от

5. В зависимости от

6. Середина пролета

7. Высота

8. Промежуточная опора

9. Строительный раствор

10. Облицованный

7. Decide if the sentences are true or false.

1. Walls can protect areas, support the superstructures of buildings and separate space.
2. There are several kinds of structural walls.
3. Walls give protection against intrusion and weather.
4. A header is a brick laid so that only the side is seen on the face of the wall.
5. A layer of insulating material is generally put in the space under the walls.
6. Self-bearing walls are one storey high.
7. Solid walls help moisture evaporate better than cavity walls.
8. The brick courses are separated by thin layers of mortar.
9. Walls can be load bearing or non-load bearing.
10. The space between outer and inner wall is about 5 metres.
11. Walls can only be faced with lining boards.

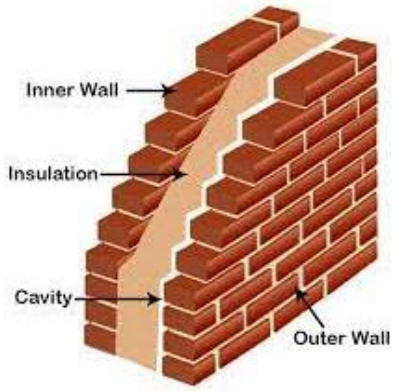
8. Match the antonyms.

1. breadthwise	**a.** cold
2. horizontal	**b.** outer
3. stretcher	**c.** low
4. inner	**d.** lengthwise
5. high	**e.** vertical
6. heat	**f.** header

9. Complete the text with words from the box.

roofs	depends	weight
thicker	resist	entire
require	structural	windows

Walls.



Wall structure.

Wall is a (1) _____ element used to divide or enclose, and, in building construction, to form the periphery of a room or a building. In traditional masonry construction, walls supported the (2) _____ of floors and roofs, but modern steel and reinforced concrete frames, as well as heavy timber and other structures, (3) _____ exterior walls only for shelter.

The traditional load-bearing wall of masonry is of a thickness proportional to the forces it has to (4) _____: its own weight, the dead load of floors and (5) _____, and the live load of people, as well as the lateral forces of arches, vaults and wind. Such walls are often (6) _____ toward the base, where maximum loading accumulates. They can be thickened along their (7) _____ length or only at particular points where the force is concentrated.

Doors and (8) _____ weaken a wall. Usually, windows must be placed one above the other in multi-storey buildings to leave vertical wall masses to transfer loads directly to the ground.

Positioning of walls (9) _____ on the type of support given floors and roofs. All types of floors and roofs except the dome are most easily supported on straight, parallel walls.

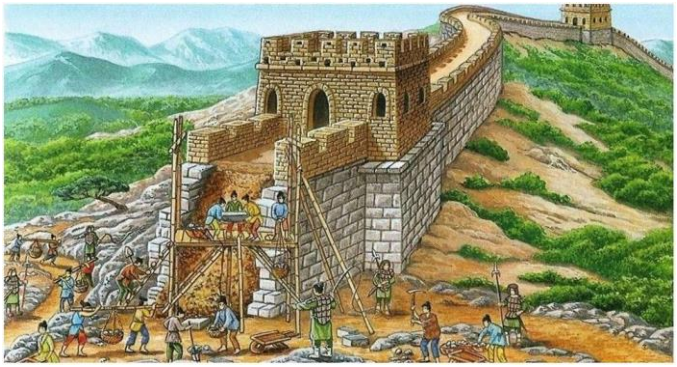
10. Translate some facts about The Great Wall of China.

Великая Китайская стена.

Великая Китайская Стена является одним из крупнейших памятников архитектуры. Этот символ Китая начал свое зарождение в III веке до н.э. как несколько независимых друг от друга стен, возводимых разными китайскими государствами. По легенде, направление и место постройки стены рабочим указал огромный дракон. Он прошел вдоль границ страны, а рабочие возвели стену на

месте его следов. Некоторые утверждают, что даже сама форма, которую образовала стена, имеет сходство с драконом.

Стену постоянно достраивали на протяжении двух тысяч лет – до 1644 года. За все время строительства менялся, как правило, только материал: примитивную глину, гальку и утрамбованную землю сменяли известняк и другие породы камня. Однако сама конструкция, как правило, не изменялась, хотя ее параметры варьируются: высота 5-7 метров, ширина около 6,5 метра, башни через каждые двести метров. Наиболее распространен тип башни в два этажа.



The Great Wall of China.

Source: https://dvizhenie24.ru

Длина стены составляет около 21 000 км. В строительстве участвовала пятая часть населения страны, т.е. около миллиона человек. Участки стены, сохранившиеся до нашего времени, были построены при династии Мин (Ming). Основными строительными материалами были кирпич и каменные блоки, делавшие конструкцию более надежной.

Sources: https://ru.wikipedia.org; https://histrf.ru

11. Complete the sentences.

enemies	years	bricks	soldiers
hard	stones	hand	countries

1. In Ancient China there were many _____.
2. People built the wall because they didn't want their _____ in their country.
3. For more than 2,000 _____, they built the wall.
4. More than one million _____ guarded the wall.
5. Working on the wall was very _____.
6. People made the wall with _____ and _____.
7. People transported the stones and bricks by _____.

12. Work in groups. Find more information about other world famous ancient or modern walls.

REVIEW. UNITS 1–2.

1. Fill in the gaps using the words in the box.

road	glazed	double	storeys	course	wood

1. The wall has a _____ function: it encloses the building and at the same time supports the covering.
2. The red brick _____ is above the two black brick courses.
3. The house is built of _____.
4. There are three _____ in the building.
5. The wall was decorated with _____ bricks.
6. People also used the Great Wall of China as a _____.

2. Choose the correct answer (multiple correct answers are possible).

1. Curtain walls _____.

a) support themselves plus the weight of floors or other walls above;

b) require intermediate supports within a storey height.

2. Bricks can be put _____.

a) breadthwise;

b) lengthwise;

c) depthwise.

3. _____ is a brick laid so that only the end is seen on the face of the wall.

a) a header;

b) a legger;

c) a stretcher.

4. The points of contact between two stones are called _____.

a) joists;

b) joints.

5. The brick courses are separated by thick beds of _____.

a) glass;

b) mortar;

c) sand;

d) water;

e) wood.

6. Walls usually have several separate components: _____.

a) structural elements;

b) insulation;

c) intrusion;

d) finish elements.

7. Columns are _____ load bearing elements.

a) horizontal;

b) vertical;

c) diagonal.

8. Walls can be _____.

a) enclosing;

b) load bearing.

9. Ceilings, vaults and roofs are _____.

a) supports;

b) coverings.

10. Building walls support the _____ of building.

a) understructures;

b) superstructures.

11. Cavity walls help moisture _____ better than solid walls.

a) appear;

b) intrude;

c) evaporate;

d) support.

3. Find all the words related to Units 1-2 (direction of letters ↕ and →) and give their translation.

B	X	C	O	N	S	T	R	U	C	T	I	O	N	I	Y	C	J	P
L	U	V	L	Z	T	R	U	S	S	I	M	B	L	N	T	R	F	B
K	D	W	E	C	O	U	R	S	E	B	R	V	S	I	B	H	C	F
S	P	A	N	F	O	U	N	D	A	T	I	O	N	C	S	L	U	P
T	C	B	G	Y	F	P	H	Y	C	G	V	A	U	L	T	J	D	H
J	F	N	T	G	E	B	G	J	S	T	O	N	E	W	O	R	K	V
O	E	U	H	K	X	T	T	F	T	Z	I	P	O	X	R	E	D	H
I	C	K	W	F	B	U	I	L	D	I	N	G	N	L	E	E	F	K
N	W	A	I	I	F	P	U	Z	O	U	S	M	G	O	Y	C	Q	Q
T	K	T	S	U	P	E	R	S	T	R	U	C	T	U	R	E	M	A
G	Y	W	E	T	R	M	C	S	Q	U	L	O	A	D	W	I	W	W
R	L	I	U	U	W	V	X	S	P	M	A	E	L	W	A	L	L	A
J	C	S	C	M	A	I	M	A	M	T	T	V	V	W	N	I	T	U
W	M	W	C	O	V	E	R	I	N	G	I	J	M	Z	K	N	M	A
B	E	N	C	L	O	S	E	T	K	Y	O	Z	K	R	X	G	T	B
E	L	L	G	D	E	C	K	M	K	N	N	G	G	Z	L	N	K	N
A	S	T	R	E	T	C	H	E	R	H	D	F	Q	X	V	I	L	O
M	W	M	G	O	Q	V	E	V	A	P	O	R	A	T	E	T	R	D

UNIT 3. FOUNDATIONS

1. Read the words and learn them by heart.

pile – свая

to drive a pile – забивать сваю

stiffness – жесткость

helical pile – спиральная свая

pier – опора, стойка, столб

footing – фундамент, основание; опора

caisson – свая-колонна, кессонная свая

settlement – осадка, оседание

constraint – нехватка, ограничение

semi-arid – полузасушливый

scour – размыв, подмыв (*n*); размывать, подмывать (*v*)

foundation scour – размыв фундамента (основания)

to swell – разбухать, вспучиваться, вздуваться

to shrink – давать усадку, усыхать, сжиматься

frost heave – вспучивание грунта при замерзании

(load) bearing capacity – несущая способность

subsoil – подпочва, естественное грунтовое основание

reinforced concrete – железобетон

to embed – погружать, заглублять, вмонтировать

to distort – перекашивать(ся), деформировать(ся)

property line – граница землевладения

to settle – садиться, осаждаться, давать осадок

differential settlement – неравномерная осадка

raft slab – сплошной фундамент, опорная плита

bearing pile – несущая свая, свая-стойка

pre-tensioned concrete – предварительно напряженный бетон

stiff – жесткий (о конструкции), крепкий, негибкий

deep foundation – фундамент глубокого заложения

shallow foundation – фундамент мелкого заложения

spread footing – фундамент на естественном основании

2. Starting off. Answer the questions.

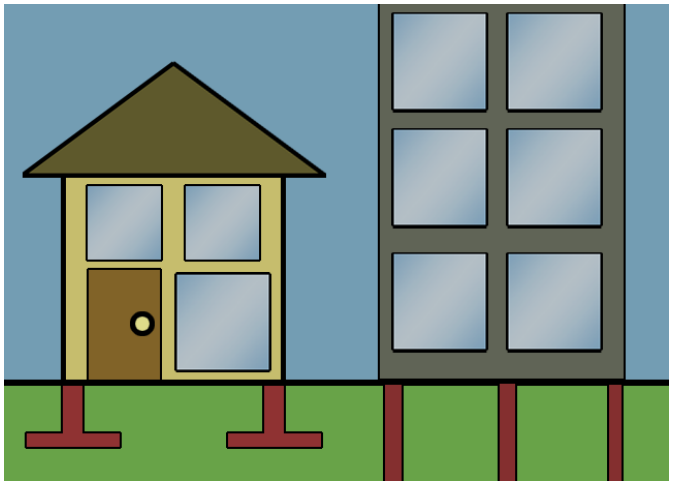
1. What is a foundation?
2. Can weather conditions affect a foundation?

3. Read and translate the text about foundations and their types and check your ideas.

Foundations.

The foundations, walls, floor, stairs and roof are some of the building elements that all types of building have in common.

Foundations are structures that transfer weights from walls and columns to the ground. The type of foundation depends on the conditions of the ground (or subsoil). Subsoil may be rock, gravel, sand or clay. There are two types of foundations: shallow foundations and deep foundations. Shallow foundations are usually embedded a metre into the soil, whereas deep foundations are embedded more in depth. A deep foundation is used to transfer a load from a structure through an upper weak layer of soil to a stronger deeper layer of soil. They are recommended in case of very large design loads, a poor soil at shallow depth or site constraints, such as property lines. There are different types of deep foundations including helical piles, caissons, piers, and earth stabilized columns. The naming conventions for different types of foundations vary among different engineers. Historically, piles were wood, later steel, reinforced concrete, and pre-tensioned concrete.



Shallow foundations of a house versus the deep foundations of a skyscraper.

Source: https://en.wikipedia.org

Foundations are designed to have an adequate load capacity with limited settlement by a geotechnical engineer, and the foundation itself is designed structurally by a structural engineer.

The primary design concerns are settlement and bearing capacity. When considering settlement, total settlement and differential settlement are normally considered. Differential settlement is when one part of a foundation settles more than another part. This can cause problems to the structure the foundation is supporting. It is necessary that a foundation is not loaded beyond its bearing capacity or the foundation will fail.

When designing foundations, it is also important to consider scour (when flowing water removes supporting soil from around a foundation) and frost heave (when water in the ground freezes and forms ice lenses).

Changes in soil moisture can cause clay to swell and shrink. This swelling can vary across the footing due to seasonal changes or the effects of vegetation removing moisture. The variation in swell can cause the soil to distort, cracking the structure over it. This is a particular problem for house footings in semi-arid climates such as South Australia, Southwestern US, Turkey, Israel, Iran and South Africa where wet winters are followed by hot dry summers. Raft slabs with inherent stiffness have been developed in Australia with capabilities to resist this movement.

Sources: Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 24.
Гарагуля С.И. Английский язык для студентов строительных специальностей. Learning Building Construction in English: учебное пособие / С. И. Гарагуля. – Ростов н/Д: Феникс, 2011. – С. 224-225.
Ивянская И.С. Английский язык для архитекторов: учебник / И.С. Ивянская. – 2-е изд., перераб. и доп. – М.: КУРС: ИНФРА-М, 2014. – С.76.

4. Answer the questions.

1. What are foundations?
2. What are the main features of shallow foundations?
3. What are the main features of deep foundations?
4. Describe the difference between a structural engineer and geotechnical engineer.
5. What is scour?
6. What can changes in soil moisture cause?
7. What is the difference between total settlement and differential settlement?
8. In what cases are deep foundations recommended?
9. What is frost heave?
10. What materials are piles made of?

5. The sentences below all contain mistakes. Find and correct the mistakes.

1. Scour occurs when water in the ground melts to form ice lenses.

_____

2. Raft slabs with inherent softness have been developed in Australia.

_____

3. The primary design concerns are settlement and cubic capacity.

_____

4. Shallow foundations are embedded more in depth.

_____

5. Helical piles, caissons, piers and earth stabilized columns are examples of shallow foundations.

_____

6. The swelling can vary across the footing due to mood changes or the effects of zoology removing moisture.

_____

7. It is necessary that a foundation is loaded beyond its bearing capacity.

_____

8. Foundations transfer height from walls and columns to the ground.

_____

6. Match the words to the definitions.

1. pile	**a.** to become larger and rounder than normal
2. foundations	**b.** a strong column or post of wood, metal, or concrete that is pushed into the ground to help support a building
3. semi-arid	**c.** to put something firmly and deeply into something else, or to be put into something in this way
4. to distort	**d.** the layer of soil between the ground's surface and the lower layer of hard rock
5. to shrink	**e.** a quality in a substance or material, especially one that means that it can be used in a particular way
6. to embed	**f.** firm, hard, or difficult to bend
7. subsoil	**g.** having little rain but not completely dry
8. to swell	**h.** to change the shape of something so that it looks strange or unnatural
9. property	**i.** the structures below the surface of the ground that support a building
10. stiff	**j.** to become smaller, or to make something smaller, through the effects of heat or water

7. Match the English words with their Russian equivalents.

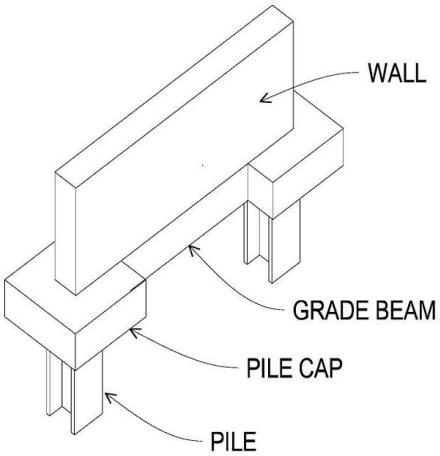
1. pile cap	**a.** бурение с промывкой скважины
2. stratum (*pl.* strata)	**b.** фундаментная балка
3. wet boring	**c.** слой (грунта)
4. rotary boring	**d.** поперечное сечение
5. cross-section	**e.** сваебойная машина, строительный копёр (для забивки свай)
6. grade beam	**f.** вращательное бурение
7. pile driver	**g.** ростверк

8. Read and translate the text about deep foundations and methods of driving piles.

Deep Foundations.

A deep foundation is a type of foundation distinguished from shallow foundations by the depth they are embedded into the ground.

Prefabricated piles are driven into the ground using a pile driver. Driven piles are either wood, reinforced concrete, or steel. Wooden piles are made from trunks of tall trees. Concrete piles are available in square, octagonal, and round cross-sections. They are reinforced with rebar and are often prestressed. Steel piles are either pipe piles or some sort of beam section.



Foundation and pile elements.

Source: https://www.wikiwand.com

Driving piles is advantageous because the soil displaced by driving the piles compresses the surrounding soil, causing greater friction against the sides of the piles, thus increasing their load-bearing capacity.

Foundations relying on driven piles often have groups of piles connected by a pile cap (a large concrete block into which the heads of the piles are embedded) to distribute loads which are larger than one pile can bear. Pile caps and isolated piles are typically connected with grade beams to tie the foundation elements together; lighter structural elements bear on the grade beams while heavier elements bear directly on the pile cap.

Rotary boring techniques offer larger diameter piles than any other piling method and permit pile construction through particularly dense or hard strata. Construction methods depend on the geology of the site, in particular, whether boring is to be undertaken in dry ground conditions or through water-logged but stable strata, i.e. wet boring.

Source: Гарагуля С.И. Английский язык для студентов строительных специальностей. Learning Building Construction in English: учебное пособие / С. И. Гарагуля. – Ростов н/Д: Феникс, 2011. – С. 229-230.

9. Choose the correct answer (multiple correct answers are possible).

1. A deep foundation is distinguished from shallow foundations by the _____ they are embedded into the ground.

a) width;

b) depth.

2. Foundations relying on driven piles often have groups of piles connected by a _____.

a) pile hat;

b) pile coat;

c) pile cap.

3. _____ piles are made from trunks of tall trees.

a) steel;

b) wooden;

c) metal;

d) concrete.

4. The soil displaced by driving the piles _____ the surrounding soil.

a) extends;

b) compresses;

c) lengthens.

5. Rotary boring techniques offer larger diameter piles than any other piling method and permit pile construction through particularly _____ strata.

a) loose;

b) dense;

c) hard.

10. Give English equivalents to the following words and word combinations and make up sentences.

1. Отличающийся от
2. Забитые сваи
3. Заболоченный, пропитанный водой (о почве)
4. Восьмиугольный
5. Сухая земная поверхность
6. Трубчатая свая
7. Увеличивая
8. Выдержать
9. Окружающий
10. Квадратный
11. В особенности

11. Match the English words with their Russian equivalents.

1. friction pile	**a.** заливать
2. bearing pile	**b.** временно
3. to withdraw	**c.** несущая свая, свая-стойка, свая-колонна
4. hollow	**d.** плавающий фундамент
5. to fill with	**e.** цилиндрический корпус
6. caisson	**f.** копать, рыть
7. cylindrical shell	**g.** свая-колонна, кессонная свая
8. floating foundation	**h.** арматурный стержень
9. to pour	**i.** убирать, выводить
10. to dig (dug-dug)	**j.** висячая свая
11. reinforcing bar	**k.** пустой, полый, пустотелый
12. temporarily	**l.** наполнять, заполнять

12. Read the text and match each paragraph with a heading.

A. Caissons.

B. Floating foundations.

C. Some types of pile foundations.

D. Bearing piles.

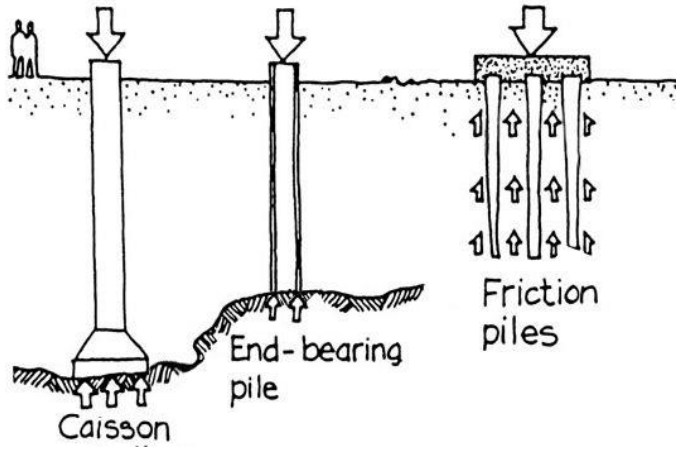
Foundations of residential and industrial buildings.

1. _____

The foundations in residential and industrial buildings support considerably heavy loads. Spread footings are used, as are pile foundations, which are of two types, bearing and friction.

2. _____

A bearing pile is a device to transmit the load of the building through a layer of soil too weak to take the load to a stronger layer of soil some distance underground; the pile acts as a column to carry the load down to the bearing stratum. The pile length may be a maximum of about 60 metres but is usually much less. The piles are put in place by driving them into the ground with large mechanical hammers. Hollow steel pipes are also driven, and the interiors are excavated and filled with concrete to form bearing piles; sometimes the pipe is withdrawn as the concrete is poured.



Types of pile foundations.

Source: https://www.pinterest.ru

3. _____

An alternative to the bearing pile is the caisson. A round hole is dug to a bearing stratum with a drilling machine and temporarily supported by a steel cylindrical shell. The hole is then filled with concrete poured around a cage of reinforcing bars; and the steel shell may or may not be left in place, depending on the surrounding soil. The diameter of caissons varies from one to three metres. The friction pile of wood or concrete is driven into soft soil where there is no harder stratum for bearing beneath the site.

4. _____

When the soil is so soft that even friction piles will not support the building load, the final option is the use of a floating foundation, making the building like a boat that obeys Archimedes' principle. Floating foundations consist of flat reinforced concrete slabs.

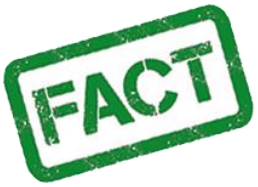
Source: Гарагуля С.И. Английский язык для студентов строительных специальностей. Learning Building Construction in English: учебное пособие / С. И. Гарагуля. – Ростов н/Д: Феникс, 2011. – С. 226-228.

13. Decide if the sentences are true or false.

1. The diameter of caissons varies from three to five metres.
2. A bearing pile transmits the load of the building through a layer of soil too weak to take the load to a stronger layer of soil some distance underground.
3. The foundations in residential and industrial buildings support considerably lightweight loads.
4. Floating foundations consist of flat wooden slabs.
5. Pile foundations are of several types.
6. When the soil is so hard that even friction piles will not support the building load, the final option is the use of a running foundation.

14. Match the words to the definitions.

1. friction pile	**a.** to become ice due to cold conditions
2. to freeze	**b.** it ties the foundation elements together
3. residential	**c.** a foundation that is constructed close to the surface
4. grade beam	**d.** a pile that depends on frictional resistance between itself and the material it passes through
5. shallow foundation	**e.** made up of many homes



15. Translate some facts about the history of foundation development in Ancient Rome.

Фундаменты в Древнем Риме.

Первые фундаменты появились в те времена, когда человек научился возводить достаточно сложные жилища, по сравнению с примитивными укрытиями. Развитие

фундаментов происходило постепенно в зависимости от технологического прогресса, накопленного опыта и знаний.

Изначально опора для жилого дома была примитивной и небольшой. Древние люди искали большие камни и уже на них после различного рода модификаций располагали свои постройки. Позже в качестве опоры дома стала использоваться древесина, что послужило зарождению свай.

Римские строители обладали глубокими знаниями, так как они строили все города, все постройки по одному шаблону. Независимо от местности, все города должны были быть одинаковыми. Такой подход стал важным в развитии оснований для построек, так как необходимо было приспосабливать каждую основу под различные грунты, особенности местности и климата. В мягкой почве использовались сваи из дерева. При наличии более твердой почвы применялись ростверки из дерева прямо на самой поверхности. Изредка строились каменные фундаменты из блоков. Огромный вклад в развитие данного направления внес Витрувий (Vitruvius), который раскрыл основные аспекты строительства оснований того времени. Римские правила строительства фундаментов господствовали и в остальной Европе еще долгое время.

Source: https://fundamentaya.ru

16. Complete the text with words from the box.

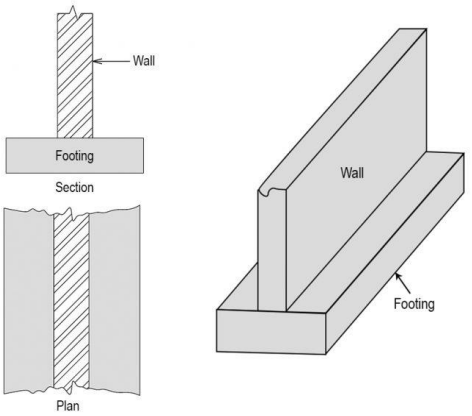
move	size	tropical
earth	important	building
poured	varies	footings

Foundations of Low-Rise Buildings.

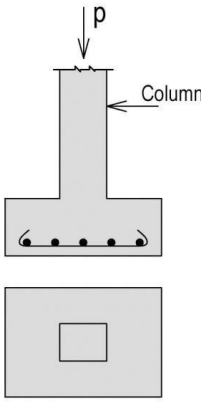
All foundations must transmit the building loads to a stable stratum of (1) _____. There are two criteria for stability: first, the soil under the foundations should be able to receive the imposed load without more than about 2.5 centimetres of settlement and, second, the settlement should be uniform under the entire (2) _____. It is also (3) _____ that the bottom of the foundation be below the maximum winter frost level. Wet soil expands as it freezes, and repeated freeze-thaw cycles can (4) _____ the building up and down, leading to possible displacement and damage. Maximum frost depth (5) _____ with climate and

topography. It can be as deep as 1.5 metres in cold continental climates and is zero in (6) _____ and some subtropical areas.

The foundation systems for low-rise residential buildings are suitable for their light loads; nearly all are supported on spread (7) _____, which are of two types – continuous footings that support walls and isolated pad footings that support concentrated loads. The footings themselves are generally made of concrete (8) _____ directly on undisturbed soil to a minimum depth of about 30 centimetres.



Continuous footings.



Pad footings.

Source: https://www.geoengineer.org

Foundation walls can be built of reinforced concrete or masonry, particularly concrete block. Concrete blocks are of a standard (9) _____ larger than bricks.

***

continuous footing – ленточный фундамент

pad – опорная плита, опорный камень

17. Answer the questions.

1. What are the criteria for foundation stability?
2. Why is it important that the foundation bottom be below the maximum winter frost level?
3. What is the maximum frost depth?
4. What are foundations of low-rise buildings characterized by?
5. What materials can foundation walls be built of?

18. Make a presentation about types of foundations.

UNIT 4. COLUMNS

1. Read the words and learn them by heart.

pier – столб
lateral – боковой
entablature – антаблемент
hexagonal – шестиугольный
polygonal – многоугольный
semicircular – полукруглый
pilaster – пилястра
freestanding column – отдельно стоящая колонна
compression – сжатие
capital – капитель (колонны)
base – база (колонны)
post – столб, стойка (опорной конструкции)
colonnade – колоннада
coupled (twin) columns – парные (двойные) колонны
pilaster strip – лопатка (пилястра без базы и капители)
engaged column – связанная колонна, приставная колонна

2. Starting off. Answer the questions.

1. What is a column?
2. What is the function of a column?
3. Are columns used frequently in the construction of buildings in your country?

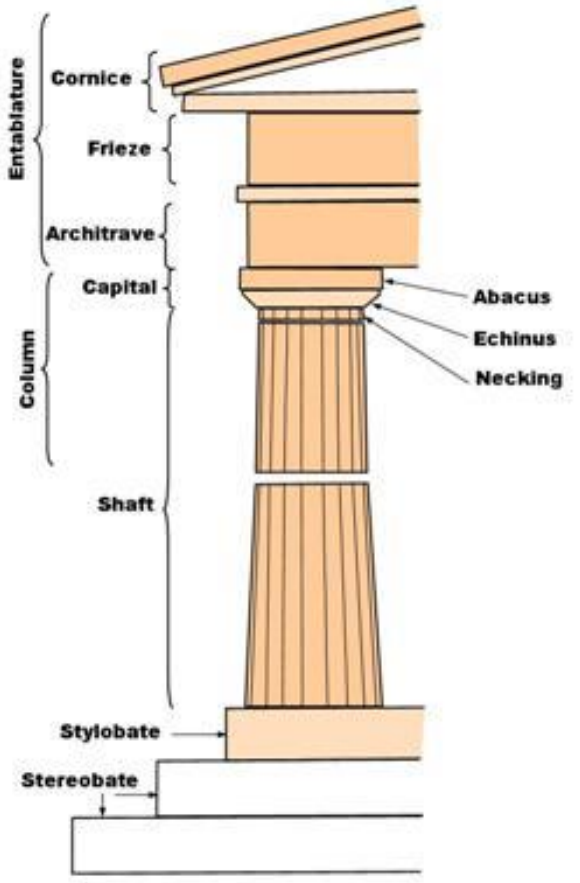
3. Read and translate the text about columns and check your ideas.

Columns.

A column or pillar in structural engineering is a structural element that transmits, through compression, the weight of the structure above to other structural elements below. In other words, a column is a compression member. Columns are typically constructed from such materials as stone, brick, block, concrete, timber, steel and so on. The term column applies especially to a large round support with a capital and a base. A small wooden or metal support is typically called a post, and supports with a rectangular or other non-round section are usually called piers.

For the purpose of wind or earthquake engineering, columns may be designed to resist lateral forces. Other compression members are often termed “columns” because of the similar

stress conditions. Columns are frequently used to support beams or arches on which the upper parts of walls or ceilings rest. In architecture, “column” refers to such a structural element that also has certain proportional and decorative features. A column might also be a decorative element not needed for structural purposes.



