МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

КАЗАНСКИЙ ГОСУДАРСТВЕННЫЙ АРХИТЕКТУРНО-СТРОИТЕЛЬНЫЙ УНИВЕРСИТЕТ

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CONSTRUCTION MATERIALS

Учебное пособие

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

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INTRODUCTION

Данное учебное пособие предназначено для студентов первого курса, обучающихся по направлению подготовки 08.03.01 «Строительство». Учебное пособие нацелено на развитие и совершенствование умений и навыков устной речи в деловой и общепрофессиональной коммуникации, а также формирование профессионально ориентированной лингвистической компетентности студентов. Учебное пособие “Construction Materials” направлено на развитие разных видов речевой деятельности: чтения, диалогической и монологической речи, навыков письменного и устного перевода.

Структура учебного пособия состоит из семи разделов (Units). Деление на разделы осуществляется в соответствии с тематикой. Первый раздел знакомит студентов с основными строительными материалами и их типами, историей развития строительных материалов, а также их основными свойствами. Разделы 2-5 посвящены строительным материалам, созданным человеком. Во втором разделе раскрывается информация о цементе, бетоне и его основных типах. В третьем разделе изучается такой важный строительный материал как кирпич, а также рассматривается черепица. Четвертый раздел посвящен основным характеристикам и типам стекла и металла. Более подробно изучается сталь и ее классификация. В пятом разделе детально описываются полимеры и их использование в строительстве. Шестой раздел посвящен природным строительным материалам. Особое внимание уделяется древесине и камню. Рассматриваются различные виды камней, которые активно применяются на различных этапах строительных и отделочных работ. Завершающий раздел посвящен необычным материалам, применяемым в строительстве, к примеру, бумага, лед и др.

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 текст 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 строительных материалах. Таким образом, изучив представленные в учебном пособии материалы, студенты смогут на базовом уровне участвовать в процессе коммуникации на профессиональные темы.

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

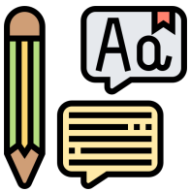
В конце учебного пособия представлены итоговые задания (Final Tasks) для оценки общего уровня усвоения всех изученных строительных материалов.

Учебное пособие “Construction Materials” содержит дополнительные тексты для чтения (Supplementary Texts for Reading), содержащие более подробную информацию об отдельных строительных материалах. 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. CONSTRUCTION MATERIALS. GENERAL INFORMATION

1A. WHAT ARE BUILDING MATERIALS?



1. Read the words and learn them by heart.

concrete – бетон
carpentry – плотничество
to ensure – обеспечить
roofing – кровельные работы
substance – вещество
clay – глина
to cut corners – искать легкие пути, экономить (на качестве)
trade – занятие, ремесло, профессия
durability – долговечность, прочность
plumbing – водопроводное дело

2. Before you start. Answer the questions.

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

3. Read and translate the text about construction materials and check your ideas.

What Are Building Materials?

Building material is any material that can be used for construction purposes. It commonly includes wood, concrete, steel, cement, aggregates, bricks, clay, metal, etc. In this modern age, engineers have learned to mix and match the right materials to come up with higher quality structures. Of course, the choice is always based on the client's budget and the effectiveness of the materials in building projects.

Many naturally occurring substances, such as clay, rocks, sand, and wood, even twigs and leaves, have been used to construct buildings. Some of these are still widely used in the modern construction scene, especially in the USA, where most houses are still made of wood.

Many man-made materials came out in the previous years and some are synthetic. Although not natural, some are used to make eco-friendly houses.

Most building materials today are being manufactured. And the industry is a well-established one in many countries.

Source: https://zaitoon.com.pk/types-of-building-materials-used/

The use of these materials is typically segmented into specific specialty trades, such as carpentry, insulation, plumbing, and roofing work. All building materials can be used to create a quality structure. But that depends on how they are used in construction. This is why project managers and engineers need to analyze carefully the material they need in their projects.

It is important to choose the right building materials, because they have a big impact on the quality of the structure. No matter how good a construction team is when the materials are cheap and substandard, the building will still see many problems and won't last long.

Sadly, the selection of right building materials is often overlooked. Many project planners tend to cut corners and push aside the use of the best quality materials. Often, cost is the reason for choosing alternative materials that aren't as good as the original choice. But clients need to consider that they can deliver the highest quality building to their tenants by using the most suitable materials. This also ensures the safety and durability of the building.

Source: https://www.procrewschedule.com/building-materials-types-and-uses-in-construction/

4. Decide if the sentences are true or false.

1. Generally, building materials include wood, concrete, steel, cement, aggregates, etc.
2. Clay, rocks, sand, and wood are man-made materials.
3. The use of building materials is typically segmented into such trades as sewing, printing and publishing.
4. It is important to choose the right building materials, because they have a low impact on the quality of the structure.
5. Cost can be the main reason for choosing other materials that aren't as good as the original choice.

5. Match the words to the definitions.

1. synthetic	**a.** to make certain that something will happen properly
2. to cut corners	**b.** produced by combining different artificial substances, rather than being naturally produced
3. tenant	**c.** the process of insulating something, or being insulated
4. durability	**d.** the activity of making and repairing wooden objects
5. to ensure	**e.** someone who lives in a house, room etc. and pays rent to the person who owns it
6. insulation	**f.** the work of fitting and repairing water pipes, baths, toilets, etc.
7. carpentry	**g.** staying in good condition for a long time, even if used a lot
8. clay	**h.** the job of building or repairing roofs
9. plumbing	**i.** to save time, money, or energy by doing things quickly and not as carefully as you should
10. roofing	**j.** a type of heavy sticky earth that can be used for making pots, bricks, etc.

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

1. Качество
2. Строительные цели
3. Экологически безопасный, экологичный
4. Иметь большое воздействие
5. Оттеснять, отодвигать в сторону
6. Подходящие материалы
7. Обеспечивать безопасность
8. Упускать из виду, не замечать
9. Тщательно анализировать
10. Смешивать и сочетать
11. Прочно устоявшийся

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

1. The of building is right selection overlooked materials.
2. used Building construction is material for material.
3. choosing reason is the alternative Cost cheaper materials for.
4. a big quality Building impact materials have on the of structure the.
5. sand and used wood are rocks widely in Clay construction.
6. mix Engineers and the match can materials.
7. Cheap many and can substandard cause materials problems.
8. Building wood materials include concrete steel cement.

8. Complete the text with words from the box.

Egypt	basalt	iconic
pyramids	included	to coat
close	building sites	perhaps

What materials were used to build the Pyramids of Giza?

Giza lies outside of Cairo, Egypt, and is home to one of the most _____[1] structures of early civilization on earth, the Pyramids of Giza. These magnificent _____[2] are the most famous of all Egyptian pyramids, largely because of the scale of their construction, which occurred from about 2550 to 2459 BC. This period was the time when human civilization was not developed especially in masonry. The Pyramids of Giza are the oldest among the Seven Wonders of the Ancient World. The materials used to build the pyramids _____[3] limestone, pink granite, basalt and mud bricks.

Limestone was utilized in the core of the pyramid, which was found near the _____[4] during the pyramid construction era. White limestone was used _____[5] the interior walls.

Granite was used in conjunction with limestone to cover the interior walls of the pyramids. Granite was not as _____[6] as the limestone quarries.

_____[7] was often used to cover the floor of the pyramid.

Mud bricks were _____[8] the most common building material in _____[9]. They were used to build the walls of the pyramids.

UNIT 1. CONSTRUCTION MATERIALS. GENERAL INFORMATION

1B. FIRST CONSTRUCTION MATERIALS

1. Read the words and learn them by heart.

cave – пещера
shelter – кров, укрытие
mud – грязь, илистый грунт
castle – замок
straw – солома
trace – след
thatched roof – соломенная крыша, тростниковая крыша
mold (mould) – форма
to polish – шлифовать
tile – черепица

2. Before you start. Answer the questions.

1. What construction materials were first used by people to build their houses?
2. How were early human shelters built?

3. Read and translate the text about first construction materials and check your ideas.

First Construction Materials.

A very long time ago, people didn't build homes. They slept in forests and caves, which were dark and didn't have windows.

People used wood and plants to make shelters – simple places to sleep in. They were at first very simple and perhaps lasted only a few days or months. People cut wood from trees to make the shape of the shelter. Then they used other plants to make the roof and the walls. The very simplest shelters leave no traces, that's why we can say little about very early construction.

The first houses were made from dry plants like straw. These houses weren't very strong.

The Ancient Egyptians built houses with bricks made of mud and straw. They put the mixture into moulds and left them in the sun to dry. Then they built walls with the bricks and put

wet mud on top. There were holes in the walls for windows and doors. Egyptian houses had flat roofs. People often slept on the roof because it was cool. In the past other people in Asia, Africa, and South and North America built mud houses, too.

Source: https://www.pinterest.ru/pin/147000375323592170/

Some people in the past built houses from stone because it was strong. Poor people lived in small houses with only one room. Important rich people built stone castles to live in, which took many years to build.

The Ancient Greeks built houses with mud bricks on top of stone blocks. The roofs were usually made of tiles. The Incas lived in Peru. They built houses with stone blocks. Each block was carefully cut and polished so the houses looked great when they were finished. The houses had roofs made of straw.

The Ancient Chinese people built wooden houses. They had long roofs made of bamboo. Many Chinese houses were built on platforms to protect the wood from water.

The Ancient Romans built houses with wood, mud, and stone. They also used some materials that we use today, like concrete.

Source: Oxford Read and Discover. Homes around the world. – Oxford University Press, 2010. – pp. 4-7.

4. Answer the questions.

1. Why can we say little about very early construction?
2. Where did people sleep before they started building houses?
3. What materials did the Ancient Egyptians use to build a house?
4. Did the Egyptian houses have a conical roof?
5. What materials did the Ancient Greeks use to build a house?
6. Why were many Chinese houses built on platforms?
7. How did the Incas build houses?
8. What materials did the Ancient Romans use to build a house?
9. Why did some people in the past build houses from stone?
10. How did people make the shape of the shelter?

5. Match the words to the definitions.

1. tile	**a.** a hard, natural substance that is found in the ground
2. wood	**b.** the dried stems of plants that animals sleep on, and that are used for making things such as baskets, hats, etc.
3. mud	**c.** a large hole in the side of a cliff or mountain
4. stone	**d.** a thin curved piece of baked clay used for covering roofs
5. straw	**e.** a very large strong building, built in the past as a safe place that could be easily defended against attack
6. bamboo	**f.** the material that trees are made of
7. castle	**g.** a place that protects you from bad weather or danger
8. cave	**h.** a tall tropical plant with hollow stems that is used for making furniture
9. shelter	**i.** a container that is used to make something in a particular shape
10. mould	**j.** wet earth that has become soft and sticky

6. Match the types of materials with the pictures.

mud house wooden house stone house castle cave straw house

Source: Oxford Read and Discover. Homes around the world. – Oxford University Press, 2010. – P. 36.

7. Match. Then write the sentences in order.

Leave holes for windows and doors.

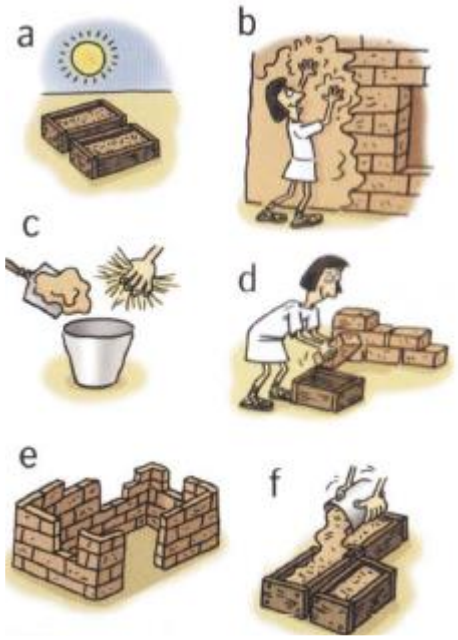
Build a wall.

Put the mixture into moulds.

Leave the moulds in the sun.

Put wet mud on the wall.

Mix mud and straw.



How to make bricks from mud and straw:

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

Source: Oxford Read and Discover. Homes around the world. – Oxford University Press, 2010. – p. 37.

8. Translate the facts about the first construction materials.

Во все времена человек строил жилище, чтобы защититься от жары и холода, дождя и снега. Сначала это были пещеры, а потом – строения из камня и глины.

Первыми строительными материалами были камень, дерево и кирпич. Выбор материала зависел от местности, в которой строился дом. К примеру, пирамиды в Древнем Египте возводились из каменных блоков, многие здания на Руси строилось из дерева. А в Древней Индии использовался кирпич, изобретенный до нашей эры.

Древний Рим и Египет использовали его для возведения арок, и других сложных конструкций. Материал формовали и сушили на солнце. Несмотря на то, что обожженный кирпич известен уже более 4000 лет, сегодня он – один из наиболее популярных строительных материалов.

9. Complete the text with words from the box.

Roman	emerged	roofs
stone	available	sandstone
durability	significance	material

Stone construction in Egypt.

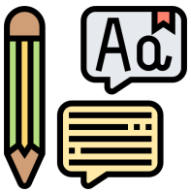
Like the other great river valley cultures, Egypt built its cities with mud brick; fired brick did not appear there until _____[1] times. Timber was used sparingly, for it was never abundant. It was used mainly in _____[2], where it was heavily supplemented by reeds. Only a few royal buildings were built with full timber frames.

A new technology of cut-stone construction _____[3] in the temples and pyramids of the 4th dynasty (c. 2575 – c. 2465 BC). Egypt, unlike Mesopotamia, had excellent deposits of _____[4] exposed above ground; limestone, _____[5], and granite were all _____[6]. But the extracting, moving, and working of stone was a costly process. Stone emerged as an elite construction material used only for important buildings.

The Egyptians developed cut stone for use in royal mortuary buildings not only for its strength but also for its _____[7]. It seemed the best _____[8] to offer eternal protection to the pharaoh. Thus, stone had both a functional and symbolic _____[9].

UNIT 1. CONSTRUCTION MATERIALS. GENERAL INFORMATION

1C. TYPES AND PROPERTIES OF CONSTRUCTION MATERIALS



1. Read the words and learn them by heart.

alloy – сплав
compression – сжатие
amount – количество
stiff – жесткий, твердый
brittle – хрупкий, непрочный
acid – кислота
to expand – расширяться
to conduct – проводить
property – свойство
to expose – подвергать действию
chemical resistance – устойчивость к химическому воздействию
force – сила
stretching force – растягивающая сила
fire-resistance – огнеупорность, огнестойкость
thermal conductivity – теплопроводность
to contract – сжиматься, сокращаться
to resist – препятствовать, противостоять
tension – растяжение, натяжение

2. Before you start. Answer the questions.

1. What properties do building materials have?
2. Give examples of natural and man-made materials.

3. Read and translate the text about types and properties of construction materials and check your ideas.

Types and Properties of Construction Materials.

Materials belong to two basic groups: natural materials and man-made materials. Naturally occurring materials generally are used as they are found, except for being cleaned, cut, or processed in a simple way that does not use much energy. Natural materials include stone, wood, sand, etc. Man-made materials are created through processes that

can alter the microstructure of the substances used to make the materials. Such materials include ceramics, metals and their alloys, plastics, glass, cement, concrete, etc.

Materials used for construction purposes possess different properties. They differ in durability, strength, weight, fire-resistance and, naturally, cost. Most properties of materials fall into several groups: mechanical, chemical, electrical, magnetic, thermal, etc.

Some of the most important mechanical properties are strength, hardness, elasticity, plasticity, brittleness, etc.

When materials are exposed to forces, such as tension (stretching forces ←□→) and compression (crushing forces →□←), they deform – that is, they change shape. The type of deformation depends on the type of force that is applied.

When a material is subjected to tension, its length will increase by a certain amount. This is called extension or elongation. It is especially important to understand the performance of materials in tension, as their tensile strength (ability to resist tension) is usually lower than their compressive strength (ability to resist compression).

Some materials can extend significantly, but still return to their original shape. A material's ability to do this is called elasticity. Rubber is an example of a very elastic material.

If a material has a very low elasticity, and is strong, engineers say it is stiff. If a material has low elasticity and is weak, it is described as brittle – that is, it breaks very easily. Glass is an example of a brittle material.

Some materials can change shape significantly, but do not return to their original shape. We say these materials are plastic.

The hardness of a material affects its durability – that is, how long it will last. Generally hard materials are more durable than soft.

The ability of construction materials to resist the effects by chemicals like acids, salts, etc. is known as chemical resistance.

The properties of a material to conduct or to resist electricity through them are electrical properties of material.

Some materials conduct heat better than others. Therefore, thermal conductivity varies, depending on the material. As the temperature increases, most materials expand (increase in size due to heating), and as temperature falls, they contract (decrease in size due to cooling).

Sources: https://theconstructor.org/building/properties-of-building-materials-construction/14891/, http://www.bntu.by/images/stories/fes/OldSite/news/1kurs_1sem_fes_sf.pdf, Professional English in Use. Engineering. – Cambridge University Press, 2009. – pp. 42, 44.

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

1. If a material has a very low elasticity, and is strong, it is called _____.

a) stiff;

b) brittle.

2. Plastic materials can change shape significantly and generally they _____.

a) do not return to their original shape;

b) return to their original shape.

3. Thermal conductivity varies, depending on _____.

a) cost;

b) material;

c) durability.

4. When temperature falls, most materials _____.

a) expand;

b) contract;

c) disappear.

5. It is important to understand the performance of materials in tension, because their tensile strength is usually _____ than their compressive strength.

a) higher;

b) lower;

c) wider;

d) narrower.

6. Materials differ in _____.

a) durability;

b) strength;

c) weight;

d) fire-resistance;

e) cost.

5. Complete the sentences using the words in the box. You will need to use one word twice.

compression	deformation	elongation	extension	tension

1. A stretching force is called _____.
2. A crushing force is called _____.
3. Extension is also called _____.
4. Tension causes _____ or _____.
5. Tension or compression cause _____.

Source: Professional English in Use. Engineering. – Cambridge University Press, 2009. – P. 43.

6. Match the words to the definitions.

1. elongation	**a.** the property of allowing heat or electricity to go through something
2. elasticity	**b.** the act of pressing something into a smaller space or putting pressure on it from different sides until it gets smaller
3. alloy	**c.** a substance used in chemistry or produced by a chemical process
4. tension	**d.** the ability of something to stretch and go back to its usual length or size
5. compression	**e.** a quality in a substance or material, especially one that means that it can be used in a particular way
6. deformation	**f.** the amount of force that stretches something
7. conductivity	**g.** a metal that is made by mixing two or more metals, or a metal and another substance
8. chemical	**h.** the physical power and energy that makes someone strong
9. property	**i.** the process of becoming or making something become longer
10. strength	**j.** a change in the usual shape of something, especially one that makes it worse, or the process of changing something's shape

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

1. Простым способом
2. Свойства материала
3. Влиять

4. Твердость материала
5. Значительно
6. Низкая эластичность
7. Исходная форма
8. Охлаждение
9. Увеличиваться
10. Уменьшаться

8. Translate the facts about some properties of construction materials.

В процессе строительства строительные конструкции подвергаются различным технологическим, физико-механическим и физическим воздействиям. Инженер-строитель должен правильно выбрать материал, который обладает необходимыми свойствами. Строительные материалы отличаются физическими и механическими свойствами. К примеру, прочность, упругость, пластичность, хрупкость, твердость являются механическими свойствами материала.

В зависимости от поведения под нагрузкой стройматериалы подразделяются на:

- Пластичные – те, которые изменяют форму без трещин, а после снятия нагрузки сохраняют измененную форму.
- Хрупкие – они хорошо сопротивляются сжатию и гораздо хуже растяжению. Природный камень, бетон, кирпич, стекло, гранит являются примерами хрупких материалов.