Elements of a column.

Source: https://www.designingbuildings.co.uk

They can be subdivided into freestanding columns and columns that are elements of the building. The freestanding column can be a triumphal column, i.e. be a monument. Usually, it is situated in the centre of a square, e.g. the Alexandriisky Column in St. Petersburg. If the column is not freestanding, it can be circular, polygonal in section and engaged. The engaged column is attached to the wall. It can be a half column (if it projects one half its diameter, so it is semicircular), a quarter column and a three quarter column. The engaged columns are usually only decorative. The pilaster is an engaged rectangular pier with a capital and base. The pilaster strip is a pilaster without base and capital. There are also coupled or twin columns. A long sequence of columns joined by an entablature is known as a colonnade.

Columns can be classified according to their cross-sectional shape. The most common shapes of a column include:

1. Rectangular.
2. Square.
3. Circular.
4. Hexagonal.
5. Octagonal.

Sources: https://en.wikipedia.org; https://www.designingbuildings.co.uk;

Ивянская И.С. Английский язык для архитекторов: учебник. – М.: КУРС: ИНФРА-М, 2014. – С. 65.

4. Match the types of a column with the pictures.

1. freestanding column
2. half column
3. pilaster
4. colonnade

a) _____

b) _____

c) _____

d) _____

5. Match the words to the definitions.

1. entablature	**a.** support with a rectangular or other non-round section
2. colonnade	**b.** the upper part of a classical building supported by columns or a colonnade, comprising the architrave, frieze and cornice
3. pilaster	**c.** having a shape with six straight sides
4. compression	**d.** a row of columns separated from each other by an equal distance
5. pier	**e.** attractive, but not always necessary or useful
6. lateral	**f.** a flat square column attached to the wall of a building for decoration
7. hexagonal	**g.** relating to the sides of something, or movement to the side
8. decorative	**h.** the act of pressing something into a smaller space or putting pressure on it from different sides until it gets smaller
9. earthquake	**i.** to fight against or oppose something or someone
10. to resist	**j.** a sudden violent movement of the surface of the earth, sometimes causing great damage

6. Give English equivalents to the following words and word combinations and make up sentences.

1. Часто
2. Триумфальная колонна
3. Длинный ряд (последовательность)
4. Противодействовать (противостоять)
5. Вес конструкции
6. Центр площади
7. Термин
8. Форма поперечного сечения
9. Декоративная особенность
10. Поддерживать балки
11. Землетрясение
12. Цель
13. Арки

7. The sentences below all contain mistakes. Find and correct the mistakes.

1. In structural engineering a column has only decorative features.

_____

2. A long sequence of columns joined by an entablature is known as a pilaster.

_____

3. The freestanding column is attached to the wall.

_____

4. The pilaster strip has both base and capital.

_____

5. Triangle is the most common shape of a column.

_____

6. A column is a structural element that transmits, through extension, the weight of the structure above to other structural elements below.

_____

7. Columns are rarely used to support beams or arches.

_____

8. The Alexandriisky Column in St. Petersburg is the example of an engaged column.

_____

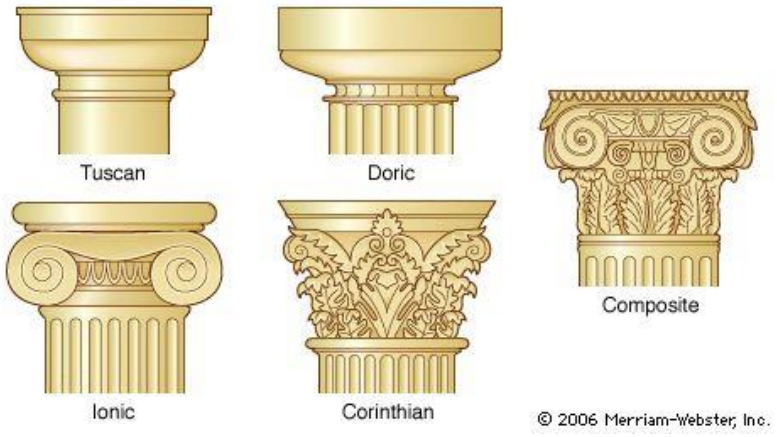
8. Complete the text about architectural orders with words from the box.

columns	base	previous
principal	wider	classified
richly	animal	decoration

Architectural Orders.

The evolution of columns in the ancient world has been (1) _____ within architectural orders. The three (2) _____ orders are Doric, Ionic and Corinthian. First though, we may place Egyptian columns which stood on a (3) _____ and carried sculpted decoration of leaves on the column shaft and Persian columns which often had (4) _____ figures such as bulls as their capitals. In the Greek world the first order was Doric whose columns were (5) _____ at the bottom and had a simple capital but no base. Ionic columns stand on a base and have a capital in the form of a double scroll (volute). Corinthian columns are

usually slimmer and taller, stand on a base and have a (6) _____ decorated capital, usually with sculpted flower and leaf (7) _____.



Types of orders.

These three all have vertical fluted carving. The Romans introduced the Tuscan column which had no flutes and a simple base and capital. Roman Doric columns were similar but with flutes. Composite (8) _____ mixed the elements of the (9) _____ styles.

***

volute – валюта

flutes – канелюры

carving – резьба

column shaft – стержень (ствол) колонны

9. Translate some facts about the columns in Ancient Greece.

Колонны в Древней Греции.

Архитектура колонн Древней Греции развивалась в течение многих веков. Постепенно дерево было заменено камнем, главным образом, мрамором. В 8 в. до н.э. в Греции уже закладываются основы ордеров, в которых колонна играла значимую роль. Ордерные колонны Греции состояли из опорной части – базы, ствола, капители. На капитель опирается антаблемент. В греческом ордере существовало три ордера: дорический, ионический, коринфский. Дорические колонны Древней Греции не обладали базой. Стволы дорических колонн Греции украшены каннелюрами. Примеры дорических древних колонн в храмах Геры в Пестуме (5 в. до н.э.), Зевса в Олимпии (460-е до н.э.), Парфеноне (447–432 до н.э.).

Source: http://www.facade-project.ru

10. Make a presentation about famous columns in your country.

REVIEW. UNITS 3–4.

1. Fill in the gaps using the words in the box.

shallow	settlement	beam	scour	depends
layer	transfer	methods	foundations	frost heave

1. They used the device to _____ loads from floors to columns.
2. There may be a lot of conditions which may require deep _____ for ensuring stability and durability of a structure.
3. A _____ foundation transfers building loads to the earth very near the surface.
4. The _____ was embedded in a foundation.
5. The thin _____ of soil that covers most of the earth's land surface is vital to human survival.
6. Piles are driven into the ground by different _____.
7. The shape and size of a caisson _____ on the nature of structure.
8. Most houses experience some degree of _____ within the first few years after construction.
9. _____ is a fundamental process dominating over soil surfaces in cold regions.
10. The bridge failure was the direct result of the foundation _____ due to flooding.

2. Compile as many words as you can with the letters of the word.

FOUNDATION

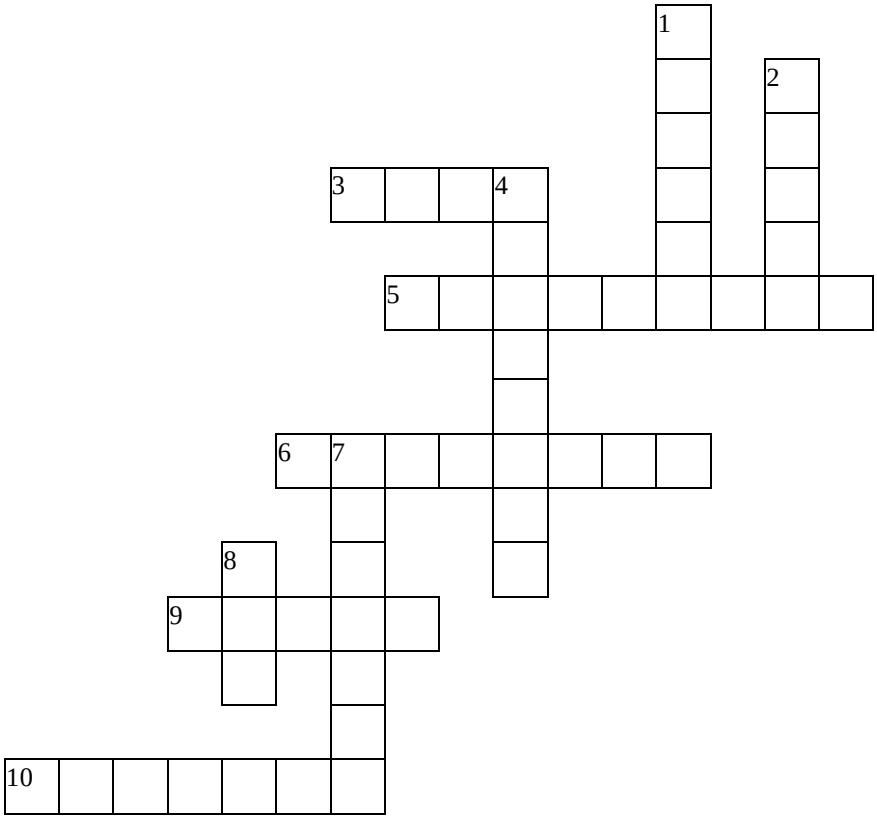
_____

_____

_____

_____

3. Complete the crossword.



Across

3. A type of foundation that transfers building loads to the earth farther down from the surface than a shallow foundation does.

5. A long sequence of columns joined by an entablature.

6. A type of foundation making the building like a boat that obeys Archimedes' principle.

9. A thin sheet of a substance on top of a surface, or a level of material that is different from the material on either side.

10. The layer of soil between the ground's surface and the lower layer of hard rock.

Down

1. A structural element that transmits the weight of the structure above to other structural elements below.

2. To put something firmly and deeply into something else, or to be put into something in this way.

4. An engaged rectangular pier with a capital and base.

7. For the purpose of wind or earthquake engineering, columns may be designed to resist _____ forces.

8. A pile _____ is a large concrete block into which the heads of the piles are embedded.

UNIT 5. BEAMS

1. Read the words and learn them by heart.

bending – изгиб
to cure – затвердевать
to deflect – прогнуться
I-beam – двутавровая балка
axial load – осевая нагрузка
to induce – воздействовать
C-channel – швеллер, швеллерный профиль
angle – уголковый профиль, уголок
cylindrical shell – цилиндрическая оболочка
tendon – элемент напрягаемой арматуры
prestressed concrete beam – предварительно напряженная железобетонная балка
adjacent – прилежащий, смежный, соседний
girder – главная балка, балочная ферма
eccentric load – нецентральная нагрузка
compressive stress – сжатие, сжимающее напряжение
shear stress – напряжение сдвига, касательное напряжение
tensile stress – напряжение на растяжение, сила натяжения
wide-flange beam – двутавровая широкополочная балка

2. Starting off. Answer the questions.

1. What is a beam?
2. What is a function of a beam?

3. Read and translate the text about beams and their types and check your ideas.

Beams.

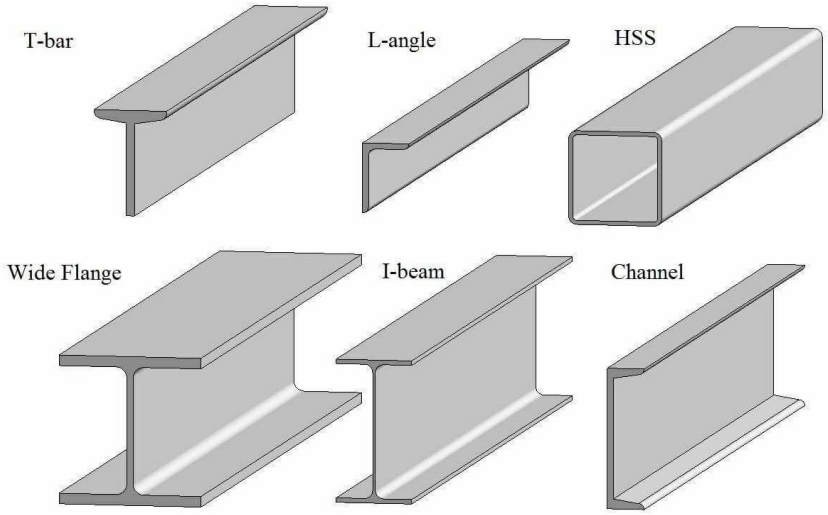
A beam is a structural element that is capable of withstanding load primarily by resisting bending. The bending force induced into the material of the beam as a result of the external loads and external reactions to these loads is called a bending moment.

Beams generally carry vertical gravitational forces but can also be used to carry horizontal loads (i.e. loads due to an earthquake or wind). The loads carried by a beam are

transferred to columns, walls, or girders, which then transfer the force to adjacent structural compression members.

Beams are characterized by their profile (the shape of their cross-section), their length, and their material. In contemporary construction, beams are typically made of steel, reinforced concrete or wood. One of the most common types of steel beam is the I-beam or wide-flange beam (also known as a universal beam). This is used in steel-frame buildings and bridges. Other common beam profiles are the C-channel, the hollow structural section (HSS) beam, the pipe, and the angle.

Internally, beams experience compressive, tensile and shear stresses as a result of the loads applied to them. Typically, under gravity loads, the original length of the beam is slightly reduced at the top of the beam, resulting in compression, while the same original beam length at the bottom of the beam is slightly stretched, and so is under tension. Above the supports, the beam is exposed to shear stress.



Types of beams.

Source: https://www.engineeringdiscoveries.net

There are some reinforced concrete beams that are entirely in compression. These beams are known as prestressed concrete beams, and are fabricated to produce a compression more than the expected tension under loading conditions. High strength steel tendons are stretched while the beam is cast over them. Then, when the concrete has begun to cure, the tendons are released and the beam is immediately under eccentric axial loads. This eccentric loading creates an internal moment, and, in turn, increases the moment carrying capacity of the beam. They are commonly used on highway bridges.

Most beams in reinforced concrete buildings have rectangular cross sections, but the most efficient cross section is a universal beam. A universal beam is only the most efficient shape in one direction of bending up and down looking at the profile as an I. If the beam is bent side to side, it functions as an H where it is less efficient. The most efficient shape for bending in any direction is a cylindrical shell or tube. Efficiency means that for the same cross-sectional area (volume of beam per length) subjected to the same loading conditions, the beam deflects less. Other shapes, like L (angles), C (channels) are also used in construction when there are special requirements.

Source: Гарагуля С.И. Английский язык для студентов строительных специальностей. Learning Building Construction in English: учебное пособие / С. И. Гарагуля. – Ростов н/Д: Феникс, 2011. – С. 161-162.

4. Choose the correct answer (multiple correct answers are possible).

1. Efficiency means that for the same cross-sectional area subjected to _____ loading conditions, the beam deflects less.

a) different;

b) the same.

2. Beams are characterized by _____.

a) profile;

b) length;

c) depth;

d) materials.

3. Internally, beams experience _____ stresses.

a) shear;

b) tensile;

c) impressive;

d) compressive.

4. The eccentric loading creates an _____ moment.

a) eternal;

b) external;

c) internal.

5. In modern construction, beams are generally made of _____.

a) glass;

b) reinforced concrete;

c) steel;

d) brick.

6. _____ beams are commonly used on highway bridges.

a) high density concrete;

b) prestressed concrete;

c) lightweight concrete;

d) reinforced concrete.

5. Match the words to the definitions.

1. tendon	**a.** a long, thick piece of metal or concrete, etc. that supports a roof, floor, bridge, or other large structures
2. compressive stress	**b.** a form of concrete where initial compression is given in the concrete before applying the external load so that stress from external loads is counteracted in the desired way during the service period
3. girder	**c.** a steel cable used in prestressed concrete structural elements like beam, column, etc.
4. prestressed concrete	**d.** the elongation of the material when a stretching force is applied along with the axis of applied force
5. tensile stress	**e.** very near, next to
6. adjacent	**f.** a force that causes a material to deform to occupy a smaller volume

6. Give English equivalents to the following words and word combinations and make up sentences.

1. Железобетон
2. Условия
3. Длина
4. Современный
5. Стальной каркас (рама)

6. Целиком (полностью)

7. Уменьшать(ся)

8. Требования

9. Направление

10. В нижней части балки

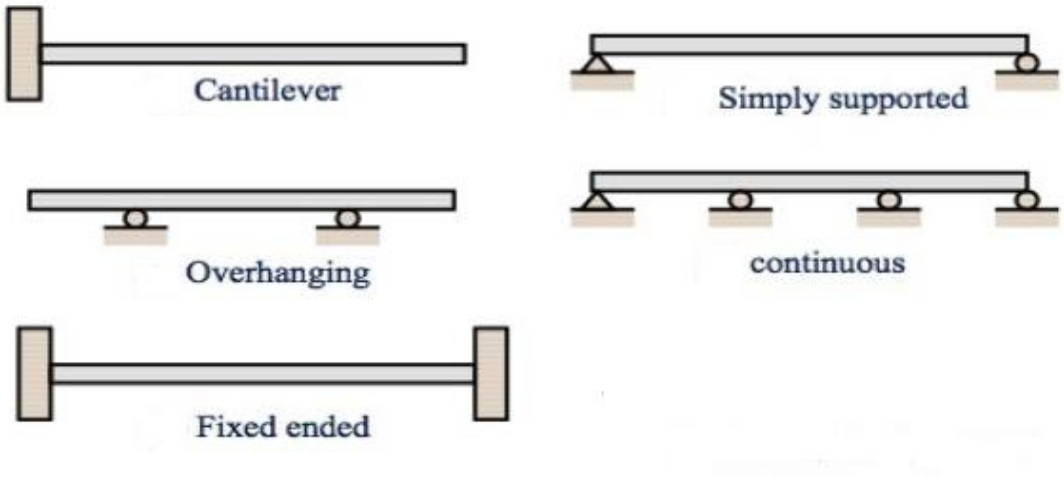
11. Подвергающийся

7. Complete the text with the words from the box.

ends	horizontal	withstand
concrete	fixed	similar
combination	strains	types

Types of beams.

A beam is a lengthened and (1) _____ support made of metal, wood, reinforced or prestressed (2) _____. Simple beams are made up of only one piece, of a section calculated to (3) _____ the strains. When the (4) _____ become too strong, reinforced beams or compound beams are then used.



Types of beams (according to end support).

Source: https://civilengineering.blog

According to end support there are several (5) _____ of beams:

1. Simply supported beam is supported at both (6) _____.

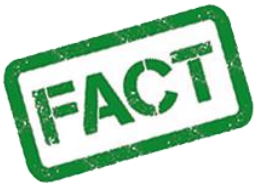
2. Continuous beam is (7) _____ to simply supported beam except more than two supports are used on it. It is used in long concrete bridges.

3. The overhanging beam is a type of beam in which the end proportion of the beam extends more from support. It is the (8) _____ of both a cantilever and a simply supported beam.

4. A cantilever beam is a rigid structural element supported at one end and free at the other.

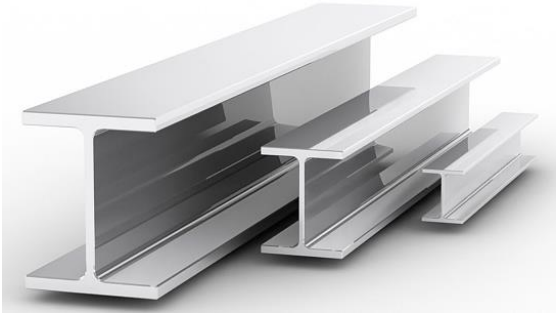
5. A fixed beam is supported between two (9) _____ ends.

8. Translate some facts about advantages and disadvantages of beams.



Преимущества и недостатки
металлических двутавровых балок.

Название двутавровой балки происходит от лат. *taurus* (бык), т.к. двутавровые балки «двурогие» по обеим сторонам. Главные приемущества двутавровой балки – это надежность и прочность. Кроме этих главных показателей можно выделить следующие преимущества:



I-beam.

Source: https://uminp.com

1. Относительно небольшой вес. Специальная форма сечения не требует достаточно большого количества металла для производства, поэтому вес готовой продукции небольшой.

2. Высокая экономичность. Двутавр обладает высокой жесткостью, что позволяет использовать его для укрепления колонн и опор без дополнительных армирующих элементов.

3. Хорошая устойчивость к сжатию и изгибающим нагрузкам.

4. Все характеристики и геометрические показатели не меняются со временем и др.

Двутавровая балка имеет ряд недостатков, которые тоже необходимо знать и учитывать:

1. Низкие показатели огнеупорности.

2. Подвергается воздействию коррозии и др.

Source: https://kpmtrade.ru

UNIT 6. TRUSSES

1. Read the words and learn them by heart.

node – узел фермы
web – решетка (фермы)
ceiling joist – потолочная балка
rafters – стропила
a bottom chord – нижний пояс (фермы)
a top chord – верхний пояс (фермы)
deflection – прогиб, перекос, деформированность
shearing – сдвиг (вид деформации), деформация под действием боковых сдвигов
corner joint – угловое соединение
assembly – сборная конструкция
planar truss – плоская ферма
space frame truss – пространственная ферма

2. Starting off. Answer the questions.

1. What is a truss?
2. Where is a truss used?

3. Read and translate the text about a truss and its types and check your ideas.

Truss.

A truss is a structure that consists of members organised into connected triangles so that the overall assembly behaves as a single object. Trusses are most commonly used in bridges, roofs and towers. A truss is usually fabricated from metal or timber.

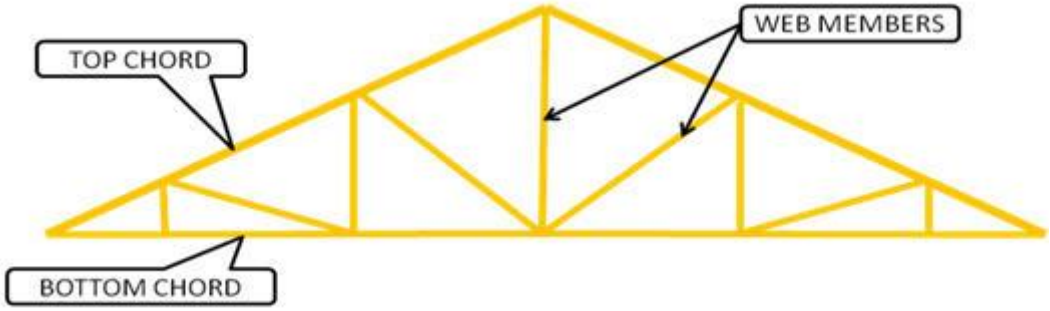
A web of triangles joined together enables the even distribution of weight and the handling of changing tension and compression without bending or shearing. The triangle is geometrically stable when compared to a four (or more)-sided shape which requires that the corner joints are fixed to prevent shearing.

Triangular units consist of straight members. The ends of these members are connected at joints, known as nodes. They are able to carry significant loads, transferring them to supporting structures such as load-bearing beams, walls or the ground.

In general, trusses are used to:

1. support considerable external load over a large span;
2. minimise the weight of a structure;
3. reduce deflection;
4. support heavy loads.

Trusses are typically made up of three basic elements. The connected pieces forming the top and bottom of the truss are referred to respectively as the top and bottom chords. A top chord is usually in compression, whereas a bottom chord is usually in tension. The sloping and vertical pieces connecting the chords are collectively referred to as the web of the truss.



Truss elements.

Source: https://www.bestructural.com/

The efficiency of trusses means that they require less material to support loads compared with solid beams. Generally, the overall efficiency of a truss is optimised by using less material in the chords and more in the bracing elements.

Types of trusses

1. Simple truss. The simplest form of a truss is one single triangle. It might be found in a framed roof consisting of rafters and a ceiling joist.

2. Planar truss. A planar truss is a truss in which all the members lie in a two-dimensional plane. This type of truss is typically used in series, with the trusses laid out in a parallel arrangement to form roofs, bridges, and so on. The depth of a truss, or the height between the upper and lower chords, is what makes it an efficient structural form.

3. Space frame truss. In contrast to a planar truss which lies in a two-dimensional plane, a space frame truss is a three-dimensional framework of connected triangles.

Source: https://www.designingbuildings.co.uk

4. Decide if the sentences are true or false.

1. A truss is made up of a web of circles joined together to enable the even distribution of weight.
2. Trusses support considerable external load over a large span.
3. The ends of the straight members are connected at nodes.
4. A truss is usually made from curved pieces of metal or timber.
5. Trusses are typically made up of eight basic elements.
6. The efficiency of trusses means that they require more material to support loads compared with solid beams.
7. A planar truss is a truss in which all the members lie in a three-dimensional plane.
8. Space frame truss is the simplest form of a truss.
9. A planar truss is typically used in series.
10. A simple truss might be found in a framed roof consisting of rafters and a ceiling joist.

5. Match the words to the definitions.

1. top chord	**a.** a truss which members and nodes lie within a two-dimensional plane
2. planar truss	**b.** the horizontal member defining the lower edge of a truss, carrying ceiling loads where applicable
3. bottom chord	**c.** a truss which members and nodes extend into three dimensions
4. space truss	**d.** members that join the top and bottom chords to form the triangular patterns that give truss action
5. joint	**e.** an inclined or horizontal member that establishes the upper edge of a truss
6. web	**f.** the point of intersection of a chord with the web or webs

6. Give English equivalents to the following words and word combinations and make up sentences.

1. Итоговый (общий, суммарный)
2. Производить
3. Равномерный

4. Распределение

5. Двухмерная плоскость

6. Требовать

7. Предотвратить

8. Существенный (значительный)

9. Сокращать (уменьшать)

10. Соответственно

11. Простейшая форма

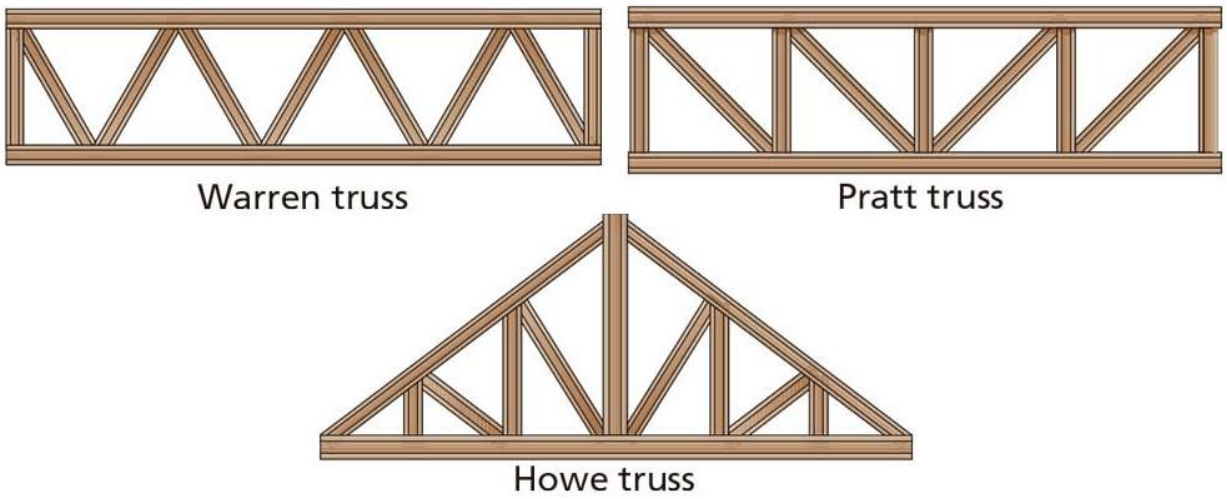
12. Трехмерный

13. Устойчивый

7. Read the text about the basic forms of trusses and answer the questions below.

Forms of trusses.

There is a wide range of truss forms that can be created, varying in materials, overall geometry and span. Some of the most common forms are described below.



Forms of trusses.

Source: https://www.blinklearning.com

Pratt truss

The Pratt truss (first proposed by Thomas Pratt in 1844) is one of the most common forms of truss and is made up of vertical and diagonal members that form an ‘N’ shape. The vertical members are in compression, whilst the diagonal members are in tension. This simplifies and produces a more efficient design since the steel in the diagonal members can be reduced.

This has a few effects – it reduces the cost of the structure due to more efficient members, reduces the self-weight, and eases the constructability of the structure. This type of truss is most appropriate for horizontal spans, where the force is predominantly in the vertical direction.

Howe Truss

Howe trusses are essentially the opposite of Pratt trusses in terms of geometry. In fact, looking at a Pratt truss upside-down will visualize a Howe truss. The entire structure is still relatively the same, but the diagonal braces are now occupying the opposite or the unoccupied joints. This switch in position of the diagonal members has a very important structural effect.

Warren truss

The Warren Truss (named after the British engineer James Warren in 1846) is another very popular truss structure system and is easily identified by its construction from equilateral triangles. One of the main advantages of a Warren Truss is its ability to spread the load evenly across a number of different members. This truss type is more advantageous for spanned loads, but not suitable where the load is concentrated at a single point or node.

Sources: https://www.designingbuildings.co.uk; https://skyciv.com

***

equilateral triangle – равносторонний треугольник
constructability – конструктивность

1. Why does a Pratt truss simplify and produce a more efficient design?
2. What effects does a Pratt truss have?
3. What is the difference between a Howe truss and a Pratt truss?
4. What is the main advantage of a Warren Truss?

8. There are many other truss forms. Make a presentation about the following forms:

1. North light truss.
2. King post truss.
3. Queen post truss.
4. Fink truss.
5. Saw-tooth truss.
6. Gambrel truss, etc.

9. Complete the text about the history of trusses with words from the box.

roofing	commonly	wrought iron
built	primitive	parallel
trusses	machinery	purposes

History of Trusses.

Trusses were probably first used in (1) _____ lake dwellings during the early Bronze Age, about 2500 BC. The first trusses were (2) _____ of timber. The Greeks used trusses extensively in (3) _____, and trusses were used for various construction (4) _____ in the European Middle Ages. Andrea Palladio's *I quattro libri dell'architettura* (1570; *Four Books on Architecture*) contained plans for timber (5) _____. A major impetus to truss design came in the development of covered bridges in the United States in the early 19th century. Cast iron and (6) _____ were succeeded by steel for railroad truss bridges. The two systems most (7) _____ used are the Pratt and the Warren; in the former, the sloping web members are (8) _____ to each other, while, in the latter, they alternate in direction of slope. Trusses are also used in many kinds of (9) _____, such as cranes and lifts and in aircraft wings.

10. Translate some facts about trusses.

История ферм.

Историю появления ферм связывают с Америкой и с деревянными фермами для железнодорожных мостов. Инженер Таун (Towne) в 1829-1830 гг. предложил многорешетчатые дощатые фермы, наибольший пролет которых составил 40 м.

В 1840 архитектор Штата Массачусетс (Massachusetts) по имени Вильям Гау (William Howe) запатентовал конструкцию, которая внешне была очень похожа на деревянную ферму, но имела важное отличие – вертикальные элементы, работающие на растяжение, были выполнены не из дерева, а из чугуна. Это создавало возможность периодически подтягивать их, обеспечивая, таким образом, плотность узлов.

В 1844 году Пратт (Pratt) заменил деревянные, нисходящие к середине пролета, раскосы (diagonal web elements) чугунными. В 1847 году Виппл (Whipple) опубликовал

труд «Работа по мостостроению», в котором исследовались теоретические вопросы проектирования ферм.

В 1850 году он запатентовал ферму, в которой сжатые элементы были выполнены из чугуна, а растянутые из сварочного железа. Это было вызвано тем, что плохая работа чугуна на растяжение приводила к авариям мостов.

Балочные фермы приобрели свой современный вид уже в начале 20 в.

Source: https://stroyone.com/bridge/truss-bridge/fermy.html.

11. Here are some words but the letters are mixed up. Fill in the table.

Letters	Correct word	Translation
1. Sgarihen		
2. emAsbsly		
3. refRta		
4. aanPlr		
5. niJjot		
6. Cdohr		
7. beW		
8. enefDlciot		
9. oNde		
10. sTusr		

12. Comment on the issues.

1. Truss.
2. Truss elements.
3. Truss types.
4. Truss forms.
5. The use of trusses.

REVIEW. UNITS 5–6.

1. Fill in the gaps using the words in the box.

withstand	geometry	fabricated	overhanging	space frame
vertical	beams	planar	truss	cantilever

1. A _____ is made up of a web of triangles joined together to enable the even distribution of weight.
2. A _____ truss is a truss in which all the members lie in a two-dimensional plane.
3. _____ are characterized by their profile (the shape of their cross-section), their length and their material.
4. The Howe trusses are essentially the opposite of Pratt trusses in terms of _____.
5. A beam is a structural element which can _____ loads primarily by resisting bending.
6. A truss is usually _____ from straight pieces of metal or timber.
7. A _____ beam is a rigid structural element supported at one end and free at the other.
8. The Pratt truss is made up of _____ and diagonal members that form an ‘N’ shape.
9. The _____ beam is a type of beam in which the end proportion of the beam extends more from support.
10. A _____ truss is a three-dimensional framework of connected triangles.

2. Compile as many words as you can with the letters of the word.

CANTILEVER

_____

_____

_____

_____

3. Find all the words related to Units 5-6 (direction of letters ↕ and →) and give their translation.

W	T	A	Y	G	U	W	M	L	J	D	P	I	F	U	R
Y	E	W	E	B	C	H	M	I	P	O	K	L	S	E	A
U	N	C	S	P	A	N	E	R	B	E	A	M	T	C	F
A	S	S	E	M	B	L	Y	G	I	R	D	E	R	E	T
E	I	K	W	I	T	H	S	T	A	N	D	R	E	U	E
Y	O	S	J	X	I	I	X	B	P	B	F	W	S	Q	R
A	N	J	N	G	N	N	O	S	T	B	R	U	S	I	Q
C	I	V	O	S	C	O	M	P	R	E	S	S	I	O	N
F	Q	S	D	M	S	D	E	F	L	E	C	T	I	O	N
P	C	B	E	N	D	I	N	G	H	A	N	G	L	E	J
I	K	U	E	U	P	L	A	N	A	R	T	A	W	N	X
S	H	E	A	R	I	N	G	N	F	V	C	L	O	A	D
Y	C	A	N	T	I	L	E	V	E	R	A	S	H	Y	R
E	O	X	N	M	G	C	H	O	R	D	T	R	U	S	S
J	O	I	N	T	P	A	D	J	A	C	E	N	T	Q	F

UNIT 7. FRAMING CONSTRUCTION

1. Read the words and learn them by heart.

carpenter – плотник

plywood – фанера, клееная фанера

stud – стойка каркаса

wall sheathing – обшивка стен

cladding – облицовка, обшивка (стен здания)

subflooring – черновой настил

gypsum board – гипсокартон

oriented strand board (OSB) – ориентированно-стружечная плита

post-and-beam construction – стоечно-балочная конструкция

light-frame construction – легкая каркасная конструкция

framing – каркас, рама, деревянная конструкция

frame (framing) construction – каркасная конструкция, рамная конструкция

bearing wall – несущая стена

dimensional lumber – стандартные пиломатериалы

lintel – верхняя горизонтальная перемычка в оконном или дверном проеме

joist – опорная балка, перекладина, ригель

softwood forest – хвойный лес

bracing – связи жесткости, система связей, крепление

platform framing – деревянная каркасная конструкция с разрезными стойками

balloon framing – деревянная каркасная конструкция с неразрезными стойками

2. Starting off. Answer the questions.

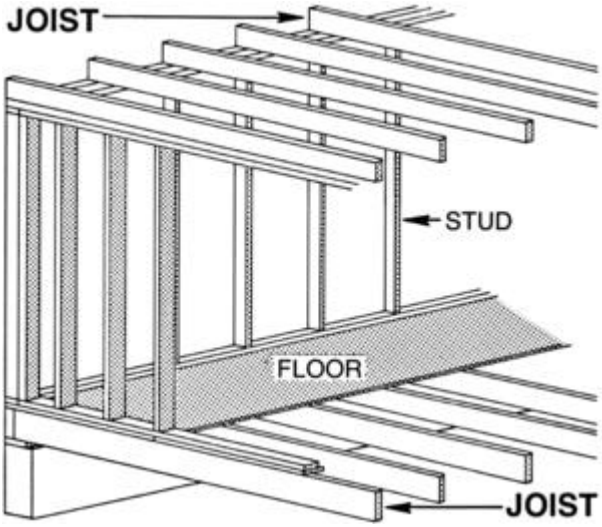
1. What is a frame?
2. What is the function of frames?

3. Read and translate the text about a frame and its types and check your ideas.

Framing Construction.

Framing is a building technique based on structural members which provide a stable frame. Framing materials are usually wood or structural steel.

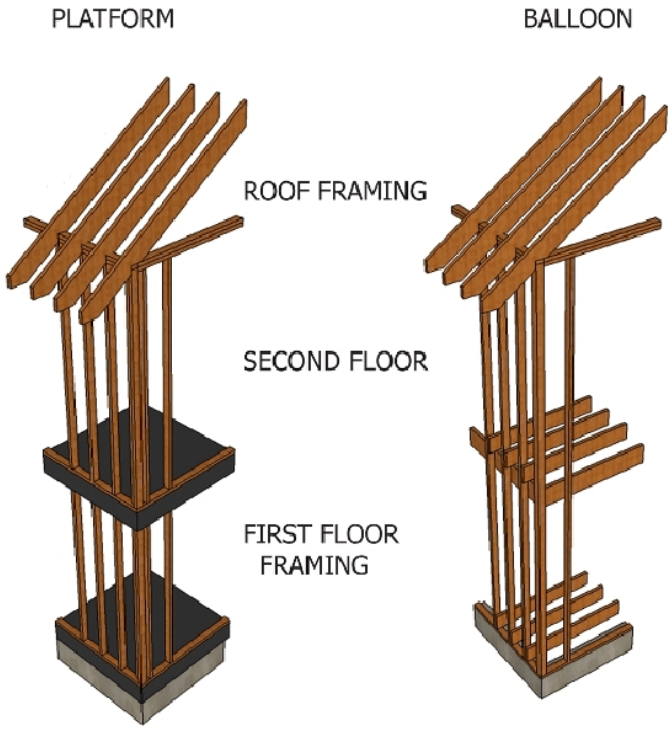
Framing is divided into two broad categories, heavy-frame construction (heavy framing) if the vertical supports are few and heavy such as in timber framing, steel framing; or light-frame construction (light-framing) if the supports are more numerous and smaller, such as balloon, platform, or light-steel framing. Light-frame construction using dimensional lumber has become the dominant construction method in North America and Australia due to the economy of the method; use of minimal structural material allows builders to enclose a large area at minimal cost while achieving a wide variety of architectural styles.



Framing elements.

Source: https://en.wikipedia.org

Modern light-frame structures usually gain strength from rigid panels (plywood and other plywood-like composites such as oriented strand board (OSB) used to form all or part of wall sections), but until recently carpenters employed various forms of diagonal bracing to stabilize walls. Diagonal bracing remains a vital interior part of many roof systems.



Frame types.

Source: https://www.researchgate.net

The balloon-frame house with wood cladding, invented in Chicago in the 1840s, aided the rapid settlement of the western U.S. In North America, with its abundant softwood forests, the framed building enjoyed an extensive revival after World War II in the form of platform frames. In platform framing, each floor is framed separately, as contrasted with balloon framing, in which the studs (vertical members) extend the full height of the building. Freed from the heavy timbers of the post-and-beam system, platform framing can

offer ease of construction. Carpenters first fabricate a floor, which consists of wood joists and subflooring. The floor often serves as a working platform on which the stud wall frames are fabricated in sections and then lifted into place. On top of this is placed a second floor or the roof. The roof is formed of rafters (sloping joists) or wood trusses. The standard interior wall sheathing is gypsum board, which provides fire-resistance, stability, and a surface ready for finishing. Framed structures traditionally were constructed individually at each house site; today many of the framing elements are mass-produced elsewhere and assembled on-site.

Source: https://www.britannica.com

4. Choose the correct answer (multiple correct answers are possible).

1. If the supports are more numerous and small, _____ is used.

a) heavy-frame construction;

b) light-frame construction.

2. Light-frame construction has become the dominant construction method in _____.

a) South America;

b) Australia;

c) North America;

d) Antarctic.

3. Light-frame construction allows _____.

a) using minimal structural materials;

b) enclosing a large area at minimal cost;

c) achieving a wide variety of architectural styles.

4. In _____ the studs (vertical members) extend the full height of the building.

a) platform framing;

b) balloon framing.

5. Today many of the framing elements are _____.

a) mass-produced elsewhere and assembled on-site;

b) constructed individually at each house site.

6. Framing materials are _____.

a) glass;

b) wood;

c) sand;

d) steel.

7. The standard interior wall sheathing is _____.

a) glass;

b) brick;

c) tile;

d) gypsum board.

5. Match the words to the definitions.

1. lintel	**a.** a construction method in which the studs (vertical members) extend the full height of the building (usually two stories)
2. stud	**b.** a beam placed across the openings like doors, windows etc.
3. sheathing	**c.** the foundation beneath finish flooring materials
4. platform framing	**d.** a vertical framing member which forms part of a wall or partition
5. balloon framing	**e.** the board or panel material used in floor, wall and roof, which covers the entire building's framework
6. subfloor	**f.** a construction method in which each floor is framed independently by nailing the horizontal framing member to the top of the wall studs

6. Give English equivalents to the following words and word combinations and make up sentences.

1. Устойчивый каркас
2. Многочисленный
3. Ведущий строительный метод
4. При минимальных затратах
5. Широкое разнообразие
6. Набирать прочность
7. Крайне необходимый (очень важный)

8. Обширный

9. Поверхность

10. Отделка

11. Служить

12. Огнестойкость

7. Complete the text about steel frames with words from the box.

loads	resist	residential
high	span	frame
horizontal	technique	earthquakes

Steel Frames.

Steel frame is a building (1) _____ with a “skeleton frame” of vertical steel columns and (2) _____ I-beams, constructed in a rectangular grid to support the floors, roof and walls of a building which are all attached to the (3) _____. The development of this technique made the construction of the skyscraper possible.

Steel frames.

Source: https://www.smarterhomes.org.nz

Steel beams are horizontal structural members that (4) _____ loads applied laterally to their axis. Steel columns are vertical structural members that transfer compressive (5) _____.

Steel frame construction is commonly used in high-rise, industrial, warehouse, (6) _____ buildings and so on.

Its advantages include relatively low weight, high strength, ability to (7) _____ large distances, ease of installation, availability of a wide range of ready-made structural sections, ability to resist dynamic forces such as wind and (8) _____, adaptability to any kind of shape, etc.

Types of steel frame construction include:

- Conventional steel fabrication: steel components are fabricated off-site, cut to the correct lengths and welded together.
- Bolted steel: steel components are fabricated off-site and bolted in place on site.
- Light gauge steel: similar to timber frame construction, with light gauge steel members instead of timber studs.

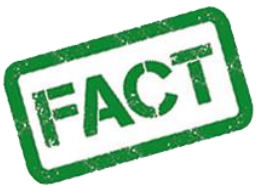
As steel softens at (9) _____ temperatures, which can cause structural collapse, frames require some form of fire protection. They may be encased in masonry or concrete, or sprayed with an insulating coating. Steel is also prone to corrosion in humid climates or marine environments.

***

to weld – соединять сваркой, сваривать

bolt – болт (*n*); скреплять, стягивать болтами (*v*)

light gauge steel framing – легкие стальные тонкостенные конструкции



8. Translate some facts about frames.

Каркас.

Каркас – внутренняя несущая конструкция, которая должна выдерживать нагрузки, обеспечивать прочность и устойчивость объекта. Каркасы зданий состоят, в основном, из колонн, ригелей, ферм и т.д.

Применение каркасов в сочетании с легкими ограждающими конструкциями стен и перегородок из эффективных материалов способствует снижению веса зданий по сравнению со зданиями, имеющими массивные стены. Здания с каркасом требуют меньшего расхода железобетона, чем крупнопанельные, но при этом увеличивается расход стали.

Каркасы зданий выполняются из железобетона, стали, алюминиевых сплавов, дерева. Железобетонные и стальные каркасы применяются в промышленных и уникальных общественных зданиях – выставочных павильонах, стадионах и др.; деревянные каркасы используются в малоэтажных проектах домов и временных сооружениях.

Source: https://ru.wikipedia.org

9. Read the text about timber framing and find out its advantages. Complete the text with words from the box.

techniques	structures	outside
dimensions	materials	advantages
stone	quickly	elegant

Timber Framing. Advantages.

Timber framed (1) _____ use fewer, larger timbers with (2) _____ from 15 to 30 cm. Timber-framed construction offers a lot of (3) _____. It is kind to the environment (when the wood used is taken from sustainable forests) and the frames can be put up (4) _____. Its design is (5) _____ and simple, and also both practical and adaptable. It can give a house character, both inside and (6) _____. Thanks to its strength, large open spaces can be created, something which is not so easy to obtain with other (7) _____. It is very versatile, so timber-framed houses can also be clad with (8) _____ or brick. This offers two more advantages: the house can blend in with the surrounding area (both urban and rural) and it is very energy-efficient. Timber is also cheaper than other (9) _____.

Timber framing.

Source: https://compoundsecurityspecialists.co.uk/timber-frame-construction/

10. Read the text about the disadvantages of timber frames.

Timber Framing. Disadvantages.

There are several advantages to timber frame construction, but there are also disadvantages that you should be aware of before deciding if it meets your needs.

Wood is a porous and very combustible material, susceptible to water, fire and bugs. Water can be absorbed into the material, causing it to rot and mould, which can compromise the strength and cause adverse health effects. This can be a major problem in humid climates. Wood

is also very flammable, which makes the material a fire hazard. Ants and termites eat wood framing, with serious effects on the strength of the construction.

Logging for timber framing can have a major environmental impact. Producing boards and beams for timber frame construction requires cutting down trees. Large, old-growth forests are sometimes clear cut to produce wood for timber construction, which can lead to other problems such as soil erosion and destruction of wildlife habitats.

Wood is an excellent transmitter of sound waves so any noise inside or outside is easily heard throughout the home. This can be a major problem if there are several people living in the house or if it is located near a noisy street as sounds are transmitted very clearly.

Timber frames are quite strong up and down, but not as strong as other materials horizontally. So, if your building design has a large room with a long span, it will be difficult for timber frame construction to handle the weight. You may need to have a post in the middle to absorb some of the weight.

Source: Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 11.

11. Decide if the sentences are true or false.

1. Wood is susceptible to water and bugs.
2. Timber frame construction is suitable for very long spans.
3. Producing boards and beams for timber frame construction is not concerned with cutting down trees.
4. Wood is flammable.
5. Water can be absorbed into the material, causing it to rot and mould, which can be a major problem in dry climates.

UNIT 8. FORMWORK

1. Read the words and learn them by heart.

formwork – опалубка
rot – разложение, распад
versatile – многофункциональный
shuttering – затяжка, форма, опалубка
mould – форма
live load – рабочая нагрузка, непостоянная нагрузка
permanent insulated formwork – несъемная изолированная опалубка
shear reinforcement – арматура для восприятия напряжений сдвига
flexible – гибкий
stay-in-place formwork – несъёмная опалубка
dead load – собственный вес, постоянная, статическая нагрузка
interlocking – взаимосвязанный
to exert – оказывать, прилагать
particleboard – древесно-стружечная плита
workmanship – мастерство, качество, квалификация
re-usable formwork – опалубка многократного использования
insulating concrete forms – несъёмная опалубка из гранулированного пенополистирола
glass fibre reinforced plastics – стеклопластик

2. Starting off. Answer the questions.

1. What is a formwork?
2. What is the function of formwork?

3. Read and translate the text about a formwork, its functions and types and check your ideas.

Formwork.

Formwork is the term used for the process of creating a temporary mould into which concrete is poured and formed. It is a vertical or horizontal arrangement made to keep concrete in position until it gains strength and shape. Traditional formwork is fabricated using timber, but it can also be constructed from steel, glass fibre reinforced plastics and other materials.

Formwork which supports vertical arrangement is known as shuttering. So, shuttering is a vertical temporary arrangement which is arranged to bring concrete in a desired shape.

When selecting formwork, the type of concrete and temperature of the pour are important considerations as they both affect the pressure exerted.

Timber formwork.

Source: https://www.123rf.com

The formwork sides must be capable of resisting the hydrostatic pressure of the wet concrete which will diminish to zero within several hours depending on the rate of curing. The formwork base must also be capable of resisting the initial dead load of the wet concrete and the dead load of the dry set concrete. Once the concrete has gained sufficient strength the formwork can be removed. High quality workmanship and inspection are necessary to ensure a high standard and appearance of the resulting concrete structure.

Formwork comes in several types:

Traditional timber formwork. The formwork is built on site out of timber and plywood or moisture-resistant particleboard. It is easy to produce but time-consuming for larger structures, and the plywood facing has a relatively short lifespan. It is still used extensively where the labour costs are lower than the cost of producing re-usable formwork from such materials as steel or plastic. It is also the most flexible type of formwork.

Engineered Formwork System. This formwork is built out of prefabricated modules with a metal frame (usually steel or aluminium) and covered on the application (concrete) side with material having the wanted surface structure (steel, aluminum, timber, etc.). The advantage of formwork systems, compared to traditional timber formwork, is the speed of construction. Metal formwork systems are better protected against rot and fire than traditional timber formwork.

Re-usable plastic formwork. This formwork is generally used for quick pours of concrete. The formwork is assembled either from interlocking panels or from a modular system and is used for relatively simple concrete structures. It is not as versatile as timber formwork due to the prefabrication requirements and is best suited for lost-cost, repetitive structures such as mass housing schemes.

Stay-in-place structural formwork. This formwork is generally assembled on site using prefabricated fibre-reinforced plastic. It is used for concrete columns and piers and stays in place, acting as permanent axial and shear reinforcement for the structural member. It also provides resistance to environmental damage for both the concrete and reinforcing bars.

Permanent Insulated Formwork. This formwork is assembled on site, usually out of insulating concrete forms (ICF). The formwork stays in place after the concrete has cured, and may provide advantages in terms of speed, strength, superior thermal and acoustic insulation.

Sources: https://www.designingbuildings.co.uk/wiki/Formwork; https://en.wikipedia.org/wiki/Formwork

4. The sentences below all contain mistakes. Find and correct the mistakes.

1. Formwork is the process of creating a permanent mould into which sand is poured and formed.

_____

2. Engineered formwork is assembled on site, usually out of insulating concrete forms (ICF).

_____

3. When selecting formwork, the type of water and pressure of the pour are important considerations.

_____

4. Timber formwork systems are better protected against rot and fire than any other formwork.

_____

5. Stay-in-place structural formwork is used for metal columns and piers.

_____

5. Choose the correct answer (multiple correct answers are possible).

1. Formwork is a _____ arrangement made to keep concrete in position until it gains strength and shape.

a) vertical;

b) horizontal.

2. Formwork can also be constructed from _____.

a) timber;

b) glass;

c) glass fibre reinforced plastics;

d) sand;

e) steel.

3. When selecting formwork, it is important to consider _____.

a) the cost of concrete;

b) the type of concrete;

c) temperature of the pour;

d) pressure of the pour.

4. _____ is assembled either from interlocking panels or from a modular system and is used for relatively simple concrete structures.

a) Traditional timber formwork;

b) Stay-in-place structural formwork;

c) Permanent insulated formwork;

d) Re-usable plastic formwork;

e) Engineered formwork system.

5. _____ is generally assembled on site using prefabricated fibre-reinforced plastic.

a) Traditional timber formwork;

b) Stay-in-place structural formwork;

c) Permanent insulated formwork;

d) Re-usable plastic formwork;

e) Engineered formwork system.

6. Once the concrete has gained sufficient strength the formwork can be _____.

a) made;

b) removed;

c) installed.

7. _____ is best suited for lost-cost, repetitive structures such as mass housing schemes.

a) Engineered formwork system;

b) Stay-in-place structural formwork;

c) Permanent insulated formwork;

d) Re-usable plastic formwork.

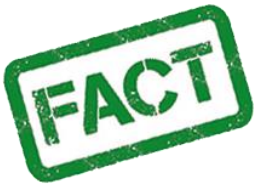
6. Match the words to the definitions.

1. formwork	**a.** the weight of people or goods in a building or vehicle
2. rot	**b.** hard material made from small pieces of wood mixed with glue, often used instead of wood in making furniture because it is cheaper
3. dead load	**c.** the process of creating a temporary mould into which concrete is poured and formed
4. workmanship	**d.** the degree of skill with which a product is made or a job done
5. live load	**e.** the constant weight of a structure or vehicle, excluding the weight of passengers or goods
6. particleboard	**f.** the process of decaying

7. Put the words into the correct order to make complete sentences about formwork requirements.

1. the satisfy requirements formwork should A following good.
2. strong to A withstand and dead live formwork enough should be loads.
3. its be should capable of retaining It shape.
4. used in a suitable formwork reuse Material should be for.
5. A lightweight as should be formwork as possible.
6. should A on a firm formwork rest base.

8. Translate some facts about formwork.



История опалубки.

Опалубка – это вспомогательная конструкция из дерева, металла либо других материалов, которая служит для придания конструкциям из бетона, железобетона и других строительных растворов определенных параметров – таких как форма, геометрические размеры, положение в пространстве, структура поверхности и др. Опалубка или опалубочная система состоит из формообразующих элементов и поддерживающих конструкций. После затвердевания

строительного раствора опалубку обычно удаляют. Существует также несъёмная опалубка, которая не удаляется, а становится частью строительной конструкции.

Опалубку как временную форму использовали в строительстве с древних времен. История развития опалубочных технологий тесно связана с эволюцией архитектурных форм. Появление в III – начале II века до н.э. так называемого римского бетона стало решающим шагом в развитии арочно-купольной системы. Для создания арок, сводов и куполов древнеримские строители применяли как съёмную опалубку, которую изготавливали из деревянных досок, так и несъёмную – из кирпичей или каменных блоков.

Source: https://ru.wikipedia.org

9. Complete the text about steel frames with words from the box.

lifespan	useful	difference
multiple	popular	surfaces
installed	similar	features

Metallic Formwork: Steel and Aluminum.

Steel formwork is becoming more (1) _____ due to its long service life and (2) _____ reuses. Although it is costly, steel formwork is (3) _____ for multiple projects, and it is a viable option when many opportunities for reuse are expected.

The following are some of the main (4) _____ of steel formwork:

- Waterproof, strong and durable, with a long (5) _____;
- Creates a smooth finish on concrete (6) _____;
- Reduces honeycombing effect in concrete;
- Easily (7) _____ and dismantled and suitable for curved structures.

Aluminum formwork is very (8) _____ to steel formwork. The main (9) _____ is that aluminum has a lower density than steel, which makes formwork lighter. Aluminum also has a lower strength than steel, and this must be considered before using it.

***	*British English*	*American English*
	aluminium	aluminum

REVIEW. UNITS 7–8.

1. Fill in the gaps using the words in the box.

shape	live loads	mould	lightweight	wooden
studs	reused	balloon	construction	platform

1. The module frames can be _____ thousands of times.
2. Plastic formwork panels are _____, so even one person can lift them.
3. Formwork is a vertical or horizontal arrangement made to keep concrete in position until it gains strength and _____.
4. The advantage of engineered formwork systems, compared to traditional timber formwork, is the speed of _____.
5. Pour concrete into a _____ to shape it correctly.
6. Structural designs must consider _____ such as wind or movable objects.
7. Exterior wall _____ are the vertical members to which the wall sheathing is attached.
8. _____ formwork is made of timber and plywood and assembled at the building site.
9. In _____ framing, the studs extend the full height of the building.
10. In _____ framing, each floor is framed separately.

2. Compile as many words as you can with the letters of the word.

VERSATILE

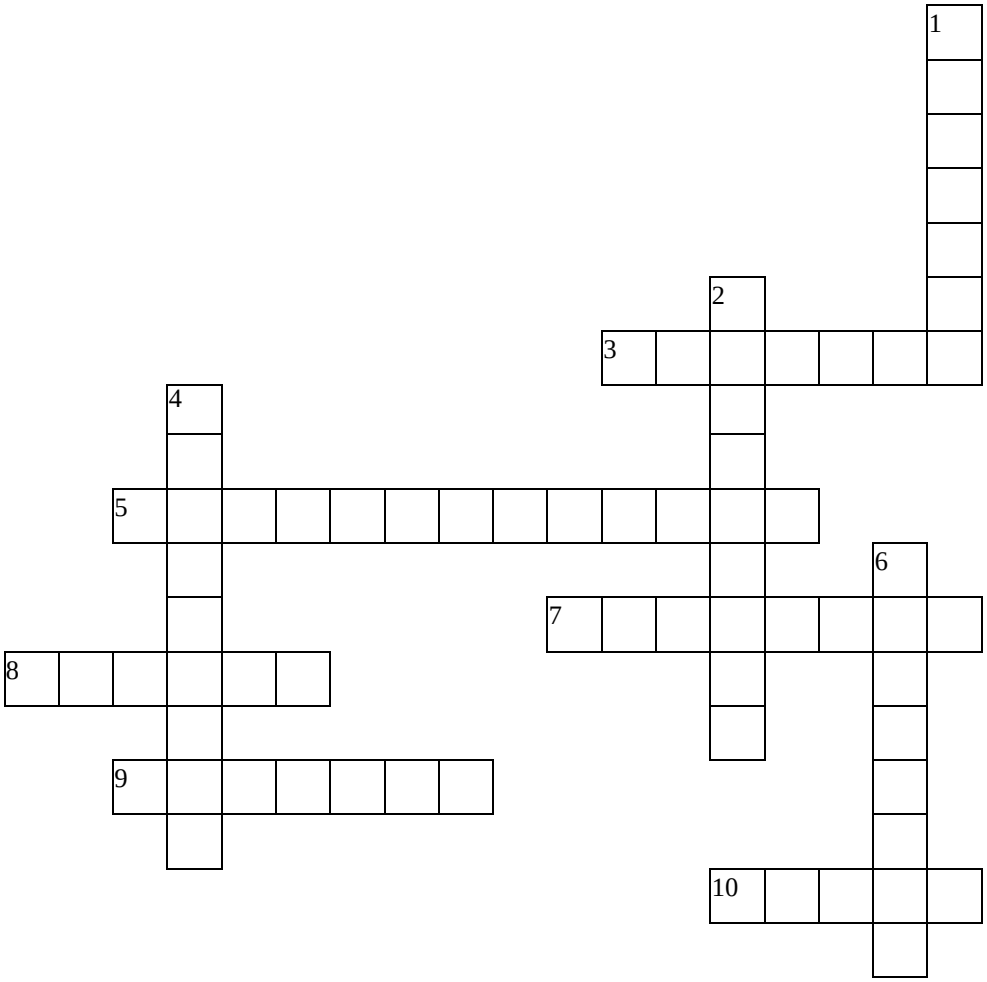
_____

_____

_____

_____

3. Complete the crossword.



Across

3. _____ wall bears the weight of the house from top to bottom.