UNIT 1. CONSTRUCTION MATERIALS. GENERAL INFORMATION

REVIEW

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

alloy	moulded	chemicals	brittle	thermal conductivity
durable	roofing	contracts	rubber	properties

1. _____ is a material property that describes ability to conduct heat.
2. One of the _____ of copper is that it conducts heat and electricity very well.
3. Wood is a _____ material.
4. Metal _____ as it cools.
5. Each year, factories release millions of tons of toxic _____ into the atmosphere.
6. Brass is an _____ of copper and zinc.
7. Tyres are almost always made of_____.
8. Slates and tiles are _____ materials.
9. The children _____ little pots from clay.
10. Glass is a _____ material.

2. Translate the sentences.

1. Влажные материалы менее прочны, более тяжелы и теплопроводны, чем сухие.
2. Гидрофизические свойства связаны с воздействием воды на материал.
3. Чтобы изготовить кирпич, необходимо применение глины и песка.
4. Речной песок не содержит глинистых частиц.
5. Все египетские пирамиды изначально были не желтыми, а белыми. Этот факт объясняется тем, что в качестве облицовки для поверхностей пирамид использовались отполированные плиты известняка.
6. Первыми строительными материалами, которыми пользуются и по сей день, являются глина и песок.

7. Теплофизические свойства материалов связаны с изменением температуры.

8. По происхождению строительные материалы подразделяют на природные и искусственные.

9. Кирпич, цемент, железобетон, стекло и др. являются искусственными материалами.

10. Свойства сухих и влажных материалов отличаются.

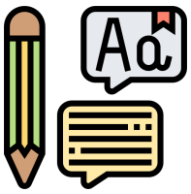
3. Find all the words related to Unit 1 (direction of letters ↕ and →) and give their translation.

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

MAN-MADE BUILDING MATERIALS

UNIT 2. CEMENT AND CONCRETE

2A. CEMENT



1. Read the words and learn them by heart.

lime – известь
lighthouse – маяк
crushed – дробленый
harbour – гавань, порт
to quarry – добывать
volcanic ash – вулканический пепел
vital – жизненно важный
calcined gypsum – обожженный гипс
carbonation – насыщение углекислотой, карбонизация
scarce – недостаточный, дефицитный
pozzolanic cement – пуццолановый цемент
finely-ground – мелкодробленый, тонкоизмельченный

2. Before you start. Answer the questions.

1. When do you think cement was first used?
2. What country do you think invented Portland Cement?
3. Why is cement so popular?

3. Read and translate the text about the history of cement and check your ideas.

History of Cement.

Cement is a material made by heating grains of rock and clay. Throughout history, cementing materials have played a vital role and were used widely in the ancient world. The Egyptians used calcined gypsum as cement and the Greeks and Romans used lime made by heating limestone and added sand to make mortar, with coarser stones for concrete.

The Romans found that cement could set under water and this was used for the construction of harbours. This cement was made by adding crushed volcanic ash to lime and was later called “pozzolanic” cement, named after the village of Pozzuoli near Vesuvius.

In places where volcanic ash was scarce, such as Britain, crushed brick or tile was used instead. The Romans were therefore probably the first to use systematically the properties of cementitious materials for specific applications and situations.

After the Romans, there was a general loss in building skills in Europe, particularly with regard to cement. Mortars hardened mainly by carbonation of lime, a slow process. The use of pozzolana was rediscovered in the late Middle Ages.

The Renaissance and Age of Enlightenment brought new ways of thinking which led to the industrial revolution. In the eighteenth century, in Britain there was a need to build lighthouses on exposed rocks to prevent shipping losses. The constant loss of ships drove cement technology forwards.

Joseph Aspdin took out a patent in 1824 for “Portland Cement”, a material he produced by firing finely-ground clay and limestone until the limestone was calcined. He called it Portland Cement because the concrete made from it looked like Portland stone, a widely-used building stone in England quarried on the Isle of Portland.

Joseph Aspdin
Source: https://www.pinterest.ru

While history usually regards Aspdin as the inventor of Portland cement, Aspdin’s cement was not produced at a high-enough temperature to be the real forerunner of modern Portland cement. Nevertheless, it was a major innovation.

A few years later, in 1845, Isaac Johnson made the first modern Portland Cement by firing a mixture of chalk and clay at much higher temperatures, similar to those used today.

Source: https://www.understanding-cement.com/history.html

4. Write correct sentences.

1. The Middle Ages brought new ways of thinking which led to the industrial revolution.

_____

2. Isaac Johnson made the first modern Portland Cement by firing a mixture of sand and clay at much lower temperatures.

_____

3. The Egyptians used lime as cement.

_____

4. The Greeks and Romans used lime made by heating limestone and added rock to make mortar.

_____

5. In Britain volcanic ash was abundant.

_____

6. In Britain there was a need to build storehouses on exposed rocks to prevent shipping losses.

_____

7. Cement is a material made by cooling grains of rock and sand.

_____

8. After the Romans, mortars hardened mainly by carbonation of water, a quick process.

_____

5. Match the words to the definitions.

1. lime	**a.** to dig stone or sand from a quarry
2. to quarry	**b.** a tower with a powerful flashing light that guides ships away from danger
3. carbonation	**c.** relating to or caused by a volcano
4. scarce	**d.** chemical reaction of carbon dioxide to give carbonates, bicarbonates, and carbonic acid
5. cement	**e.** an area of water next to the coast, often protected from the sea by a thick wall, where ships and boats can shelter
6. harbour	**f.** someone or something that existed before something similar that developed or came later
7. volcanic	**g.** a white substance obtained by burning limestone, used for making cement
8. forerunner	**h.** small sticks of a white or coloured substance like soft rock, used for writing or drawing
9. lighthouse	**i.** a grey powder made from lime and clay that becomes hard when it is mixed with water and allowed to dry, and that is used in building
10. chalk	**j.** not easy to find or get

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

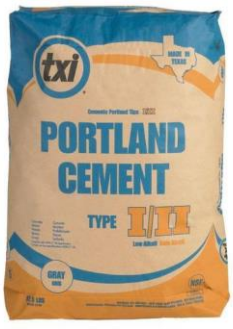
1. Эпоха просвещения
2. Широко используемый
3. Средние века
4. Похожий
5. Навыки
6. Более крупные камни
7. Промышленная революция
8. Цементирующие материалы
9. Открыть заново
10. Играть жизненно важную роль
11. Древний мир
12. Нагревание
13. Обжиг
14. Постоянный

7. Complete the text with words from the box.

increase	type	grey
concrete	emission	lowest-cost
replacement	available	heating

Portland Cement.

Portland cement is the most common _____[1] of cement in general use around the world as a basic ingredient of _____[2] and mortar. It is a fine powder, made by _____[3] (about 1350–1400°C) limestone with clay and then grinding this product (called clinker) with a source of sulfate (most commonly gypsum). Several types of Portland cement are _____[4]. The most common, called ordinary Portland cement (OPC), is _____[5], but white Portland cement is also available.



Source: https://www.indiamart.com/

The production of Portland cement contributes to about 10% of world carbon dioxide _____[6]. The International Energy Agency has estimated that cement production will _____[7] by between 12 and 23% by 2050 to meet the needs of the world's growing population. There are several researches into a suitable _____[8] of Portland cement by supplementary cementitious materials.

The low cost and widespread availability of the limestone and other naturally-occurring materials used in Portland cement make it one of the _____[9] materials widely used over the last century. Concrete produced from Portland cement is one of the world's most popular construction materials.

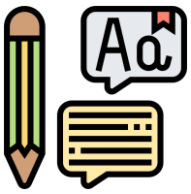
8. Find more information about the following issues.

1. Environmental impacts of cement.
2. Cement industry in the world.
3. Cement industry in Russia.
4. Modern cements.
5. Cement testing.

MAN-MADE BUILDING MATERIALS

UNIT 2. CEMENT AND CONCRETE

2B. CONCRETE



1. Read the words and learn them by heart.

additive – добавка
batching – дозирование
excess – излишний, избыточный
plasticizer – пластификатор
to delay – отсрочить, замедлять
to pour – укладывать бетонную смесь
fine aggregate – мелкий заполнитель
concrete mix design – подбор/проектирование состава бетонной смеси
structural strength – конструктивная прочность
coarse aggregate – крупный заполнитель
concrete setting – затвердевание бетона
retarder – добавка для замедления процесса схватывания

2. Before you start. Answer the questions.

1. What is concrete made of?
2. Where is concrete commonly applied?

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

Concrete.

The most widely used cement-based material is concrete, which is made from cement, fine aggregate (sand), coarse aggregate (gravel) and water. After concrete has set, it needs time to reach its structural strength – the strength needed to perform effectively. Generally, engineers consider that this strength is reached after 28 days – a point called 28-days strength.

Concrete mix designs, when are specified by engineers, state the proportions of cement, fine aggregate and coarse aggregate to be used for specific structures. For example, a 1:2:4 (one-two-four) mix consists of one part cement, two parts fine aggregate and four parts coarse

aggregate. For mixing precise quantities – known as batching – proportions are measured by weight. Mix designs also specify the water-cement ratio – the amount of water added relative to the amount of cement used. Excess water reduces the strength of concrete, so the quantity of water is kept to a minimum. But as drier concrete is more difficult to work with, an additive (added chemical substance) called a plasticizer is often used. This helps the concrete to flow more easily. Other additives can also be used – for example, a retarder may be added to delay setting, which gives workers more time to pour (place) the concrete.

Concrete may be delivered ready-mixed, but it is one of the few building materials that can be made on the building site.

Source: Professional English in Use. Engineering. – Cambridge University Press, 2009. – p.38.

4. Choose the correct answer.

1. The most widely used cement-based material is _____.

a) steel;

b) concrete.

2. Mix designs specify the _____ ratio.

a) sand-rock;

b) water-cement;

c) clay-lime.

3. Excess water _____ the strength of concrete.

a) reduces;

b) increases;

c) levels.

4. Drier concrete is _____ to work with.

a) easier;

b) better;

c) more difficult.

5. _____ helps the concrete to flow more easily.

a) retarder;

b) water;

c) plasticizer.

5. Find words and expressions in the text to match the descriptions.

1. gravel used in concrete _____
2. sand used in concrete _____
3. powder that enables concrete to set _____
4. mixing concrete accurately _____
5. different types of chemicals put in concrete _____
6. allows concrete to stay wet for longer _____
7. makes drier concrete easier to work with _____

Source: Professional English in Use. Engineering. – Cambridge University Press, 2009. – p.39.

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

blocks	bricks	concrete	ingredient
concrete	materials	mixture	walls

Cement and Concrete.

The most common type of cement is Portland cement, which is the basic _____[1] of concrete and mortar.

It is made of Portland cement clinker (calcium silicates, aluminium and other compounds) and other minor constituents.

Portland cement clinker is produced by heating a mixture of raw _____[2] up to 1450° C in a kiln.

There are three production stages:

- preparation of the raw mixture,
- production of the clinker,
- preparation of the _____[3].

Limestone is the main raw material for the production of clinker, followed by sand, shale, iron ore, slag, etc. About 2% gypsum is also added and then the _____[4] is pulverised. The resulting powder will react when water is added.

Portland cement is commonly used to produce _____[5], which is made of gravel, sand, cement and water. Blocks of cinder concrete and ordinary concrete are known as Concrete Masonry Units (CMU). They are larger than ordinary _____[6] and used for applications

where appearance is not very important, such as in factory walls, garages and industrial buildings. One of the advantages of concrete _____[7] is that they can be reinforced, grouting the voids, inserting rebar, so that they are stronger than typical masonry _____[8].

***

shale – сланец	to grout – заполнять раствором
slag – шлак	void – пустота
cinder concrete – шлакобетон	rebar – арматурный стержень

Source: Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 12.

7. Choose the best alternative.

1. Portland cement is the basic ingredient of *concrete/aluminium*.
2. The main raw material for the production of clinker is *brick/limestone*.
3. Portland cement is used to produce *gravel/concrete*.
4. Concrete Masonry Units are larger than ordinary *bricks/stones*.
5. Concrete blocks can be *reinforced/industrial*.
6. Reinforced concrete blocks are stronger than masonry *industries/walls*.

Source: Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 13

8. Match the words to the definitions.

1. masonry	**a.** a mixture of cement, sand, small stones and water
2. brick	**b.** brick work
3. concrete	**c.** white rock often used for making cement
4. limestone	**d.** a reddish-brown rectangular block used to build walls and houses

Source: Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 13.

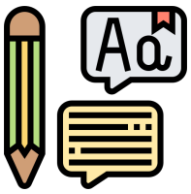
9. Make a list of advantages and disadvantages of concrete.

Advantages	Disadvantages
1. …	1. …

MAN-MADE BUILDING MATERIALS

UNIT 2. CEMENT AND CONCRETE

2C. TYPES OF CONCRETE



1. Read the words and learn them by heart.

pumice – пемза
steel rod – стальной стержень
density – плотность
bar – стержень (арматуры)
precast concrete – сборный бетон
reinforced concrete – железобетон, армированный бетон
high-density concrete – высокоплотный бетон
prestressed concrete – предварительно напряженный бетон
lightweight concrete – легкий бетон
glass concrete – стеклобетон
to embed – погружать, внедрять
nuclear power plant – атомная электростанция

2. Before you start. Answer the questions.

1. How many types of concrete do you think exist nowadays?
2. Why do we need so many types of concrete?

3. Read and translate the text about the types of concrete and check your ideas.

Types of Concrete.

Today, there are many different types of concrete.

1. *High-density concrete* has a very specific purpose. This type of heavyweight concrete has a greater density than other types and is manufactured using crushed rocks as coarse aggregate. As it provides good protection from x-rays and radiation, it is often used in nuclear power plants and other such buildings.

2. *Precast concrete* is created and cast in a factory according to exact specifications. Precast concrete units are then transported to the site and assembled. The advantage of using

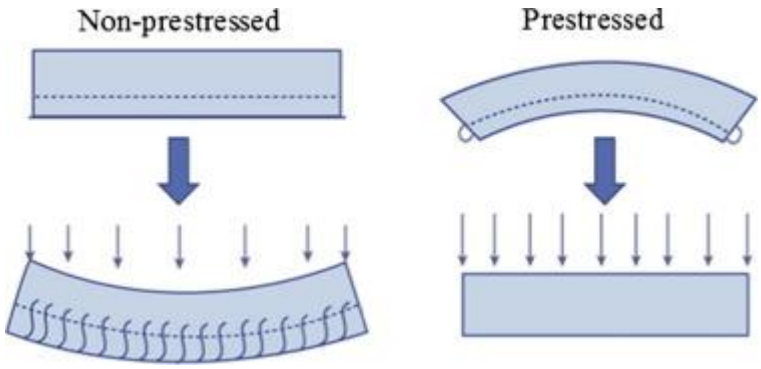
precast concrete is its speedy assembly. Since the units are manufactured in a factory, they are of very high quality. They are typically used for structural components such as wall panels, beams, columns, floors, staircases and so on.

3. *Reinforced concrete* is widely used in industry and modern construction. The strength of reinforced concrete is aided by placing steel rods or cables in the concrete before it sets. Lately, people have used fibers to reinforce this concrete.

These reinforcements resist tensile forces while the concrete itself helps resist compressive forces. They create a strong bond and, as a result, the two materials resist a variety of applied forces. In essence, they become a single structural element.

Invented in the 19th century, it dramatically changed the construction industry. Buildings, bridges and roadways rely on reinforced concrete.

4. Many large concrete projects use *prestressed concrete* units. Prestressed concrete is created using a special technique. Like reinforced concrete, it includes bars. But these bars are stressed before the actual application of the concrete.



When the concrete is mixed and placed, these bars are placed at each end of the structural unit where they are used. When the concrete sets, this unit is put into compression.

This process makes the lower section of the unit stronger against tensile forces. It requires heavy equipment, however, and skilled labor. Normally, prestressed units are created and assembled on-site. Prestressed concrete is used to build bridges, heavy loaded structures or roofs that have long spans.

5. *Lightweight concrete* is a kind of concrete that has a density of less than 1920kg/m^3. Lightweight concrete is created by using lightweight aggregates, which include natural materials like pumice, artificial materials or processed materials. Its most important property is that it has very low thermal conductivity.

Common uses for lightweight concrete include creating long spanning bridge decks and building blocks. It can also be used to protect steel structures.

6. Another, more modern form of concrete, *glass concrete* features the use of recycled glass. This form of concrete is used when aesthetic appeal is an important element in the design of the concrete. Commonly used on decorative facades, this concrete can have colored glass embedded during the mixing process.

Source: https://www.dcpu1.com/blog/different-types-of-concrete/

4. Decide if the sentences are true or false.

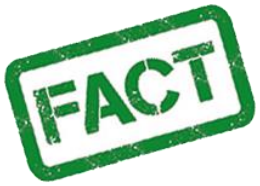
1. Generally, glass concrete units are created and assembled on-site.
2. Lightweight concrete has a greater density than other types.
3. The strength of reinforced concrete is aided by placing wooden rods or cables in the concrete before it sets.
4. The main disadvantage of using precast concrete is its speedy assembly.
5. Glass concrete is commonly used on decorative facades.
6. Lightweight concrete is created by using lightweight aggregates including only natural materials.
7. Prestressed concrete includes bars, which are stressed before the actual application of the concrete.
8. Lightweight concrete protects steel structures.
9. Reinforced concrete uses recycled glass.

5. Match the types of concrete with their functions.

1. lightweight concrete	**a.** is used to build bridges, heavy loaded structures or roofs that have long spans
2. reinforced concrete	**b.** is used when aesthetic appeal is an important element in the design of the concrete
3. precast concrete	**c.** buildings, bridges and roadways rely on it
4. prestressed concrete	**d.** the advantage is its speedy assembly
5. high-density concrete	**e.** has very low thermal conductivity and can be used to protect steel structures
6. glass concrete	**f.** provides good protection from x-rays and radiation

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

1. Определенная цель
2. Искусственные материалы
3. Тяжелый бетон
4. Лестница
5. Балки
6. Рентгеновские лучи
7. В соответствии с
8. Кардинально изменить
9. Квалифицированная рабочая сила
10. Тяжелое строительное оборудование



7. Translate some facts about concrete.

В зависимости от условий эксплуатации будущих железобетонных конструкций производители строительных материалов выпускают бетонные смеси тех или иных видов. Итак, в зависимости от условий работы будущей железобетонной конструкции выбираются следующие виды смесей:

- обычный (для создания фундаментов, колонн, балок и других железобетонных конструкций);
- гидротехнический (для облицовки каналов, плотин и др.);
- для аэродромных и дорожных покрытий;
- бетон специального назначения (например, для защиты от радиации).

Прочность бетона является важным параметром. Чем больше цемента входит в состав смеси, тем выше класс будущего бетона. Это один из важнейших параметров, который учитывается в любых типах смесей, независимо от их классификации.

8. Make a presentation about other types of concrete used in construction.

UNIT 2. CEMENT AND CONCRETE

REVIEW

1. Translate the sentences.

1. Железобетоон – строительный материал, состоящий из бетона и стали, был запатентован в 1867 году Жозефом Монье (Joseph Monier).
2. Преднапряженные конструкции – железобетонные конструкции, напряжение в которых искусственно создается во время изготовления, путем натяжения части или всей арматуры.
3. В мировой строительной практике стеклобетон стал использоваться с 1969 года.
4. Русские ученые Н. А. Белелюбский, Н. Н. Лямин, В. И. Чарномский и др. внесли большой вклад в науку о цементе и бетоне.
5. По происхождению заполнители подразделяются на природные и искусственные.
6. Песок является примером мелкого заполнителя.
7. В 1825 году Е. Г. Челиев, ведущий архитектор России, издал книгу о производстве цемента и бетона.
8. Добавки в бетон улучшают многие характеристики используемой смеси, к примеру, уменьшается время застывания, изменяется прочность и т.д.
9. Цемент используется для изготовления бетона и строительных растворов.