5. Engineered formwork is built out of _____ modules.

7. The wood from trees such as pines.

8. A horizontal support of timber, stone, concrete, or steel across the top of a door or window.

9. A building material that's made from layers of wood that are glued together.

10. To use something such as influence, etc. in order to make something happen.

Down

1. A building technique based on structural members which provide a stable frame.

2. A person who makes and repairs wooden objects and structures.

4. Able to be used for many different purposes.

6. A vertical or horizontal arrangement made to keep concrete in position until it gains strength and shape.

UNIT 9. ROOFS

1. Read the words and learn them by heart.

tile – черепица
to slope – иметь наклон, клониться
tie-beam – стропильная затяжка
purlin – прогон, обрешетина
roofing felt – рубероид
slate – шиферная кровельная плитка
roof guttering – водосточный жёлоб крыши
ridge piece – коньковый брус (крыши)
to overlap – перекрывать, частично накладываться друг на друга
batten – деревянная рейка, вагонка, обрешетина
gable(d) roof – двускатная крыша
hipped roof – четырехскатная крыша
mansard roof – мансардная крыша
pitched roof – скатная крыша, наклонная крыша

2. Starting off. Answer the questions.

1. What is a roof?
2. What is the function of a roof?

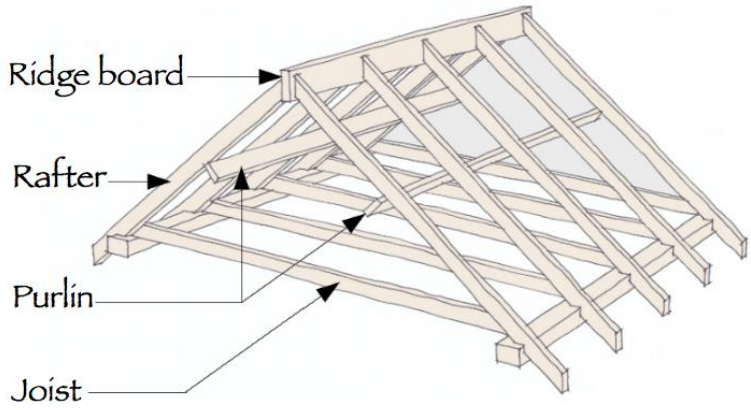
3. Read and translate the text about roofs and check your ideas.

Roofs.

The roof of a building often reflects the climate of the place in which the building is located since it protects the people in it from rain and sun. In dry countries the roof is flat and can be used as an outdoor room when the sun is not too hot. Where it often rains the roof usually slopes so that the wet can run off it, and where there are snowfalls, the roof slopes steeply so that the snow will slide off and not build up into a thick layer. A roof that slopes is called a pitched roof.

Later people found it inconvenient to live in a house with sloping sides, so they built upright walls and laid big beams called tie-beams across the top at regular distances from each other. Then they put up the triangular frameworks resting on the tie-beams. These triangles of

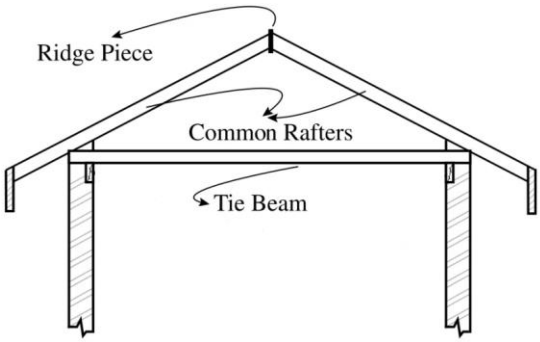
beams are called trusses. A ridge-piece, purlins and rafters were used to complete the skeleton of the roof.



Roof elements.

Source: https://www.quora.com

In the Middle Ages the wooden frame of the roof was not hidden by a ceiling on the inside and was often richly decorated.



Elements of a pitched roof.

Source: https://civilarcho.com/pitched-roof/

The waterproof covering of a pitched roof is usually of tiles, slates, etc. Tiles are thin slabs of baked clay, generally red or brown in colour. Strips of wood called battens are fixed to the outside of the rafters, usually over sheets of weatherproof roofing felt which help to keep out draughts and wind-blown snow. The tiles or slates are then nailed to the battens in regular horizontal rows. Flat roofs usually consist of boards covered with overlapping sheets of roofing felt coated with bitumen. When a roof has to cover a large space, steel trusses are used instead of wood. Large flat roofs may be made of reinforced concrete with a waterproof covering.

Source: Гарагуля С.И. Английский язык для студентов строительных специальностей. Learning Building Construction in English: учебное пособие / С. И. Гарагуля. – Ростов н/Д: Феникс, 2011. – С. 336-337.

4. Decide if the sentences are true or false.

1. The roof design depends on the climate of the place in which a building is located.
2. The roof of a building protects people from rain and sun.
3. In dry countries the roof usually slopes steeply.

4. A roof that slopes is called a flat roof.

5. Triangular frameworks are called trusses.

6. In the Middle Ages the wooden frame of the roof was hidden by a ceiling.

7. Strips of wood called battens are fixed to the inside of the rafters.

8. Tiles are thin slabs of baked wood.

9. Sheets of weatherproof roofing felt help to keep out rains.

10. When a roof covers a large space, wood trusses are used.

5. Match the words to the definitions.

1. tile	**a.** the system of open pipes on a building that collects and carries away rain
2. to overlap	**b.** the waterproof layer that protects from moisture
3. batten	**c.** a horizontal beam that serves to prevent two other structural members from separating, especially one that connects two corresponding rafters in a roof or roof truss
4. slate	**d.** a long strip of wood that is fixed to something to strengthen it or to hold it firm
5. guttering	**e.** to cover something partly by going over its edge; to cover part of the same space
6. tie-beam	**f.** a dark grey rock that can be easily divided into thin pieces, or a small, thin piece of this used to cover a roof
7. roofing felt	**g.** a flat square piece of baked clay or other material, used for covering roofs, floors, etc.

6. Give English equivalents to the following words and word combinations and make up sentences.

1. Водонепроницаемый (непромокаемый)

2. Обожжённая глина

3. Отражать

4. Защищать

5. Стекать

6. Толстый слой

7. Вертикальный (прямой)

8. Средние века

9. Потолок

10. Богато украшенный

11. Сквозняк

12. Горизонтальные ряды

7. Complete the text about cut and fixed roofs with the words from the box.

ready	truss	water
conditions	wood	made
nailed	carpenter	bearing

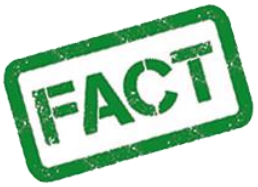
Cut and fixed roofs.

Roofs can be divided in cut roofs, where a (1) _____ measures, cuts and places every length of wood needed for the frame; and fixed roofs, (2) _____ of pre-built and assembled trusses. Trusses are custom-designed by computer so as to adapt to the typical weather (3) _____ of the house. As they generally rest only on outside walls, they leave the inside free to move walls and to accommodate different room sizes.

When the frame of the roof is (4) _____, a waterproof membrane is placed over it and it is held in place by battens (long pieces of (5) _____) that are nailed into the (6) _____ and are the supporting system for the tiles. Tiles are then (7) _____ to the wood. To take away the (8) _____ from the building guttering is used. As heat can go straight out of the roof, insulation is also necessary.

When designing the roof structure, it must be remembered that all the load on the roof has to be transferred to the supporting beams, (9) _____ walls, foundation and the earth.

8. Translate some facts about the history of mansard roofs.



История мансардных крыш.

История мансарды началась в XVII веке. Связана она с именем знаменитого французского архитектора Франсуа Мансара

(François Mansart). Несмотря на то, что до Мансара французские архитекторы использовали высокие французские крыши для жилых помещений, именно он наиболее часто стал использовать их для достижения декоративных эффектов. Одним из первых он снабдил крышу красивыми окнами и превратил чердак в апартаменты для не очень знатных гостей. Эта идея стала популярной в Париже. Стало модно иметь жилую мансарду, а главное очень выгодно. Городские власти Парижа собирали налоги с домовладельца в зависимости от этажности. Но чердак этажом не считался, поэтому денег за него не брали.

В Россию мода на мансарды пришла в начале XVIII века. В Санкт-Петербурге многие здания начали проектировать и строить именно с мансардами. Но много света они дать не могли. В Москве мансард практически не было.

В XX веке, в эпоху индустриального домостроения, когда в архитектуре доминировали плоские крыши, про мансарды практически забыли. С первой половины 1990-х годов, с появлением новых строительных материалов и технологий, мансарды в России стали приобретать большую популярность.

Source: https://ru.wikipedia.org

9. Read about the types of roofs and match the pictures to the correct types.

Types of roofs.

When choosing a roof for your home, the essential consideration should be more than just the design and materials used. The roof type will significantly determine the roof strength, energy efficiency and sustainability. Depending on the shape and number of the slopes roofs may be of different types.

Flat Roof. This roof type may not be entirely flat but have a low-sloped pitch that makes them appear flat. They are more convenient for commercial buildings, but they can also be installed in residential properties. They provide more outdoor space.

For residential buildings, they provide more space for homeowners looking to create space for home gardens. They require fewer roofing materials that make the roof cheaper to construct and maintain. The top needs to be completely waterproof.

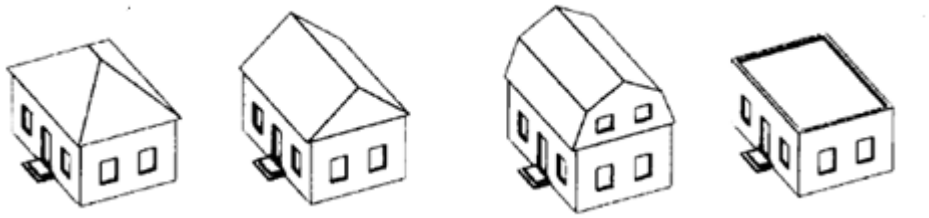
Gable Roof. This roof type is known for its distinguishable triangular shape feature. It's one of the most popular roofs in America. The gable roof is easy to build due to its design and

facilitates home ventilation. The simple design also makes it cheaper to install. The gable roof requires proper frame construction to avoid collapsing.

Mansard Roof. This roof type was adapted from the French and has a much steeper lower slope. Mansard roofs usually have four sides with two slopes on each side. The space created by the roof allows more room inside.

Hip Roof. This roof type has four sides with a slope on every side. They are a preferable option for Americans living in windy areas. The four-sided roof provides stability and durability. However, this roof type doesn't leave much room for ventilation. Their design makes them suitable for snowy areas as snow can slide down easily.

Source: https://championroofing.com/4-types-of-roofs/



1. _____ 2. _____ 3. _____ 4. _____

10. Answer the questions.

1. What does the roof type roof significantly determine?
2. What type of roof can provide more space for homeowners looking to create space for home gardens?
3. What type of roof was adapted from the French?
4. What are the advantages of a gable roof?
5. How many sides does a hip roof have?
6. What type of roof doesn't leave much room for ventilation?
7. Does the top of the flat roof need to be completely waterproof?

11. Make a presentation about other types of roofs and roof developments, for example, green roofs, cool roofs, etc.

UNIT 10. FLOORS

1. Read the words and learn them by heart.

subflooring – черновой настил

slab floor – перекрытие из плит

floor covering – напольное покрытие

joist slab – балочное перекрытие

one-way slab – плита, армированная в одном направлении

two-way slab – плита, армированная в двух направлениях

beam-and-slab floor – железобетонное балочное перекрытие

post-tensioned floor – предварительно напряженное перекрытие

above grade – над уровнем земли

reinforcing steel – арматура

two-way flat plate slab floor – двухсторонняя плоская плита перекрытия

drop panel – прямоугольная плита-оголовок (на железобетонной колонне для опирания плиты перекрытия), утолщение железобетонной плиты перекрытия

2. Starting off. Answer the questions.

1. What is a floor?
2. What is the function of floors?

3. Read and translate the text about floors and check your ideas.

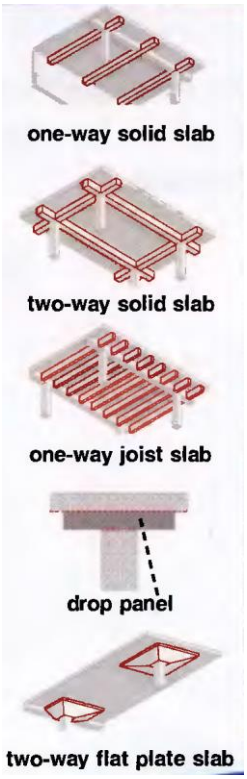
Floors.

Floors are horizontal elements bearing the load of people, furniture and equipment, supported by walls or columns and dividing the building into storeys. Floors vary from simple dirt in a cave to many-layered surfaces made with modern technology. Floors may be stone, wood, bamboo, metal or any other material that can support the expected load.

Floor structure contributes to the general strength of the building system. It is formed of a steel I-beam frame with a horizontal upper surface to which a number of adjacent composite floor panels is fastened firmly.

Floors consist of a subfloor for support and a floor covering used to give a good walking surface. There is a wide variety of floor covering materials: carpet, ceramic tiles, wood flooring, laminated wood or stone.

In modern buildings the subfloor often has electrical wiring, plumbing, and may provide other services built in, like underfloor heating. Subfloors that are below the ground typically are made of concrete. Subfloors above the ground typically are made of plywood.



The arrangement of structural slabs and support.

Concrete floors are common in both single storey buildings and high-rises. There are several different methods of arranging the structural slabs and support. It is important to be familiar with all types.

A standard beam-and-slab floor has concrete slabs supported by concrete beams. Beyond this, designs become more complex. A one-way solid slab floor has load-bearing steel running in the direction of the span. However, a two-way solid slab floor has load-bearing steel running in two directions. These are supported by concrete columns. Concrete drop panels are located in between the columns and the floor. A similar floor without drop panels is called a two-way flat plate slab floor. These are well-suited for above grade floors. Last, a one-way joist slab has a series of horizontal beams that contain reinforcing steel.

There are additional ways to reinforce a concrete floor. Running tendons through concrete, and then tightening and anchoring them after curing creates a strong post-tensioned floor.

Sources: Career Paths. Construction 1. Buildings. Book 2 / Virginia Evans, Jenny Dooley, Jason Revels. – Express Publishing, 2012. – p. 32; Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 25.

4. Give English equivalents to the following words and word combinations and make up sentences.

1. Электрическая проводка
2. Водопроводная система
3. Отопление

4. Пещера

5. Способствовать (вносить вклад)

6. Высотные здания

7. Закрепление (фиксирование)

8. Более сложный

5. Choose the correct answer (multiple correct answers are possible).

1. Floors are _____ elements bearing the load of people, furniture and equipment.

a) vertical;

b) horizontal.

2. Floors may be _____.

a) stone;

b) wood;

c) bamboo;

d) metal.

3. Floors consist of _____.

a) subfloor;

b) floor covering;

c) extra floor.

4. A standard beam-and-slab floor has _____.

a) load-bearing steel running in the direction of the span;

b) concrete slabs supported by concrete beams;

c) a series of horizontal beams that contain reinforcing steel.

5. Running tendons through concrete, and then tightening and anchoring them after curing creates a strong _____ floor.

a) under-tensioned;

b) over-tensioned;

c) post-tensioned.

6. _____ are located in between the columns and the floor.

a) One-way solid slabs;

b) Two-way solid slabs;

c) Concrete drop panels.

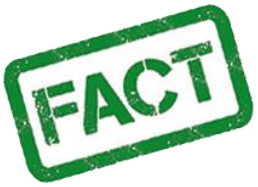
6. Put the words into the correct order to make complete sentences about floors.

1. are ways to floor reinforce additional There a concrete.
2. A directions two-way load-bearing has steel floor running in solid slab two.
3. panels drop are between located the and Concrete the columns floor.
4. supported walls are by Floors columns or.
5. A is for used support subfloor.
6. covering is walking to A give floor a good used surface.

7. Match the words from A and B to make phrases.

A	**B**
1. floor	**a.** solid slab floor
2. two-way	**b.** covering
3. drop	**c.** floor
4. post-tensioned	**d.** joist slab
5. load-bearing	**e.** panels
6. one-way	**f.** grade
7. above	**g.** steel
8. many-layered	**h.** technology
9. modern	**i.** surfaces
10. expected	**j.** load

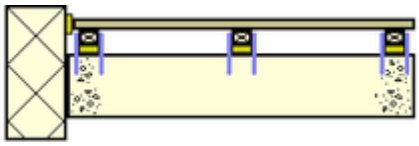
8. Translate the text about floating floors.



Плавающие полы.

Плавающий пол – это способ установки напольного покрытия, при котором отсутствует связь напольного покрытия с

базовой конструкцией здания. Это позволяет полностью исключить влияние процессов усадки конструкции здания на структуру пола.



Floating floor over concrete.

Таким образом, плавающий пол – это несколько слоев разных материалов, не скрепленных с основанием. Поскольку сегодня много строительных и отделочных материалов, то и конструкции могут быть разными. Например, бетонный плавающий пол.

Основные достоинства:

- повышение шумоизоляции на 50%;
- дополнительная теплоизоляция в помещениях;
- простота и скорость монтажа;
- прочность;
- легкость ухода.

Основным недостатком является уменьшение высоты комнат.

Sources: https://stroikadialog.ru; https://ru.wikipedia.org

9. Complete the conversation between a supervisor and an employee with words from the box.

hold the load	have to redo
could collapse	beams and joists
cut wrong	putting

Supervisor: Well, the joists and beams were (1) _____. They're too small for that project. We're going to (2) _____ all of them.

Employee: Isn't there something else we can do? Like (3) _____ a thicker subfloor?

Supervisor: No, it's too dangerous. The smaller beams can't (4) _____. We have to replace them.

Employee: That will be really expensive. We'll have to order brand new (5) _____.

Supervisor: I know, but it's a safety issue. The floor (6) _____. So we have to fix it.

REVIEW. UNITS 9–10.

1. Fill in the gaps using the words in the box.

battens	concrete floor	flat roofs	high-rise	hip roof
drop panels	gable roof	above grade	gutters	subfloor

1. _____ doesn't leave much room for ventilation.
2. _____ provide more space for homeowners looking to create space for home gardens.
3. _____ is known for its distinguishable triangular shape feature.
4. _____ should be cleaned regularly, otherwise water is unable to flow away from the roof.
5. The contractor is installing structural slabs _____ rather than underground.
6. In modern buildings the _____ often has electrical wiring, plumbing, and may provide other services built in, like underfloor heating.
7. Strips of wood called _____ are fixed to the outside of the rafters, usually over sheets of weatherproof roofing felt.
8. This _____ building is over fifty storeys tall.
9. Concrete _____ are located in between the columns and the floor.
10. The _____ of the building is reinforced by steel beams.

2. Compile as many words as you can with the letters of the word.

WEATHERPROOF

_____

_____

_____

_____

3. Find all the words related to Units 9-10 (direction of letters ↕ and →) and give their translation.

V	J	R	T	X	T	W	A	T	E	R	P	R	O	O	F
T	N	N	W	V	M	V	C	O	V	E	R	I	N	G	R
L	J	B	R	S	R	M	A	T	T	B	E	B	T	L	P
D	O	A	E	S	L	A	B	Y	I	X	I	B	D	P	R
C	I	T	R	A	F	T	E	R	L	M	N	G	Q	W	B
Z	S	J	O	E	L	O	Q	X	E	T	F	X	S	S	G
E	T	G	O	M	V	O	B	O	O	C	O	K	P	U	M
T	G	A	F	G	N	M	A	N	S	A	R	D	W	B	V
P	P	B	P	U	Z	F	T	N	L	B	C	S	J	F	U
U	T	L	Z	T	S	L	T	Y	O	L	I	L	W	L	F
R	Y	E	G	T	N	I	E	A	P	A	N	A	N	O	L
L	Q	Y	S	E	C	A	N	Z	E	X	G	T	N	O	A
I	X	Q	N	R	O	G	B	E	A	M	D	E	B	R	T
N	A	P	T	I	M	G	O	D	S	L	D	N	O	I	D
A	X	C	I	N	U	D	L	P	A	N	E	L	M	N	E
E	I	I	O	G	A	O	V	E	R	L	A	P	Y	G	I

UNIT 11. CEILINGS

1. Read the words and learn them by heart.

ceiling – потолок
suspended ceiling – подвесной потолок
gypsum ceiling – гипсовый потолок
stretched ceiling – натяжной потолок
plaster – штукатурка
void – пустота, пустое пространство
vent – вентиляционное отверстие
maintenance – эксплуатация и техническое обслуживание
to tailor – настраивать, приспосабливать
transverse (cross) – поперечный
enclosure – огораживание, огороженное пространство
light fittings – осветительные приборы
treatment – обработка
PVC – поливинилхлорид
fabric membrane – мембранная ткань
underside – нижняя поверхность, нижняя часть
acoustic ceiling – акустический потолок (потолок с сильным звукопоглощением)
noise reduction coefficient (NRC) – коэффициент звукопоглощения

2. Starting off. Answer the questions.

1. What is a ceiling?
2. What is the function of ceilings?

3. Read and translate the text about ceilings and check your ideas.

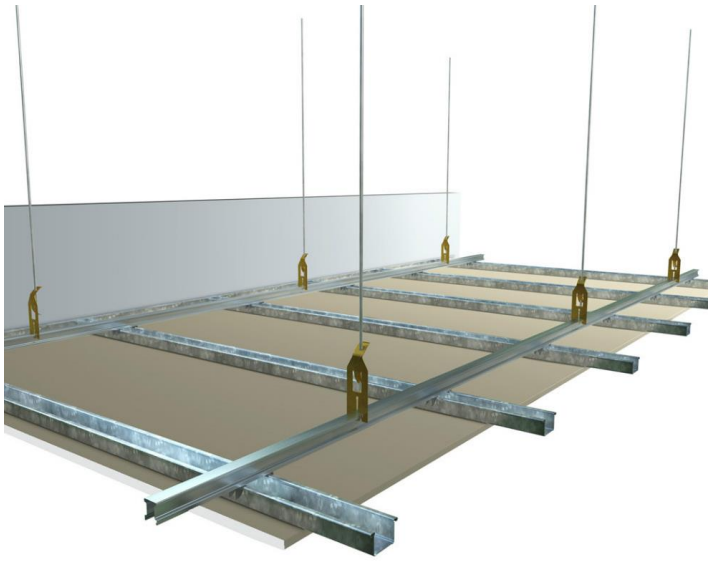
Ceilings.

To cover a room, beams of stone, wood, iron or reinforced concrete are thrown from one wall to another. These transverse (or cross) beams are then linked together at the right angle by other shorter beams. Ceilings help to create enclosure and separation between spaces, they help to control the diffusion of light and sound around a room, and help prevent the passage of sound between rooms. They have fire resistant properties and may also accommodate building services such as vents, lighting and so on, as well as being able to conceal other services such as pipes and wiring.

Ceilings are classified according to their appearance or construction. Ceilings can be suspended, stretched (which hide all defects), etc.

In some buildings, it is possible to omit a ‘finished’ ceiling completely and simply expose the structural and mechanical components of the building to the interior. This offers the advantages of economy and ease of access for maintenance.

The most common type of ceiling is the suspended ceiling, which is suspended from structural elements above (typically a floor or roof slab), creating a void between the underside of the slab and the top of the suspended ceiling. As well as concealing the underside of the slab, this void can provide a useful space for the distribution of heating, ventilation and air conditioning (HVAC) services and plumbing and wiring services, as well as providing a platform for the installation of light fittings, wireless antenna, fire and smoke detectors and so on.



Suspended ceiling system.

https://www.baysideplasterboard.com.au/

Acoustic ceilings tend to be made from fibrous materials that absorb sound energy, unlike plaster and gypsum ceilings. They do not necessarily reduce the transmission of sound between spaces, rather they reduce the amount that reflects back into the space and so can be used to tailor the acoustic character of a space. The sound absorption performance of a ceiling material is expressed in terms of its noise reduction coefficient (NRC).

A stretched ceiling (or stretch ceiling) is a form of suspended ceiling that consists of a thin membrane stretched across a frame that runs around the perimeter of the ceiling. They are typically lightweight and relatively easy to install and can span large areas. The fabric membrane is commonly a PVC coated polyester which can be supplied in a wide range of colours.

A cathedral ceiling is any tall ceiling area similar to those in a church.

Ceilings have frequently been decorated with fresco painting, mosaic tiles and other surface treatments. Many historic buildings have celebrated ceilings. Perhaps the most famous is the Sistine Chapel ceiling by Michelangelo.

Ceiling height may have psychological impacts.

Sources: https://www.designingbuildings.co.uk; https://en.wikipedia.org/wiki/Ceiling

4. Decide if the sentences are true or false.

1. Ceilings control the diffusion of light and sound around a room.
2. Ceilings do not have fire resistant properties.
3. It is possible to omit a 'finished' ceiling completely and simply expose the structural and mechanical components of the building.
4. Noise reduction coefficient deals with the sound absorption performance of a ceiling material.
5. A suspended ceiling conceals the underside of the slab.
6. Plaster and gypsum ceilings do not absorb sound energy.
7. Cathedral ceiling consists of a thin membrane stretched across a frame that runs around the perimeter of the ceiling.
8. A stretched ceiling is relatively easy to install and can span large areas.
9. A cathedral ceiling is low ceiling area similar to those in a church.
10. Ceilings conceal other services such as pipes and wiring.

5. Complete the sentences with words from the text.

1. _____ can span large areas.
2. Ceiling height may have _____ impacts.
3. The most common type of ceiling is _____.
4. Ceilings are classified according to _____ and _____.
5. To cover a room, _____ of stone, wood, iron or reinforced concrete are thrown from one wall to another.
6. Many _____ buildings have celebrated ceilings.
7. A stretched ceiling consists of a thin membrane stretched across a _____.
8. Acoustic ceilings do not necessarily _____ the transmission of sound between spaces.
9. Ceilings may also accommodate building services such as vents, _____ and so on.

6. Match the words to the definitions.

1. suspended ceiling	**a.** the part of an electric light unit that is fixed to a ceiling or wall, into which the bulb is fitted
2. enclosure	**b.** a ceiling covered with or built of material with special acoustical properties
3. light fitting	**c.** a secondary ceiling, hung below the main (structural) ceiling
4. stretched ceiling	**d.** ceiling system consisting of a perimeter track and lightweight fabric membrane which stretches and clips into the track
5. cathedral ceiling	**e.** situated or extending across something
6. transverse	**f.** an area that is surrounded by a barrier
7. acoustic ceiling	**g.** a high ceiling that has two sides that slant downwards from a pointed top

7. Give English equivalents to the following words and word combinations and make up sentences.

1. Поперечные балки
2. Огнеупорные свойства
3. Обработка поверхности
4. Волокнистые материалы
5. Отражать
6. Поглощать
7. Часто
8. Фресковая живопись
9. Мозаичная плитка
10. Высота потолка
11. Сикстинская капелла
12. Легкость доступа
13. Нижняя часть плиты
14. Полезный
15. Распределение
16. Отопление

17. Беспроводной
18. Детектор дыма
19. Исторические здания
20. Устанавливать

8. Complete the text about the Sistine Chapel ceiling with the words from the box.

electing	painters	relationship
best known	art	Vatican
elements	Church	includes

The Sistine Chapel ceiling.

The Sistine Chapel ceiling painted by Michelangelo between 1508 and 1512, is a cornerstone work of Renaissance (1) _____. The ceiling is that of the Sistine Chapel, the large chapel built in the (2) _____ between 1477 and 1480 by Pope Sixtus IV, for whom the chapel is named. It was painted at the commission of Pope Julius II. The Sistine Chapel was used for great ceremonies such as (3) _____ and inaugurating new popes.

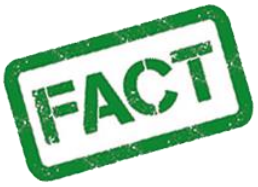
Sistine Chapel ceiling by Michelangelo.

Source: https://www.thoughtco.com

The ceiling's various painted (4) _____ form part of a larger scheme of decoration within the Chapel, which includes the large fresco *The Last Judgement* on the sanctuary wall, also by Michelangelo, wall paintings by several leading (5) _____ of the late 15th century including Sandro Botticelli, Domenico Ghirlandaio and Pietro Perugino, and a set of large tapestries by Raphael, the whole illustrating much of the doctrine of the Catholic (6) _____.

Central to the ceiling decoration are nine scenes from the Book of Genesis, of which *The Creation of Adam* is the (7) _____, the hands of God and Adam being reproduced in countless imitations. The complex design (8) _____ several sets of individual figures.

The complex and unusual iconography of the Sistine ceiling has been explained by some scholars as representing the essential phases of the spiritual development of humankind seen through a very dramatic (9) _____ between humans and God.



9. Translate some facts about the history of stretched ceilings.

История натяжных потолков.

Впервые идея декорировать потолок материалом упоминается в летописях древнего мира. В богатых домах античной Греции, Рима и Египта было принято подвешивать под потолком отрезы шелковой ткани, гармонирующей с цветом стен.

Позже идея оформления жилища с помощью тканевых потолков стала популярной в Европе. В 17 веке на место шелка пришел более практичный и доступный хлопок, который обрабатывали раствором мела для улучшения свойств и внешнего вида. Поменялась и система крепления: теперь полотна не свободно струились, а натягивались и закреплялись. Тем не менее, позволить себе подобную роскошь могли только знатные люди.

Третье, ставшее триумфальным, возвращение моды на натяжные потолки произошло в середине 20 века. Законодательницей новой моды стала Франция. Именно здесь натуральную, но недолговечную ткань заменили на новое достижение химической промышленности – поливинилхлорид. Возрожденная традиция декорировать потолки материалом обрела новую жизнь. Кроме того, теперь они не нуждались в регулярном обновлении.

Source: https://www.sirius-potolki.ru

UNIT 12. ARCHES

1. Read the words and learn them by heart.

arch – арка
cyclopean – гигантский, крупный
Mycenean – микенский
gap – промежуток
curve – кривая
pointed – остроконечный
inverted – перевернутый
corbel arch – ложная арка
voussoir – клинчатый камень
arc – дуга
noncircular – некруглый
midpoint – серединная точка
span – расстояние (между опорами арки свода)
advancing course – выдвигающийся вперед горизонтальный ряд кладки
curved – изогнутый
lintel – перемычка окна или двери
flank to flank – бок о бок, рядом
keystone – замковый камень
monolithic – монолитный
segmental – сегментный
wedge – клин (*n*); закреплять клином (*v*)
rough – неотделанный, необработанный
uniformly – одинаково, единообразно
spring (springing line) – линия пят (линия начала изгиба арки)

2. Starting off. Answer the questions.

1. What is an arch?
2. What is the function of arches?

3. Read and translate the text about arches and check your ideas.

Arches.

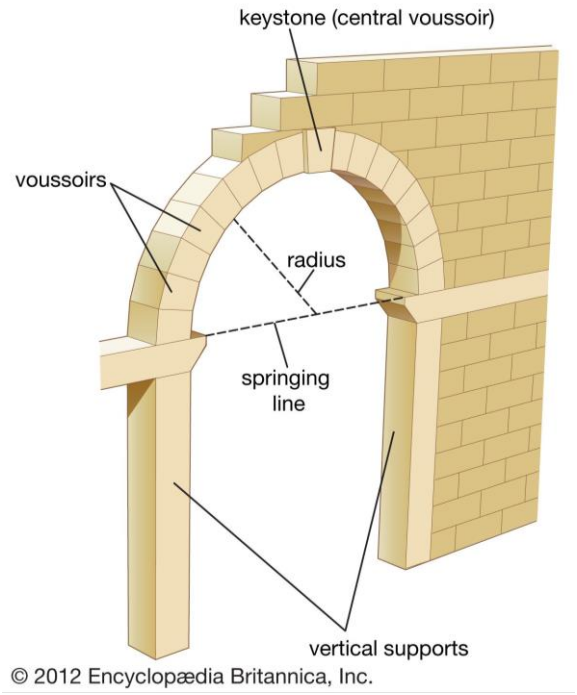
Throughout most of architectural history, the arch has been the chief means of overcoming the spanning limitations of single blocks of stone or lengths of timber.

There were three types of arches in ancient architecture. One, which survives today in Mycenean cyclopean construction, consisted of only three rough blocks of stone, the central one

somewhat larger than the gap between the other two and wedged between them. A second, of which monumental examples survive in Egypt from the 3rd millennium BC, consisted of only two long blocks inclined toward one another as an inverted V-shape. This form was probably constructed even earlier in timber. The third, of which surviving examples are very widespread, was what is commonly known as the false or corbeled arch.

None of these early forms was very efficient. Spans rarely exceeded 2 m. The spanning of substantially wider gaps called for true arches constructed on centering from large number of bricks or stone voussoirs. Small true brick arches appeared first in Mesopotamia and Egypt.

The Romans needed large buildings. They used stone, brick and concrete as building materials. Their architecture had the round arch as its basis. The arch is a curved member that is used to span an opening and to support loads from above. The arch formed the basis for the evolution of the vault. The Roman arch is a round arch drawn from a single centre, formed in a continuous curve. The arch can be called a curved lintel. Its construction depends essentially on the wedge. In the Figure a series of wedge-shaped blocks – i.e. ones in which the upper edge is wider than the lower edge – are set flank to flank. These blocks are called voussoirs. The central voussoir is called the keystone. The point from which the arch rises from its vertical supports is known as the spring, or springing line. The curve in an arch may be semicircular, segmental (consisting of less than one-half of a circle), or pointed (two intersecting arcs of a circle), and noncircular curves can also be used successfully.



Parts of an arch.

The Romans used the semicircular arch in bridges, aqueducts and large-scale architecture. The Arabs popularized the pointed arch in their mosques. Medieval Europe made great use of the pointed arch, which constituted a basic element in Gothic architecture. In the late Middle Ages the segmental arch was introduced. This form and the elliptical arch had great value in bridge engineering. One of the most ancient kinds of arch is a corbel arch or false arch: it is masonry built over a wall opening by uniformly advancing courses from each side until they meet at midpoints.

In masonry construction, arches have several great advantages over horizontal beams, or lintels. They can span much wider openings, and this can be achieved using small, easily carried blocks of brick or stone rather than by a massive, monolithic stone lintel. An arch can also carry a much greater load than a horizontal beam.

Sources:

Ивянская И.С. Английский язык для архитекторов: учебник. – М.: КУРС: ИНФРА-М, 2014. – С. 68-70.

Безручко Е. Н. Английский для архитекторов: учебное пособие по английскому языку для студентов архитектурных и строительных специальностей вузов / Е. Н. Безручко. – Ростов н/Д: Издательский центр «МарТ»; Феникс, 2010. – С. 188.

4. The sentences below all contain mistakes. Find and correct the mistakes.

1. The point from which the arch rises from its vertical supports is known as voussoir.

_____

2. The vertical supports in an arch may be semicircular, segmental (consisting of less than one-half of a circle), or pointed (two intersecting arcs of a circle).

_____

3. There were five types of arches in ancient architecture.

_____

4. In masonry construction, horizontal beams have several great advantages over arches.

_____

5. Early forms of arches were very efficient.

_____

6. The arch is a straight member that is used to span an opening and to support loads from above.

_____

7. The Arabs popularized the corbel arch in their mosques.

_____

8. In the late Middle Ages the pointed arch was introduced.

_____

9. Roman architecture had the square arch as its basis.

_____

10. The central spring is called the keystone.

_____

5. Match the words to the definitions.

1. aqueduct	**a.** wedge stone
2. keysone	**b.** is an arch with a pointed crown, whose two curving sides meet at a relatively sharp angle at the top of the arch
3. voussoir	**c.** the point from which the arch rises from its vertical supports
4. corbel arch	**d.** central voussoir
5. pointed arch	**e.** a construction like an arch but composed of masonry courses corbeled until they meet
6. spring (springing line)	**f.** having an uneven or irregular surface; not smooth or level
7. rough	**g.** an artificial channel for conveying water, typically in the form of a bridge across a valley or other gap

6. Give English equivalents to the following words and word combinations and make up sentences.

1. Главный способ
2. Древняя архитектура
3. Каменные блоки
4. Наклоненный друг к другу
5. Общеизвестный
6. Превышать
7. Существенно (значительно)
8. Сплошная (непрерывная) кривая
9. Край
10. Вертикальные опоры
11. Полукруглый
12. Крупномасштабный
13. Мечеть
14. Средневековый
15. Готическая архитектура
16. Строительство мостов

7. Match the synonyms.

1. to apply	**a.** side
2. brickwork	**b.** to build
3. lateral	**c.** huge
4. faced	**d.** restriction
5. massive	**e.** masonry
6. to construct	**f.** lined
7. limitation	**g.** to use

8. Replace the words in italics by synonyms.

emerge main popular go beyond instead

1. The arch has been the *chief* means of overcoming the spanning limitations of single blocks of stone.
2. Spans rarely *exceeded* 2 m.
3. From the first century AD the Romans began to use concrete *in place* of cut stone for all the longer spans.
4. The pointed arches were *widespread* in the Middle Ages.
5. The Islamic pointed arches were the first to *appear*.

9. Put the words and phrases from the box in the correct column.

steel, corbeled, stone, rounded, voissoir, spring, keystone, cast-iron, reinforced concrete, inverted, timber, pointed, brick

Arch	Building Material
…	…

10. Match the English types of arches to their Russian equivalents.

1. арка зонтичная	**a.** corbel(ed) arch
2. арка колоколообразная	**b.** horseshoe arch
3. арка ложная	**c.** umbrella arch
4. арка подковообразная	**d.** elliptical arch
5. арка полукруглая	**e.** pointed arch
6. арка ребристая	**f.** triumphal arch
7. арка стрельчатая	**g.** ribbed arch
8. арка триумфальная	**h.** bell arch
9. арка эллиптическая	**i.** semicircular arch

11. Draw the types of arches given in exercise 10 and describe them.

12. Complete the text about the Triumphal arch on the Square of Star with the words from the box.

participated	reign	consists of
laid	decided	sculptors
celebrate	elaborate	parades

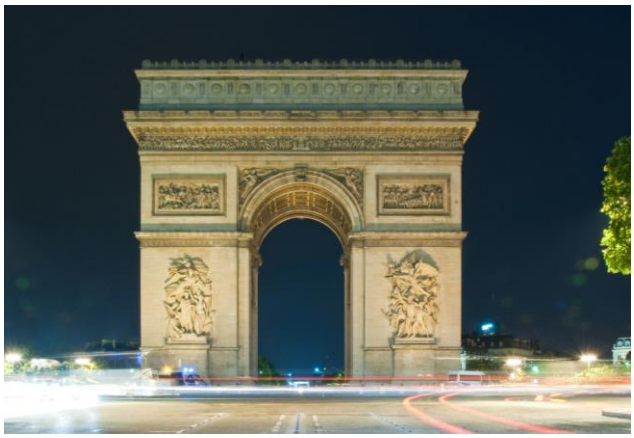
Triumphal arch on the Square of Star.
(Arc de Triomphe. Place de 1'Etoile)

A triumphal arch is a structure in the shape of a monumental archway, usually built to (1) _____ a victory in war. The arch is invariably a free-standing structure, quite separate from city gates or walls. In its simplest form a triumphal arch (2) _____ two pillars connected by an arch, crowned with a superstructure on which a statue or a quadriga might be put or which can have commemorative inscriptions. More (3) _____ triumphal arches have side archways, typically a pair.

Napoleon (4) _____ to erect two triumphal arches in Paris in 1806 as the monuments to the glory of French arms. One of them was erected on the Place de 1'Etoile (since 1970 – the Place Charles de Gaulle).

The cornerstone of the arch was (5) _____ on August 15, 1806. Architect J.F. Chalgrin was in charge of the construction. After his death in 1811 another architect continued the work. The construction was finally completed during the (6) _____ of King Louis-Philippe. The names of 558 generals who (7) _____ in the battles of these wars are carved on the inner walls of the arch.

From the top of the arch you can see the entire city. The grave of the Unknown Soldier is located under the central vault of the arch. Military (8) _____ begin here.



Triumphal arch on the square of star.

Source: https://en.wikipedia.org

The arch is 50 m high and 45 m wide. It is decorated by reliefs made by famous French (9) _____ and represent the most significant moments of the Wars of the French Revolution and the Napoleonic Wars.

In 1840 the funeral procession accompanying the remains of Napoleon I to the capital passed under this arch.

In 1885 the triumphal arch was covered by black crepe for an entire day as a token of mourning for the great French writer Victor Hugo, son of a Napoleonic general. Under the arch passed the processions accompanying the presidents of France on their final journey.

***

quadriga – квадрига (антич. двухколёсная колесница, запряжённая четвёркой лошадей в один ряд)

Place = Square; (франц.) Arc = Arch, Etoile – Этуаль (Звезда)

Charles de Gaulle – Шарль де Голь (1890–1970), французский политический и государственный деятель, основатель и первый президент Пятой республики

Jean-Frangois Chalgrin – Шальгрен Жан Франсуа (1739 – 1811)

Louis-Philippe – Людовик-Филипп, французский король (1830 – 1848)

13. Make a presentation about one of the topics.

1. Roman arches.
2. Gothic arches.
3. Famous triumphal arches.

4. Modern arched type structures.

5. Ancient arched type structures.

14. Translate some facts about arches.

Арки.

Арка выкладывается обычно из камней клиновидной формы.

Впервые арки (каменные) появились в архитектуре Древнего Востока. Затем получили широкое распространение в античном Риме.

Арки можно классифицировать с разных точек зрения, например:

1. по функции: обеспечивающие проход; несущие, являющиеся частью конструкции, например, поддерживающие мост или акведук; не выполняющие никакой конструктивной роли – декоративные; арки, являющиеся памятниками – мемориальные или триумфальные;

2. по положению: отдельно стоящие или являющиеся частью сооружения;

3. по конструкции: клинчатые, ложные и др.;

4. по форме – подковообразные, стрельчатые и т.д. Стрельчатые арки характерны для готической архитектуры, подковообразные – для арабской;

5. по количеству ярусов: одноярусные, двухярусные, многоярусные;

6. по месту возникновения и стилю: голландская, готическая и т.д.;

7. по материалу, из которого выполнены: каменные, железобетонные, кирпичные и т.д.

Source: Ивянская И.С. Английский язык для архитекторов: учебник. – М.: КУРС: ИНФРА-М, 2014. – С. 287-288.

REVIEW. UNITS 11–12.

1. Fill in the gaps using the words in the box.

voussoirs	span	transverse	acoustic	stretched
triumphal	plumbing	unsuitable	beams	pointed

1. _____ arch was the basic element in Gothic architecture.
2. _____ ceilings tend to be made from fibrous materials that absorb sound energy.
3. To cover a room, _____ of stone, wood, iron or reinforced concrete are thrown from one wall to another.
4. Arches can _____ much wider openings.
5. A _____ ceiling consists of a thin membrane stretched across a frame that runs around the perimeter of the ceiling.
6. The void between the slab and the top of the suspended ceiling can provide a useful space for the distribution of heating, ventilation and air conditioning (HVAC) services and _____ and wiring services.
7. A series of wedge-shaped blocks which are set flank to flank are called _____.
8. A _____ arch is a structure in the shape of a monumental archway, usually built to celebrate a victory in war.
9. The main roof beams are given extra support by the smaller _____ beams.
10. Arches were known in ancient Egypt and Greece but were considered _____ for monumental architecture and were little exploited.

2. Compile as many words as you can with the letters of the word.

MAINTENANCE

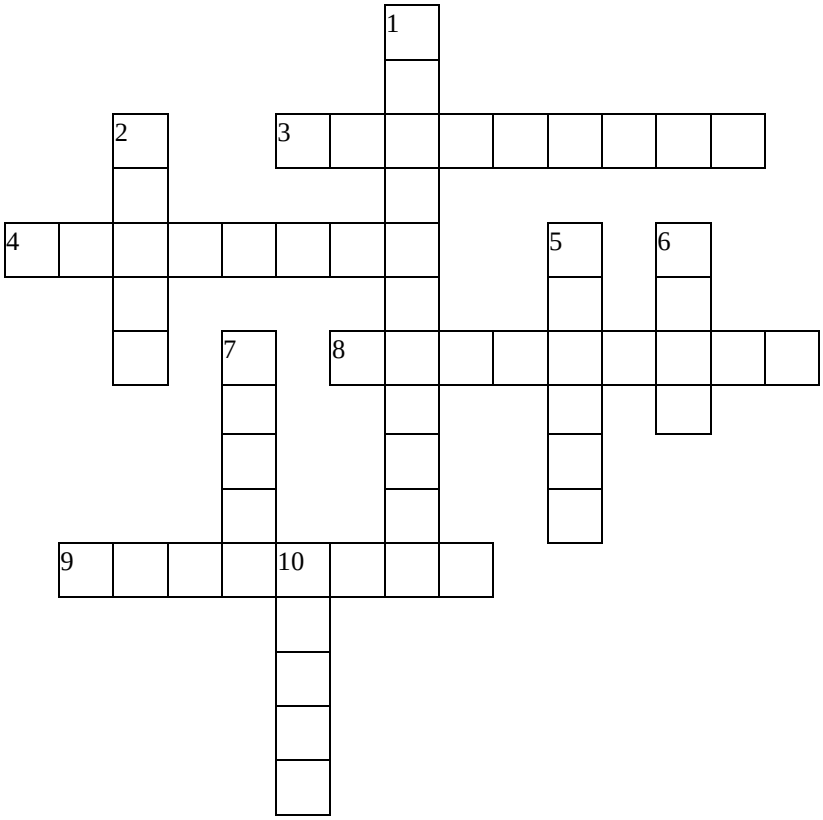
_____

_____

_____

_____

3. Complete the crossword.



Across

3. In a way that is the same in all cases and at all times.

4. A point at or near the center or middle.

8. The bottom or lower side or surface of something.

9. Put upside down or in the opposite position, order or arrangement.

Down

1. The act of keeping property or equipment in good condition by making repairs, correcting problems, etc.

2. A piece of wood, metal or other material with a pointed edge at one end and a wide edge at the other, used to keep two things apart or, when forced between two things, to break them apart.

5. The point from which the arch rises from its vertical supports.

6. A completely empty space.

7. A line or outline which gradually deviates from being straight for some or all of its length.

10. Having a coarse or uneven surface, as from projections, irregularities, or breaks; not smooth.

UNIT 13. VAULTS

1. Read the words and learn them by heart.

vault – свод
curvature – изгиб, кривизна
groin vault – крестовый свод
rib – ребро крестового свода
rib (ribbed) vault – ребристый свод
fan vault – веерный свод
corbel vault – ложный свод
convex – выпуклый
concave – вогнутый
star vault – звёздчатый свод
buttress – контрфорс (вертикальный выступ, выполняющий функцию усиления несущей стены)
voussoir vault – клинчатый свод
shell vault – свод-оболочка
barrel vault – цилиндрический свод
intersection – пересечение
outward – внешний
rigidity – жесткость
conical – конический

2. Starting off. Answer the questions.

1. What is a vault?
2. What is the function of vaults?

3. Read and translate the text about vaults and check your ideas.

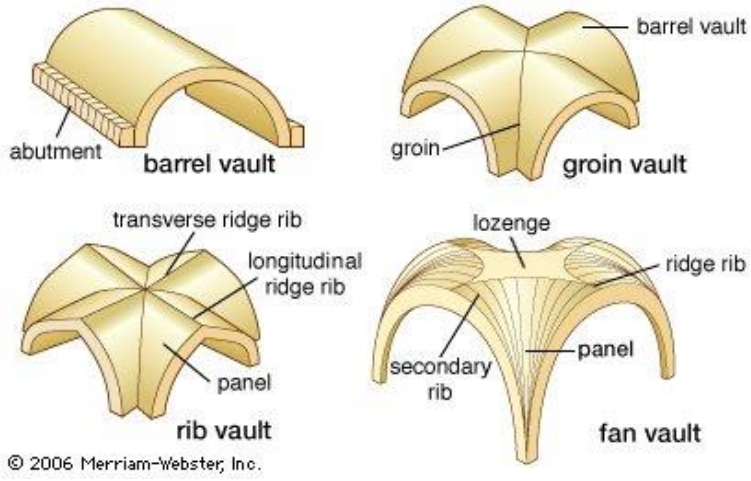
Vaults.

A vault is a structural form composed of a series of arches, typically found in the construction of ceilings or roofs. Vaults must be able to withstand the outward pressure on the lower parts of the vault imposed by the structure above. The pressure can be resisted by thick supporting walls, supporting columns, buttresses, etc.

The simplest kind of vault is known as the barrel (wagon or tunnel) vault, which is generally semicircular in section: it is a series of arches placed side by side, i.e., one after another. Barrel vaults are known from Ancient Egypt, and were used extensively in Roman architecture. Early barrel vault designs occur in northern Europe, Turkey, Morocco and other

regions. In medieval Europe the barrel vault was an important element of stone construction in monasteries, castles and other structures.

Roman architects discovered that two barrel vaults that intersected at right angles formed a groin vault, which, when repeated in series, could span rectangular areas of unlimited length. The groin vault, however, requires great precision in stone cutting, an art that declined in the West with the fall of Rome. Groin vault construction was first exploited by the Romans. It reached its ultimate expression in the Gothic architecture of the Middle Ages.



Types of vaults.

Source: https://www.britannica.com

Medieval European builders developed modification, the rib vault, a skeleton of arches or ribs on which the masonry could be laid. The medieval mason used pointed arches; unlike round arches, these could be raised as high over a short span as over a long one. To cover rectangular areas, the mason used two intersecting vaults of different widths but of the same height.

A fan vault is a concave conical vault whose ribs, of equal length and curvature, radiate like the ribs of a fan. In addition to these kinds there are many others. The main of them are star vault (or stellar vault, star-ribbed vault), voussoir vault, conical vault, corbel vault (a masonry roof constructed from opposite sides or a circular base, by courses projecting slightly inward until they meet).

Nineteenth-century builders, using new materials, could construct large iron skeletons as frameworks for vaults of lightweight materials – for example, the glass-vaulted Crystal Palace of the 1851 Great Exhibition in London. Because the new materials eliminated weight problems, the simple barrel vault returned to favour for such structures as railroad terminals and exhibition halls. In many modern frame systems the vault has lost its functional significance. The reinforced-concrete shell vault is an important innovation. A shell vault is a structure of thin material gaining its rigidity through its calculated shape.

Sources: https://www.britannica.com/technology/vault-architecture;

Ивянская И.С. Английский язык для архитекторов: учебник. – М.: КУРС: ИНФРА-М, 2014. – С. 72.

4. Answer the questions.

1. What is a vault?
2. What modification did Medieval European builders develop?
3. What is a shell vault?
4. In what types of buildings was a barrel vault used in medieval Europe?
5. Is the vault still functionally significant in modern frame systems?
6. What can vaults withstand?
7. What did the Roman architects discover?
8. What does the groin vault require?
9. What is an important innovation?
10. Where did early barrel vault designs occur?

5. Match the types of vaults to the definitions.

1. rib vault	**a.** a structure of thin material gaining its rigidity through its calculated shape
2. groin vault	**b.** vault reinforced by masonry ribs
3. fan vault	**c.** a structure having the form of a vault but constructed on the principle of a corbel arch
4. barrel vault	**d.** vault produced by the intersection at right angles of two barrel vaults
5. shell vault	**e.** a continuous arched shape that may approximate a semi-cylinder in form, resembling the roof of a tunnel
6. star vault	**f.** a concave conical vault whose ribs, of equal length and curvature, radiate like the ribs of a fan
7. corbel vault	**g.** a ribbed vault in which the ribs and liernes are arranged in a starlike pattern

6. Give English equivalents to the following words and word combinations and make up sentences.

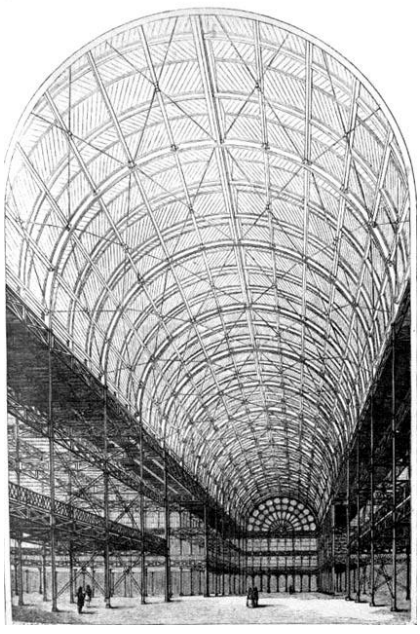
1. Противодействовать (оказывать сопротивление)
2. Простейший вид

3. Широко (обширно) используется
4. Легковесные материалы
5. Замки
6. Безграничный (бесконечный)
7. Высокая точность
8. Приходить в упадок
9. Ширина
10. Монастыри
11. Одинаковая длина
12. Устранять (исключать)
13. Выставочные залы

7. Complete the text about the Crystal Palace with the words from the box.

method	opposite	months
palace	designed	daylight
wide	require	strong

Crystal Palace.



The Roof of the Exhibition Hall.

Source: https://victorianweb.org

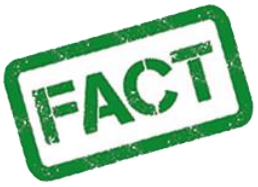
Generally regarded as the first modern building, the Crystal Palace was (1) _____ by Sir Joseph Paxton (1801–1865) for the Great Exhibition of the Works of Industry of All Nations, the first world's fair, held in Hyde Park, London, during the summer of 1851. Featuring modular, prefabricated, iron and glass construction, the Crystal Palace stretched 1,848 feet long, 72 feet (2) _____, and 64 feet high, with a barrel-vaulted transept rising to 104 feet. It was built from start to finish in just seven (3) _____, at a cost of £170,000.

The introduction of the sheet glass (4) _____ into Britain by Chance Brothers in 1832 made possible the production of large sheets of cheap but

(5) _____ glass, and its use in the Crystal Palace created a structure with the greatest area of glass ever seen in a building. It astonished visitors with its clear walls and ceilings that did not (6) _____ interior lights.

Inside, it was impossible for visitors to discern the size of the building, and the Crystal Palace was in all likelihood the first building in which a person, standing at one end, could not see the (7) _____ end. Moreover, the glass walls and roof provided a maximum of (8) _____ and a minimum of enclosure, prompting many visitors to describe the building as a "fairy palace".

It has been suggested that the name of the building was given by the playwright Douglas Jerrold, who in July 1850 wrote in the satirical magazine *Punch* about the forthcoming Great Exhibition, referring to a "(9) _____ of very crystal".



8. Translate some facts about the history of vaults.

Эволюция сводов.

Конструкция сводов являлась следующим шагом в развитии архитектуры. Ей предшествовала стоечно-балочная система. Несмотря на то, что блоки из камня и кирпич вскоре заменили древесину, стоечно-балочная система оставалась основным принципом строительства в архитектуре Древнего Египта и Древней Греции. Величина прочности камня на изгиб ограничивала в стоечно-балочной конструкции ширину пролета примерно до 5 м.

Ситуация изменилась лишь с изобретением цемента и бетона, а также с развитием науки, которая позволила рассчитывать более сложные конструкции. Применение сводов, где камень работает уже не на изгиб, а на сжатие, позволило значительно превысить размер пролета от 5 метров стоечно-балочной системы.

Хотя цилиндрические своды появились уже в IV – III тыс. до н.э. в Египте и Месопотамии, их массовое использование началось лишь в архитектуре Древнего Рима. К этому времени принято относить изобретение основных типов сводов. Со временем число этих типов увеличилось.

Source: https://ru.wikipedia.org

UNIT 14. DOMES

1. Read the words and learn them by heart.

dome – купол
lantern – фонарь
купола (просвет в крыше)
onion dome – луковичный купол
to surpass – превосходить
saucer dome – плоский купол
apex – вершина (сооружения)
Mycenae – Микены (древний город, один из центров Микенской культуры, позднее – греческой цивилизации)
pendentives – паруса купола
drum – барабан (купола)
rotunda – ротонда

2. Starting off. Answer the questions.

1. What is a dome?
2. What is the function of domes?

3. Read and translate the text about domes and check your ideas.

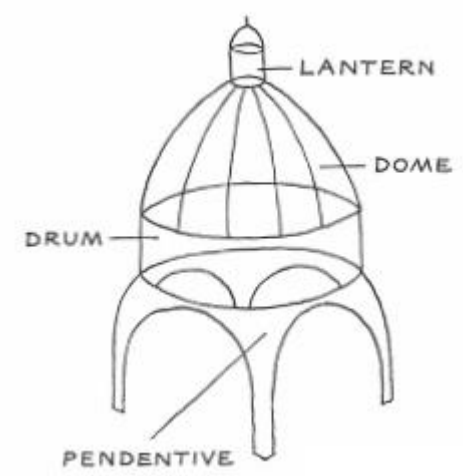
Domes.

The dome has a long history in the built environment, and has been a design feature of many different kinds of architecture around the world. Domes are prominent features of Persian, Roman, Byzantine, Islamic and Italian Renaissance design.

In its simplest form, a dome is a hollow semi-spherical structural element. Domes can be supported by an elliptical or circular wall called a “drum”. If this structure extends to ground level, the round building may be called a “rotunda”. Circular domes can be raised over square or rectangular buildings by pendentives. Pendentives are vaults in the form of spherical triangles that connect arches from corner piers and unite at the apex of the arches to form a circular base upon which the domes rests.

The simple dome form, set directly on the ground, was the first completely manmade enclosure. Simple domed huts can still be found throughout the world. However, as construction

and design techniques developed, they became more popular as a means of showcasing grand structures such as cathedrals, legislative buildings, etc.



Dome elements.

Source: https://architecturaltravels.wordpress.com

The dome, having sharply pointed profile, had already achieved monumental proportions by about the 14th century BC in the great tombs at Mycenae. But these tombs were not completely freestanding.

The full development of the potential of the truly freestanding dome owed much to Roman concrete. Roman builders constructed over the Pantheon in the early 2nd century a dome that has twice since been equaled but never really surpassed.

The later Western development was initiated by an achievement that probably exceeded that of the Pantheon dome. This was Brunelleschi's construction of the dome of Florence Cathedral in the early 15th century. A major difficulty here was the octagonal plan form which Brunelleschi was constrained to follow throughout the height of the dome itself. His central idea was to construct it, nevertheless, as if it were a circular dome of the same internal diameter as the diagonals of the octagon − a diameter that slightly exceeded that of the Pantheon dome. In this way he succeeded in completing it as the first Renaissance double dome.

A dome can be considered as an arch which has been rotated around its vertical axis. A small dome can be constructed of ordinary masonry. Larger domes have all been built as double domes, with inner and outer shells. Many domes are topped by a lantern, a structure with openings (or windows) to admit light in the interior.

Domes can be of different kinds, e.g. saucer and onion domes. Saucer domes have profiles of less than half a circle. They are seen occasionally in Byzantine churches and mosques.

The onion dome resembles more than half of a sphere. Their height usually exceeds their width and they are often gilded or brightly painted. These are traditionally associated with Russian architecture, in particular their multi-domed churches.

Sources: Ивянская И.С. Английский язык для архитекторов: учебник. – М.: КУРС: ИНФРА-М, 2014. – С. 194-195;

Безручко Е. Н. Английский для архитекторов: учебное пособие по английскому языку для студентов архитектурных и строительных специальностей вузов / Е. Н. Безручко. – Ростов н/Д: Издательский центр «МарТ»; Феникс, 2010. – С. 201.

4. Decide if the sentences are true or false.

1. A dome is a hollow semi-spherical structural element.
2. Saucer domes have profiles of less than half a circle.
3. A major difficulty in the construction of Florence Cathedral was the hexagonal plan form which Brunelleschi was constrained to follow throughout the height of the dome itself.
4. A dome can be considered as an arch which has been rotated around its vertical axis.
5. A drum is a structure with openings (or windows) to admit light in the interior.
6. The dome, having sharply pointed profile, had already achieved monumental proportions by about the 14th century BC in the great pyramids of Egypt.
7. Roman builders constructed over the Pantheon in the early 2nd century a dome that has twice since been equaled but never really surpassed.
8. Onion domes are traditionally associated with Russian architecture, in particular their multi-domed churches.
9. The simple dome form was set directly on the ground.
10. The full development of the potential of the truly freestanding dome owed much to Roman concrete.