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

REINFORCEMENT

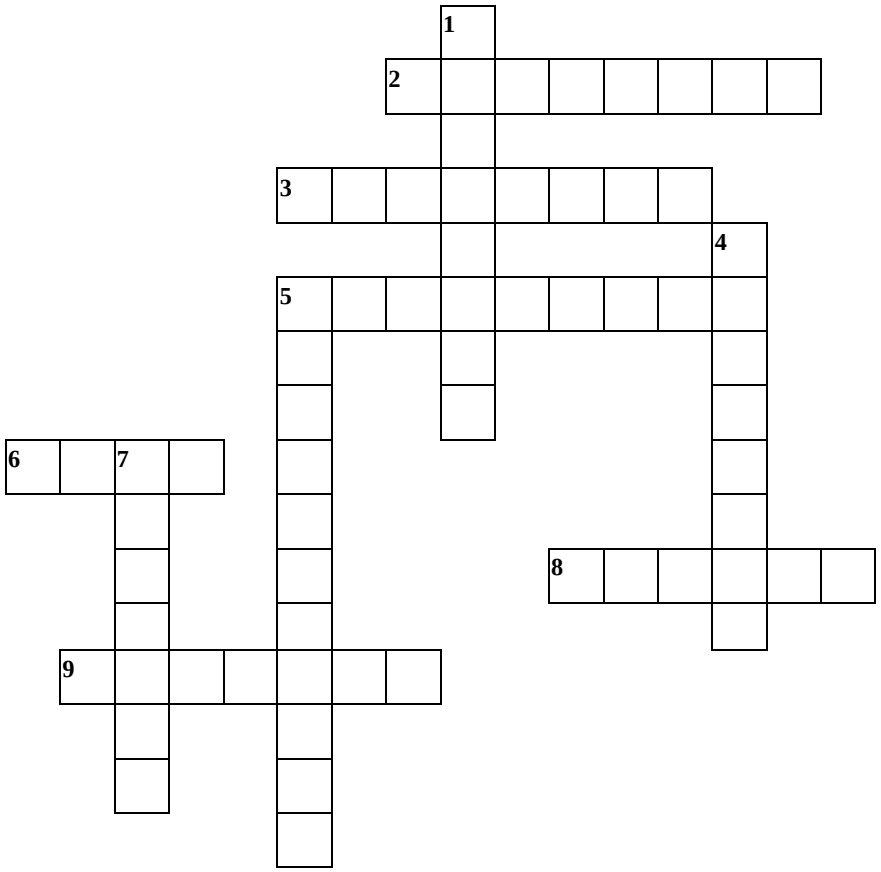
_____

_____

_____

_____

3. Complete the crossword.



Across

2. In 1845 Isaac Johnson made the first modern _____ cement by firing a mixture of chalk and clay at higher temperatures.

3. The Romans made cement by adding crushed _____ ash to lime.

5. A white or light grey rock that is used as a building material and in the making of cement.

6. Sand is an example of _____ aggregate.

8. _____ water reduces the strength of concrete.

9. The relationship between the mass of a substance and its size.

Down

1. A very hard building material made by mixing together cement, sand, small stones, and water.

4. _____ may be added to delay setting, which gives workers more time to pour the concrete.

5. _____ concrete is a kind of concrete that has a density of less than 1920kg/m^3.

7. High-density concrete is often used in _____ power plants.

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

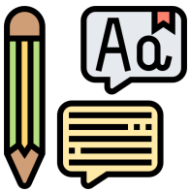
plasticizer	reinforced concrete	prestressed concrete	density	nuclear power plant
limestone	Portland cement	quarried	sets	fine aggregates

1. As of 2018, the International Atomic Energy Agency reported there were 450 _____ in operation in 30 countries around the world.
2. _____ includes bars, which are stressed before the actual application of the concrete.
3. _____ consist of natural sand or any crushed stone particles.
4. _____ is widely used in industry and modern construction.
5. Joseph Aspdin was an English cement manufacturer who obtained the patent for _____ on 21 October 1824.
6. Concrete poured in hot weather _____ more quickly.
7. _____ is a substance that is added to a material to make it softer and more flexible, to increase its plasticity.
8. Aluminium has a low _____.
9. _____ has numerous uses: as a building material, an essential component of concrete (Portland cement), as aggregate for the base of roads.
10. Chalk is _____ from the surrounding area.

MAN-MADE BUILDING MATERIALS

UNIT 3. BRICK AND TILE

3A. BRICK



1. Read the words and learn them by heart.

frequent – частый to retain – сохранять, поддерживать

masonry – кладка raw material – сырьевой материал

load-bearing – несущий (нагрузку) expertise – компетентность, профессионализм

settling – осадка

2. Before you start. Answer the questions.

1. What do you know about bricks?
2. Are brick structures popular in your country?

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

Brick.

Masonry construction is a method that has been used for centuries around the world. It is usually used for walls of buildings, retaining walls and monuments. The most frequent type of masonry is brick, however concrete block is also becoming more and more popular. Brick was one of the first building materials that man used. It has been used since the times of the ancient Egyptians because it offers a great number of advantages. First of all, it has an affordable price and it is made of accessible raw material, which has long durability and good insulating properties. It is a strong material and is perfect for load-bearing systems where the loads are compressive. It is the size of a man's hand and

Source: https://www.constructionexec.com/article/reduce-costs-by-building-with-brick

therefore, simple to use. The appearance of the final work depends on the ability and expertise of the bricklayer. Another advantage of using brick is that, like stone, it offers increased comfort in the heat of the summer and the cold of the winter. Being heat resistant, this material also offers good fire protection.

One of the disadvantages of using this material is that masonry must be built on a firm foundation to prevent settling and cracking. Moreover, this is a heavy material, consequently the structural requirements will have to be increased, especially if the area is subject to earthquakes.

Source: Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 12.

4. Choose the correct answer.

1. Masonry construction has been used _____ around the world.

a) recently;

b) for centuries.

2. The appearance of the final brickwork depends on the ability and expertise of the _____.

a) plumber;

b) bricklayer;

c) carpenter.

3. Brick is the size of a man's _____.

a) hand;

b) leg;

c) head.

4. Brick has been used since the times of the _____ because it offers a great number of advantages.

a) ancient Egyptians;

b) modern Egyptians;

c) Aztecs.

5. Brick _____.

a) doesn't offer fire protection;

b) offers good fire protection.

5. Make a list of advantages and disadvantages offered by brick.

Advantages	Disadvantages
1. …	1. …

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

1. Доступное сырье
2. Изоляционные свойства
3. Следовательно
4. Землетрясение
5. Растрескивание
6. Повышенный комфорт
7. Доступная цена
8. Зависеть от
9. Прост в использовании
10. Прочный фундамент

7. Have you ever made a brick wall? Read 7 bricklaying tips. Do you know any other tips?

Seven bricklaying tips to help you work efficiently.

- Have a ready supply of bricks near the work area.
- Mix the mortar using four parts of sand to one of cement (4:1).
- Add a plasticiser to the mix, so it adheres better to the bricks.
- Don't make the mortar too 'wet' as the weight of the bricks will push it out of the seam.
- Only mix sufficient for one hour's bricklaying (even less if the weather is hot), as it will dry out before you can use it.
- Don't add water to a mortar mix if it becomes too dry/stiff to use, throw it away and mix again.
- Place the mortar as near to the work area as possible.

  Safety tip – use gloves when mixing/using cement as it can irritate and burn skin.

Source: https://www.davesdiytips.com/basic-bricklaying-tips-advice/

8. Complete the text with words from the box.

Europe	building	manufacture
cooler	entire	settlement
straw	invention	fell

History of bricks and brickmaking.

Man has used brick for _____[1] purpose for thousands of years. Bricks date back to 7000 BC, which makes them one of the oldest known building materials. They were discovered in southern Turkey at the site of an ancient _____[2] around the city of Jericho.

The first bricks, made in areas with warm climates, were mud bricks dried in the sun for hardening. Ancient Egyptian bricks were made of clay mixed with _____[3]. The evidence of this can be seen today at ruins of Harappa Buhen.

The greatest breakthrough came with the _____[4] of fired brick in about 3,500 BC. From this moment on, bricks could be made without the heat of sun and soon became popular in _____[5] climates.

The Romans only used white or red clay to _____[6] bricks. The Romans succeeded in introducing fired bricks to the _____[7] country thanks to mobile kilns. Roman bricks differed in size and shape from other ancient bricks. They used brick for public and private buildings over the entire Roman empire.

During the period of the Roman Empire, the Romans spread the art of brickmaking throughout _____[8] and it continued to dominate during the medieval and Renaissance period.

When the Roman Empire _____[9], the art of brickmaking nearly vanished and it continued only in Italy and the Byzantine Empire.

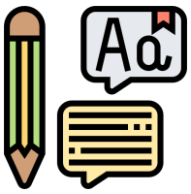
9. Find more information about the following issues.

1. Optimal dimensions, characteristics of brick.
2. Uses of brick.
3. Modern brick production.

MAN-MADE BUILDING MATERIALS

UNIT 3. BRICK AND TILE

3B. TILE



1. Read the words and learn them by heart.

cork – пробка
row – ряд
to exclude – исключать, не допускать
to overlap – перекрывать
uniform – однородный, единообразный
groove – прорез
grid – сетка
ceiling – потолок
tile – кафель, черепица, плитка
glazed tile – глазурованная плитка
unglazed tile – неглазурованная плитка
terracotta – терракота (обожженная чистая глина)
sand grout – жидкий цементно-песчаный раствор
grout lines – межплиточный шов
travertine – травертин (разновидность известняка)

2. Before you start. Answer the questions.

1. What do you know about tiles?
2. Where are tiles applied?

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

Tile.

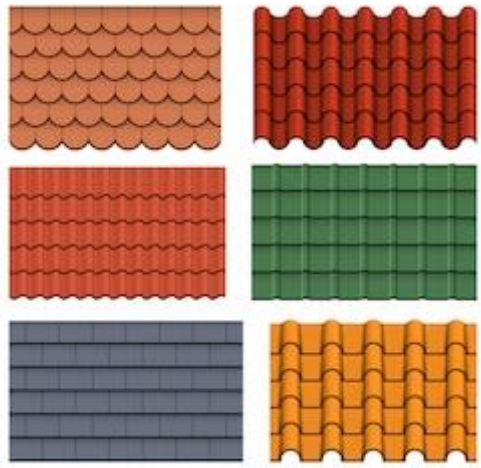
Tiles are thin objects, usually square or rectangular in shape. A tile is a manufactured piece of such material as ceramic, stone, metal, baked clay, or even glass, generally used for covering roofs, floors, walls, etc.

Tiles are most often made of ceramic, typically glazed for internal uses and unglazed for roofing, but other materials are also commonly used, such as cork, concrete and other composite materials, stone. Thinner tiles can be used on walls than on floors, which require more durable surfaces that will resist impacts.

Roof tiles are designed mainly to keep out rain, and are traditionally made from locally available materials such as terracotta. Modern materials such as concrete, metal and plastic are also used and some clay tiles have a waterproof glaze. A large number of shapes (or "profiles") of roof tiles have evolved.

Roof tiles are 'hung' from the framework of a roof by fixing them with nails. The tiles are usually hung in parallel rows, with each row overlapping the row below it to exclude rainwater and to cover the nails that hold the row below.

Floor tiles are commonly made of ceramic or stone, although recent technological advances have resulted in rubber or glass tiles for floors as well. Ceramic tiles may be painted and glazed. Small mosaic tiles may be laid in various patterns. Floor tiles are typically set into mortar. The spaces between the tiles are commonly filled with sanded or unsanded floor grout.



Source: https://www.shutterstock.com/search/roof+tiles

Natural stone tiles can be beautiful but as a natural product they are less uniform in colour and pattern, and require more planning for use and installation. Mass-produced stone tiles are uniform in width and length. Granite or marble tiles are sawn on both sides and then polished or finished on the top surface so that they have a uniform thickness.

Some stone tiles such as polished granite, marble, and travertine are very slippery when wet. Ceramic tiles for use in wet areas can be made more slip-resistant either by using very small tiles so that the grout lines act as grooves.

Rubber floor tiles have a variety of uses, both in residential and commercial settings. They are especially useful in situations where it is desired to have protection for an easily breakable floor. Some common uses include flooring of garage, swimming pool decks, sport courts, gyms, and dance floors.

Plastic floor tiles that can be installed without adhesive or glue are a recent innovation and are suitable for areas subject to heavy traffic, wet areas and floors that are subject to movement.

Ceiling tiles are lightweight tiles used inside buildings. They are placed in an aluminium grid; they provide little thermal insulation but are generally designed either to improve the acoustics of a room or to reduce the volume of air being heated or cooled.

Source: https://en.wikipedia.org/wiki/Tile#:~:text=A%20tile%20is%20a%20manufactured,other%20objects%20such%20as%20tabletops.&text=Tiles%20are%20often%20used%20to,tiles%20to%20complex%20or%20mosaics.

4. Write correct sentences.

1. Tiles are made of only ceramic, typically unglazed for internal uses and glazed for roofing.

_____

2. Some stone tiles such as polished granite, marble, and travertine are very slippery when dry.

_____

3. Thinner tiles are used more on floors than on walls, which require more durable surfaces that will resist impacts.

_____

4. Glass tiles are useful when it is desired to have protection for an easily breakable floor.

_____

5. Plastic floor tiles have been used for thousands of years.

_____

6. The spaces between the tiles are commonly filled only with sanded floor grout.

_____

7. The floor tiles are ‘hung’ from the framework of a roof by fixing them with nails.

_____

8. Ceiling tiles are lightweight tiles used outside buildings.

_____

9. Mass-produced stone tiles are absolutely different in width and length.

_____

10. Ceiling tiles provide a lot of thermal insulation.

_____

11. There are no ways of making ceramic tiles for use in wet areas more slip-resistant.

_____

12. Common uses of glass tiles include flooring of garage, swimming pool decks, sport courts, gyms, and dance floors.

_____

5. Match the words to the definitions.

1. tile	**a.** a metal frame with bars across it
2. cork	**b.** a flat square piece of baked clay or other material, used for covering walls, floors, etc.
3. grout	**c.** to cover something partly by going over its edge; to cover part of the same space
4. grid	**d.** the inner surface of the top part of a room
5. to overlap	**e.** a mixture of sand, water and cement or lime that you spread between tiles when you fix them to a wall
6. ceiling	**f.** the light, soft bark (= outer covering) of a Mediterranean tree

6. Translate some facts about tiles.

По мнению исследователей, первая плитка по размерам и форме напоминала мозаику, которая во втором и третьем тысячелетии до нашей эры использовалась для отделки храмов и дворцов. Однако от мозаики такая плитка отличалась целостным рисунком, изображенным на каждой плитке. Она была немного тоньше небольшого кирпича. На плитку наносился орнамент. Современная плитка в восточном стиле унаследовала общие с плиткой Междуречья (Mesopotamia) тенденции в изготовлении орнамента, однако значение большинства символов утеряно.

Долгое время отделка в вавилонских (Babylonian) храмах и дворцах выполнялась покрытым глазурью кирпичом – предшественником керамической плитки. Толщина глазури на таких кирпичах превышала 10мм, что придавало ей необычайную прочность. В Вавилоне популярными были рисунки, изображающие растения, животных, геометрические фигуры.

Однако керамическая плитка в том виде, в каком ее знаем мы, появилась только в эпоху древнеперсидской династии Ахеменидов (Achaemenid). В древнеиранских городах Сузе (Susa) и Персеполе (Persepolis) была найдена керамическая плитка размером 15х15 см и толщиной 10 мм.

Source: https://ru.wikipedia.org/wiki/Керамическая_плитка

UNIT 3. BRICK AND TILE

REVIEW

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

marble	wall	mass-produce	temperatures	unglazed
grout	ceiling	brick	building materials	load-bearing

1. There are two types of tiles: glazed and _____.
2. Tiles are unitized elements of fired clay, metal, glass, or stone used for a finished surface on the floor, wall, or _____.
3. A _____ is a type of block used to build walls, pavements and other elements in masonry construction.
4. Fired bricks are one of the longest-lasting and strongest _____.
5. The British used the manufacturing process to _____ ceramic tiles, making them more affordable for the middle class.
6. After laying, the gaps between the individual mosaic pieces are filled with_____.
7. The house has a small backyard, surrounded by a high brick _____.
8. Roof tiles of some Greek temples were made of _____.
9. Hollow bricks are used mostly in partition walls where _____ is not required.
10. After burning, fire bricks can withstand very high _____ without their shape, size, or strength being affected.

2. Translate the sentences.

1. До XIX века техника производства кирпичей оставалась примитивной.
2. Керамическая черепица обладает хорошими шумопоглощающими свойствами.
3. Форма кирпичей в Древнем Риме варьировалась, использовались прямоугольные, треугольные и круглые кирпичи.
4. Покрытие из черепицы не требует ремонта в течение долгого периода времени.

5. Существуют разные стандарты размеров кирпича, например, в Великобритании стандартный кирпич имеет размеры 215×102,5×65 мм.

6. Декоративная плитка была известна и широко использовалась в древнем мире.

7. Привычный нам кирпич прямоугольной формы (его удобней было держать в руке) появился в Англии в XVI веке.

8. Кирпич делится на две большие группы: красный и белый. Красный кирпич состоит в основном из глины, белый – из песка и извести.

3. Find all the words related to Unit 3 (direction of letters ↕ and →) and give their translation.

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

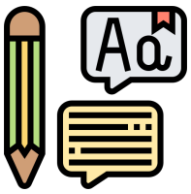
4. Look at the picture, which describes common types of brick. Find extra information about these types.

Source: https://www.thebalancesmb.com/bricks-types-uses-and-advantages-844819

MAN-MADE BUILDING MATERIALS

UNIT 4. GLASS AND METAL

4A. GLASS



1. Read the words and learn them by heart.

silica – кварц	grain – мельчайшая частица
furnace – печь	outermost – наиболее удаленный от середины
to temper – закалять	toughened glass – закаленное стекло
sheet – лист	tempered glass – закаленное высокопрочное стекло
layer – слой	stainless steel – нержавеющая сталь
transparent – прозрачный	structural glass – профильное строительное стекло
glass pane – оконное стекло	laminated glass – многослойное безосколочное стекло
iron oxide – окись железа	solar control glass – солнцезащитное стекло

2. Before you start. Answer the questions.

1. What do you know about glass?
2. Is it often applied in construction of buildings and structures in your country?

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

A. The material glass is made of.
B. Transparent buildings: problems and possible solutions.
C. An interesting experiment.
D. Types of glass.

Glass.

1. _____

Tiny pieces of materials are called grains. People can make a lot of things from grains of rock, soil, or sand. For example, they can make glass.

The grains of sand on many beaches are made of a mineral called silica. To make glass, people put silica and other chemicals into a furnace. At 1,500 degrees centigrade, the mixture becomes hot, liquid glass. Today most glass is made by machines. There are lots of types of glass. Some glass is very strong. At the Grand Canyon Skywalk in Arizona in the USA you can walk on glass.

2. _____

For most engineering and architectural uses we need safety glass. One type of safety glass is toughened glass, also called tempered glass. As the term suggests, the glass is tempered – it is heated and kept hot for a certain time, to change its structure. Then if tempered glass is broken, it breaks into tiny pieces. The disadvantage of toughened glass is that it can't withstand impacts from small objects, such as flying stones. So, in cases where impacts are a problem, another type of safety glass – laminated glass – is generally used. This is made by laminating glass with a polymer – in other words, making a glass and polymer "sandwich", with a sheet of polymer in the middle and sheets of glass at either side. The advantage of having a laminated material is not just its very strong. The layers of glass are bonded to a layer of polymer – so if the glass does break, the broken pieces are held together, and don't fly.