5. Match the words to the definitions.

1. dome	**a.** building with a circular ground plan, covered by a dome
2. saucer dome	**b.** a structure with openings (or windows) to admit light in the interior
3. rotunda	**c.** a dome which has a profile of more than half a sphere
4. pendentives	**d.** a hollow semi-spherical structural element
5. lantern	**e.** a curved triangle of vaulting formed by the intersection of a dome with its supporting arches
6. drum	**f.** an elliptical or circular wall that supports a dome
7. onion dome	**g.** a dome which has a profile of less than half a circle

6. Give English equivalents to the following words and word combinations and make up sentences.

1. Застроенная окружающая среда
2. Выраженный признак

3. Уровень земли
4. Созданный человеком
5. Законодательный
6. Позолоченный
7. Гробницы
8. Достижение
9. Вертикальная ось
10. Пропускать свет

7. Complete the text about the Pantheon with the words from the box.

including	consists of	rain
rectangular	temple	marble
statesman	destination	monuments

Pantheon.

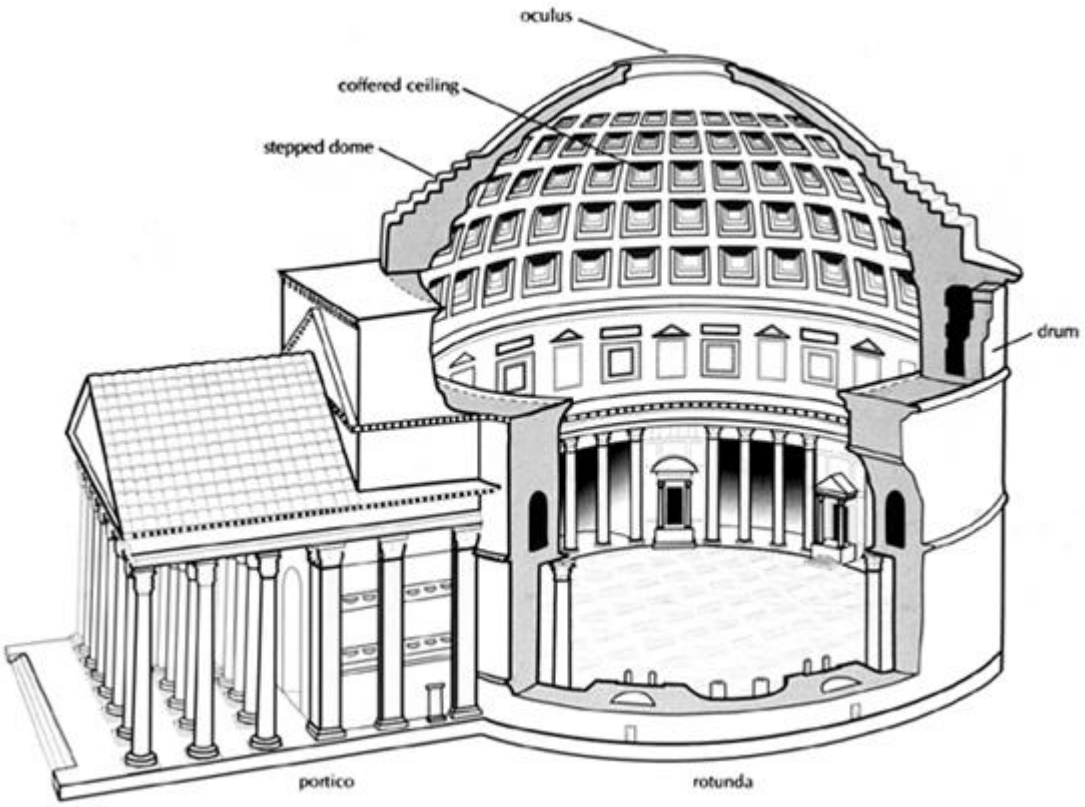
The Pantheon is one of the best-preserved (1) _____ of ancient Rome. The structure, completed around 126-128 A.D. during the reign of Emperor Hadrian, features a rotunda with a massive domed ceiling. The Pantheon is situated on the site of an earlier structure of the same name, built around 25 B.C. by (2) _____ Marcus Agrippa, and is thought to have been designed as a (3) _____ for Roman gods.

Due to a lack of written records, many unknown things surround the present-day Pantheon, (4) _____ who designed it and how long its construction took.

The Pantheon's design has influenced countless buildings throughout history, across Europe and America. Today, the Pantheon continues to function as a church, as well as a major tourist (5) _____.

Made primarily from bricks and concrete, the Pantheon (6) _____ three sections: a portico with granite columns, a massive domed rotunda and a rectangular area connecting the other two sections.

Measuring 142 feet in diameter, the domed ceiling was the largest of its kind when it was built. At the top of the dome sits an opening, or oculus, 27 feet in width. The oculus, which has no covering, lets light – as well as (7) _____ – into the Pantheon.



The Pantheon.

Source: https://www.pinterest.es

The walls and floor of the rotunda are decorated with (8) _____ and the domed ceiling contains five rings of (9) _____ 28 coffers.

When the artist Michelangelo saw the Pantheon, centuries after its construction, he said it was the design of angels, not of man.

8. Translate some facts about the dome of Florence Cathedral.

The dome of Florence Cathedral.
(Cattedrale di Santa Maria del Fiore)

В 1420-1436 годах по проекту выдающегося инженера и архитектора эпохи Возрождения Филиппо Брунеллески (Filippo Brunelleschi) возвели огромный купол, шедевр инженерного искусства, который стал одним из символов Флоренции и эпохи Возрождения.

Восьмигранный купол диаметром 42,2 м является самым большим после купола древнеримского Пантеона, который имеет диаметр 43,2 м. Идея восьмигранного стрельчатого свода была уже намечена строителем собора Арнольфо ди Камбио (Arnolfo

di Cambio) в 1296 году. Его кирпичная модель высотой 4,6 метра и длиной 9,2 метра стояла в боковом проходе недостроенного здания.

Santa Maria del Fiore (Dome).

Source: https://architime.ru

Однако сложность заключалась не только в возведении купола столь большого размера, но и в сооружении специальных строительных приспособлений, что казалось тогда невозможным.

Брунеллески предложил сделать восьмигранный купол из камня и кирпича, кроме того, он решил создать целый ряд машин для подъёма строительного материала и работы на большой высоте.

Купол состоит из двух оболочек, связанных 24 рёбрами и 6 горизонтальными кольцами. Внешняя оболочка купола облицована красным кирпичом, на фоне которого выделяются восемь рёбер из белого камня. Брунеллески также усовершенствовал технику подъёма тяжелых платформ с кирпичами.

Для возведения обеих оболочек, внутренней и внешней, было использовано 4 миллиона кирпичей различных форм и размеров, и это самый большой кирпичный купол в мире.

Source: https://ru.wikipedia.org

9. Make a presentation about a famous dome of a building. Find out the following points:

1. architects which took part in its construction;
2. the author of the dome;
3. the main idea of its construction;
4. the main feature of the dome.

REVIEW. UNITS 13–14.

1. Fill in the gaps using the words in the box.

groin	directions	arch	Romans	rib
pendentives	ceiling	drum	pressure	polygonal

1. Vault is a structural member consisting of an arrangement of arches, usually forming a _____ or roof.
2. Domes became technically significant with the introduction of the large-scale masonry hemispheres by the _____.
3. Since the walls permitted few openings and had to be round or _____ to give continuous support, early domes were difficult to incorporate into complex structures, especially when adjacent spaces were vaulted.
4. A vault must be able to withstand the outward _____ on the lower parts of the vault imposed by the structure above.
5. The evolution of the vault begins with the discovery of the _____, because the basic "barrel" form, which appeared first in ancient Egypt and the Near East, is simply a deep or three-dimensional arch.
6. Byzantine architects perfected a way of raising domes on piers instead of walls, which permitted lighting and communication from four _____.
7. Medieval European builders developed a modification, the _____ vault, a skeleton of arches or ribs on which the masonry could be laid.
8. The transition from a cubic plan of the dome to the hemisphere was achieved by four inverted spherical triangles called _____.
9. A _____ vault is formed by two barrel vaults intersecting at right angles.
10. Domes can be supported by an elliptical or circular wall called a _____.

2. Find all the words related to Units 13-14 (direction of letters ↕ and →) and give their translation.

C	P	C	O	N	I	C	A	L	Q	C	A	P	E	X
G	T	F	D	U	D	A	K	U	L	U	O	L	P	Z
E	E	J	R	Q	O	U	T	W	A	R	D	A	E	W
H	F	B	U	T	T	R	E	S	S	V	E	N	N	M
D	C	Z	M	X	R	R	N	B	P	A	O	T	D	N
R	V	V	R	R	O	T	C	N	E	T	R	E	E	C
V	S	R	I	B	T	C	C	J	A	U	N	R	N	O
O	G	C	G	Y	U	C	F	W	S	R	F	N	T	R
U	B	I	I	M	N	O	M	D	Q	E	C	Y	I	B
S	A	G	D	S	D	N	J	N	M	D	O	F	V	E
S	R	X	I	G	A	C	R	Q	I	N	H	K	E	L
O	R	D	T	H	Y	A	D	O	M	E	R	K	S	P
I	E	L	Y	B	F	V	P	S	U	R	P	A	S	S
R	L	A	I	N	T	E	R	S	E	C	T	I	O	N
V	A	U	L	T	A	B	B	B	C	O	N	V	E	X

3. Compile as many words as you can with the letters of the word.

CURVATURE

UNIT 15. DOORS

1. Read the words and learn them by heart.

leaf – створка (двери)
hinged door – дверь на петлях
compartment – отделение, перегородка
solid door – сплошная; цельная дверь
glazed – застекленный
revolving door – вращающаяся дверь
multileaf door – (много)створчатая дверь
swing door – распашная дверь, дверь, открывающаяся в любую сторону
sliding door – скользящая, раздвижная дверь
flush door – гладкая, плоская, щитовая дверь
pocket door – раздвижная дверь, дверь-купе
folding door – створчатая, складная дверь

2. Starting off. Answer the questions.

1. What is a door?
2. What is the function of doors?

3. Read and translate the text about doors and check your ideas.

Doors.

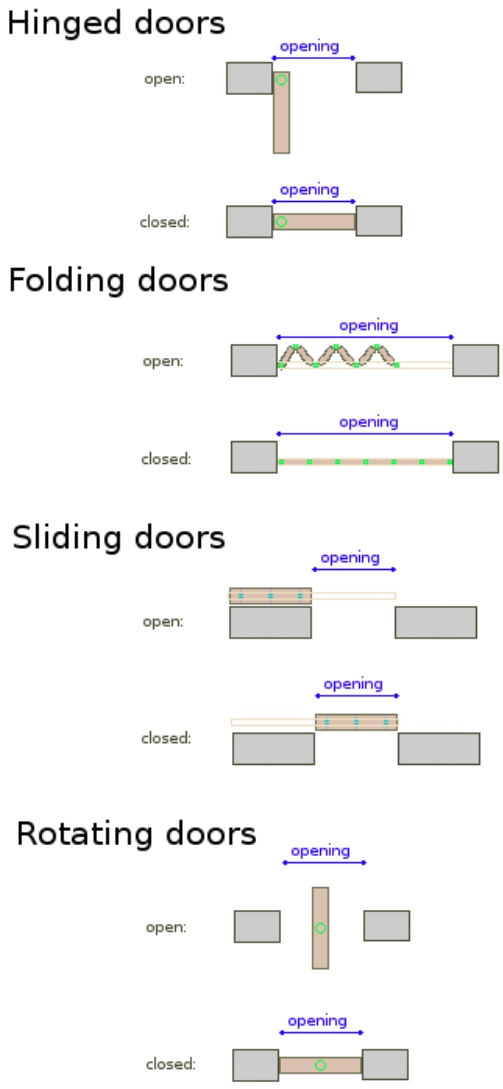
A door is usually a movable barrier by which an entry is closed and opened. Doors satisfy a lot of human needs. The created opening in the wall is a doorway. A door's essential and primary purpose is to provide security by controlling access to the doorway. Doors are generally made of a material suited to the door's task.

Doors may incorporate locking mechanisms to ensure that only some people can open them. Doors may have devices such as doorbells by which people outside announce their presence.

There are many kinds of doors with different purposes. According to the number of leaves they can be single, double or multileaf doors. The most common type is the single-leaf door, which consists of a single rigid panel that fills the doorway. There are many variations on

this basic design, such as the double-leaf door, which has two adjacent independent panels hinged on each side of the doorway.

According to their structure they can be paneled, flush or boarded doors. A flush door is a completely smooth door, having plywood fixed over a light timber frame. Doors can be glazed, halfglazed, solid, etc.



Types of doors.

According to the method of opening, doors may be termed hinged, sliding, folding doors, etc.

Hinged doors. A hinged door traditionally has 2-3 hinges on the vertical long edge of the door and is either left or right-handed. The axis of rotation is usually vertical.

Sliding doors. It is often useful to have doors which slide along tracks, often for space or aesthetic considerations. Doors which slide inside a wall cavity are called pocket doors.

Revolving doors. A revolving door has several leaves, generally four, radiating from a central shaft, forming compartments that rotate about a vertical axis. A revolving door allows people to pass in both directions without colliding.

Automatically opening doors. An automatic door, also known as an auto door, is a door that opens automatically, usually on sensing the approach of a person. Automatically opening doors are generally fitted with safety sensors which prevent the door from colliding with an object by stopping or slowing its motion.

Source: https://en.wikipedia.org/wiki/Door

4. Choose the correct answer.

1. The opening in the wall is called _____.

a) a doorbell;

b) a doorway.

2. Doors which slide inside a wall cavity are called _____.

a) revolving doors;

b) pocket doors;

c) hinged doors.

3. According to the method of opening, doors can be _____.

a) single, double or multileaf doors;

b) hinged, sliding, folding doors;

c) glazed, halfglazed, solid doors.

4. _____ are generally fitted with safety sensors which prevent the door from colliding with an object by stopping or slowing its motion.

a) hinged doors;

b) auto doors.

5. A flush door is a completely smooth door, having _____ fixed over a light timber frame.

a) plywood;

b) softwood;

c) hardwood.

6. A door is a usually _____ barrier by which an entry is closed and opened.

a) fixed;

b) movable.

7. Doors may have devices such as _____ by which people outside announce their presence.

a) door knobs;

b) doorbells;

c) spyholes.

8. _____ senses the approach of a person.

a) hinged door;

b) automatically opening door;

c) pocket door.

5. Here are some words but the letters are mixed up. Fill in the table.

Letters	Correct word	Translation
1. afLe		
2. orwoaDy		
3. alzGed		
4. vinReolvg		
5. paCorenmtmt		
6. Slido		
7. etPkoc		
8. soSenr		
9. dinSlig		
10. Fshlu		

6. Give English equivalents to the following words and word combinations and make up sentences.

1. Запирающий механизм
2. Датчик безопасности
3. Вход
4. Человеческие потребности
5. Обеспечить безопасность
6. Доступ
7. Дверной звонок
8. Разные цели
9. Вертикальная ось
10. Оповещать (объявлять)
11. Примыкающий
12. Столкновение
13. Приближение человека
14. Замедление
15. Движение

7. Complete the text about the ancient doors with the words from the box.

timber	door	believed
bottom	earliest	England
carved	panels	archaeologists

Ancient Doors.

The (1) _____ recorded doors appear in the paintings of Egyptian tombs, which show them as single or double doors, each of a single piece of wood. People may have (2) _____ these were doors to the afterlife.

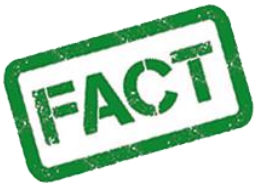
The most ancient doors were made of (3) _____, such as those referred to in the Biblical depiction of King Solomon's temple being in olive wood, which were (4) _____ and overlaid with gold. A 5,000-year-old door has been found by (5) _____ in Switzerland.

Britain's oldest door in Westminster Abbey.

Source: https://www.ancient-origins.net

Ancient Greek and Roman doors were either single doors, double doors, triple doors, sliding doors or folding doors. In the tomb of Theron at Agrigentum there is a single four-panel (6) _____ carved in stone. Among existing examples, the bronze doors in the church of SS. Cosmas and Damiano, in Rome, are important examples of Roman metal work of the best period; they are in two leaves, each with two (7) _____, and are framed in bronze. Those of the Pantheon are similar in design, with narrow horizontal panels in addition, at the top, (8) _____ and middle.

The oldest door in (9) _____ can be found in Westminster Abbey and dates from 1050.



8. Translate some facts about revolving doors.

Вращающаяся дверь.

Вращающаяся дверь – это конструкция из трех или четырех дверей, закрепленных на центральном валу и вращающихся по вертикальной оси.

Вращающиеся двери помогают поддерживать оптимальную температуру в здании, предотвращая повышение или падение температуры в помещении. Существуют и автоматические вращающиеся двери; они обычно снабжены датчиками безопасности. В некоторых странах (например, в Израиле) стандарты изготовления вращающихся дверей приняты на государственном уровне.

A revolving door.

Source: https://www.indiamart.com

Первая вращающаяся дверь была создана немецким изобретателем из Берлина Бонхакером (Bockhacker), запатентовавшим ее концепцию 22 декабря 1881 года; в документах она называлась «Tür ohne Luftzug» – «дверь без сквозняка». 17 августа 1888 года американский изобретатель Теофил ван Каннель (Theophilus Van Kannel) из Филадельфии получил патент на похожую конструкцию.

Впервые вращающаяся дверь была установлена в 1899 году в одном из ресторанов в Нью-Йорке.

Научные исследования относительно того, как вращающиеся двери помогают сберегать тепло в зданиях и так ли это на самом деле, проводятся с 1930-х годов.

Концепция вращающихся дверей периодически подвергается различной критике – от трудности в использовании до опасностей, возникающих при необходимости быстрой эвакуации из помещения.

Source: https://ru.wikipedia.org

9. Make a presentation about famous ancient or modern doors or types of doors.

UNIT 16. WINDOWS

1. Read the words and learn them by heart.

blind – штора
glass block – стеклоблок
light – световой проем
pane – оконное стекло
glazed – застекленный
pediment – фронтон
sash window – подъёмное окно
sill (cill) – подоконник
fenestration – распределение окон в здании
picture window – панорамное окно
double-hung sash – двойное окно с вертикально передвигающимися створками
louvers – жалюзи
shutter – ставень
single-hung sash – окно с одной подъёмной створкой
casement – створный оконный переплет
sliding window – раздвижное окно
casement window – створчатое распашное окно

2. Starting off. Answer the questions.

1. What is a window?
2. What is the function of windows?

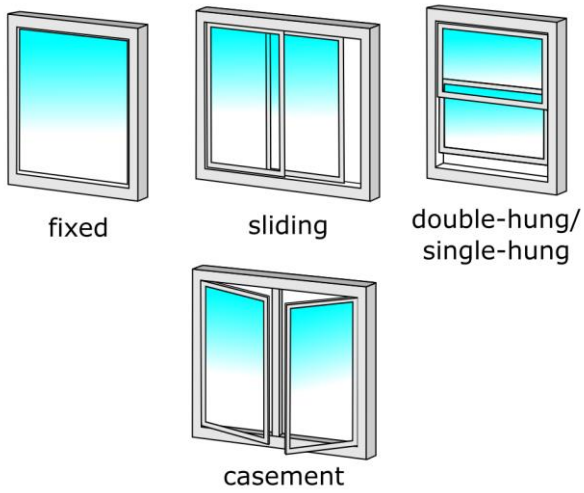
3. Read and translate the text about windows and check your ideas.

Windows.

A window is an opening in a wall, door or roof, that allows the passage of light and air. A window consists of a window frame, glazed casements, a sill. They usually have a single, double or triple glazing (used in warm, temperate and very cold climates respectively). Windows can be made of glass blocks (usually in staircases, entrance halls, etc.).

Windows can be fixed, which cannot be opened, their function is limited to allowing light to enter. Fixed windows are commonly used in conjunction with other openable types of windows. A window in a vertically sliding frame is called a sash window: a single-hung sash has

only one half that moves; in a double-hung sash both parts slide. A casement window opens sideward on a hinge.



Types of windows.

Source: https://commons.wikimedia.org

Sometimes the wall is fully glazed; there can be also floor-to-ceiling glazing. The arrangement of windows in the exterior walls of a building is called fenestration. Sometimes rooms have picture windows, i.e. the main large windows from which panoramic beautiful views open and which usually have only one pane.

Over the windows pediments are often used. They can be straight, triangular, broken, etc.

The windows can have shutters, louvers or blinds; at night they can be curtained.

It is important that windows be made of suitable and durable materials:

1. With good thermal and sound insulation properties.
2. Capable of resisting wind, and rain.
3. Easy to clean.
4. Providing safety.

Sources: https://www.britannica.com/technology/window; https://www.designingbuildings.co.uk; Ивянская И.С. Английский язык для архитекторов: учебник / И.С. Ивянская. – 2-е изд., перераб. и доп. – М.: КУРС: ИНФРА-М, 2014. – С. 77.

4. Answer the questions.

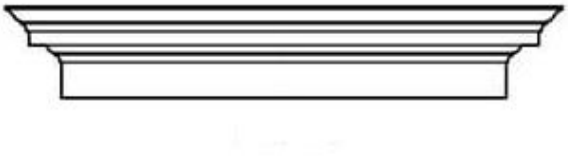
1. What does a window consist of?
2. What type of windows is called fixed?
3. What properties should materials for windows have?
4. What types of pediments do you know?
5. In what climates is the single glazing used?
6. Can fixed windows be used in conjunction with other types of windows?

5. Match the words to the definitions.

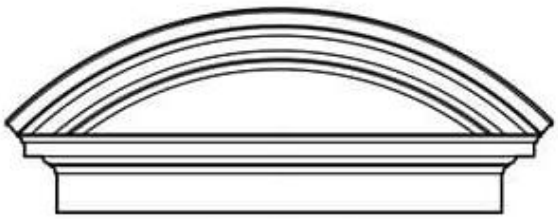
1. picture windows	**a.** an opening in a wall, door or roof, that allows the passage of light and air
2. sash window	**b.** a window set on a vertical hinge so that it opens like a door
3. pediment	**c.** the main large windows from which panoramic beautiful views open and which usually have only one pane
4. casement window	**d.** wooden or metal covers fitted on the outside of a window, which can be opened to let in the light, or closed to keep out the sun or the cold
5. window frame	**e.** a large triangular structure built over a door or window as a decoration
6. shutter	**f.** the portion of the window that holds the glazing
7. window	**g.** a window in a vertically sliding frame

6. Match the types of pediments with the pictures.

straight	triangular	broken	segmental

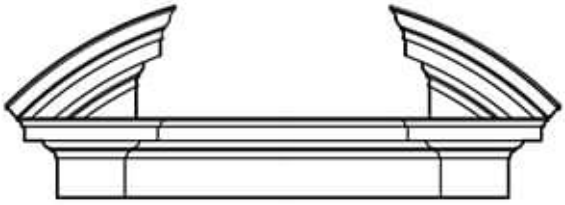


1. _____



2. _____

3. _____



4. _____

7. Give English equivalents to the following words and word combinations and make up sentences.

1. Умеренный (о климате)
2. Обеспечивающий безопасность
3. Звукоизоляция
4. Свойства
5. Способный
6. Подходящий
7. Полностью остекленный
8. Совместно с

8. Complete the text about the ancient windows with the words from the box.

disappearance	known	subdivided
paintings	ancient	appeared
glazed	churches	development

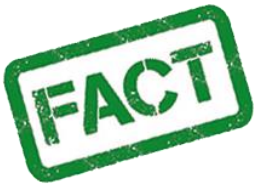
Ancient Windows.

Windows are a very (1) _____ invention, probably coincident with the development of fixed and enclosed houses. Representations of windows occur in early wall (2) _____ in Egypt and in reliefs from Assyria. Assyrian windows were (3) _____ by little colonnettes.

The devotion of the ancient Greeks to the house built around a court led to an almost total (4) _____ of windows in their architecture. In Roman imperial times, however, the glazed window first definitely (5) _____, and fragments of glass in a bronze frame have been found in Pompeii, among other sites. In general, however, (6) _____ windows were very exceptional in Roman times.

In Early Christian and Byzantine (7) _____, windows became more numerous and were often glazed. Thus, it is (8) _____ that the windows of Hagia Sophia at Constantinople (begun 532) were filled with marble frames enclosing panes of glass.

It was not until the 12th and 13th centuries in western and northern Europe, however, that this stained-glass technique reached its most distinguished (9) _____.



9. Translate some facts about wooden windows.

Деревянные окна.

Дерево считается одним из традиционных материалов для изготовления окон. С давних времен практически все окна были сделаны из дерева.

Окна из дерева очень красивые, в большинстве случаев являются важным эстетическим элементом интерьера. Они отличаются разнообразием цветов.

Wooden window frame.

Source: https://sami-stroim.com

Другое преимущество состоит в том, что тепловое расширение древесины под воздействием высоких температур является достаточно низким. Следует также отметить хорошую теплоизоляцию, прочность и длительный срок службы. Если в доме установлены деревянные окна, то в этом случае меньше проблем с конденсатом, потому что они, благодаря своим природным свойствам, могут регулировать количество влаги в помещении. Даже когда деревянное окно местами повреждено или начинает подвергаться частичному разрушению, всегда можно реставрировать его, что в случае окон из ПВХ невозможно.

Еще одним преимуществом окон из дерева является возможность изготавливать нестандартные конструкции различной геометрии, что не всегда под силу производителям окон ПВХ. Особенно хорошо справляется древесина в плане арочных и круглых окон. Весьма интересным является также тот факт, что есть возможность перекраски оконного профиля, изменяя цвет.

Source: https://www.oknamedia.ru/novosti/derevyannye-okna-preimuschestva-i-nedostatki-44670

UNIT 17. STAIRS

1. Read the words and learn them by heart.

handrails – поручни
spiral stairs – винтовая лестница
tread – ступень (лестницы)
riser – подступёнок, подъём ступени лестницы
landing – лестничная площадка

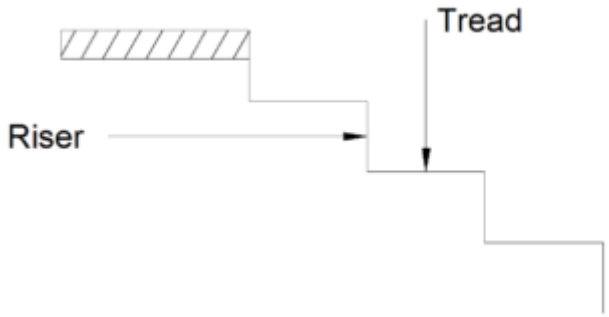
2. Starting off. Answer the questions.

1. What is the definition of stairs?
2. What is the function of stairs?

3. Read and translate the text about stairs and check your ideas.

Stairs.

Staircases are powerful design elements and an opportunity for creative expression. Staircases have traditionally been built of wood, stone or marble, and iron or steel. They can be spiral (twisting around a centre pole with steps radiating out of it), straight (they stretch from lower to upper level in one straight run), circular (sweeping in a broad curve from one level to another) or they can have other shapes. They can be wide or narrow, steep or gradual.



Elements of the staircase.

Source: http://www.civilology.com

Their design is influenced by their function and their style varies according to how their parts are built and combined. Staircases are built according to rules that are important for safety, indicating the heights of risers, depth and width of treads and placement of handrails. The horizontal surface of a step is called its tread and the vertical front its riser.

The first measurement to take when building a staircase is the distance between the two finished floors. This determines the height of the staircase. Its riser must not exceed 22 cm in residential buildings. The average width is 80 cm, and anyway it should not be less than 60 cm. A landing must be placed to divide a long staircase into smaller sections.

Source: Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 26.

4. Answer the questions.

1. What is the design of the stairs influenced by?
2. What type of stairs is called straight?
3. What is the first measurement to take when building a staircase?
4. What materials are staircases built of?
5. What determines the height of the staircase?

5. Match the words to the definitions.

1. staircase	**a.** the upper horizontal part of a step in a staircase
2. riser	**b.** a set of stairs and its surrounding walls or structure
3. tread	**c.** a level area at the top of a staircase or between one flight of stairs and another
4. handrail	**d.** a vertical section between the treads of a staircase
5. landing	**e.** a long piece of metal or wood which is fixed near stairs where people could slip and fall, and which people can hold on to for support

6. Give English equivalents to the following words and word combinations and make up sentences.

1. Превышать
2. Жилые здания
3. Разделять
4. Горизонтальная поверхность
5. Возможность
6. Мрамор
7. Прямой

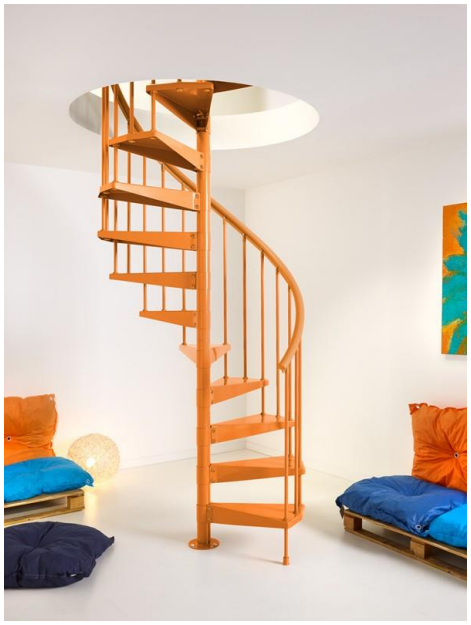
7. Complete the text about the spiral staircase with the words from the box.

mentioned	location	equal
circle	rotate	crucial
codes	factors	move

Spiral Staircase.

A spiral staircase is a round stair system in which the individual steps are connected to a center column, hence forming a complete (1) _____. The diameter of the circle creates the diameter of the staircase.

The steps of a spiral staircase (2) _____ around a central point as we move up the stair or down the stair, hence making a spiral design. The depth of each step of a spiral stair remains (3) _____. The handrails (4) _____ around the perimeter of the spiral curve.



Spiral Staircase.

Source: https://www.captainbobcat.com

The six essential (5) _____ considered in the design of the spiral staircase are:

1. Height of the staircase.
2. Diameter of the staircase.
3. (6) _____ of the staircase.
4. Functionality.
5. Aesthetics.
6. Style of handrails, etc.