Source: https://www.buildings.com/articles/27881/glass-buildings-reflect-many-benefits

3. _____

Glass is a fashionable material in contemporary architecture. Transparent buildings and structures are very popular nowadays. Structural glass components such as columns and beams are often required, but this material seems structurally unsafe because of its brittleness. For this reason, a new construction technique has been developed using:

- very long overlapping glass segments to create glass beams;
- a small stainless-steel profile that has been added to the layout of the glass beam to reinforce it.

4. _____

To prove that glass structures can be as safe as reinforced concrete, an experimental transparent pavilion has been designed (with dimensions 9×9×3.6 m^3) that combines a number of innovative ideas. Many different kinds of glass and glass systems have been used. The outermost ana the triple-layered insulating glass units have been tempered and sometimes laminated and some glass has also been coated with solar control glass to reflect some of the unwanted sunshine outwards. In other cases, glass that can be heated electrically and glass panes free of iron oxide have been used to make the inside light more natural.

Sources: Oxford Read and Discover. Homes around the world. – Oxford University Press, 2010. – p. 13-14.
Professional English in Use. Engineering. – Cambridge University Press, 2009. – p. 36.
Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 15.

4. Decide if the sentences are true or false.

1. The sand on many beaches is made of cement.
2. Glass is very popular in contemporary architecture.
3. Silica and other chemicals are put into a furnace to make glass.
4. Laminated glass is made by laminating glass with a polymer.
5. In the case of tempered glass it is heated and kept hot for a certain time to change its structure.
6. The advantage of toughened glass is that it can withstand impacts from small objects, such as flying stones.
7. There is only one type of glass in the experimental pavilion.
8. In the case of tempered glass a glass and polymer "sandwich" is made, with a sheet of glass in the middle and sheets of polymer at either side.

5. Match the words to the definitions.

1. outermost	**a.** fragility
2. stainless steel	**b.** at the greatest distance from the centre
3. brittleness	**c.** flat sheet of glass used in a window or door
4. pane	**d.** a very small piece of material
5. grain	**e.** a container for a very hot fire, used to produce heat, or liquid metal
6. furnace	**f.** a metal made from steel that does not rust

6. Match the types of safety glass with the pictures.

laminated glass	tempered glass

Source: Professional English in Use. Engineering. – Cambridge University Press, 2009. – p. 37.

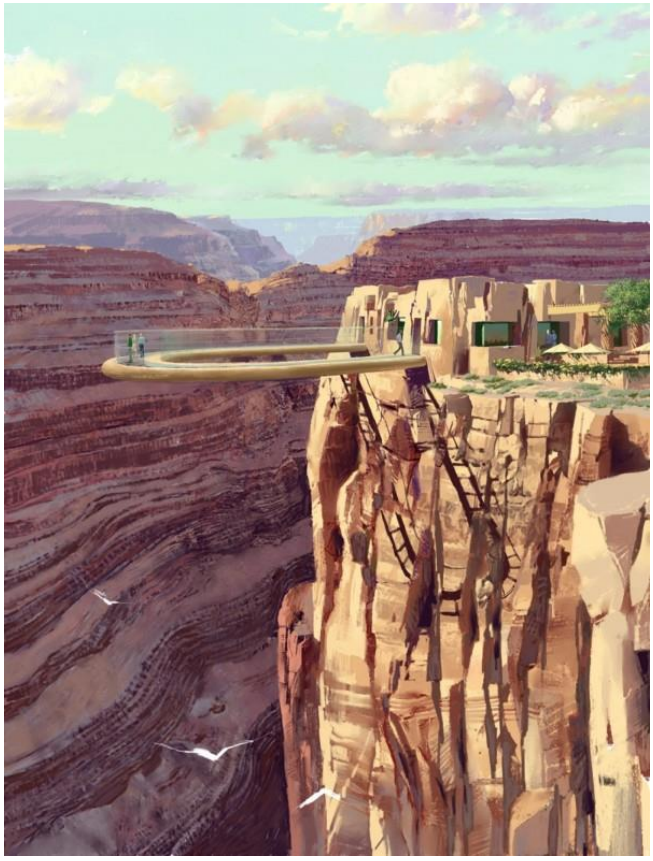
7. Give English equivalents to the following words and word combinations and make up sentences.

1. Инновационные идеи
2. Нежелательный
3. Современная архитектура
4. Солнечный свет
5. Выдерживать воздействие
6. По обе стороны
7. Маленькие осколки
8. Более естественный
9. Отражать
10. Прозрачное здание

8. Translate some facts the Grand Canyon Skywalk in Arizona (USA) to learn more about the application of glass in construction.

20 марта 2007 года Большой Каньон преобразился благодаря новому мосту. Абсолютно прозрачный мост позволяет видеть пропасть под ногами. Консольный мост (cantilever bridge), все основные элементы которого состоят из ламинированного стекла, выступает на 21,34 метра над пропастью каньона, на 1200

метров возвышаясь над рекой Колорадо. Ширина сооружения составляет 2,8 метров, являясь единственным в мире консольным сооружением таких внушительных размеров.



Основной целью главного ответственного инженера Марка Джонсона было создание сооружения, способного преобразить Большой Каньон и сделать его еще более уникальным, что позволило бы привлечь больше туристов. Нет лучшего материала, чем стекло, который позволил бы создать чувство невесомости над землей. Именно поэтому архитекторы и инженеры без сомнения отдали предпочтение использованию в конструкции стекла. Ламинированное стекло толщиной в 54,1 см было изготовлено в Германии и доставлено в США для монтажа. Основные требования, которым должен соответствовать материал:

– максимальная прозрачность;

– способность выдерживать ветровые нагрузки, направленные вверх и вниз;

– способность выдерживать нагрузки, создаваемые посетителями;

– нескользящая поверхность стеклянного пола;

– безопасная эксплуатация при температуре 50 С;

– способность обеспечить безопасность посетителей.

Для изготовления стеклянного моста использовалось стекло с низким содержанием железа. Для большей прочности стекло было закалено.

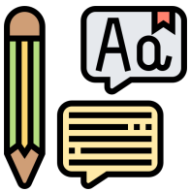
Source: http://art-solution.com.ua/poleznaia-informatsiia/bolshoi-kanion/

9. Find other examples of glass buildings and structures.

MAN-MADE BUILDING MATERIALS

UNIT 4. GLASS AND METAL

4B. METAL



1. Read the words and learn them by heart.

copper – медь	fusible – способный плавиться
cast iron – чугун	wrought iron – кованое железо
malleable – пластичный	ductile – ковкий, поддающийся обработке
harsh weather – суровая погода	ductility – ковкость, пластичность
to recycle – перерабатывать	circumstances – обстоятельства

2. Before you start. Answer the questions.

1. What metals do you know?
2. What construction elements are made of metals?

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

Metal.

Metals are solid materials that are generally hard, malleable, fusible, ductile, and have good electrical and thermal conductivity. There are many different types of metal used in construction industry. Designers, architects and builders use metal in construction and manufacturing because of its durability, resistance to all forms of weather and all-round strength. However, the types of metals used may differ depending on the circumstances. For example, what are the differing benefits of aluminium, steel and copper? Where and in which circumstances would you consider using each one of these?

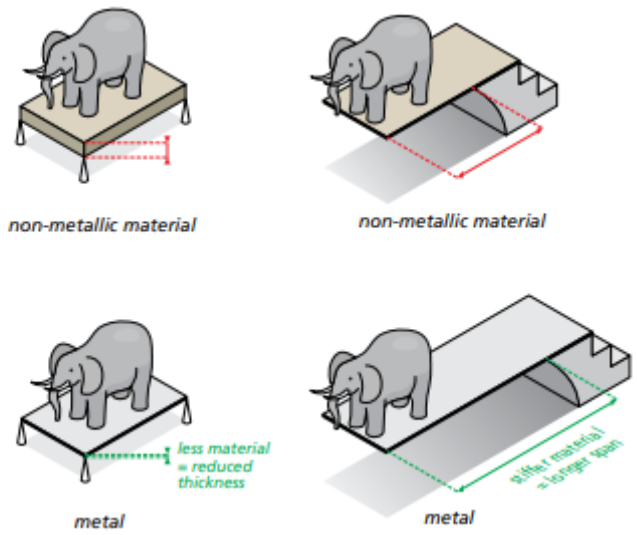
There are advantages to each of them depending on what look or finish you want to achieve, or job you want the particular metal to perform.

The following three performance properties make metals essential for buildings:

1. Due to their high strength, metals can bear high loads with less material or be used to reinforce other materials.

2. Thanks to their high stiffness, metals can span greater distances, allowing more design freedom.

3. Metal building products, with appropriate surface treatment, when necessary, are weatherproof, seismic proof, corrosion resistant and immune to the harmful effects of UV rays, ensuring a very long service life without degradation.



Metals can be recycled without loss of quality. Metals continually recover their original performance properties, even after multiple recycling. This allows them to be used again and again for the same application. By contrast, the performance characteristics of most non-metallic materials degrade after recycling.

The most common metals are iron, aluminium, copper, steel, which have their particular qualities.

Two types of iron are commonly used in construction: cast iron and wrought iron. Cast iron is melted, poured, and moulded, and is often used in large architectural projects. Wrought iron is highly malleable, meaning it can be heated, and re-heated, and worked into various shapes. In fact, it gets stronger the more it's worked. Wrought iron has a much higher tensile strength than cast iron, making it more suitable for horizontal beams in construction.

Aluminium is also commonly used in the industry, because it is resistant to corrosion, highly conductive and ductile, lightweight and strong. Because it is resistant to harsh weather, the metal is used in windows, doors, etc. The metal is processed into sheets and tubes. HVAC ducts, roofs made of aluminium are also frequently found in the building industry.

Copper has been used for a variety of purposes for thousands of years and is valued for its conductivity, corrosion resistance, strength and ductility. People use copper to make statues. There are more than 80 metric tons of copper in the Statue of Liberty in New York.

Sources: https://www.metalsforbuildings.eu/assets/pdf/bd5643ba39/MFB-leaflet-LR-EN.pdf
https://www.designingbuildings.co.uk/wiki/Metal_in_construction#:~:text=Metals%20are%20solid%20material%.

4. Answer the questions.

1. What are metals?
2. Describe the difference between cast iron and wrought iron.
3. What are the properties of aluminium?
4. Do metals lose quality after being recycled?
5. What three performance properties make metals essential for buildings?

5. Match the metals with their properties.

aluminium, copper, cast iron, wrought iron

lightweight, corrosion resistant, ductile, resistant to harsh weather, malleable, higher tensile strength

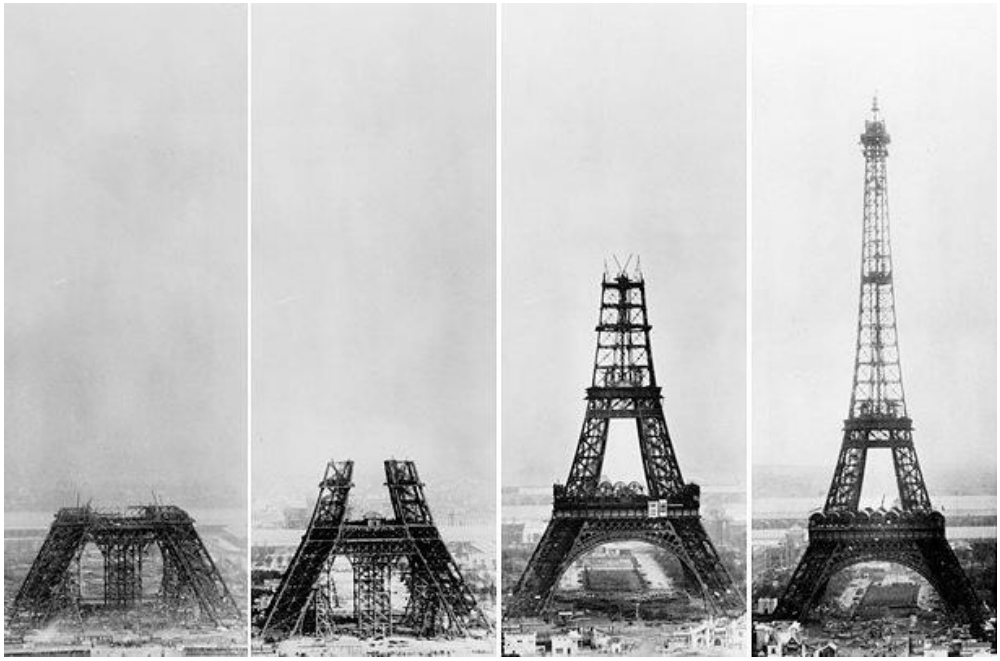
6. Match the words to the definitions.

1. copper	**a.** to put used objects or materials through a special process so that they can be used again
2. cast iron	**b.** the conditions that affect a situation, action, event, etc.
3. to recycle	**c.** severe and unpleasant weather
4. circumstances	**d.** a chemical element that is a reddish-brown metal, used especially for making wire and coins
5. harsh weather	**e.** to spoil or destroy the beauty or quality of something
6. to degrade	**f.** a type of iron that is hard, breaks easily, and is shaped in a mould

7. Translate the text about the Eiffel Tower to learn more about the application of iron in construction.

Историческое событие произошло в 1778 году, когда был построен первый мост из железа. Так началось применение железа как строительного материала. Из других архитектурных металлических сооружений стоит выделить Эйфелеву башню. Ее проект был разработан инженером из Франции Густавом

Эйфелем в 1889 году. Решение о строительстве Эйфелевой башни принималось тяжело, так как многие ученые того времени считали, что через 20 лет башня рухнет от коррозии металла. Эйфель к тому времени имел немалый опыт. Он построил ряд мостов и других сооружений, широко используя при этом металлические конструкции.



Тем не менее, решение о строительстве было принято. Сейчас это одно из самых прочных металлических сооружений в мире. Это уникальное сооружение имеет высоту более 300 метров и весит около 7 тыс. тонн. Опыт строительства Эйфелевой башни использовали в создании американских небоскребов.

Source: http://metallurgu.ru/books/item/f00/s00/z0000007/st027.shtml

8. What other world-famous metal structures do you know? Describe them.

9. Read the text about aluminium and match each paragraph with a heading.

A. Aluminium is everywhere.

B. Corrosion resistance.

C. Conductivity.

D. Strength and malleability.

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

Aluminium.

1. _____

Aluminium is a lightweight, high-strength material, resistant to corrosion and easily recycled. When alloyed with other elements, it can be processed by casting, rolling or forging. This makes it a favorite material of engineers in almost every field, from construction, rail transport, and aviation to the electrical industry, and many more.

2. _____

Some aluminium alloys can be as strong as many steels, and its ductility and malleability mean it is easy to form. Without aluminium there would be no air transport.

3. _____

Aluminium is highly reactive. This means that it changes chemically when it comes to contact with certain other substances. When aluminium is exposed to oxygen, it reacts. The result is a strong but thin oxide film on the surface of aluminium. If the film is damaged, it forms again in most conditions. This gives aluminium excellent corrosion resistance. It also makes aluminium easy to colour and decorate.

4. _____

Its high electrical conductivity – combined with its lightness and strength – mean that aluminium is used more frequently than copper for overhead power cables. Aluminium has a lower conductivity than copper, but engineers prefer the lower density and cost of aluminium.

Source: Oxford English for Careers. Engineering 1 / P.Astley, L. Lansford – Oxford University Press, 2017. – p. 68.

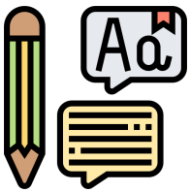
10. Discuss the questions.

1. What properties does aluminium have?
2. What property protects aluminium from corrosion?
3. In what fields of engineering is aluminium used?

MAN-MADE BUILDING MATERIALS

UNIT 4. GLASS AND METAL

4C. STEEL



1. Read the words and learn them by heart.

carbon – углерод
chromium – хром
carbon steel – углеродистая сталь
mild steel – низкоуглеродистая сталь
to deteriorate – ухудшаться
to corrode – ржаветь, подвергаться действию коррозии
alloy steel – легированная сталь
low alloy steel – низколегированная сталь
tungsten – вольфрам
high carbon steel – высокоуглеродистая сталь
cobalt – кобальт
medium carbon steel – среднеуглеродистая сталь
to eliminate – исключать
tool steel – инструментальная сталь
approximately – приблизительно
high strength low alloy steel – высокопрочная низколегированная сталь

2. Before you start. Answer the questions.

1. What do you know about steel?
2. Is steel widely used in construction?

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

Steel.

Steel is the most widely used engineering material. Technically, though, this well-known alloy of iron and carbon is not as simple as one might think. Steel comes in a huge range of different grades, each with different characteristics. For the inexperienced, it can be difficult to know there to begin.

A good place to start is with the two main types of steel. The first, carbon steels, consist of iron and carbon, and contain no significant quantities of other metals. Carbon steel can be divided into three main grades:

- Mild steel – the most widely used grade – is a low carbon steel which contains up to approximately 0.3% carbon. One weakness of mild steel is that it corrodes – its surface progressively deteriorates due to chemical reaction. The reaction takes place between the iron in the steel and the oxygen (O_2) in the air, to form iron oxide.
- Medium carbon steel contains between approximately 0.3% and 0.6% carbon.
- High carbon steel contains between approximately 0.6% and 1.4% carbon.

The second main category of steel is alloy steels, which consist of iron, carbon and one or more alloying metals. Specific grades of alloy steel include:

- low alloy steels, which contain 90% or more iron, and up to approximately 10% of alloying metals such as chromium, nickel, etc.
- high strength low alloy steels, which contain smaller quantities of the above metals (typically less than 2%)
- stainless steels, which contain chromium as well as other metals – such as nickel – and which do not rust.
- tool steels, which are extremely hard, are used in cutting tools. They contain tungsten and/or cobalt.

Source: https://medium.com/@hariomtmtgroup/why-it-is-still-important-to-use-structural-steel-in-construction-projects-2263a6fcbbb2

Steel is resistant to corrosion and general deterioration. It can be used both for exterior as well as internal infrastructure. Compared to conventional concrete buildings, steel buildings offer a longer lifetime and they cause less harm to the environment thanks to the resistance and

durability. Because steel buildings are usually pre-fabricated or made in sections and parts that are assembled on the construction site, they are cheaper than conventional buildings.

Nowadays steel buildings are often appreciated for their design. In fact, the flexibility of this material allows different forms and shapes. More than any other building material, steel has a high strength-to-weight ratio. This means that it is easy and cheap to span large distances elegantly eliminating columns. Thanks to this, it is easier to subdivide office- and warehouse space.

Sources: Professional English in Use. Engineering. – Cambridge University Press, 2009. – p. 30.
Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 14.

4. Decide if the sentences are true or false.

1. Steel is an alloy of iron and carbon.
2. Mild steel is a high carbon steel.
3. Alloy steels contain carbon.
4. Chromium and nickel are used as alloying metals in steel.
5. Low alloy steels contain more chromium than iron.
6. Steel buildings are usually pre-fabricated or made in sections and parts that are assembled on the construction site.
7. Tungsten is added to steel to make it softer.
8. More than any other building material, steel has a low strength-to-weight ratio.
9. Steel buildings cause less harm to the environment.
10. Stainless steel is an alloy steel.

Source: Professional English in Use. Engineering. – Cambridge University Press, 2009. – p. 31.

5. Complete the sentences with words from the text.

1. Steel can be used both for the exterior and the interior _____ of a building.
2. Steel is _____ to corrosion, rusting and general deterioration.
3. Steel buildings have a longer _____ compared to conventional concrete buildings.
4. Steel buildings are usually _____ than _____ buildings.
5. It is easy and cheap to span large _____ elegantly.
6. By eliminating _____, it is easier to subdivide office and warehouse space.

Source: Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 14.

6. Match the words to the definitions.

1. flexibility	**a.** when a metal becomes reddish brown because of air and water
2. alloy	**b.** being bent easily without breaking
3. deterioration	**c.** the period of time for which a building is expected to last
4. lifetime	**d.** a particular level of quality that a product, material, etc. has
5. rusting	**e.** becoming worse in quality or condition
6. grade	**f.** a composite metal made by mixing other metals together

7. Complete the text with words from the box.

importance	skyscrapers	locations
recently	commercial	green
consists of	option	various

Structural steel.

Steel has been used in construction since the first _____[1] were built in the late 19th century. But _____[2], steel has become an _____[3] for smaller buildings and even personal residences. It is considered a "_____[4]" product, because it is entirely recyclable. In fact, a builder will be able to buy recycled steel for a new _____[5] building or home.

Today's global construction market _____[6] structural steel as its primary material. Structural steel used in commercial, industrial and residential constructions can be found in _____[7] shapes (used for very precise angles and support structures). Their grades and standards might differ depending upon the geographical _____[8]; however, there is no denying its _____[9] in the construction market worldwide.

UNIT 4. GLSS AND METAL

REVIEW

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

layers	corrode	degraded	protective	grains
alloy	laminated glass	protect	wrought iron	circumstances

1. Brass is an _____ of copper and zinc.
2. _____ is a type of safety glass that holds together when shattered.
3. Every day the environment is further _____ by toxic wastes.
4. Steel tends to _____ faster in a salty atmosphere.
5. Tiny pieces of materials are called _____.
6. Obviously we can't deal with the problem until we know all the _____.
7. The _____ gate, as usual, was open and he parked in front of the house.
8. These alloys _____ against corrosion.
9. We put on two _____ of paint.
10. People who work with furnaces in a steel factory need to wear _____ clothing.

2. Translate the sentences.

1. По химическому составу выделяют легированную и углеродистую сталь.
2. Сталь – сплав железа с углеродом.
3. Закаленное стекло применяют для устройства дверей, перегородок и т.д.
4. В эпоху Средневековья сталь широко применялась для изготовления оружия.
5. Хром повышает твердость и прочность стали.
6. Кованое железо – это сплав железа с очень низким содержанием углерода (менее 0,08%) в отличие от чугуна (от 2,1% до 4%).
7. Характерной особенностью стали является ее способность изменять свои механические свойства.
8. Кованое железо больше не производится в промышленных масштабах.

9. Современное стекло очень безопасное и прочное. Это достигается при помощи специальных технологий.

10. В начале прошлого века алюминий практически не использовался в строительстве, так как был слишком дорогим металлом и не выпускался в достаточных объемах.

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

Letters	Correct word	Translation
1. gowruht inor		
2. tccuanmirsces		
3. dioreaterte		
4. fucnrae		
5. ciuohrmm		
6. tegsuntn		
7. lmeaballe		
8. tnnsarparet		
9. ylaer		

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

TRANSPARENT

_____

_____

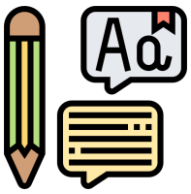
_____

_____

MAN-MADE BUILDING MATERIALS

UNIT 5. POLYMERS

5A. POLYMERS



1. Read the words and learn them by heart.

fluid – жидкость
to cure – затвердевать
to drain waste – сливать отходы
polyimide – полиимид
epoxy resin – эпоксидная смола
municipal water – водопроводная вода
engineering plastics – конструкционный пластик
corrosive fluid – жидкость, вызывающая коррозию
adhesive – вяжущее вещество
compounds – соединения, сложные вещества
thermoplastic – термопласт
elastomer – эластомер
plastic foam – пенопласт
versatile – многофункциональный
electrical wiring – электрическая проводка
thermosetting plastics – реактопласт, термореактивный пластик
chemical resistance – устойчивость к химическому воздействию

2. Before you start. Answer the questions.

1. What do you know about polymers?
2. How are polymers used in construction?

3. Read the text and about polymers and check your ideas.

Polymers.

Polymers are usually called by their common name, plastic. But what, exactly, is a polymer or plastic?

Polymers are compounds made up of several elements that are chemically bound. Most compounds consist of large numbers of tiny molecules, which contain just a few atoms. For

example, a water molecule – H_2O – contains two hydrogen atoms and one oxygen atom. But the molecules of polymers contain huge number of atoms, joined together in long chains.

Most of the polymers used in industry are not natural, but synthetic. The term 'plastic' is generally used to refer to synthetic polymers – in other words, those that are man-made.

Synthetic polymers can be divided into two main categories:

Thermoplastics can be melted be heat, and formed in shaped containers called moulds. After the liquid plastic has cooled, it sets to form a solid material. A thermoplastic is a type of plastic that can be heated and moulded numerous times. Examples of thermoplastics that are common in engineering include:

- Polycarbonate – used to make strong, transparent panels;
- PVC (polyvinylchloride) is the plastic which has seen the most rapid growth in recent times in industry. PVC is often used in piping systems because of its good chemical resistance to corrosive fluids. PVC pipes are used for a great number of applications: to drain waste, for natural gas distribution, for electrical and communications wiring, for municipal water.

Thermosetting plastics, also called thermosets, can be heated and moulded like thermoplastics. They may also be mixed from cold ingredients. However, during cooling or mixing, a chemical reaction occurs, causing thermosets to cure. This means they set permanently, and cannot be moulded again. Examples of thermosets used in engineering are:

Source: https://theconstructor.org/building/plastics-construction-material/12438/

- epoxy resins – used in very strong adhesives;
- polyimides – strong and flexible, used as insulators in some electric cables.

Two more categories of polymer are engineering plastics and elastomers. Engineering plastics are mostly thermoplastics that are especially strong. Elastomers are very elastic polymers which can be stretched by force to at least twice their original length, and can return to their original length when the force is removed.

Plastic products offer a number of ecological advantages: they save resources, have a low maintenance cost and can be recycled. Furthermore, they contribute to save energy (plastic

foams are used for thermal insulation in many applications). Plastic is also useful for noise protection and insulation.

The main fields of application of these materials are pipes, wall covering, flooring (both in houses and in public areas) and window frames (made of PVC). As it is entirely man-made, plastic is extremely versatile. Improvements made through research have increased its acceptance among designers and contractors.

Sources: Professional English in Use. Engineering. – Cambridge University Press, 2009. – p. 34.
Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 16.

4. Answer the questions.

1. What is a polymer?
2. How can plastic save energy?
3. What is plastic insulation useful for?
4. What are the main fields of application of plastic?
5. What does PVC stand for?
6. What is the application of PVC pipes?
7. What categories can synthetic polymers be divided into?
8. Describe the difference between thermoplastics and thermosets.
9. What polymers are called elastomers?
10. What are the advantages offered by plastic products?

5. Choose the correct answer.

1. Plastic products save _____.

a) industry;

b) materials;

c) resources.

2. Plastic insulation is also useful for _____ protection.

a) recycled;

b) resources;

c) noise.

3. PVC is the plastic whose use has grown more _____.

a) recently;

b) slowly;

c) primary.

4. The _____ fields of application of these materials are in flooring.

a) alternative;

b) main;

c) useless.

5. PVC has good _____ resistance to corrosive fluids.

a) physical;

b) public;

c) chemical.

6. PVC pipes are used for _____ gas distribution.

a) natural;

b) chemical;

c) piping.

Source: Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 16.

6. Match the words to the definitions.

1. versatile	**a.** a substance that flows and is not solid
2. polymer	**b.** unwanted materials or substances that are left after you have used something
3. adhesive	**c.** a chemical substance consisting of large molecules made from many smaller and simpler molecules
4. fluid	**d.** the smallest unit into which any substance can be divided without losing its own chemical nature, usually consisting of two or more atoms
5. piping	**e.** to become bigger or longer when you pull a material and then return to its original shape when you stop
6. molecule	**f.** a substance such as glue that you use to stick two things together
7. waste	**g.** several pipes, or a system of pipes, used to send liquid or gas in or out of a building
8. to stretch	**h.** having many different uses

7. Read the extract describing a plastic panel manufacturing process. Then decide whether the sentences below are true of false, and correct the false sentences.

By this stage of the process, the plastic is solid, and has fully cooled. Selected panels can now undergo quality-control testing, to check they are strong enough to cope with the tough conditions they will be exposed to in use. Tests include tensile testing, where narrow lengths of panel are subjected to high tension loads to check they do not stretch of fracture. More tests are carried out to check the panels' resistance to impacts. Any products that fail the tests are returned to the beginning of the production process, melted down, and their material is reused.

1. The plastic was heated earlier in the process.
2. The plastic has now set.
3. The plastic is now liquid.
4. To pass one of the tests, the plastic must be an elastomer.
5. The material is a thermosetting plastic.
6. The material is a thermoplastic.

Source: Professional English in Use. Engineering. – Cambridge University Press, 2009. – p. 35.

8. Translate the text to learn more about the application of polymers in construction.

Строительная индустрия относится к наиболее крупным потребителям синтетических полимеров. Поэтому применение полимеров в строительстве увеличивается из года в год.

Использование полимерных материалов в строительстве имеет такие преимущества как сокращение расходов, устойчивость к коррозии, изоляционные свойства и др. В большинстве случаев, полимерные материалы устойчивы к кислотам и другим химическим реагентам. Они не требуют дополнительной защиты поверхности и могут быть окрашены в разные цвета. Пластмассы легко перерабатываются в строительные изделия.

Но необходимо учитывать и их недостатки, к примеру, некоторые пластические массы имеют способность выделять в окружающую среду вредные вещества. Под действием солнечных лучей, повышенной температуры физико-механических свойства пластмассы ухудшаются.

Source: http://www.hintfox.com/article/primenenie-polimerov-v-stroitelstve.html

9. Read the text about amazing use of plastic and answer the questions.

Source: https://www.dailymail.co.uk/travel/

Did you know that people also build structures under the ocean? The Poseidon Undersea Resort in Fiji is a hotel 12 meters under the ocean. It's made of very strong metal and plastic. The windows are made of special, clear plastic, so people can see fish and other ocean animals from the hotel. To get to the hotel, you travel by submarine!

Source: https://sportsvenuebusiness.com

The 02, in London in the United Kingdom is a dome. It was built for the millennium, the year 2000. The roof is made of a special plastic and glass material. It's 365 meters wide – one meter for every day of the year. It has also 12 support towers – one tower for every month of the year.

1. Where is the Poseidon Undersea Resort?
2. How do you get to the Poseidon Undersea Resort?
3. What is made of a special plastic?
4. What is the O2?
5. How wide is the roof of the O2?

Source: Oxford Read and Discover. Super Structures. – Oxford University Press, 2010. – pp. 14, 18.

10. Circle the correct words.

1. To get to the Poseidon Undersea Resort, you travel by *car*/*submarine*.
2. The O2 is in *London*/*Manchester*.
3. People can see *fish*/*the mountains* from the Poseidon Undersea Resort.
4. The O2 was built for the *Olympics*/*millennium*.

11. What other engineering wonders are made using plastic? Make a presentation on this topic.

UNIT 5. POLYMERS

REVIEW

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

materials	rust	fluids	adhesive
approximately	transparent	synthetic	transported

1. Potentially, plastics do not _____ or need regular re-painting.
2. These tanks are used for storing such _____ as oil and petrol.
3. The light weight of plastics enables them to be easily _____ and moved on site.
4. PVC can be manufactured in a variety of colours or can be _____.
5. _____, also known as glue, cement, is any non-metallic substance applied to one or both surfaces of two separate items that binds them together and resists their separation.
6. In the United Kingdom _____ 500,000 tonnes of PVC are produced each year.
7. Thermosets also present an increased utilisation as reinforcing and structural _____.
8. Thermoplastics and thermosets are _____ polymers.

2. Translate the sentences.

1. По отношению к нагреву полимеры подразделяют на термопластичные и термореактивные.
2. Человек давно использует природные полимерные материалы в своей жизни.
3. Промышленное производство полимеров началось в начале XX века.
4. Эластомеры – это полимеры, обладающие высокоэластичными свойствами.
5. Наука о полимерах стала развиваться как самостоятельная область знания к началу Второй мировой войны.
6. Производство синтетических полимеров началось в 1906 году, когда Лео Бакеланд (Leo Baekeland) запатентовал так называемую бакелитовую (Bakelite) смолу.
7. Многие полимеры, такие как эпоксидные смолы, склонны к воспламенению.

3. Read the extract from a leaflet sponsored by the plastics industry. Choose a heading for each paragraph. There is one you do not need.

a) An important new use of plastic.
b) Plastic and the environment.
c) A history of plastic.
d) New life of old plastic?
e) Physical qualities.

1. _____

Though natural rubber was used as early as 1600 BC and significant developments were made in the early nineteenth century, it was the development of plastics during the twentieth century which really revolutionized the world.

2. _____

Its uniquely versatile properties – its strength, the fact that it can be made either flexible, as in shoes or watchstraps, or rigid, as in tables or chairs, and its lightweight and water-resistant – mean that plastic has already replaced many traditional materials such as wood, metal, ceramic. The world must have been a very different place before plastic.

3. _____

A recent development which is likely to revolutionize manufacturing is 3D printing. Plastic is built up, layer on layer, to create complex solid objects.

4. _____

Recycled plastic is now being used in very creative ways, too. In Taiwan, plastic bottles were used to build EcoARK exhibition centre, while in Bangalore, India, a new, longer-lasting more durable road surface has been laid using around 10% of the city's waste plastic. This will cut the need for road repairs.

Source: Navigate. Advanced. Coursebook. – Oxford University Press, 2016. – p. 76.

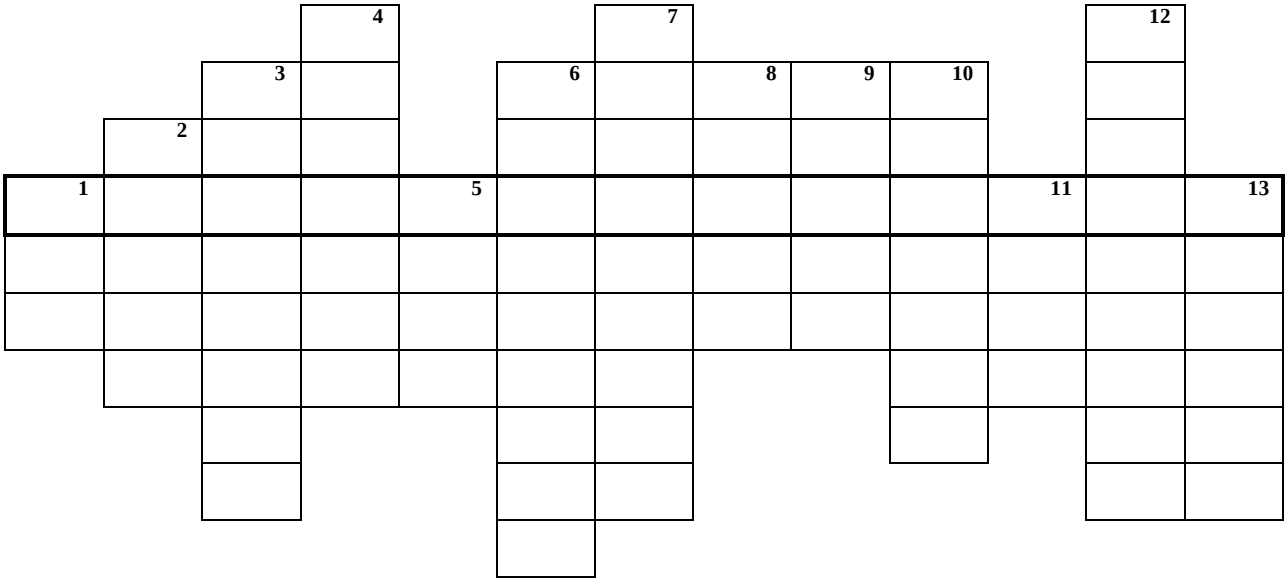
4. Match the words in the leaflet to the definitions.

1. doesn't let water through easily _____
2. not heavy _____
3. able to bend _____
4. having many different uses _____
5. likely to last a long time _____
6. difficult to move or bend _____

Source: Navigate. Advanced. Coursebook. – Oxford University Press, 2016. – p. 76.

5. Complete the crossword.

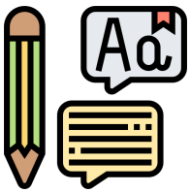
1. A shorter name for polyvinylchloride.
2. Used for forming melted plastic.
3. A group of atoms.
4. A long chain of atoms.
5. To set permanently.
6. A very elastic polymer.
7. A plastic that sets permanently.
8. Polyimides are used as insulators in some electric _____.
9. A very strong thermoset resin.
10. Not natural.
11. Particles that form molecules.
12. Another word for ‘not natural’.
13. Plastic products contribute to save _____.



NATURAL BUILDING MATERIALS

UNIT 6. TRADITIONAL BUILDING MATERIALS

6A. WOOD AND TIMBER



1. Read the words and learn them by heart.

to saw – пилить
board – доска
cross section – поперечное сечение
plywood – фанера
engineered wood – обработанная древесина, композитная древесина
particle board (chipboard) – ДСП (древесно-стружечная плита)
medium-density fibreboard – древесно-волокнистая плита средней плотности
solid wood – массивная древесина
sawmill – лесопилка
structural timber – строительный лесоматериал
stress-graded – сортированный по прочности
rough sawn timber – черновой пиломатериал (не подвергавшийся дополнительной обработке)
orientated strand board – ориентированная стружечная плита, плита OSB
glue-laminated sections (glulams) – клееный брус, клееная древесина

2. Before you start. Answer the questions.

1. What properties of wood do you know?
2. Is wood widely used in construction in your country?

3. Read and translate the text about wood and timber and check your ideas.

Wood and timber.

In engineering, wood can be categorized as:

- solid wood – wood that has been sawn into specific shapes and sizes, but whose natural structure remains intact;

- engineered wood – made by bonding (sticking together) layers of solid wood, or by mixing quantities of wood particles and bonding them with resin.

In industry, wood is often referred to as timber (BrE) or lumber (AmE).

Solid structural timber is wood intended to support loads in a structure. Generally, timber is cut to the required section – the width and depth that determine its cross section – at a sawmill, where a range of section sizes are produced. Timber from sawmills is generally supplied in rough-sawn sections. This refers to the surface texture produced by sawing timber in a circular saw. If the timber needs to have a smooth finish – for example, because it will be visible in the structure – it can subsequently be planed to smooth its surface.

Source: https://www.vectorstock.com/royalty-free-vector/cartoon-timber-wood-log-and-trunk-stump-and-vector-23665501

Because the strength of wood varies, structural timber must be stress-graded. This means its strength is tested in order to give it a stress grade – a standard strength value which an engineer can use for design calculations. Timber can be mechanically stress-graded, where its strength is checked by machine. It can also be visually stress-graded, where the wood is examined by an inspector who looks for potential weaknesses.

Engineered wood includes:

- cheap, low-strength boards, such as particle board (often called chipboard) and medium-density fibreboard (MDF)
- stronger boards suitable for structural use – primarily orientated strand board (OSB), which is made from strands of wood bonded with resin, and plywood, which consists of several layers of solid wood.
- glue-laminated sections – sometimes called glulams – which can be used as major structural elements, such as beams in large buildings.

Source: Professional English in Use. Engineering. – Cambridge University Press, 2009. – p. 40.

4. Write correct sentences.

1. Structural timber is wood which function is to dig loads in a structure.

_____

2. Engineered wood is a type of wood that has been sawn into specific shapes and sizes, but whose natural structure remains intact.