Spiral stairs can be customized based on the design, budget, and the safety concerns of the client. Among the factors (7) _____, the first three are considered primary requirements to commence the design.

The determination of the height of the spiral staircase is the most (8) _____ measurement in the design. It is the measurement on which the safety concerns of the spiral staircase lie. Always design the spiral staircase based on the respective building (9) _____ of the area that takes into consideration the functionality, loads and traffic coming on it.

REVIEW. UNITS 15–17.

1. Fill in the gaps using the words in the box.

pediment	stairs	glass	revolving	fixed
measurements	sliding	handrail	glazed	flush

1. The straight flight of _____ was commonly used in traditional homes.
2. Modern windows are usually _____.
3. Spiral stairs have a _____ on the outer side only, and on the inner side just the central pole.
4. The main types of 19th and 20th century innovations include the _____ door, the folding door, the sliding door, etc.
5. A _____ window is a window that cannot be opened.
6. _____ doors are simple door designs that have plain facings on both sides.
7. During the High Renaissance in Italy and France, window openings were frequently decorated with an architrave, a cornice and _____.
8. A _____ door is a type of door which opens horizontally by sliding, usually parallel to a wall.
9. Stairs must have certain _____ so that people can comfortably use them.
10. Modern windows are often made with double or triple thicknesses of _____; these are called double- or triple-glazed windows.

2. Compile as many words as you can with the letters of the word.

MEASUREMENT

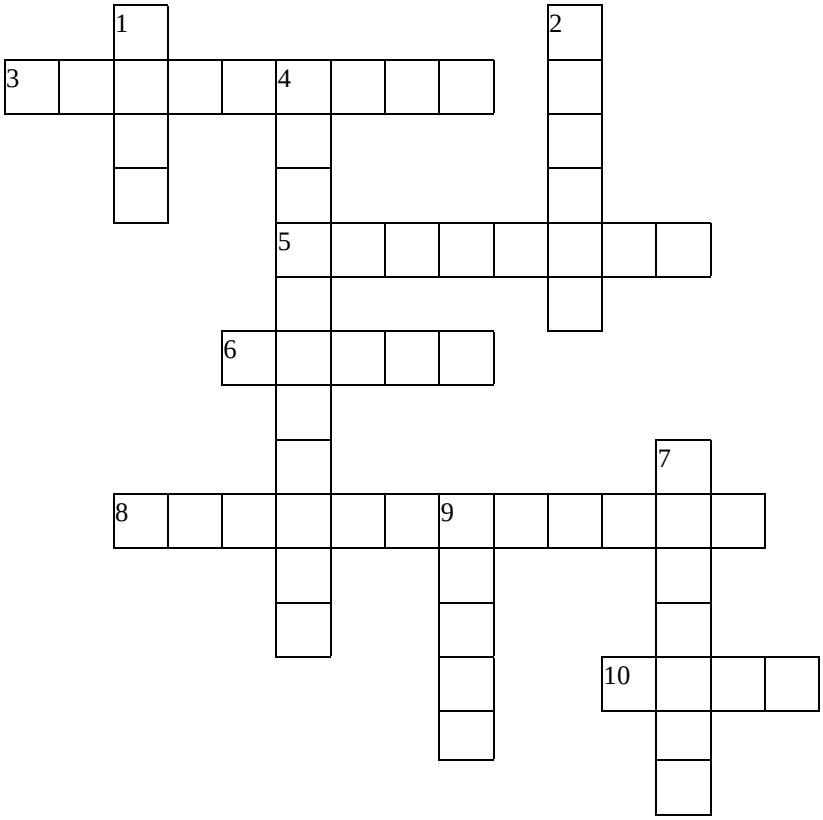
_____

_____

_____

_____

3. Complete the crossword.



Across

3. A set of stairs and its surrounding walls.
5. A large triangular structure built over a window.
6. The horizontal surface on which you put your foot on a step.
8. The arrangement of windows in the exterior walls of a building.
10. A shelf or slab of stone, wood, or metal at the foot of a window opening.

Down

1. A sheet of glass in a window.
2. Fitted with panes of glass.
4. A separate section or part of a structure.
7. _____ door is a type of door which opens by folding back in sections.
9. The flat vertical part of a step or a stair.

FINAL TASKS

1. Complete the chart with the words from the box.

pendentives, roofing felt, a top chord, voussoir, drum, web, deep, spring (springing line), mansard, purlin, rotunda, node, a bottom chord, tile, shallow, Pratt, slate, pile, keystone, footing, rafters, settlement, gable, wedge, lantern

foundation	dome	truss	roof	arch

2. Choose the correct answer (multiple correct answers are possible).

1. Walls are _____ elements.

a) enclosing;

b) load bearing.

2. Ceilings, vaults and roofs are _____.

a) supports;

b) coverings.

3. Cavity walls help moisture _____ better than solid walls.

a) appear;

b) intrude;

c) evaporate;

d) support.

4. _____ foundation is a type of foundation which is placed at a greater depth below the ground surface and transfers structure loads to the earth at depth.

a) shallow;

b) deep.

5. Alexandriisky Column in St. Petersburg is the example of _____.

a) a freestanding column;

b) an engaged column.

6. Beams are characterized by _____.

a) profile;

b) length;

c) depth;

d) materials.

7. _____ is a three-dimensional framework of connected triangles.

a) simple truss;

b) planar truss;

c) space frame.

8. If the supports are more numerous and small, _____ is used.

a) heavy-frame construction;

b) light-frame construction.

9. _____ is assembled either from interlocking panels or from a modular system and is used for relatively simple concrete structures.

a) traditional timber formwork;

b) stay-in-place structural formwork;

c) permanent insulated formwork;

d) re-usable plastic formwork;

e) engineered formwork system.

10. _____ have profiles of less than half a circle.

a) onion domes;

b) saucer domes.

11. A standard beam-and-slab floor has _____.

a) load-bearing steel running in the direction of the span;

b) concrete slabs supported by concrete beams;

c) a series of horizontal beams that contain reinforcing steel.

12. _____ consists of a thin membrane stretched across a frame that runs around the perimeter of the ceiling.

a) acoustic ceiling;

b) stretched ceiling;

c) cathedral ceiling.

13. The curve in an arch may be _____.

a) segmental;

b) semicircular;

c) pointed;

d) noncircular.

14. The simplest kind of vault is known as _____, which is generally semicircular in section.

a) groin vault;

b) fan vault;

c) barrel vault;

d) rib vault.

15. When selecting formwork, it is important to consider _____.

a) the cost of concrete;

b) the type of concrete;

c) temperature of the pour;

d) pressure of the pour.

16. _____ is masonry built over a wall opening by uniformly advancing courses from each side until they meet at midpoints.

a) barrel arch;

b) corbel arch.

17. Floors consist of _____.

a) subfloor;

b) floor covering;

c) extra floor.

18. _____ is known for its distinguishable triangular shape feature.

a) flat roof;

b) gable roof;

c) mansard roof.

19. In _____ the studs (vertical members) extend the full height of the building.

a) platform framing;

b) balloon framing.

20. _____ is easily identified by its construction from equilateral triangles.

a) Howe truss;

b) Warren truss;

c) Pratt truss.

21. Doors which slide inside a wall cavity are called _____.

a) revolving doors;

b) pocket doors;

c) hinged doors.

22. The horizontal surface of a step is called _____.

a) tread;

b) riser.

23. A window in a vertically sliding frame is called a _____ window.

a) fixed;

b) sash;

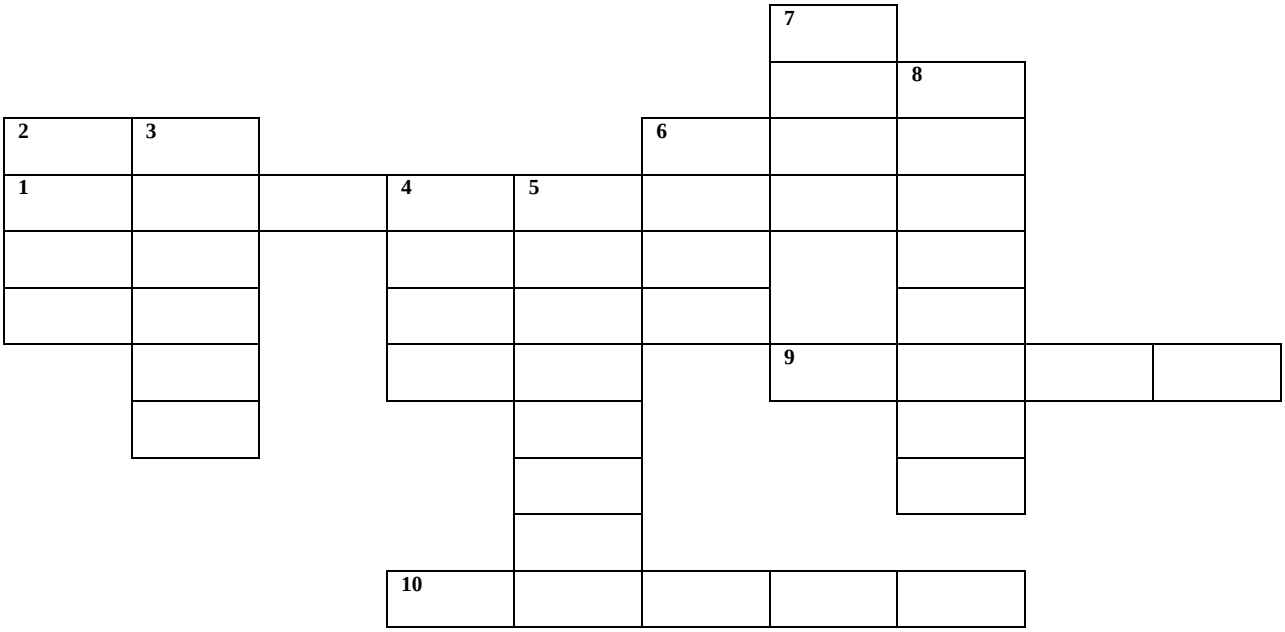
c) casement.

24. Brunelleschi constructed of the dome of _____.

a) Florence Cathedral;

b) Milan Cathedral.

3. Complete the crossword.



Across:

1. Engaged column with a rectangular or other non-round section.
9. The external upper covering of a house or other building.
10. A structure that consists of a web of triangles supporting a roof or a bridge.

Down:

2. The length of something from one end to the other.
3. An opening in the wall or roof of a building, fitted with glass in a frame to admit light or air and allow people.
4. A curved symmetrical structure spanning an opening and typically supporting the weight of a bridge, roof, or wall above it.
5. A rough floor laid as a base for a finished floor.
6. A vertical framing member which forms part of a wall or partition.
7. A rounded vault forming the roof of a building or structure, typically with a circular base.
8. A vertical or horizontal arrangement made to keep concrete in position until it gains strength and shape.

4. Think of a well-known building. Describe its design.

1. What shape is it?
2. What is it made of?
3. Does it have stairs, windows, doors, walls, a roof?
4. What type of foundation is used?
5. What are the rooms used for?
6. How is it decorated?

5. Compile as many words as you can with the letters of the word.

CONSTRUCTION

_____

_____

_____

_____

SUPPLEMENTARY TEXTS FOR READING

Text 1. Bricklaying and Concrete Blocks.

When a wall is built of bricks, the bricks are set in mortar. Mortar consists of a mixture of sand and either lime or Portland cement or, more often, a mixture of the two. Enough water is used in mixing the mortar to produce a paste in which the bricks can be firmly bedded. The bricks must be carefully arranged, or bonded as it is called, in the wall in order to produce a structure of good strength and appearance, the pattern of the brickwork depending on the bond which is used. The pointing or finishing of mortar joints is also given careful I attention since it affects the appearance and the weather resistance of the wall.

Each layer of bricks is called a course and the bricklayer has to be very skilful to keep the courses exactly level and the thickness of mortar between each course of bricks the same throughout the length and depth of the wall. The corners of the walls must be absolutely upright.

When bricks are built in curves, as m arches or curved walls, the bricklayer has to shape the bricks in order to fit them together. Sometimes quite soft bricks called rubbers are used; these can be rubbed on a hard stone in order to shape them so accurately that they can be built with thin mortar joints. Work of this type is known as gauged brickwork and demands great skill.

Blocks of cinder concrete, ordinary concrete, or hollow tile are generally known as concrete masonry units. They are usually much larger than ordinary bricks and so are much faster to lay for a wall of a given size. Furthermore, cinder and concrete blocks typically have much lower water absorption rates than brick. They are often used as the structural core for veneered brick masonry, or are used alone for the walls of factories, garages and other industrial style buildings where such appearance is acceptable or desirable. Such blocks often receive a stucco surface for decoration. Surface-bonding cement, which contains synthetic fibers for reinforcement, is sometimes used in this application and can impart extra strength to a wall. Surface-bonding cement is often pre-coloured and can be stained or painted thus resulting in a finished stucco-like surface.

The primary structural advantage of concrete blocks in comparison to smaller clay-based bricks is that a concrete masonry unit wall can be reinforced by filling the block voids with concrete with or without steel rebar. Generally, certain voids are designated for filling and

reinforcement, particularly at comers, wall-ends, and openings while other voids are left empty. This increases wall strength and stability more economically than filling and reinforcing all voids Steel reinforcement can be embedded in horizontal mortar joints of concrete block walls. The introduction of steel reinforcement generally results in a concrete masonry unit wall having much greater lateral and tensile strength than unreinforced walls. Some concrete blocks are coloured, and some employ a split face, a technique that results in two blocks being manufactured as one unit and later split into two. This gives the blocks a rough face replicating the appearance of natural, quarried stone, such as brownstone. For applications such as roadway sound control walls, the face patterns may be complex and even artistic.

Source: Гарагуля С.И. Английский язык для студентов строительных специальностей. Learning Building Construction in English: учебное пособие / С. И. Гарагуля. – Ростов н/Д: Феникс, 2011. – С. 244-246.

Text 2. Masonry.

Masonry is the building of structures from individual units laid in and bound together by mortar; the term masonry can also refer to the units themselves. The common materials of masonry construction are brick, stone such as marble, granite, travertine, limestone; concrete block, glass block, and tile. Masonry is a highly durable form of construction. However, the materials used, the quality of the mortar and workmanship, and the pattern m which the units are assembled can affect the durability of the overall masonry construction.

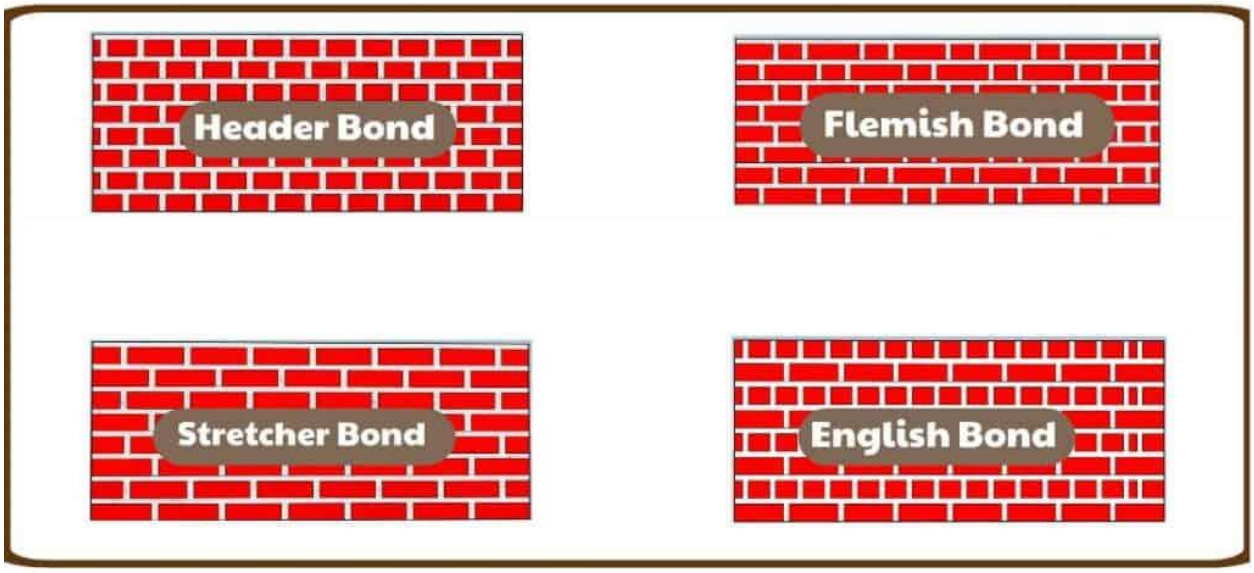
Masonry is commonly used for the walls of buildings, retaining walls and monuments. Brick and concrete block are the most common types of masonry in use in industrialized nations and maybe either weight-bearing or a veneer. Concrete blocks, especially those with hollow cores, offer various possibilities in masonry construction. They generally provide great compressive strength and are best suited to structures with light transverse loading when the cores remain unfilled. Filling some or all of the cores with concrete or concrete with steel reinforcement (typically rebar) offers much greater tensile and lateral strength to structures.

The use of materials such as brick and stone can increase the thermal mass of a building, giving increased comfort in the heat of summer and the cold of winter, and can be ideal for passive solar applications. Brick will not require painting and so can provide a structure with reduced life-cycle costs, although sealing appropriately will reduce potential spalling due to frost damage. Non-decorative concrete block generally is painted or stuccoed if exposed. The appearance, especially when well crafted, can impart an impression of solidity and permanence.

Masonry is heat resistant and thus provides fire protection. Masonry walls are more resistant to projectiles, such as debris from hurricanes or tornadoes than walls of wood or other softer, less dense materials.

Extreme weather causes degradation of masonry wall surfaces due to frost damage. This type of damage is common with certain types of brick, though rare with concrete block. If non-concrete (clay-based) brick is to be used, care should be taken to select bricks suitable for the climate m question. Masonry tends to be heavy and must be built upon a strong foundation (usually reinforced concrete) to avoid settling and cracking. If expansive soils (such as adobe clay) are present, this foundation needs to be quite elaborate and the services of a qualified structural engineer may be required, particularly in earthquake prone regions.

Masonry boasts an impressive compressive strength (vertical loads) but is much lower in tensile strength (twisting or stretching) unless reinforced. The tensile strength of masonry walls can be strengthened by thickening the wall, or by building masonry piers (vertical columns or ribs) at intervals. Where practical, steel reinforcements can be added.



Types of bond.

Source: https://civiconcepts.com

The strength of a masonry wall is not entirely dependent on the bond between the building material and the mortar; the friction between the interlocking blocks of masonry is strong enough to provide a great deal of strength on its own. The blocks sometimes have grooves or other surface features added to enhance this interlocking, and some dry set masonry structures forego mortar altogether.

Solid masonry without steel reinforcement tends to have very limited applications in modem wall construction. While such walls can be quite economical and suitable in some applications, susceptibility to earthquakes and collapse is a major issue. Solid unreinforced masonry walls tend to be low and thick as a consequence.

Solid brickwork is made of two or more layers of bricks with the units running horizontally (called stretcher bricks) bound together with bricks running transverse to the wall (called header bricks). Each row of bricks is known as a course. The pattern of headers and stretchers employed gives rise to different bonds such as the common bond (with every sixth course composed of headers), the English bond, and the Flemish bond (with alternating stretcher and header bricks present on every course). There are no significant utilitarian differences between most bonds, but the appearance of the finished wall is affected. Vertically staggered bonds tend to be somewhat stronger and less prone to major cracking than a non-staggered bond.

Source: Гарагуля С.И. Английский язык для студентов строительных специальностей. Learning Building Construction in English: учебное пособие / С. И. Гарагуля. – Ростов н/Д: Феникс, 2011. – С. 247-249.

Text 3. Brickwork.

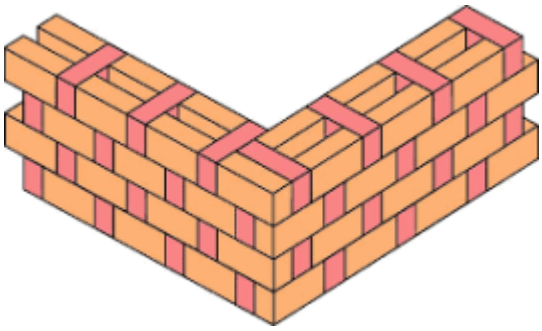
Brickwork masonry is produced when a bricklayer uses bricks and mortar to build up structures such as walls, bridges and chimneys. Brickwork is also used to finish openings such as doors or windows in buildings made of other materials. Where the bricks are to remain fully visible, as opposed to being covered up by plaster or stucco, this is known as face-work.

Flemish bond, also known as Dutch bond, has historically always been considered the most decorative bond, and for this reason was used extensively for dwellings until the adoption of the cavity wall. It is created by alternately laying headers and stretchers in a single course. The next course is laid so that a header lies in the middle of the stretcher in the course below. Again, this bond is one brick thick. It is quite difficult to lay Flemish bond properly, since for best effect all the perpendiculars (vertical mortar joints) need to be vertically aligned. If only one face of a Flemish bond wall is exposed, one third of the bricks are not visible, and hence may be of low visual quality. This is a better ratio than for English bond, the main rival of Flemish bond for load-bearing walls.

A common variation found in early 18th century buildings is glazed-headed Flemish bond, in which the exposed headers are burned until they vitrify with a black glassy surface.

Rat-trap bond, also known as Chinese bond, is a type of garden wall bond in which the stretchers and headers are laid on their sides, with the base of the stretcher facing outwards. This gives a wall with an internal cavity bridged by the headers, hence the name.

The main advantage of this bond is economy in use of bricks, giving a wall of one brick thickness with fewer bricks than a solid bond.



Rat-trap bond.

Source: https://civiconcepts.com

Rat-trap bond was in common use in England for building houses of fewer than three storeys up to the turn of the 20th century and is today still used in India as an economical bond, as well for the insulation properties offered by the air cavity. Also, many brick walls surrounding kitchen gardens were designed with cavities so hot air could circulate in the winter, warming fruit trees or other produce spread against the walls, causing them to bloom earlier and forcing early fruit production.

In UK building yards what many would refer to as a house brick is known as a common with larger breezeblock-like materials being called solids Mortar is often referred to as mud due to its appearance Commons usually feature a frog, an indent in one surface that faces up during laying. This is packed with mud as laying progresses and helps add lateral strength to the layer, as opposed to the vertical strength formed by the compressive weight of the brickwork on itself. Ties are metal products that are approximately the length of a common. They are used to tie layers of brickwork into one another. This is particularly important if a building is constructed with an inner and outer wall featuring a cavity where the ties will be placed through the cavity between mortar layers in the two walls. This allows the two walls to function better as one structural unit without filling the cavity with a solid material and so lowering its insulative properties. Ties are simply lengths of stainless steel wire, around twice as thick as that used to form a steel coat hanger, and have a loop at either end that is buried in the mortar as the wall progresses. Due to being stainless and reasonably thick, they are also somewhat expensive. However, ties must be stainless to avoid them rotting in the alkaline conditions created by the cement in the mortar.

Source: Гарагуля С.И. Английский язык для студентов строительных специальностей. Learning Building Construction in English: учебное пособие / С. И. Гарагуля. – Ростов н/Д: Феникс, 2011. – С. 251-252.

Text 4. Veneer Masonry.

A masonry veneer wall consists of masonry units, usually clay- based bricks, installed on one or both sides of a structurally independent wall usually constructed of wood or masonry. In this context the brick masonry is primarily decorative, not structural.

The brick veneer is generally connected to the structural wall by brick ties (metal strips that are attached to the structural wall, as well as the mortar joints of the brick veneer). There is typically an air gap between the brick veneer and the structural wall. As clay- based brick is usually not completely waterproof, the structural wall will often have a water-resistant surface (usually tar paper) and weep holes can be left at the base of the brick veneer to drain moisture that accumulates inside the air gap. Concrete blocks, real and cultured stones, and veneer adobe are sometimes used in a very similar veneer fashion.

Most insulated buildings that utilize concrete block, brick, adobe, stone, veneers or some combination thereof feature interior insulation in the form of fiberglass batts between wooden wall studs or in the form of rigid insulation boards covered with plaster or dry wall. In most climates this insulation is much more effective on the exterior of the wall, allowing the building interior to take advantage of the aforementioned thermal mass of the masonry. This technique does, however, require some sort of weather-resistant exterior surface over the insulation and, consequently, is generally more expensive.

Source: Гарагуля С.И. Английский язык для студентов строительных специальностей. Learning Building Construction in English: учебное пособие / С. И. Гарагуля. – Ростов н/Д: Феникс, 2011. – С.343.

Text 5. How to Build a Brick Wall.

There are 11 steps in this guide to building a brick wall.

Step 1: Start your brick wall at the corners

Firstly, lay out the bricks at both ends of your wall where the pillars will start. This should be done after any necessary foundations have been prepared. Using your string line, make a straight guideline at brick height between the two outside bricks.

Step 2: Mix the mortar

Following this, heap five shovels full of sand and one of cement on an old board. Turn shovel to mix to a consistent colour. Form a central hollow, pour in water and mix. Repeat for a smooth, creamy texture that’s wet but not too loose.

Step 3: Lay the first course of bedding mortar

Next you should lay a 1-2cm mortar bed along the string line. Starting at one end, lay the first brick and tap slightly to 'bed in'. 'Butter up' one end of the next brick with mortar and abut it to the first. Repeat using string line as a guide.

Step 4: Create the brick pillars

At the point where you want your pillars to start, place a brick side-on to the end of the wall. As you build up the wall, each consecutive course of pillar bricks must be laid in the opposite direction.

Step 5: Cutting bricks

When building pillars, at certain courses you'll need to lay half-bricks. To make a cut, place the brick on its side, locate the bolster at the split point and strike the head firmly with a club hammer. It should split cleanly first time.

Step 6: Keep the pillars one course ahead

Always build at least a course higher on the pillars than the rest of the wall. Move the string line up as you build, bedding it into the mortar on the pillars. For a stretcher bond, the end of each brick should be over the centre of the one beneath.

Step 7: Make sure you're sticking to 10mm mortar joints

Horizontal and vertical mortar joints should be 10mm thick. With standard bricks there should be 75mm from the top of each brick to the top of the one beneath. If your bricks soak up moisture fast, you may want to 'joint up' (step 10) as you go.

Step 8: Add a coping stone

You may want to add a coping stone to finish when you reach the top of the pillars. Alternatively, you could create a pleasant effect at less cost by bedding bricks into the mortar on their sides

Step 9: Decorative brick soldier course

Adding a 'soldier course' is an attractive option to top the main part of a garden wall. Turn your bricks vertically lengthways and lay along the full length. Use a second, higher string line to keep a uniform finish

Step 10: How to finish the mortar beds

To finish the beds, use the rounded edge of a brick jointer to scrape mortar into the joints. Start with the horizonal lines and follow with the vertical – it's easier to remove any excess mortar this way

Step 11: Clean up

Lastly, give the finished wall a gentle brush over and clean up any mortar that has fallen onto the floor before it dries. You can use water to wash cement away from the floor, but be sure to keep it away from your newly-built wall!

Source: https://www.self-build.co.uk/how-build-brick-wall/

Text 6. Pipe Piles.

Pipe piles are a type of steel driven pile foundation and are a good candidate for battered piles. Pipe piles can be driven either open end or closed end. When driven open end, soil is allowed to enter the bottom of the pipe or tube. If an empty pipe is required, a jet of water or an auger can be used to remove the soil inside following driving. Closed end pipe piles are constructed by covering the bottom of the pile with a steel plate or cast steel shoe. In some cases, pipe piles are filled with concrete to provide additional moment capacity or corrosion resistance.

In the United Kingdom, this is not generally done in order to reduce the cost. In these cases, corrosion protection is provided by allowing for a sacrificial thickness of steel or by adopting a higher grade of steel. If a concrete filled pipe pile is corroded, most of the load carrying capacity of the pile will remain intact due to the concrete, while it will be lost in an empty pipe pile.

The structural capacity of pipe piles is primarily calculated based on steel strength and concrete strength (if filled). The thickness of the steel considered for determining capacity is typically reduced by 1/16 in. compared to the actual pipe to account for corrosion. Steel pipe piles can either be new steel manufactured specifically for the piling industry or reclaimed steel tubular casing previously used for other purposes such as oil and gas exploration.

Source: Гарагуля С.И. Английский язык для студентов строительных специальностей. Learning Building Construction in English: учебное пособие / С. И. Гарагуля. – Ростов н/Д: Феникс, 2011. – С.341-342.

Text 7. Open Plan Surgery.

(by Andrew Mylius)

Opening up the basement of St Pancras Station's Midland Grand Hotel has called for radical re-engineering of its foundations.

Getting miners, their excavation equipment and construction materials into the tight spaces beneath the Midland Grand Hotel fronting London's St Pancras Station was like playing sardines, says Claire Carr. She is overseeing a surgical operation to remove walls in the old hotel

basement to create a direct link between King's Cross St Pancras Underground station in front of the Midland Grand Hotel, and St Pancras International railway terminus, which is immediately behind it.

"Eurostar will start using the station in November. We're creating easy through-access for passengers moving between the London Underground and high speed trains," says Carr. She is section manager for CORBER, a joint venture between Costain, Laing O'Rourke, Bachy Soletanche and Emcor Rail, which is carrying out the rejuvenation of St Pancras station. It is doing the work for London & Continental Railways, owner and operator of High Speed 1, formerly known as the Channel Tunnel Rail Link.

Carr says that to support the hotel's seven storeys of neo-gothic brickwork, walls in the basement chambers were up to 1.5 m thick, carrying point loads of 500 kN. The space was divided into four rooms, roughly 7 m square, two either side of a 3 m wide corridor. Doors giving access to the corridor, and from the corridor into each of the rooms, were between 800 mm and 900 mm wide. "Space within the chambers was limited, and the doorways formed extremely tight bottlenecks on movements of people and materials," Carr says. Opening the basement up to create space for free-flowing passenger movement follows a 60-pomt method statement. "We've arrived at the point where we've got a large open plan area dotted with columns – we've come a long way," Carr summarises.