_____

3. As a rule timber is cut to the required section (the width and depth that determine its cross section) at a windmill.

_____

4. In engineering, wood can be categorized as artificial wood and engineering lumber.

_____

5. Generally, structural timber must be weight-graded.

_____

6. Timber can be visually stress-graded, where its strength is checked by machine.

_____

7. Plywood is a type of cheap, low-strength board.

_____

8. Chipboard, orientated strand board, glulams are examples of solid wood.

_____

5. Complete the sentences below using words and expressions from the text.

1. Wood cut in a circular saw is called _____ timber.
2. After timber is tested for strengths and weaknesses, it is given a _____.
3. When timber is inspected by a person who looks for weaknesses, it is _____ stress-graded.
4. When timber is inspected by a machine which tests its strength, it is _____ stress-graded.

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

1. Промышленность
2. Низкопрочный
3. Определять
4. Определенные формы
5. Ширина

6. Древесные частицы

7. Оставаться в неизменном виде

8. Выдерживать нагрузку

9. Впоследствии, в дальнейшем

10. Видимый, заметный

11. Требуемый, необходимый

12. Элементы конструкции

7. 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.

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

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].

8. Read about the disadvantages of timber frame and comment on the following points:

- sound
- fire
- water
- environmental impact
- strength

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.

9. Translate the text to learn more about the application of wood in construction.

Для изготовления инженерных сооружений и изделий древесина используется с давних времен. К примеру, из этого материала был изготовлен мост через реку Тибр (Tiber) в Древнем Риме, в котором не было элементов из металла. Он был построен в 614 году до н.э. и простоял на своем месте 24 года! Древесина является абсолютно возобновляемым ресурсом, что делает ее универсальным сырьем для создания многих видов изделий. Несмотря на низкую плотность, древесина обладает высокой прочностью. Это позволяет использовать ее в строительстве несущих конструкций, таких как спортивные комплексы, мосты и др.

Изготовление, транспортировка и монтаж строительных деревянных деталей требуют минимального расхода энергии, а соответственно и минимальных материальных затрат.

Деревянные постройки легко можно изменить, перестроить, или разобрать на отдельные детали.

Монтаж деревянных конструкций производится очень быстро. А расходы на создание фундамента под деревянную постройку являются минимальными.

Source: https://i.pinimg.com/

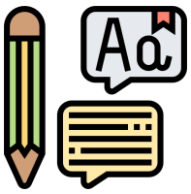
Исходя из всех этих положительных качеств, применение древесины в строительстве весьма широко. Из нее делают как целые сооружения, так и отдельные элементы (полы, стены, лестницы). Можно использовать древесину и как отделочный материал для стен, потолков и полов.

Source: http://zembr.ru/index.php/stati/stroitelstvo/353-drevesina-v-stroitelstve

NATURAL BUILDING MATERIALS

UNIT 6. TRADITIONAL BUILDING MATERIALS

6B. BAMBOO



1. Read the words and learn them by heart.

to tackle – решать

abundance – изобилие, избыток

shrinkage – сжатие, сокращение, пересыхание

appropriate – необходимый, соответствующий

prone – склонный, подверженный

to withstand – выдерживать (действие чего-либо)

suspension bridge – подвесной мост

to decay – разлагаться, разрушаться

2. Before you start. Answer the questions.

1. What do you know about bamboo?
2. How is bamboo used in construction?

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

Bamboo.

Bamboo as a building material has high compressive strength and low weight. It has been one of the most used building materials as support for concrete, especially in those locations where it is found in abundance. Bamboo is used for the construction of scaffolding, bridges and structures, houses.

Bamboos are one of the fastest-growing plants in the world and their growth is three times faster than most other species of plants. They are renewable and extremely versatile resource with multi-purpose usage.

Bamboo is conventionally associated with the region of Southeast Asia and South America where climate is best suitable for its cultivation. In many countries, bamboo is used to hold up suspension bridges.

There is very limited use of bamboo as foundation material because when in contact with moisture it decays fast. However, this issue can be tackled to quite an extent though proper treatment using appropriate chemicals.

Bamboo is extensively used for construction of walls and partitions. Posts and beams are the main elements which provide structural framework for walls. They are positioned in a way to be able to withstand forces of nature. An infill is used between framing elements to add strength and stability to the walls.

Bamboo is one of the best roofing materials. It is a proven shield against forces of nature or animals, moreover, bamboo is considerably light weighted which makes it easy to install.

Advantages of Bamboo as a Building Material

1. Tensile strength: Bamboo has higher tensile strength than steel.

2. Fire Resistance: Capability of bamboo to resist fire is very high and it can withstand temperature up to 4000 C. This is due to the presence of high value of silicate acid and water.

Source: https://cceonlinenews.com/2017/09/09/kenya-urged-to-adopt-sustainable-building-materials/

3. Elasticity: Bamboo is widely preferred in earthquake prone regions due to its elastic features.

4. Weight of bamboo: Bamboos due to their low weight are easily displaced or installed making it very easy for transportation and construction.

5. Unlike other building materials like cement, bamboo poses no danger to health.

6. They are cost effective and easy to use.

Disadvantages of Bamboo

1. Shrinkage: Bamboo shrinks much greater than any other type of timber especially when it loses water.

2. Durability: Bamboo should be sufficiently treated against insect attack before being utilized for building purposes.

3. Structural reliability of bamboo is questionable.

Source: https://theconstructor.org/building/bamboo-as-a-building-material-uses-advantages/14838/

4. Answer the questions.

1. Is bamboo a renewable material?
2. Is it easy or difficult to install a bamboo roof?
3. Does bamboo pose any danger to health??
4. Describe the advantages of bamboo as a building material.
5. What are the disadvantages of bamboo?

5. Decide if the sentences are true or false.

1. Bamboo is cost effective and easy to use.
2. Bamboo has low compressive strength and low weight.
3. Bamboos are one of the fastest-growing plants in the world.
4. Bamboo is widely used as foundation material.
5. Bamboo has lower tensile strength than steel.
6. Bamboo is fire resistant.
7. Bamboo is conventionally associated with the region of Southeast Europe and North America.
8. Bamboo shrinks more than any other type of timber.
9. Bamboo is widely used in earthquake prone regions.
10. Bamboo is used for construction of walls and partitions.

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

1. Регионы, подверженные землетрясению
2. Надежность
3. Неоднозначный, сомнительный
4. В изобилии
5. Возобновляемый
6. Решать вопрос
7. Ограниченное использование
8. Пользующийся предпочтением
9. Природная стихия
10. Не представлять опасности

11. Простой в использовании

12. Кровельные материалы

7. Match the words to the definitions.

1. shrinkage	**a.** a large quantity of something
2. to decay	**b.** a reduction in the size of something, or the process of becoming smaller
3. prone	**c.** likely to experience a particular problem more often than is usual
4. questionable	**d.** a system or method for carrying passengers or goods from one place to another
5. abundance	**e.** a bridge that has no supports under it, but is hung from strong steel ropes fixed to towers
6. scaffolding	**f.** to be slowly destroyed by a natural chemical process, or to make something do this
7. transportation	**g.** a set of poles and boards that are built into a structure for workers to stand on when they are working on the outside of a building
8. suspension bridge	**h.** not certain, or wrong in some way

8. Read the article about myths in the use of bamboo for construction. Complete the text with words from the box.

earthquakes	surrounding	steel
chemicals	dry	environment
absorbs	to ensure	principles

Common myths and misconceptions in the use of bamboo for construction.

There are a number of common myths and misconceptions _____[1] the use of bamboo for construction.

Myth 1. Bamboo only needs to be treated to protect it from decay.

Bamboo needs to be kept _____[2] in order to protect it from rot, and many existing bamboo structures are showing signs of rot because they did not follow the _____[3] of durability by design.

Myth 2: Bamboo performs well in earthquakes because it _____[4] energy.

Bamboo structures are primarily good in _____[5] because they tend to be light. Joints in bamboo buildings are able to absorb some energy.

Myth 3: Bamboo can be used as a replacement for _____[6] in reinforcement.

In reality, bamboo does not function well as a replacement for steel in concrete. _____[7] a proper connection between the bamboo and the concrete, one needs to use expensive _____[8] to form the bond, which are bad for the _____[9]. Concrete is unable to protect the bamboo from termite attack.

9. Translate the text to learn more about the application of bamboo in construction.

Бамбук – очень практичный строительный материал. Он легкий, прочный, гибкий, быстро растет. Поэтому в странах, в которых растает бамбук, он уже много веков используется в качестве основного строительного материала. Дома, возведенные из этого тропического растения, способны выдержать серьезные природные катаклизмы. В случае землетрясений, цунами и прочих стихийных бедствий, дома из бамбука, как правило, просто сгибаются, но не разрушаются; и даже если дом рухнет от сильного раскачивания, то не причинит смертельных увечий из-за легкости материала. В последнее время многие архитекторы обратили внимание на этот традиционный для Юго-Восточной Азии строительный материал и проектируют фантастические мосты и дома.

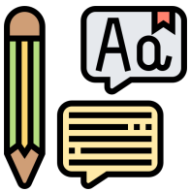
Бамбук, устойчивый и возобновляемый материал, традиционно использовался для строительства жилья на Тайване, но стал использоваться реже с приходом современных строительных материалов. Компания Zuo Studio спроектировала павильон, чтобы продемонстрировать потенциал материала в качестве возвращения к более низкоуглеродистому строительству. “Мы верим в универсальность и большие возможности, которые бамбук может предложить для создания пространства, которое способно объяснить людям, что такое бамбуковая конструкция и расширить их видение”, – сказали авторы.

Source: https://www.architime.ru/specarch/top_10_bamboo_houses/bamboo.html

NATURAL BUILDING MATERIALS

UNIT 6. TRADITIONAL BUILDING MATERIALS

6C. STONE



1. Read the words and learn them by heart.

fence – забор
acid – кислота
remainder – остаток
mankind – человечество
quartz – кварц
quartzitic sandstone – кварцитовидный песчаник
cladding – облицовка, нанесение покрытия
metamorphic rock – метаморфическая горная порода
sedimentary rock – осадочная порода
to precipitate – выделять осадок
stone quarry – каменный карьер
dolomite – доломит (известняк с большим содержанием углекислого магния)

2. Before you start. Answer the questions.

1. What do you know about stones?
2. What stones are used in construction in your country?
3. Is stone a sustainable building material?

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

Stone.

Stone walls are one of the oldest construction methods known to mankind. The first stone walls were made laying up stones without any mortar. With this method stones are held together by gravity. These walls are usually larger at the base. In Ireland and north-eastern UK counties this kind of wall was made by farmers to create fences. It was quite a long and labour-intensive method, but with no costs. When cement appeared, the first mortared stone walls were created, where cement paste fills the gaps between the stones. The first cements were made using burnt gypsum or lime, mixed with water.

Stone is a highly durable, low maintenance building material with high thermal mass. It is versatile, available in many shapes, sizes, colours and textures, and can be used for floors, walls, arches and roofs. Stone blends well with the natural landscape, and can easily be recycled for other building purposes. There are currently over 400 building stone quarries in the UK, more than enough to meet current demand.

Some of the common building stones which are used for different purposes are basalt, marble, limestone, sandstone, travertine, granite, etc. Granite is used for interior surfaces, such as walls, as well as exterior cladding, flooring, landscaping, etc. Because of the varying amounts of quartz and other minerals, granite may have a different density, porosity, strength, and hardness, depending on the stone. True granite has a light-gray-to-pink colour, but commercial granite can be found in nearly any colour, ranging from somewhat uniform gray and black to brown, black, and white combinations. All granite is very hard.

Limestone is a sedimentary rock created primarily by the decay of ancient organisms that accumulated on seabeds and lakebeds and were compacted under pressure over time. Limestone is 50% calcium carbonate ($CaCO_3$), with other forms of calcium, magnesium, silica (which gives limestone much of its hardness), and other minerals making up the remainder. Travertine, another type of limestone, is formed above ground when $CaCO_3$ precipitates out of mineral springs, particularly near hot springs.

Source: https://civildigital.com/characteristics-of-good-building-stone-construction-aggregate-properties/

Limestone has a uniform, non-crystalline structure but is vulnerable to acids, so when exposed to acid rain, the edges of limestone details can get rounded over time. There are three grades of limestone, Type I (low density), Type II (medium density), and Type III (high density). These typically come in white, beige, gray, pink, and other colours, based on mineral content. At 3 or 4 on the Mohs hardness scale, limestone is generally too soft to be polished, and its compressive strength is less than granite's.

Marble is a metamorphic rock formed when limestone, dolomite, and similar sedimentary rocks are exposed to heat and pressure over time. It typically comes in white, pink, red, and gold. It is a soft stone, similar to limestone, at about 3 or 4 on the Mohs scale. Marble is also vulnerable to acids, so common kitchen spills can easily damage and stain the surface unless sealed.

Sandstone is a sedimentary rock created when sand is compacted under pressure. Calcium carbonate, silica, and iron oxide between the grains bond them together like cement. Sandstones that undergo additional heat and pressure become quartzitic sandstone. As with other stone, mineral content dictates the colour of sandstone, but most are beige, brown, gray, light pink, or red. Sandstone is very hard, at 6 or 7 on the Mohs scale (depending on mineral composition).

Sources: Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 10.

http://www.sustainablebuild.co.uk/constructionstone.html

https://www.buildinggreen.com/feature/stone-original-green-building-material

4. Choose the correct answer. There may be more than one possible answer.

1. Marble is a _____.

a) sedimentary rock;

b) metamorphic rock.

2. There are _____ grades of limestone.

a) two;

b) three;

c) five.

3. Stone walls are one of the _____ construction methods known to mankind.

a) recent;

b) oldest;

c) newest.

4. True granite has a _____ colour.

a) dark-brown-to-white;

b) light-blue-to-pink;

c) light-gray-to-pink.

5. Travertine is a type of _____.

a) quartzitic sandstone;

b) limestone;

c) marble;

d) granite.

6. Sandstones that undergo additional _____ become quartzitic sandstone.

a) cold and pressure;

b) heat and pressure;

c) crush test.

7. Stones are available in a variety of _____.

a) shapes;

b) sizes;

c) colours;

d) textures.

5. Match the words to the definitions.

1. remainder	**a.** a type of rock that contains calcium
2. mankind	**b.** to experience something that involves a change
3. limestone	**c.** all humans considered as a group
4. cladding	**d.** the need or desire that people have for particular goods and services
5. quarry	**e.** the land at the bottom of the sea
6. demand	**f.** the part of something that is left after everything else has gone or been dealt with
7. to undergo	**g.** a place where large amounts of stone or sand are dug out of the ground
8. seabed	**h.** a cover of hard material that protects the outside of a building

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

1. Слишком мягкий
2. Подвергаться
3. Содержание минеральных веществ
4. Трудоемкий
5. Природный ландшафт
6. Морское дно
7. Спрос

8. Минеральные источники

9. Похожий

10. Первоначально, прежде всего

7. What is Mohs Hardness Scale? Make a presentation on it.

8. Stonehenge is a prehistoric stone circle monument. Complete the text with words from the box.

transported	heavier	mystery
weigh	England	elephants
cemetery	sun	stones

Stonehenge.

The Stonehenge stone circles are in _____[1]. People transported the first _____[2] to this place about 5,000 years ago. We don't know a lot about Stonehenge. Who built it? How did they build it? Why did they build it? It's a _____[3].

People built Stonehenge with bluestones and sarsen stones. There were about 80 bluestones. They came from mountains 250 kilometres away. They are very heavy – some _____[4] about 4 metric tons.

Source: https://news.sky.com/story/mystery-of-where-stonehenges-giant-stones-come-from-solved-12038846

The sarsen stones are even bigger and _____[5]. About 4,000 years ago, people _____[6] them from 30 kilometres away. The biggest sarsen stone weighs about 45 metric tons. That's like ten _____[7].

How did people use Stonehenge? Maybe they used it as a _____[8] or a place for studying the _____[9] and the stars. Maybe it was also a temple. It's still a special place for some people today. Every year, on June 21st lots of people go to Stonehenge to celebrate the longest day of the year.

Source: Oxford Read and Discover. Wonders of the Past. – Oxford University Press, 2010. – pp. 4-5.

9. Answer the questions.

1. Where did the blue stones come from?
2. How did people use Stonehenge?
3. When is the longest day at Stonehenge?

Source: Oxford Read and Discover. Wonders of the Past. – Oxford University Press, 2010. – p. 25.

10. Write the words from the box.

study	cemetery	mystery	year	kilometre	metric ton

1. tells us 'how far' _____
2. tells us 'how heavy' _____
3. tells us 'how much time' _____
4. where we put people after they die _____
5. what we do when we want to learn something _____
6. something that we don't know _____

Source: Oxford Read and Discover. Wonders of the Past. – Oxford University Press, 2010. – p. 24.

11. Write the numbers.

45	5,000	4,000	80	250

1. People transported the first stones to Stonehenge about _____ years ago.
2. The biggest sarsen stone weighs _____ metric tons.
3. The blue stones came from _____ kilometers away.
4. There were about _____ bluestones.
5. People transported the sarsen stones about _____ years ago.

Source: Oxford Read and Discover. Wonders of the Past. – Oxford University Press, 2010. – p. 25.

12. Though there is no definite evidence as to the intended purpose of Stonehenge, there are some legends. Find the information on the internet.

NATURAL BUILDING MATERIALS

UNIT 6. TRADITIONAL BUILDING MATERIALS

REVIEW

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

suspension bridge	acid	fence	limestone
withstand	trucks	prone	mankind

1. Suspension bridges may be better able to _____ earthquake movements than heavier and more rigid bridges.
2. Another problem is pollution of roads from _____ leaving the quarries.
3. The house was surrounded by a tall, wooden _____.
4. If the Earth's temperature rises, it will be a disaster for all _____.
5. Sulfuric _____ is mainly used in producing detergent, batteries, etc.
6. Japan tops the list of the earthquake _____ areas.
7. The main forces in a _____ of any type are tension in the cables and compression in the pillars.
8. _____ is sedimentary rock consisting essentially of carbonates.

2. Translate the sentences.

1. Преимущества бамбука для малоэтажного строительства – низкая стоимость, высокая прочность.
2. Природный камень используется в строительстве уже на протяжении тысячелетий.
3. Древесину используют как материал для строительства домов и сооружений. Она универсальна, поэтому подходит для любого климата.
4. Основные преимущества песчаника – устойчивость к погодным изменениям, высокая прочность и экологичность.
5. Архитекторы используют бамбук в своих проектах, этот материал может считаться "зеленой сталью XXI века".

6. Гранит – природный материал, имеющий особую прочность. Это обусловлено высоким содержанием в породе кварца – от 15 до 35 процентов.

7. Передовые технологии в сочетании с уникальными природными свойствами древесины позволяют создавать из дерева долговечные деревянные конструкции.

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

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

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

SEDIMENTARY

_____

_____

_____

_____

5. Read the text and answer the questions below.

Sustainable materials.

Due to the rise in global population and prosperity over the last few decades, one of the consequences of this phenomenon has been the increase in volume and variety of the materials used (such as raw materials, food, manufactured products and waste) with a consequent increase in the transport distances. This has created a series of negative effects on the environment, especially different kinds of pollution, leading to an ecological emergency and growing preoccupation about health. This is why the aim of eco-design is to create buildings with low ecological impact, where people can live in a comfortable, healthy way.

This is possible by using building materials that are traditionally considered eco-friendly and-sustainable: timber from forests that have been certified; quickly renewable plant materials (such as straw or bamboo); some typical traditional materials such as brick, stone, clay and cork; non-toxic, renewable and recyclable materials (natural paints, waxes, etc.). Waste materials can also be reused as a resource for construction purposes.

1. What has happened to population and wealth in the last few decades?
2. What has been one of the results of this?
3. What is the aim of eco-design?
4. Can you name some eco-friendly and sustainable materials you have found in the text?