Alongside working in confined spaces, one of CORBER's key challenges was to limit settlement "Our work strategy has been governed by the requirement to keep settlement to under 5 mm," says Carr. Instrumentation has been installed on the upper floors of the hotel to keep tabs on the building response to changes being earned out to its footings.

Work started 17 months ago with the excavation of 3 m by 2 m pits to locate the hotel corbelled brick foundations. These were found 6 m down, bearing onto London Clay. A team of miners employed by Costain carried out the excavation work, using timber props and shoring to support the sides of the holes. "Because of the conditions m which we're working, we've gone back to very traditional methods and materials," Carr notes "Timber's far easier to use than steel in tight spaces like this."

With footing levels established, ground was taken down to the same level throughout the basement area. Powered wheelbarrows and a small conveyor were used to remove spoil as two mini-diggers toiled away. Next, 1 m wide, 4.5m deep reinforced concrete strip foundations were cast either side of the walls to take temporary works loading. "We needed very substantial foundations to take propping forces when it came to opening up the walls," Carr explains.

Opening up the walls involved taking cores at high level, where they met the edges of vaults making up the basement jack arch ceiling. Subcontractor Shepley inserted I-section needles through these holes supporting them on propped I-beams running flush with and either side of the walls.

"We were strictly prohibited from opening up more than 25% of the wall at once, so we had to install the needle using a hit one, miss three, hit one pattern. Once we'd been around all the walls once, we went back and did the same again and again." Grout was used to fill cavities in the brickwork of the topmost section of wall, sandwiched between the longitudinal I-beams. The grout also flooded the void between the wall and the web and inner flanges of the I-beams, creating a composite steel-masonry-steel sandwich. Only when the grout had achieved full design strength were props supporting the I-beams jacked imperceptibly, relieving the walls of load. This enabled slots to be cut in the walls. Reinforced concrete saddles were cast, bridging between the strip foundations, on which new cast iron columns were positioned. With all of the columns in place it was finally possible to cut out the remaining brickwork. Floor level between the strip foundations was raised to the same height by placing mass concrete.

Source: New Civil Engineer International, February, 2007.

Text 8. Types of Foundations and Their Uses.

Following different types of foundations are used in construction:

Types of Shallow Foundations

Individual Footing or Isolated Footing

Individual footing or an isolated footing is the most common type of foundation used for building construction. This foundation is constructed for a single column and also called a pad foundation.

The shape of individual footing is square or rectangle and is used when loads from the structure is carried by the columns. Size is calculated based on the load on the column and the safe bearing capacity of soil.

Rectangular isolated footing is selected when the foundation experiences moments due to the eccentricity of loads or due to horizontal forces.

Combined Footing

Combined footing is constructed when two or more columns are close enough and their isolated footings overlap each other. It is a combination of isolated footings, but their structural design differs.

The shape of this footing is a rectangle and is used when loads from the structure is carried by the columns.

Spread footings or Strip footings and Wall footings

Spread footings are those whose base is wider than typical load-bearing wall foundations. The wider base of this footing type spreads the weight from the building structure over more area and provides better stability. Spread footings and wall footings are used for individual columns, walls and bridge piers where the bearing soil layer is within 3m (10 feet) from the ground surface. Soil bearing capacity must be sufficient to support the weight of the structure over the base area of the structure.

These should not be used on soils where there is any possibility of a ground flow of water above bearing layer of soil which may result in scour or liquefaction.

Raft or Mat Foundations

Raft or mat foundations are the types of foundation which are spread across the entire area of the building to support heavy structural loads from columns and walls.

The use of mat foundation is for columns and walls foundations where the loads from the structure on columns and walls are very high. This is used to prevent differential settlement of individual footings, thus designed as a single mat (or combined footing) of all the load-bearing elements of the structure.

It is suitable for expansive soils whose bearing capacity is less for the suitability of spread footings and wall footings. Raft foundation is economical when one-half area of the structure is covered with individual footings and wall footings are provided.

These foundations should not be used where the groundwater table is above the bearing surface of the soil. The use of foundation in such conditions may lead to scour and liquefaction.

Types of Deep Foundation

Pile Foundations

Pile foundation is a type of deep foundation which is used to transfer heavy loads from the structure to a hard rock strata much deep below the ground level.

Pile foundations are used to transfer heavy loads of structures through columns to hard soil strata which is much below ground level where shallow foundations such as spread footings and mat footings cannot be used. This is also used to prevent uplift of the structure due to lateral loads such as earthquake and wind forces.

Pile foundations are generally used for soils where soil conditions near the ground surface is not suitable for heavy loads. The depth of hard rock strata may be 5m to 50m (15 feet to 150 feet) deep from the ground surface.

Pile foundation resists the loads from the structure by skin friction and by end bearing. The use of pile foundations also prevents differential settlement of foundations.

Drilled Shafts or Caisson Foundation

Drilled shafts, also called as caissons, is a type of deep foundation and has an action similar to pile foundations discussed above, but are high capacity cast-in-situ foundations. It resists loads from structure through shaft resistance, toe resistance and/or combination of both of these. The construction of drilled shafts or caissons are done using an auger.

Drilled shafts can transfer column loads larger than pile foundations. It is used where the depth of hard strata below ground level is located within 10m to 100m (25 feet to 300 feet).

Drilled shafts or caisson foundation is not suitable when deep deposits of soft clays and loose, water-bearing granular soils exist. It is also not suitable for soils where caving formations are difficult to stabilize, soils made up of boulders, artesian aquifer exists.

Source: https://theconstructor.org

Text 9. The Monument to the Great Fire of London.

The Monument to the Great Fire of London, more commonly known simply as the Monument, is a fluted Doric column in London, England, situated near the northern end of London Bridge. Commemorating the Great Fire of London, it stands at the junction of Monument Street and Fish Street Hill, 202 feet (62 m) in height and 202 feet west of the spot in Pudding Lane where the Great Fire started on 2 September 1666. Constructed between 1671 and 1677, it was built on the site of St Margaret, New Fish Street, the first church to be destroyed by the Great Fire. It is Grade I-listed and is a scheduled monument. Another monument, the Golden Boy of Pye Corner, marks the point near Smithfield where the fire was stopped.

The Monument comprises a Doric column built of Portland stone topped with a gilded urn of fire. It was designed by Christopher Wren and Robert Hooke. Its height marks its distance from the site of the shop of Thomas Farriner (or Farynor), the king's baker, where the blaze began.

The viewing platform near the top of the Monument is reached by a narrow winding staircase of 311 steps. A mesh cage was added in the mid-19th century to prevent people jumping to the ground, after six people had committed suicide there between 1788 and 1842.

The Monument to the Great Fire of London.

Source: https://en.wikipedia.org

Three sides of the base carry inscriptions in Latin. The one on the south side describes actions taken by King Charles II following the fire. The inscription on the east side describes how the Monument was started and brought to perfection, and under which mayors. Inscriptions on the north side describe how the fire started, how much damage it caused, and how it was eventually extinguished. The Latin words "Sed Furor Papisticus Qui Tamdiu Patravit Nondum Restingvitur" (but Popish frenzy, which wrought such horrors, is not yet quenched) were added to the end of the inscription on the orders of the Court of Aldermen in 1681 during the foment of the Popish Plot. Text on the east side originally falsely blamed Roman Catholics for the fire (“burning of this protestant city, begun and carried on by the treachery and malice of the popish faction”), which prompted Alexander Pope (himself a Catholic) to say of the area:

Where London’s column, pointing at the skies,

Like a tall bully, lifts the head, and lies.

– Moral Essays, Epistle iii. line 339 (1733–1734).

The words blaming Catholics were chiselled out with Catholic Emancipation in 1830.

The west side of the base displays a sculpture, by Caius Gabriel Cibber, in alto and bas relief, of the destruction of the City; with Charles II and his brother, James, the Duke of York (later King James II), surrounded by liberty, architecture, and science, giving directions for its restoration.

It gives its name to the nearby London Underground station, Monument.

Source: https://en.wikipedia.org

Text 10. Beams Throughout History.

Already in the early 3rd millennium BC, in Zozer's tomb complex at Saqqara, blocks of stone were being deliberately shaped for use as ceiling beams instead of just used as found. The fact that their undersides were cut to a rounded form suggests an even earlier use of cut timber, probably palm logs.

This is to be expected, since timber is easier to cut and transport. Apart from its inferior durability, it is also a more appropriate material because the structural action of a beam involves internal tension as well as compression. Besides, timber, unlike stone, has a tensile strength along the grain to match its compressive strength. With stone there was only one possibility – the use of metal reinforcement at the bottom to improve the tensile weakness.

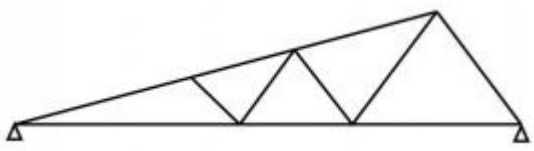
Iron beams became structurally important elements only in the late 18th century with the widespread introduction of cast iron.

Reinforced concrete became a highly versatile structural material, since the strength of the concrete, the overall geometry of the element, and the quantity and placement of the reinforcement rods were all under the designer's control.

Source: Безручко Е. Н. Английский для архитекторов: учебное пособие по английскому языку для студентов архитектурных и строительных специальностей вузов / Е. Н. Безручко. – Ростов н/Д: Издательский центр «МарТ»; Феникс, 2010. – С. 194-195.

Text 11. Types of Truss Structures.

North light truss

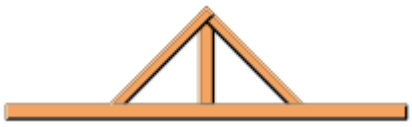


North light truss.

Source: https://www.steelconstruction.info

This form of truss is usually used for short spans in industrial buildings, and is so called because it allows maximum benefit to be gained from natural lighting by the use of glazing on the steeper north-facing pitch.

King post truss vs. Queen post truss



King post truss.

Source: https://en.wikipedia.org

Queen post truss.

Source: https://en.wikipedia.org

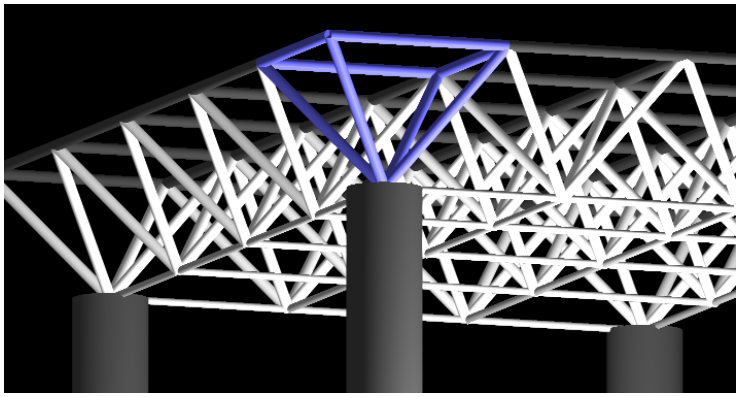
Typically, king post trusses are made from timber and spans up to 8m. The king post truss is used for simple roof trusses and short-span bridges. They take the form of a simple triangle, with a vertical member between the apex and the bottom chord.

Similar to the king post truss, but with diagonal members between the centre of the bottom chord and each of the inclined top chords, queen post trusses can span 10m.

Source: https://www.designingbuildings.co.uk

Text 12. Trusses and Space Frames.

Trusses and space frames are assemblies of linear members that act primarily in axial tension or compression as ties or struts. The term truss denotes an assembly in one plane, and the term space frame describes a three-dimensional assembly in which the interconnections are such that a load at any point is distributed in all directions through the assembly. The joints need not be rigid and, ideally, should allow free relative rotations of the members. But they must be capable of transmitting tension as well as compression. The usual role in a building is of carrying a roof – in place of the arch, dome, vault, beam, or slab.



Simplified space frame roof.

Source: https://en.wikipedia.org

In the early 19th century, the true timber truss, necessarily somewhat elaborated and with the bottom tie made from shorter lengths of timber with lapped joints was stretched to span about 150 ft. (45 m); but the first wide-span iron roofs (of basically arched form) had then been built, and future development was in iron and steel. With the introduction of wrought iron for the ties, there was a clearer differentiation between these and the struts that was carried over into steel construction. Because there was no risk of the ties buckling, they were made appreciably more slender.

The most important space frames are lighter framed equivalents of domes and vaults, or of slabs spanning in two or more directions simultaneously. The framed dome is a very early form, particularly if we include primitive dome-shaped huts. But even in fully developed timber-framing systems, the ribs were invariably aligned radially and circumferentially, and the system was then braced by additional diagonals or by the outer covering. Early iron-framed domes

merely reproduced this timber form, and it was only in the second half of the 19th century that an inherently stiff, triangulated pattern of framing was substituted. This might be regarded as the first true space frame.

Further development of the framed dome or vault has taken place almost entirely in the 20th century and has lagged somewhat behind parallel developments in airframe structures, where there was a greater incentive to seek the most efficient use of material to save weight.

Source: Безручко Е. Н. Английский для архитекторов: учебное пособие по английскому языку для студентов архитектурных и строительных специальностей вузов / Е. Н. Безручко. – Ростов н/Д: Издательский центр «МарТ»; Феникс, 2010. – С. 233-234.

Text 13. Benefits of Structural Steel Frame Construction.

With decades of evolution, structural steel has always been the favourite versatile building material for many builders in modern construction. Steel provides many overwhelming benefits which is why many architects and contractors use structural steel over other materials such as concrete and wood. Considering the freedom of design, the strength of integrity, and ease of maintenance, structural steel is the smart choice. There are many benefits of structural steel frame construction.

1) Faster Build Time

In the construction business, time is so precious that it is equals money. Every client demands their business projects to be completed under budget and ahead of schedule. But, for architects and construction crew taking shortcuts can lead to unsafe building practices. If you don’t want to exceed your deadlines and blow your budget, then structural steel frames are the way to go. Most of the steel parts are prefabricated to a specific design in the manufacturing plant and shipped out. These parts are directly erected on the site, hence eliminating the chances of human errors. Since the steel parts are prefabricated, there are already follow the respective code standards and dimensions. Therefore, your engineers do not have to worry about the quality of each piece.

2) Steel is Eco-Friendly

Since the steel frame is a completely recycled material, every steel frame structure can be recycled, making it an eco-friendly material. Eighty million tons of steel are recycled each year, thus making it the world’s most recycled product. Since 1990, the steel industry has reduced energy intensity per ton of steel produced by 28% and CO2 emissions by 35% per ton of steel shipped. By using the high-quality prefabricated steel parts, you can have an air-tight and

comfortable steel frame structure, thus ensuring that your structure is a completely sealed. If you want to keep your construction project eco-friendly, then structural steel frame is one solution.

3) Outstanding Durability

Steel has obvious durability advantages. The components included makes steel to sustain more structural weight and last longer than the wooden ones. Structural steel components are lighter and stronger than weight-bearing wood or concrete products on your steel frame structure.

4) Lightweight

When you compare the density of steel with the density of wood, steel is heavier. But the shape of the steel plays an important role to determine the weight of the material. For instance, the design of the steel I-beam is lighter than the structurally sound wood beam design. Also, lightweight steel decreases the requirement of labour, reduces shipping costs, and simplifies the structural support systems. When you get all these advantages, it can further reduce your construction project budgets.

5) Lower Costs in the Long Run

Steel has always proved to be economical in the long term. Rather than paying landfill fees for non-recyclable construction, your company can reduce the expenses by using structural steel in the steel frame structure. Since steel is durable, it requires less maintenance, hence reducing the costs throughout the building's lifetime. Due to the demand for steel in the construction business, steel prices are lower than it was some years back. With faster construction time, steel construction time, you pay fewer payments to the lender during the duration of the process.

6) Incredibly Versatile

Structural steel can be moulded in any shape and size. Steel has always been an attractive option for the construction market, due to its versatility and exterior ability. With the help of the steel, you can let your artistic imaginations and construct a building that is both safe and resilient.

7) Hybrids with Other Building Materials

Many companies have paired materials to take the best advantage of the strength, durability, and support benefits of different materials. For instance, many construction companies offer hybrid steel and wood buildings which take advantage of the insulation properties of steel and wood.

8) Easy Fabrication

Steel parts are easily fabricated in a variety of shapes and sizes. This also means that you can customise them to bear specific loads in steel frame structures. You can even support your design and structure it at places where it is needed the most. Structural steel can be easily altered even after they are installed in a building framework.

9) Pest and Insect Resistant

The components in structural steel are immune to the degrading effects made by pests and insects. On the other hand, if you install a wooden framework, you might experience pest and insect issues unless it is adequately treated.

10) Moisture and Weather Resistance

Structural steel has good moisture resistant properties depending on the carbon content. You can even enhance the rust resistance of steel by treating the metal with hot zinc coating and extra powder treatments. These treatments will help your steel frame structure to be more immune to the effects of water, further resisting the impact of the weather. There is also a structural steel myth that a steel frame structure can expose the risk of lightning strike as structural steel is an excellent conductor of electricity. The fact is that with a properly grounded steel frame structure with structural steel, it will transfer the current straight to the ground which makes it much safer than traditional non-metal structure.

Source: https://northern-weldarc.com/ten-benefits-of-structural-steel-frame-construction/

Text 14. Flat roof.

A flat roof is a roof which is almost level in contrast to the many types of sloped roofs. The slope of a roof is properly known as its pitch and flat roofs have up to approximately 10°. Flat roofs are an ancient form mostly used in arid climates and allow the roof space to be used as a living space or a living roof. Flat roofs, or “low-slope” roofs, are also commonly found on commercial buildings throughout the world. The National Roofing Contractors Association defines a low-slope roof as having a slope of 3 in 12 (1:4) or less.

Flat roofs exist all over the world, and each area has its own tradition or preference for materials used. In warmer climates, where there is less rainfall and freezing is unlikely to occur, many flat roofs are simply built of masonry or concrete and this is good at keeping out the heat of the sun and cheap and easy to build where timber is not readily available. In areas where the roof could become saturated by rain and leak, or where water soaked into the brickwork could freeze to ice and thus lead to ‘blowing’ (breaking up of the mortar/brickwork/concrete by the

expansion of ice as it forms) these roofs are not suitable. Flat roofs are characteristic of the Egyptian, Persian, and Arabian styles of architecture.

Around the world, many modern commercial buildings have flat roofs. The roofs are usually clad with a deeper profile roof sheet (usually 40mm deep or greater). This gives the roof sheet very high water carrying capacity and allows the roof sheets to be more than 60 metres long in some cases. The pitch of this type of roof is usually between 1 and 3 degrees depending upon sheet length.

A flat roof is the most cost-efficient roof shape as all room space can be used fully (below and above the roof). Having a smaller surface area, flat roofs require less material and are usually stronger than pitched roofs. This style roof also provides ample space for solar panels or outdoor recreational use such as roof gardens. Applying a tough waterproofing membrane forms the ideal substrate for green roof planting schemes.

Where gable roofs are uncommon or space is limited, flat roofs may be used as living spaces, with sheltered kitchens, bathrooms, living and sleeping areas. In third world countries, such roof tops are commonly used as areas to dry laundry, for storage, and even as a place to raise livestock. Other uses include pigeon coops, helipads, sports areas (such as tennis courts), and restaurants outdoor seating.

Source: https://en.wikipedia.org/wiki/Flat_roof#Benefits_and_uses

Text 15. Floor systems.

The continuous slab constitutes a self-contained floor system, though it may be desirable for non-structural reasons to add a separate top surface and a separate ceiling below. Before the development of the reinforced-concrete slab, the nearest equivalents were the floor composed of beams of timber or stone set immediately alongside one another, and the floor provided by a more or less solid above a brick or concrete vault. The first of these involved a very extravagant use of material and hence expenditure of effort, so it usually gave way to a more differentiated form with increasing skill in construction. The second was more efficient, inherently strong, and fireproof, and continued to be used for these reasons until supplanted by the reinforced-concrete slab. But it had the drawbacks of greater overall depth than alternative forms, and of greater weight plus the generation of outward thrusts, so that stronger walls were called for.

The alternative to these forms was always some composite system, with beams as the principal spanning and load-bearing elements. In the commonest of these systems, still widely

used, light timber beams span at short intervals between opposite walls and are covered by boards or twigs and rammed earth.

Today the usual floor system, apart from intermediate floors within single dwellings, is the reinforced-concrete slab with or without projecting beams. For very heavy loadings and wide spans, a grid of beams within a bay may be used to stiffen and strengthen the slab without requiring it to be of great thickness throughout. In all cases, the slab has a great advantage over the earlier systems because it is a good horizontal diaphragm, binding the walls or columns together and distributing any side loads between them.

Source: Безручко Е. Н. Английский для архитекторов: учебное пособие по английскому языку для студентов архитектурных и строительных специальностей вузов / Е. Н. Безручко. – Ростов н/Д: Издательский центр «МарТ»; Феникс, 2010. – С. 207.

Text 16. The Arch of Constantine.

The Arch of Constantine is a triumphal arch. It was erected to commemorate Constantine I's victory over Maxentius on October 28, 312. Dedicated in 315, it is the latest of the existing triumphal arches in Rome, from which it differs by spolia, the extensive reuse of parts of earlier buildings. The arch is 21 m high, 25.7 m wide and 7.4 m deep. It has three archways, the central one being 11.5 m high and 6.5 m wide, the lateral archways 7.4 m by 3.4 m each. The lower part of the monument is built of marble blocks, the top (called attic) is brickwork clad with marble. A staircase formed in the thickness of the arch is entered from a door at some height from the ground, in the end towards the Palatine Hill.

Source: Ивянская И.С. Английский язык для архитекторов: учебник. – М.: КУРС: ИНФРА-М, 2014. – С. 70.

Text 17. Triumphal Arch on the Square of Carrousel. (Arc de Triomphe du Carrousel)

In 1802, during the Peace of Amiens, in commemoration of the great victories of French arms, it was decided to erect a triumphal arch in Paris on the model of the arches of ancient Rome. Architects Charles Percier (1764 – 1838) and F.L. Fontaine (1762 – 1853) supervised the construction. It was begun in February 1806 on the Place du Carrousel, separating the Louvre and the Gardens of Tuileries. The name of this square comes from the festive equestrian competitions of the royal court in the seventeenth century, which were the ancestors of modern military parades.

The arch of Septimus Severus in Rome was taken as the example and two architects erected an arch 14.60 m high, 17.60 m long, and 10 m wide. Eight soldiers of different armies crown the pillars; and allegories and scenes of the victories of Napoleon's army at Ulm and Austerlitz are depicted on the bas-reliefs.

Triumphal Arch on the Square of Carrousel.

Source: https://ru.wikipedia.org

In April 1808 the Quadriga was erected on the top of the arch. Until this time, it had decorated the facade of Saint Mark's church in Venice. In the thirteenth century, this antique sculpture had been taken to Venice after the capture of Constantinople.

After the Restoration, the Quadriga was brought back to Venice, and since that time the arch has been crowned with the sculptural group made by F.J. Bosio (1768 – 1853), 3 metres in size. These four horses convey the goddess Victory, symbol of the Restoration, accompanied by allegorical figures.

Source: Ивянская И.С. Английский язык для архитекторов: учебник. – М.: КУРС: ИНФРА-М, 2014. – С. 192-193.

Text 18. Triumphal Arch in Moscow.

In the middle of 1814, a wooden Triumphal Arch was built beside the Tver Gates for the solemn meeting of the victorious Russian troops returning from West Europe. The monument became dilapidated quickly and twelve years later, in 1826, the decision was made to replace the wooden Triumphal Arch with a stone one. The famous Russian architect Osip Bove worked at a new variant for almost two years, it was adopted in April 1829. The ceremony of laying the corner stone took place the same year on August 17. A bronze plaque was bricked up in the base of the future monument with the inscription: "These Triumphal Gates are built in token of the memory of the triumph of Russian warriors in 1814". It took five years to build the Triumphal Arch (the first and only monument erected after the war of 1812 in Moscow that was in the form of an arch). Only on September 20, 1834 was the construction completed and this monument reflected the military power, glory and greatness of Russia and the heroism of its victorious soldiers.

The Triumphal Arch stood near the Tver Gates for 102 years. In 1936, the Soviet government decided to re-plan the square near the Belorussian Terminal and widen it to relieve transport traffic between Gorky Street and Leningrad Highway. The Triumphal Arch was pulled down.

Triumphal Arch in Moscow.

Source: https://ru.wikipedia.org

In 1966 the Moscow Soviet decided to reconstruct the Triumphal Arch on a new site. The architects, artists and engineers were to reconstruct the initial appearance of the monument using preserved measurements, drawings and photographs and filling in the missing ornamental elements.

The sculptural restorers studied carefully the materials in the archives and prepared the plaster casts and moulds for the details, which needed to be re-cast anew. More than 150 models, each an exact copy of a restored decorative element, were prepared.

Nowadays the Triumphal Arch stands on Victory Square, not far from the Poklonnaya Gora, forming a united historical-memorial complex with the panorama museum “Battle of Borodino”, the “Kutuzovskaya Izba” (Kutuzov’s Hut) and the other monuments nearby.

It is built, not as a set of gates with a passage through them, but as a free-standing monument with transport traffic flowing around it on both sides.

The base of the monument is formed by a one-span arch with six pairs of 12-meter-high cast-iron pillars of splendid Corinthian Order, arranged around two supports (or pylons). Between each pair of pillars, in the niches formed by them, you can see on high pedestals the powerful cast figures of warriors.

The arch is crowned by the chariot of Glory, which seems to be flying over the attic of the arch. Six horses draw the chariot. In the chariot proudly stands the winged goddess of Victory. With the laurels raised high in her right hand she crowns the victors.

In the centre of the attic, above the road, you can see memorial plaques with inscriptions on both sides of the arch. The walls of the arch are faced with white stones. The arch is

remarkable for the skillful combination in one monument of varied materials and contrasting colors – black cast-iron moldings and white stone.

Source: Ивянская И.С. Английский язык для архитекторов: учебник. – М.: КУРС: ИНФРА-М, 2014. – С. 193-194.

Text 19. Shells.

The term shell is used to denote a spanning and space-enclosing element of domed or other vaultlike form, but with a thickness and order of magnitude less than was usual for these masonry and mass-concrete forms. Like the latter, a shell may be curved in two directions or in one only; but the two curvatures of the doubly curved form may be of opposite sense, like those of a saddle − a possibility almost restricted to the fan vault in masonry – and the singly curved form may be taken to include barrel-shaped and folded or corrugated forms that span along the length of the barrel or the folds, and act as deep beams. To achieve the reduction in thickness, tensile strength must be provided in the shell itself, or at the level of support, or in both places, in accordance with the requirements of the surface geometry, the pattern of loading, and the type of support.

The shelf, together with the doubly curved tensile membrane or cable net, has so enlarged the formal vocabulary of architecture that it will continue to play an important role where economy is not the overriding consideration. The Saarinen/Ammann and Whitney roof of the TWA Terminal Building at Kennedy Airport demonstrates its versatility at the limits of practicality; Jorn Utzon's original impracticable proposal of sharply ridged shells for the Sydney Opera House went beyond these limits and called for a different arched type of construction.

Source: Безручко Е. Н. Английский для архитекторов: учебное пособие по английскому языку для студентов архитектурных и строительных специальностей вузов / Е. Н. Безручко. – Ростов н/Д: Издательский центр «МарТ»; Феникс, 2010. – С. 227-228.

Text 20. Door Designs.

Changing door designs also say a great deal about the life and times of the people behind the doors. In America's early, precarious days of colonial settlement, doors were built with more attention to strength than beauty. Heavy timbers, joined by crossed planks, were held in place with iron hinges and latches. Doors had little, if any, embellishment; the handcrafted ironwork was the only ornament, and windows in doors were rare. Style did not become a significant consideration until the more civilized times of the eighteenth century when Georgian architecture

opened the door to an expansive menu of Classical details. For architects of the period, the main entrance was the main feature of the facade. Doors were set in the center and framed with Greek and Roman columns and pediments. Columns of every Classical order and pediments of varying shapes – triangular, rounded, segmental, or open at the top – were formally arranged to complement the symmetry of the exterior design. Fanlights above and sidelights on either side of the door filled entrance halls with light while maintaining privacy and security.

Source: Ивянская И.С. Английский язык для архитекторов: учебник / И.С. Ивянская. – 2-е изд., перераб. и доп. – М.: КУРС: ИНФРА-М, 2014. – С. 196.

Text 21. Evolution of Windows.

Bringing light into buildings is the window's function. Every detail of window design, from the size and shape of the pane to the clarity and color of the glass, affects the atmosphere inside a building and the connection to the outside world.

Glassmaking was an art practiced by the Egyptians as early as 3500 B.C. It was the Romans who developed clear glass and began to use it – sparingly – in the windows of important buildings. In ordinary buildings in Europe mica was used in windows. German craftsmen developed techniques for producing larger panes of glass in the eleventh century, but glazed windows were a great luxury, reserved for palaces and churches, up to the late Middle Ages.

European settlers brought the first glass windows to America. The northern American dwellings needed shelter from the elements and had no openings except for doors. The pueblos and adobe homes of the Southwest had small openings in stone to allow air circulation while keeping the heat out. The timber homes of the early colonists had small, thick panes of glass. Many houses were built with diamond paned windows. The earliest type was a casement window that opened from side hinges.

Today's sash or double-hung window is not a modern invention. The modern style with separate top and bottom sections owes its origin to an obscure British law of 1709 that regulated building construction in London. At the time, windows had always been placed flush to the outside walls, held in place with wooden pins. For purposes of public safety, the law required that windows be recessed four inches, sitting more deeply into the interior of the facade. This modification created a large window sill. It took another twenty years for sash windows to become a prevalent feature in most homes, in the process the modern window was born.

Source: Ивянская И.С. Английский язык для архитекторов: учебник / И.С. Ивянская. – 2-е изд., перераб. и доп. – М.: КУРС: ИНФРА-М, 2014. – С. 196-197.

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Вахитова Д.К.