Source: Flash on English for Construction / Patrizia Caruzzo. – Ell S.r.1, 2012. – p. 17.

UNIT 7. OTHER BUILDING MATERIALS

7A. UNUSUAL BUILDING MATERIALS

1. Complete the dialogue on using paper as a building material with the sentences from the box.

a) It's inexpensive and can be very strong.
b) It was a terrible catastrophe and more than 6,000 people died.
c) The shelters were cheap, strong, easy to build, and they saved lives.
d) I suppose you could say that.
e) His architecture is perfect in a disaster zone.
f) If you're ever in New Zealand, try to visit it.
g) Here to tell us more is Sarah Hillyard, from the online magazine "Architect".
h) So, he designed a church from paper tubes?

P = Presenter, S = Sarah

P When we think of churches and cathedrals, we think of large buildings made of stone and glass, buildings which appear to be ancient and permanent. On today's programme, however, we're going to discuss the work of a Japanese architect who builds churches and cathedrals which are modern and temporary, and, believe it or not, made almost entirely of recycled paper. _____[1]. Hello, Sarah, and welcome to the programme.

S Hello. Thank you for inviting me.

P So, paper cathedrals? I find it hard to believe that such buildings are possible.

S Well, paper is an extremely useful building material. _____[2]. That's why Tokyo-based architect Shigeru Ban started developing it as a building material back in the 1980s. He found that paper tubing was perfect for building walls, ceilings and roofs.

P What do you mean by paper tubing?

S It's really thick and three or four metres long. You can make a wonderful column with a thick, long cardboard tube. And if you connect a number of tubes together, you can make the frame of a building.

P I see. But what's the point of making a paper or cardboard building that isn't going to last all that long?

S Well, Shigeru Ban has become known as the 'disaster architect', and for good reason. _____[3]. In fact, his work became famous when he came up with a solution to the desperate need for shelters in refugee camps in the early 1990s. Refugees who have lost their homes often don't have enough wood to build shelters. Ban's solution was to make shelters from paper tubing, and it was perfect. _____[4].

P So, how did Shigeru Ban go from building shelters to building cathedrals?

S Well, in 1995, an enormous earthquake destroyed hundreds of buildings in the city of Kobe in Japan. _____[5]. Ban designed many of the temporary shelters for people made homeless by the earthquake, but he was also asked to build a church to replace the Takatori Catholic Church because it had been so badly damaged.

P _____[6].

S Yes. It was called the Paper Dome, and it stood in Kobe for ten years. Then there was an earthquake in Taiwan and the people of Kobe decided to give the Paper Dome to the people of Taiwan. They took the Dome apart and rebuilt it in Taiwan, where you can see it today.

P How amazing. After that, every time there is a disaster, I guess people think of Ban and ask him to help.

S _____[7]. It led to his most famous design. In 2011, there was a major earthquake in the city of Christchurch in New Zealand and its cathedral was badly damaged. Ban was invited to build a temporary replacement, the Cardboard Cathedral. It's over twenty metres high and can hold seven hundred people.

P And it's still standing?

S Oh, yes. It's one of Christchurch's best-loved sites. _____[8].

Source: Navigate. Intermediate. Workbook. – Oxford University Press, 2015. – p. 30.

2. Answer the questions.

1. What do you think of the materials Shigeru Ban uses?
2. What are the advantages and disadvantages of using paper to construct buildings?
3. Why has Shigeru Ban become known as the 'disaster architect'?
4. What buildings were constructed using paper?

3. Read the text about these buildings and the materials used in their construction. Find out more information on these buildings.

In a village in Sweden, near the Arctic, there is a hotel made of ice called Ice Hotel. The hotel is open from December to April. It has 80 rooms. There are ice sculptures in the rooms. The beds, chairs, and tables are also made of ice. Even the drinking glasses are made of ice!

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

Some people make homes out of unusual materials. The house above is in New Mexico in the USA. Its walls are made of mud, car tires, and cans! The people who live here didn't use these materials because they had nothing else to use – they wanted their house to look different!

The woman below lives in EI Salvador in Central America. She built her house from plastic bottles because she didn't have enough money for bricks! It took nearly two months to collect all the bottles and three months to build the house.

Sources: Oxford Read and Discover. Homes around the world. – Oxford University Press, 2010. – p. 25.
Oxford Read and Discover. Super Structures. – Oxford University Press, 2010. – p. 17.

4. Read the text about eco homes and choose the correct words.

1. Using coal is *bad/good* for the environment.
2. Clean energy comes from the sun and the *windows/wind*.
3. Straw houses are *cold/warm*.

EcoHomes.

People are damaging the environment by using too much coal, oil, and gas for energy. Maybe in the future all homes will be more environmentally friendly and will use clean energy from the sun and the wind. We can save energy with homes that are insulated to stop energy escaping through roofs, doors, or windows. The house below is made of straw inside. It's warm

and environmentally friendly. These houses in Iceland have roofs covered in grass because grass is a good insulator.

Source: Oxford Read and Discover. Homes around the world. – Oxford University Press, 2010. – p. 25.

5. Fill in the gaps using the correct word.

1. Straw houses are environmentally _____.
2. Clean energy comes from the _____.
3. We can save _____ by insulating our homes.
4. Using too much coal, oil, and gas _____ our environment.

6. Write about homes in the future. What will they look like? What will they be made of?

7. Read the dialogue about making buildings from recycled materials and answer the questions.

P It takes a long time to build a house, and the end result is usually very expensive, as you know if you're trying to buy one. But a Chinese company has found a fantastic new way to make houses that are cheap and take less time to build. Amy Chang is here to tell us all about them. Amy, how are the houses made?

A Well, believe it or not, they are made by a 3D computer printer.

P A computer printer! You're joking!

A No, I'm not. It's true. But this computer printer is no ordinary printer. It's absolutely huge. The printer is 150 metres long and ten metres wide. It doesn't print the finished house, but it prints the different parts of it. Then, workers have to put the parts together to make the house.

P But what is the house made of? It obviously isn't paper!

A No, no. The house is made of concrete. But the interesting thing is that the company is using recycled waste to make the concrete. The waste comes from building and industry and the company needs a lot of it to make the houses. That's why they're going to build a hundred new factories in China to recycle the waste.

P So the houses are green as well as cheap and easy to build. Amy, what does a printed house look like?

A Well, these houses are much smaller than normal ones and they only have one floor. But you can have a window if you want, and you can divide the house into two rooms. It depends on the design, really.

P And what about the price? How much does one of these printed houses cost?

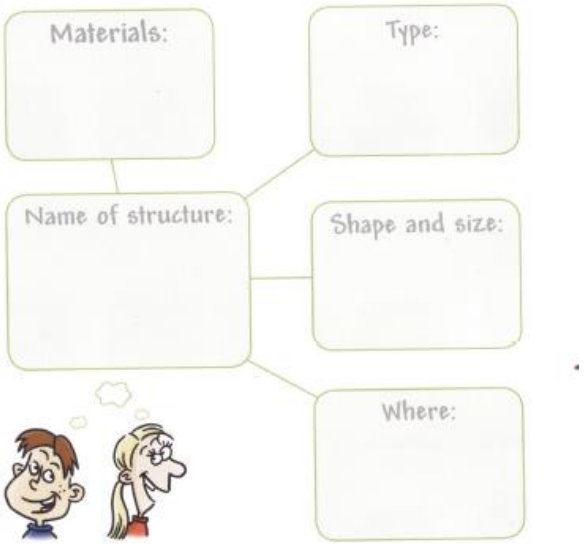
A Each one costs around 3,650 euros. But you have to go to China to buy one. Actually, the houses aren't really for people like you and me. They are really for people without a home. Perhaps they are too poor to buy a house or maybe they have lost their home in a natural disaster. The company that makes them, the WinSun Decoration Design Engineering Company, has spent years working on the houses – and the printer.

P Well, I think it's a great idea! Amy Chang, thank you for joining us.

Source: Navigate. Pre-Intermediate. Workbook. – Oxford University Press, 2015. – p. 30.

1. Do you like the idea of houses like these? Why/ Why not?
2. Would they be poplar in your country?

8. Make a poster. Use pictures and write about the super structures in your country. Complete the diagram.



Source: Oxford Read and Discover. Super Structures. – Oxford University Press, 2010. – p. 45.

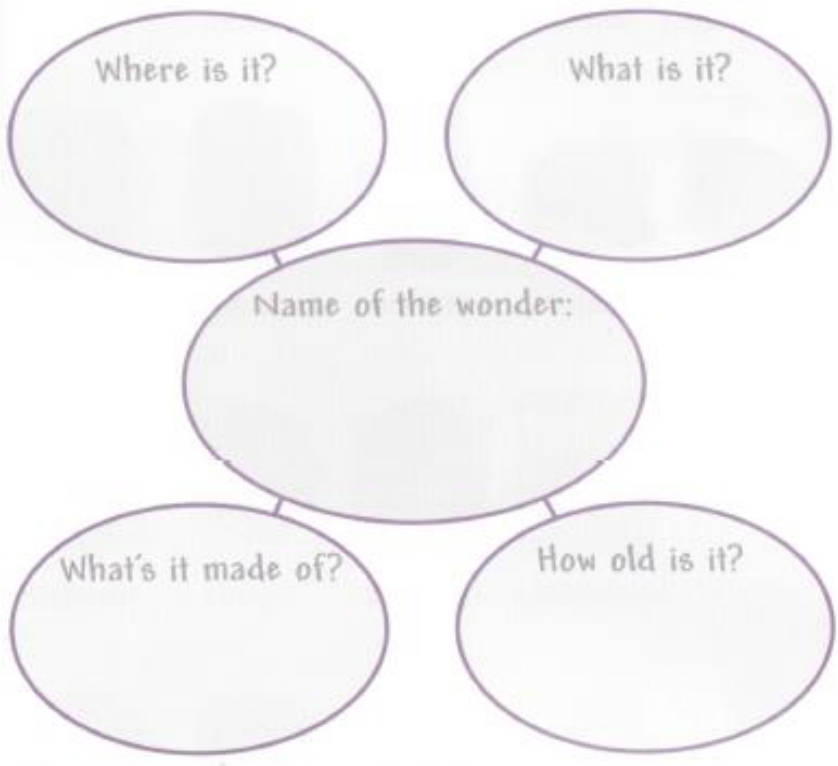
FINAL TASKS

1. Complete the chart.

concrete
wood
glass
stone
bottles
mud
plastic
bricks

Natural	Man-made

2. Think of a wonder of the past in your country. Write notes and complete the diagram. Then make a poster. Use pictures and write about the wonder. Display your poster.



Source: Oxford Read and Discover. Wonders of the Past. – Oxford University Press, 2010. – p. 45.

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

1. It is important to choose the right building materials, because they have a big impact on _____.

a) the environment;

b) the quality of the structure;

c) the price of the structure.

2. Concrete is made from _____.

a) fine aggregate;

b) cement;

c) coarse aggregate;

d) water;

e) brick.

3. Some of the most important _____ properties of a material are strength, hardness and elasticity.

a) mechanical;

b) chemical;

c) magnetic;

d) thermal.

4. Portland Cement is called so because the concrete made from it looked like Portland stone, a widely-used building stone quarried on _____.

a) the Isle of Wight;

b) the Isle of Portland;

c) the Isle of Man.

5. _____ is the size of a man's hand, and therefore simple to use.

a) concrete;

b) slab;

c) brick;

d) block.

6. The strength of _____ is aided by placing steel rods or cables in the concrete before it sets.

a) precast concrete;

b) high-density concrete;

c) reinforced concrete;

d) prestressed concrete.

7. A very long time ago people used _____ to make shelters – simple places to sleep in.

a) wood;

b) plants;

c) bricks;

d) tiles.

8. One of the disadvantages of using brick is that masonry must be built on a _____ to prevent settling and cracking.

a) firm foundation;

b) loose foundation;

c) sand.

9. A tile can be made of _____.

a) ceramic;

b) stone;

c) metal;

d) baked clay.

10. Laminated glass is made by laminating glass with a _____ – in other words, making "sandwich", with a sheet of _____ in the middle and sheets of glass at either side.

a) silica;

b) polymer;

c) stone;

d) wood.

11. _____ has a much higher tensile strength, making it more suitable for horizontal beams in construction.

a) wrought iron;

b) cast iron.

12. Alloy steels consist of _____.

a) iron;

b) carbon;

c) silica;

d) alloying metals.

13. Which of these metals are resistant to corrosion?

a) copper;

b) steel;

c) aluminium.

14. There are more than 80 metric tons of _____ in the Statue of Liberty in New York.

a) steel;

b) copper;

c) aluminium.

15. PVC (polyvinylchloride) is the example of _____.

a) thermoplastics;

b) thermosets.

16. Plastic products _____.

a) save resources;

b) can be recycled;

c) have a low maintenance cost.

17. _____– wood that has been sawn into specific shapes and sizes, but whose natural structure remains intact.

a) engineered wood;

b) solid wood.

18. Medium-density fibreboard (MDF) and orientated strand board (OSB) are the examples of _____.

a) engineered wood;

b) solid wood.

19. Bamboo is extensively used for construction of _____.

a) walls;

b) partitions;

c) foundations;

d) roof.

20. Which of these stones is not a sedimentary rock?

a) sandstone;

b) marble;

c) limestone.

21. _____ is created by the decay of ancient organisms that accumulated on seabeds.

a) marble;

b) limestone.

4. Design an unusual home. First make notes. Then display your design.

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

Source: Oxford Read and Discover. Homes around the world. – Oxford University Press, 2010. – p. 53.

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

CONSTRUCTION

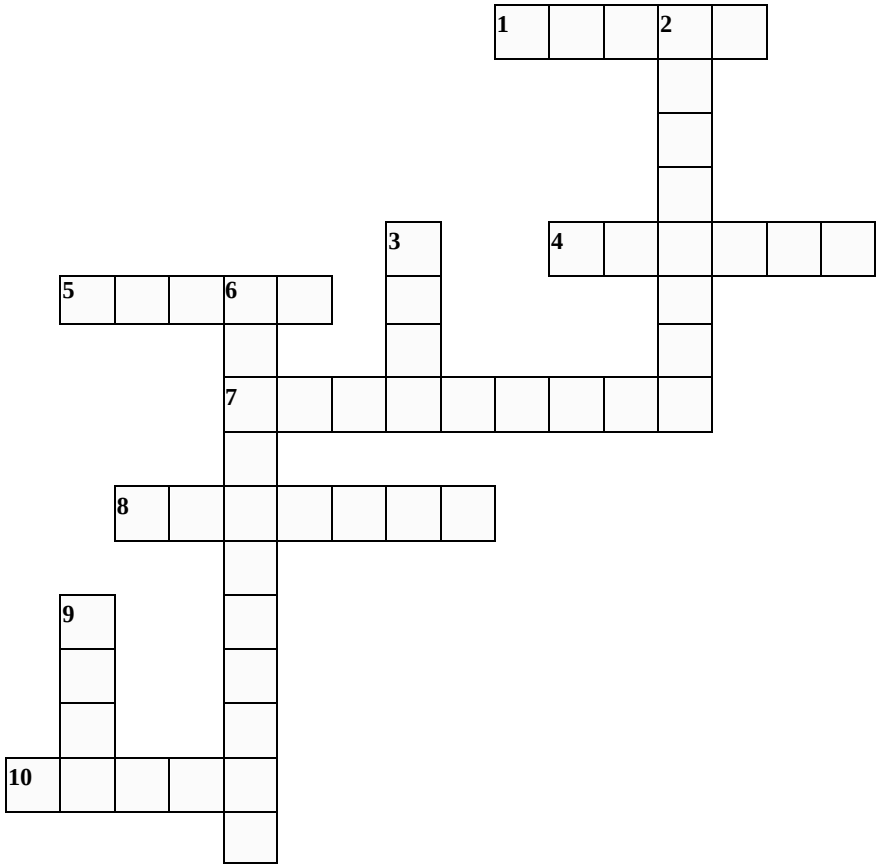
_____

_____

_____

_____

6. Complete the crossword.



Across

1. a hard block of baked clay used for building walls, houses, etc.
4. a type of hard rock that becomes smooth when it is polished, and is used for making buildings, statues, etc.
5. a hard, transparent material, used to make windows, bottles, and other objects
7. a type of rock formed from sand
8. a light strong material that is produced by a chemical process, and which can be made into different shapes when it is soft
10. a chemical element, such as iron, or a mixture of such elements, such as steel, that is generally hard and strong

Down

2. a very hard building material made by mixing together cement, sand, small stones, and water
3. a hard substance that forms the branches and trunks of trees and can be used as a building material
6. causing little or no damage to the environment
9. a thin, usually square or rectangular piece of baked clay, plastic, etc. used for covering roofs, floors, walls, etc.

SUPPLEMENTARY TEXTS FOR READING

Text 1. 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 2. The History of Bricks and Brickmaking.

During the 12th century bricks were reintroduced to northern Germany from northern Italy. This created the brick gothic period with buildings mainly built from fired red clay bricks. The examples of the Brick Gothic style buildings can be found in the Baltic countries such as Sweden, Denmark, Poland, Germany, Finland, Lithuania, Latvia, Estonia, Belarus and Russia. This period lacks in figural architectural sculptures which had previously been carved from stone. The Gothic figures were virtually impossible to create out of bricks at that time, but could be identified by the use of split courses of bricks in varying colours, red bricks, glazed bricks and white lime plaster. Eventually custom built and shaped bricks were introduced which could imitate the architectural sculptures. In the 16th century, Brick Gothic was replaced by Brick Renaissance architecture.

In medieval times, the clay for making bricks often was kneaded by workers with their bare feet. They clay was shaped into brick by pushing it into a wooden frame placed on a table, which was covered with sand or straw to prevent the clay from sticking. After excess clay was wiped off with a stick, the brick was removed from the frame.

In England the remains of buildings prove that the art of brickmaking was highly advanced by the time of Henry VIII. After the great fire of London in 1666, the city was rebuilt with mainly bricks.

Adobe brick, which is sundried brick made of clay and straw, has been made for centuries in Central America, particularly in Mexico. Some Aztec adobe structures still exist; one example is the Pyramid of the Sun, built in the 15th century.

Bricks crossed the Atlantic with Dutch and British immigrants with some brickmasons among them. In Virginia brick structures were built as early as 1611. At that time it was common for brickmasons to make the bricks on the jobsite. It is known that bricks were transported from Virginia to Bermuda in 1621 in exchange for food and oil.

Many early American skyscrapers are clad in brick or terracotta. It took 10 million bricks to build the Empire State Building.

During the Renaissance and Baroque periods, exposed brick walls became less and less popular, consequently brickwork was covered in plaster. Only during the mid-18th century brick walls started to regain their popularity.

Bricks were made by hand until about 1885. Once the Industrial Revolution broke out, the brickmaking machinery was introduced. Consequently, the number of clays that could be made into brick was greatly increased which influenced the production capacity. Handmade

brick production ranged up to 36,000 bricks per week but by 1925 a brickmaking machine made 12,000 bricks a day.

As brick structures could be built much quicker and cheaper, they replaced other raw materials like stone or rock.

During the building boom of the 19th century, when more than 10 billion bricks were produced annually, many American cities like Boston and New York favoured locally made bricks.

In Victorian London, due to the heavy fog, bright red bricks were chosen which made buildings much more visible. Although the amount of red pigment was reduced in bricks production, red remained the most desired colour for the brick and still does to this day.

It was used by some of the 20th century's most famous architects like Le Corbusier, F. L. Wright and Louis Khan. Nowadays, apart from wood, bricks seem to be commonly used building material. Consequently, brick and terracotta architecture is dominant in its field with a great development in brick industry.

Source: https://brickarchitecture.com/about-brick/why-brick/the-history-of-bricks-brickmaking

Text 3. The Type of Tile You Choose Can Make or Break Your Remodeling Project.

If you've never taken on a tiling project before, you might be surprised by the many different types of tiles available. Ceramic and porcelain tiles are the most popular, but there are also glass tiles, cement tiles, metal tiles, and stone tiles – to name just a few.

1. Ceramic Tile

Ceramic tile is one of the most common types of tile found in the home because it's suitable for many applications. Increased durability makes ceramic tile perfect for any room in the house, such as kitchens, bathrooms, or even entryways. It's easy to install, clean, and comes in hundreds of styles that can fit any design.

2. Porcelain Tile

The other most common type of tile is porcelain, which differs from ceramic tile. It is an all-purpose tile, it comes in a variety of designs, colours, and styles to allow for versatility when designing a space. Porcelain can even be used outdoors, as it will not freeze, fade, or crack. Other applications for porcelain tile include bath or kitchen tile, high-traffic areas. The biggest drawback with porcelain tile is that installation can be tricky.

3. Glass Tile

The stain resistance of glass makes it a fantastic alternative to natural stone. Specialists recommend not using glass tile in high-traffic areas like kitchen and bathroom floors. Instead, it is suggested using them in smaller applications with less traction, such as gently used table tops or desks.

4. Cement Tile

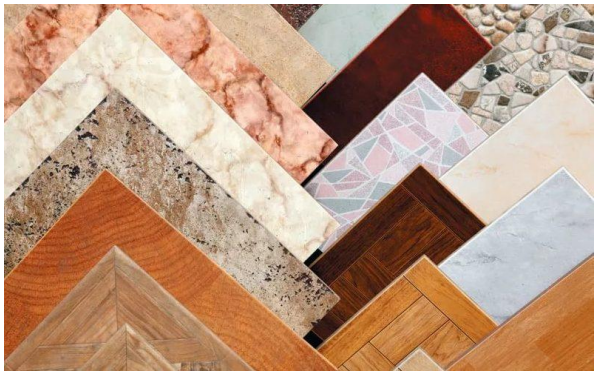
Cement tiles have been around since the 19th century. Cement tiles are extremely versatile and can provide you with amazing patterns and colours. They can also be sanded and resealed, like wood floors, if they get discoloured over time." The biggest drawback to cement tiles is that they must be resealed once a month to maintain its beauty. Cement is best used in low-traffic areas and in small quantities.

5. Marble Tile

Though costly, marble tile adds an instant touch of elegance and refinement to any room. In addition to being quite costly, marble requires a lot of upkeep to keep it looking pristine. And like any stone, marble tile is susceptible to scratches and stains in addition to being difficult to clean.

6. Mosaic Tile

Mosaic tiles give you a chance to flex your creative interior design muscles since it comes in so many different shapes, sizes, colours, styles, and even materials.



Source: https://vproizvodstvo.ru/idei/proizvodstvo_keramicheskoy_plitki/

7. Limestone Tile

Limestone is another type of natural stone tile. It delivers a natural appearance that's almost reminiscent of ancient architecture and design. Durable but soft, limestone is also easy to shape and cut for specific patterns and placements.

One thing to keep in mind about limestone tile is that it's a porous rock. In order to ensure it lasts for a long time, it must be sealed properly, otherwise it will crack and etch easily. Also, cleaning limestone can be a pain.

8. Granite Tile

Granite is a natural stone that has a similar look and feel to marble because of its natural flecks, though there are some notable differences. Granite has been overused and tends to look like a cheaper alternative.

9. Travertine Tile

Like limestone, travertine tile offers a natural, one-of-a-kind aesthetic.

Just like other natural stone tile types, it's easily impacted by water, stains, and traction. For that reason, travertine tile requires extra maintenance and a once-a-decade resealing.

10. Quarry Tile

Quarry tile is made with ground materials in a process that's very similar to brick (though technically stronger). This tile type's name implies that it comes from a quarry, but that's not actually the case. Quarry tile is made from ground minerals, like feldspar, clay, and shale, that are ground together then baked at over 2000 degrees.

They get their name from where the ground minerals come from: a quarry. Since these tiles are fired at extremely high temperatures, they are naturally dense, nonporous, and water-resistant with an extremely low water absorption rate. They can be glazed or left in the natural finish. Another benefit is that they do not have to be sealed.

11. Metal Tile

Although the cost for this type of tile is usually similar in pricing to natural stone, it will certainly withstand the test of time in both look and in function.

A primary consideration with metal tile is that it tends to scratch almost as soon as it's installed. Some people prefer this naturally occurring patina, which can soften the overall effect. If that's not your preferred finish, then metal probably isn't an ideal tile type for you.

12. Resin Tile

These tiles look great and are water-resistant.

Resin drawbacks include a propensity to chip, and this type of tile can also yellow over time, especially when exposed to the sun.

Source: https://www.realsimple.com/home-organizing/decorating/types-of-tiles

Text 4. Pros and cons of glass facade buildings.

Glass definitely looks elegant and many of the corporate tenants prefer nice shiny buildings for office spaces. This is another reason real estate developers and architects prefer glass façades as they can ask for higher rents from tenants for their sassier and shinier buildings.

Glass, instead of walls, does provide unobstructed view to the occupants of the building and since glass can be molded and bent into any shape, it is of advantage to the architects and developers in many ways. It has many disadvantages, as well. Here we look at some of the key features of glass as façades of buildings.

Advantages of glass

Since it can be made translucent or molded in different shapes, it can offer a lot of flexibility to the architect in terms of usage in the building.

Glass can transmit 75%-80% of the natural light in both the directions, something which no other substitute does. Glass can transmit light without clouding or yellowing.

The glass is usually weather resistant so it can easily withstand different weather conditions like rains, sun and wind. It does not lose its shape or shine in any weather.

Glass does not rust so it is better than iron and does not succumb to its surrounding environment conditions.

It usually has a smooth surface so in a way it is dust-proof. It requires minimal cleaning.

It is versatile in the sense that when it is combined with laminated or colour sheets, it can offer various looks and appearances.

It reduces weight on the foundation of the building and makes the building lighter as compared to walls.

Right kind of glass can reduce energy consumption for the occupants of the building and bring down electricity bills.

Glass façades require low maintenance and a swift monthly cleaning may be enough most of the time.

Most glass types are abrasion resistant which means that it will not wear out when rubbed against another material.

Disadvantages of glass

Glass façades cause a lot of glare which is a major disadvantage of glass.

Glass absorbs heat. This means that it can act as a greenhouse and hence, not suitable for countries with hot climates.

Most glasses are not earthquake-resistant and not suitable for countries that witness frequent earthquakes. To ensure earthquake-resistant homes, a very expensive kind of treatment given to glass can make it earthquake-resistant but such type of glass is not very affordable.

Use of glass in a building may result in higher costs in making the building safe and secure because glass results in a lot of transparency.

Glass is a rigid and brittle material. This means it breaks easily when a sudden pressure is applied to it.

Pros and cons of glass façade buildings

Pros	*Cons*
Adds beauty to the overall space	Causes a lot of glare
It can transmit natural light in both directions	Allows absorption of heat and act as a greenhouse
Usually weather-resistant and requires minimal cleaning	Glass façades are not earthquake-resistant
Requires low maintenance	Involves higher cost and breaks easily when sudden pressure is applied

Impact of glass façade building on environment

The extensive use of glass in buildings, may be counter-productive to global efforts towards sustainable and green buildings. Since such buildings take a lot of energy to heat and cool, most of the experts agree that glass façade buildings do not fit with most climates. Opaque walls result in lower energy consumption, as the heat is transferred to the exteriors at a very slow pace.

Source: https://housing.com/news/pros-and-cons-of-glass-facade-buildings/

Text 5. Benefits of structural steel structures.

Here we are going to focus on the benefits of structural steel structures.

1. Strong and Durable

Steel is used frequently in commercial buildings, partly due to its ability to withstand the wear and tear of weather conditions. It's stronger than most other building materials, including concrete. Another benefit is that steel has a long lifespan and often comes with a warranty. The less you have to worry about maintenance and replacing foundations, the more you can concentrate on other aspects of your business. Because of steel's strength and durability compared to wood, architects have more flexibility in designing buildings and homes, creating greater spaces

2. It doesn't grow mold

Steel is manufactured for corrosion-resistance which ensures its lifespan in water bodies and damp conditions. This property of Steel is helpful in the manufacturing of big ships and constructions in coastal areas that could otherwise be under the threat of getting mold and

therefore becoming inhospitable. It is possible to convert it into sheets or turn it into wires as per the design.

3. It can resist fire

Fires have been a big cause of accidental deaths and damage to property for a long time. These fires magnify when the vicinity has non-fire-resistant elements. Steel is resistant to high temperatures which allows great resistance to most fire accidents happening around the globe, as it is made with fire-resistance power.

4. Cost-Effective

Steel provides significant cost savings compared with other building materials. ROI for structural steel is closely associated with its strength and reliability since it will not need to be replaced for decades. Not only do you save from faster construction time, but you also save on building materials, since steel is lighter than other types of framing.

Source: http://wasatchsteel.blogspot.com/2013/04/why-is-steel-used-in-construction.html

Steel prices have remained stable and affordable for businesses of all sizes in recent years and are much lower than they were twenty years ago. Structural steel's relatively light weight helps reduce shipping costs. Part of the reason steel has become inexpensive is the manner in which it is efficiently managed across the supply chain.

5. It is safe for the environment

Steel has a low carbon effect and it's recyclable. Therefore, this makes steel a popular choice among businesses going green, because it can be used over and over without loss of quality. Producing steel has also become more environmentally safe, with a high recycle rate and an emphasis on reducing waste.

Furthermore, many modern steel plants have been designed to lower greenhouse gas emissions and to be energy-efficient. Water used to manufacture steel can also be recycled. Another dimension to steel's eco-friendly qualities is that pre-fabricated components reduce the amount of on-site machinery required to complete a project, which lowers energy costs.

Source: https://medium.com/@hariomtmtgroup/why-it-is-still-important-to-use-structural-steel-in-construction-projects-2263a6fcbbb2

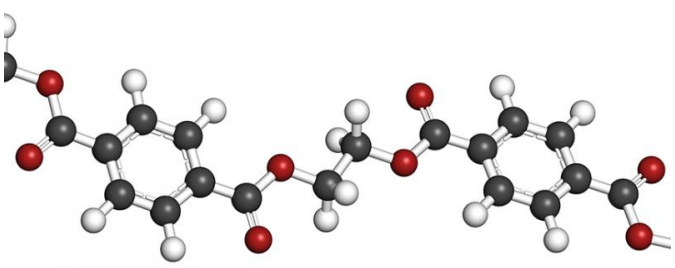
Text 6. Polymers in construction.

Polymer materials account for the highest growth area in construction materials. In basic terms, polymers are very long molecules typically made up of many thousands of repeat units. They include plastics, rubbers, thermoplastic elastomers, adhesives, foams, paints and sealants.

Well established applications of polymers in construction include areas such as flooring, windows, cladding, rainwater, pipes, membranes, seals, glazing, insulation and signage. With thousands of commercially available polymers, new applications are continuously emerging.

Confidence in the performance and properties of construction materials has always been important and may be of particular interest for polymers, which are relatively new compared to traditional material types that have been in use for hundreds or thousands of years.

The introduction of polymeric materials can bring new concerns, particularly relating to their longevity, how they will be affected by general ageing and weathering, the effects of pollution and what will happen to them at their end of life.



Source: https://www.sciencenewsforstudents.org/article/explainer-what-are-polymers

Examples of polymer materials in construction applications:

Epoxy resins

- Solid resin and Terrazzo flooring
- Anchor fixings
- Adhesives

Polycarbonate

- Lighting housings
- Fittings in hot water systems
- Glazing

Polyester (thermosetting)

- FRP Bridge sections
- Cladding Panels
- Sinks
- Surfaces and coatings

Polyethylene

- Damp-proof membranes
- Coatings

Polypropylene (PP)

- Sound insulation
- Water and waste pipes

Source: https://www.sandberg.co.uk/consultancy/polymers/polymers-in-construction/#:~:text=Polymer%20materials%20account%20for%20the,%2C%20foams%2C%20paints%20and%20sealants.

Text 7. Ten Types of Stones Used for Building Construction.

Many types of stones are available such as basalt, marble, limestone, sandstone, quartzite, travertine, slate, gneiss, laterite, and granite which can be used as construction materials. The stones used for building construction should be hard, durable, tough, and should be free from weathered soft patches of material, cracks, and other defects that are responsible for the reduction of strength and durability. Stones for construction purposes are obtained by quarrying from solid massive rocks.

Each type of stone lend itself to various construction applications based on its properties. For instance, certain types like basalt and granite have superior characteristic like high compressive strength and durability and hence employed in major construction works. However, there are stones that their characteristics (such low compressive strength and presence of deleterious materials in their constituents) makes them suitable for minor construction works for example gneiss. So, stones are used as building material and also for decorative purposes.

1. Basalt

Basalt stone, which is also known as traps, is commonly used in road construction, as aggregate in concrete production, rubble masonry works for bridge piers, river walls, and dams. The basalt stone structure is medium to fine grained and compact.

The compression strength of this stone type ranges from 200MPa to 350Mpa, and its weight is between 18KN/m3 and 29KN/m3. Basalt has good resistant to weather, impervious to moisture, very hard, and very difficult to dress in fine shapes. The colour of basalt changes from dark gray to black.

2. Granite

The application of granite in building construction involves bridge piers, retaining walls, dams, curbs, stone columns, as coarse aggregate in concrete, ballast for railways, as damp-proof course and external cladding of walls, and monumental utilizations. The structure of granite is crystalline, fine to coarse grain.

It is considerably hard and durable, and its compression strength ranges from 100MPa to 250MPa. It also has low absorption value, least porosity, good resistance to frost and weathering but it has poor resistance to fire. It takes polish well, and the colour varies from light gray to pink. The polished granite can be used as table tops, cladding for columns and walls.

3. Sandstone

Sandstones in combination with silica cement are used in the construction of heavy structures. It is also employed in masonry works, dams, bridge piers, and river walls. It is composed of quartz and feldspar and found in different colours such as white, grey, red, buff, brown, yellow, and dark gray. The compressive strength ranges between 20MPa and 170MPa, and specify gravity varies from 1.85 to 2.7. It should be known that weathering sandstone makes it unsuitable for building construction.

4. Slate

Slate shows great variation in its building properties which depend on the thickness of the sheets and the colour of the rock. It is used as roofing tiles, slabs, and pavements. It consists of quartz, mica, and clay minerals. The compression strength of slate changes from 100MPa to 200MPa, and its colour can be dark gray, greenish gray, purple gray to black. The structure of slate is fine grained and its specific gravity is 2.6 to 2.7.

5. Limestone

All Limestones are not useful for building construction. Undesirable types are rich in clay or are considerably soft and practically not suitable for construction works. However, dense, compact, and fine textured types which are free from cavities and cracks can be easily dressed and take a very fine polish.

Limestone is used for flooring, roofing, pavements and as a base material for cement. The use of limestones as facing stones should be avoided in areas where the air is polluted with industrial gases and also in coastal regions where saltish winds can attack them.

6. Laterite

Laterite is used as building stone, but its outer surface needs to be plastered. It contains a high percentage of iron oxide and can be easily cut into blocks. Laterite occurs in soft and hard

varieties and the compressive strength of laterite is between 1.9MPa and 2.3 MPa, and its strength is increased with seasoning. Laterite colour may be brownish, red, yellow, brown and grey.

7. Marble

It is used for facing and ornamental works in columns, flooring, and steps. The compressive strength of marble varies from 70MPa to 75MPa. Marble stones are quite strong, uniform in texture, least porous, and take an excellent polish. It can be easily cut and carved into different shapes. Marble is available in different colours like white and pink.

8. Gneiss

This type of stone is used for minor construction since the presence of deleterious substances in its constituents makes it undesirable for building construction. However, hard varieties of gneiss stone may be employed in construction works. The compression strength varies from 50MPa to 200MPa. It has fine to coarse grains, and its colour may be light grey, pink, purple, greenish gray and dark grey.

9. Quartzite

It is used as building blocks, slabs, and as aggregate for concrete. The structure of quartzite is fine to coarse grain and mostly granular and branded, and mainly composed of feldspar and mica in small quantities. The crushing strength is between 50MPa to 300MPa.They are available in different colours like white, gray, yellowish.

10. Travertine

It is used for paving, garden paths, and courtyards. Its specific gravity is 1.68 and compressive strength varies from 80-120 MPa. The stone is characterized by pitted holes and troughs in its surface which means that it has a porous surface and concentric texture. It can be polished to a smooth, shiny finish, and comes in a variety of colours from grey to coral-red.

Source: https://theconstructor.org/building/stones-building-constructions/36144/

Text 8. The benefits of timber as a building material.

Jeremy English, Sales Director at Södra – Sweden's largest forest-owner association – explains how timber is perfectly placed to meet the needs of the UK construction industry.

With its clean, cost effective, attractive and efficient properties, there's no doubt that timber has a huge part to play in the future of UK construction. The word about wood is spreading: Rowan Moore, The Guardian's architecture critic, recently dubbed engineered timber

“the new concrete” and “a miracle building material” thanks to its ability to extract carbon from the atmosphere rather than add to it.

Ultimate sustainability

As a uniquely renewable building resource, timber is hard to beat in the sustainability stakes. As they grow, trees absorb harmful carbon dioxide, locking CO2 into the wood forever rather than releasing it into the atmosphere. This is why trees should only be felled when they have fully matured and stopped absorbing CO2 – allowing the environment to fully benefit. And when forests are responsibly managed by owners who put more in than they take out, you can be sure that the timber you’re using has been sustainably harvested.

Embodied energy is the sum of energy required to create a product or service. In the construction industry, these factors in energy expended through building, production and transportation, typically accounting for around 30-50 per cent of a project’s entire carbon footprint. It takes very little energy to convert trees into timber for construction, while the building process typically requires a fifth of the vehicle deliveries demanded by concrete. These factors give timber the lowest embodied energy rating of any mainstream building material.

Timber is remarkably strong and durable, guaranteeing no compromise in quality even when speed of construction is taken into account. Timber structures can last hundreds of years and are less expensive and easy to maintain than other materials.

Easy to work with

Lightweight and versatile, timber is easy to handle and install. This facilitates a faster, less expensive and less disruptive construction process, making it the ideal material for brownfield site construction and urban development – as well as altogether quieter, calmer and cleaner building sites.

Off-site, timber gains points thanks to its ability to streamline the offsite manufacturing process, cutting build time by as much as 50 per cent. A timber frame can be precisely pre-cut

and easily put together with less manpower, fewer deliveries to site and minimal debris left behind. Manufacturing in a controlled factory environment also means that the weather is never a problem, it's less likely there will be any defects, and risk of injury is reduced. And with greater potential to automate more steps of the manufacturing process, dependence on traditional skilled labour is reduced. When it comes to making cost savings, timber construction is a dramatically more cost-effective form of construction than traditional building methods.

Aesthetically pleasing

The natural beauty and versatility of wood is hard to replicate. Timber naturally grows more slowly in colder climates, resulting in tighter growth-rings. This not only signifies stability and strength but also provides an additional design feature. It offers a wide range of aesthetics that give great design flexibility. It can vary in colours and texture, can be painted in any colour, waxed and varnished, carved, cut, glued and nailed or just left as it is. A timber framed building can be one of the most beautiful types of structure possible. Timber can also be clad in external materials, allowing it to complement specific local regulations and planning requirements.

Source: https://specifierreview.com/2018/03/16/timber-building-benefits/#:~:text=Timber%20is%20remarkably%20strong%20and,to%20maintain%20than%20other%20materials.

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CONSTRUCTION MATERIALS

Учебное пособие для студентов-бакалавров 1 курса направления подготовки 08.03.01 «Строительство»

Вахитова Д.К.