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HIGHRISE CONSTRUCTION

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Unit 1

The profession of civil engineers


Lead-in	**Your future profession is civil engineering. What do you know about it? What do civil engineers do?** **Do the quiz and see how much you know about this profession. Then compare your results with the keys which you can find here** **http://www.engineergirl.org/GetThere/QuizzesAndPolls/22730.aspx**

- 1. What is an engineer?

a. Engineers are math-whizzes who do one particular thing really well and they are often called on to solve really difficult math problems.

b. Engineers drive trains.

c. Engineers are professional problem-solvers that look for practical solutions that will benefit people or society. They design, create, build, improve and invent all sorts of things.

d. Engineers are people with limited social skills who would rather be with a computer than with people.

- 2. How long do engineers have to go to school?

a. You don't need more than a high school degree to be an engineer as long as you are really good with computers.

b. You need to have at least a master's degree (about 6 years of college)

c. Most engineers start out with a 4-year college degree in engineering.

d. You can start working as a professional engineer with a 2-year associate's degree.

e. All of the above.

f. None of the above.

3. Where do engineers work?

a. Engineers work from home on the computer.
b. Engineers are self-employed and work where-ever the job site is.
c. Engineers work in small engineering firms and government jobs.
d. Engineers have “regular” business offices in different companies.
e. Engineers work in manufacturing plants and large corporations.
f. Engineers work in hospitals and research labs.
g. Engineers can travel a lot and many work abroad.
h. All of the above.

- 4. Can you do anything else with an engineering degree? *

a. Yes, an engineering degree is good preparation for many different careers - especially ones that require problem-solving skills like medicine, finance, law, and business. A BS in engineering can be a stepping stone into graduate school in any of those fields.

b. Yes, an engineering degree can be a good starting point, but if you want to do anything other than engineering you will need to get a higher degree, because most employers won’t want to hire you.

c. No. Engineering degrees are very specialized so it is very important to know exactly what you want to work on before you start.

d. You can, but an engineering degree is about the same as a liberal arts degree. It doesn’t really set you apart.

- 5. What is the difference between engineering and science? *

a. Scientists “explore what is”; engineers “create what never has been.”

b. Engineers are usually concerned with the design and production of goods and services to meet the needs of society while scientists are interested primarily in understanding.

c. There is a certain amount of cross-over between engineering and science, and some engineers work on scientific research, but the training is different.

d. Engineers are trained to solve problems while scientists are trained to explore nature.

e. All of the above.

- 6. True or False: All professional engineers were math and science whizzes in high school. *

a. False. You don’t need math or science to be an engineer.

b. False. Even without being a math or science star you can learn the material and use it in an engineering career.

c. True. Math and science are all you need to be a good engineer.

d. True. You can't get into an engineering program without straight A's in all math and science classes.

What are your results? How many correct answers did you give?

If not many you must learn more about this profession to be prepared for it.

Activity 1 **1. Read the first part of the text below and underline what engineers do.**

What is civil engineering?
Part I

Civil engineering is all about helping people and shaping the world. It's the work that civil engineers do to make our lives much easier. They keep us switched on and powered up by supplying electricity and gas to our homes. They give us clean water and purify it so we can use it again. They build all sorts of things so we can get around, from roads and bridges to railways and airports. Civil engineers also do lots of other things like finding clever ways of recycling our waste, and finding solutions to problems like pollution. Civil engineers are creative people who solve problems. They come up with lots of ideas and then turn them into real things for people around the world to use. They design the transport systems to keep big cities on the move. They create easy-to-build schools so children in faraway places have somewhere to learn. They use the sun and wind's energy to make electricity for our homes. *Engineers are vital in ensuring the appearance and safety of the built environment*, and are responsible for the design and durability of its structures.

How can you comment on the phrase in italics?

2. Read the second part, match English with Russian equivalents and fill in the gaps with the words from the box.

3.

1)permanent settlements	a) оросительные канавы
2) hostile neighbor	b)подготовительные работы на строительном участке
3) reliable sources of clean water	c) постоянные поселения
4) a completed bridge	d) утилизировать отходы
5) well	e) законченный мост
6) irrigation ditches	f) колодец
7) site preparation activities	g) враждебный сосед

8) long-term durability	h) долговечность
9) dispose of waste	i)надёжные источники чистой воды

Part II

Civil engineers usually work in teams and are often involved in projects in many parts of the world. This means that languages, teamwork and communication skills will also come in useful.

Civil engineering is an exciting profession because at the end of the day you can see the results of your work, whether this is _____, a high-rise building, a subway station, or a hydroelectric dam.

Civil engineering is the design and construction of public works, such as dams, bridges and other large infrastructure projects. It is one of the oldest branches of engineering, dating back to when people first started living in _____ and began shaping their environments to suit their needs.

Early engineers built walls, roads, bridges, dams and levees; they dug _____, _____ and trenches. As larger groups of people began living together in towns and cities, these populations needed _____, the means _____, a network of streets and roadways for commerce and trade, and a way to defend themselves against _____.

Engineers may also handle _____, such as excavation, earth moving and grading for large construction projects. Additionally, civil engineers may conduct or write the specifications for destructive or nondestructive testing of the performance, reliability and _____ of materials and structures.

Activity 2 **1.To study engineering is not easy.**
The following quiz will help to find out if civil engineering career is for you.

1. Are you always accurate?
2. Are you able to recognize a problem easily?
3. Do you like using scientific principles and methods to solve problems?

4. Are you good at putting together seemingly unrelated facts to form conclusions?

5. Do you get good grades in math and science?

6. Do you enjoy knowing how things work?

7. Do you ever think of new or better ways to do things?

8. Do you like to play with computers and play video games?

9. Do you manage to take sound decisions and make people trust your judgments?

10. Can you say that you have an inquisitive cast of mind?

If you answered 'Yes' to most of the questions, you have many of the characteristics needed to work in this field, but probably not all of them. Before you go further, you will need to do some more research.

2. Read the sentences below and fill in the gaps using the words and expressions from the box and then match the explanations to the corresponding questions to the quiz.

putting things together	to form a conclusion	accurate
math and science	computers and video games	ideas and decisions
curiosity	to recognize a problem	how it works
	technologists and technicians	

1. _____ are basic tools in engineering.

2. _____ helps you to examine the relationship between one *thing* and another.

3. Engineers work _____. They must be able to work with people who have different backgrounds and special interests.

4.After the analysis of the situation you are expected _____.

5. Wanting to know how things work is something that drives all engineers. This _____ encourages engineers to break complex problems into simple ones that will be easier to handle.

6. Wanting to know _____ is essential to finding better ways to design things.

7. Engineers must be able to explain _____ to all audiences.

8. _____ provide an introduction to working with graphics as well as to problem-solving.

9. The *first step* in solving a *problem* is _____ that it does exist.

10. Follow these steps to ensure _____ and reliable measurements.

Activity 3 **1.To prepare yourself for a career in civil engineering you should know the tasks you will have to perform in your future job. This is a list of the most important tasks in the field of civil engineering. Match English and Russian equivalents.**

1)survey report	a)почва, грунт
2) blueprint	b) оборудование, оснащение
3) aerial photography	c) гидротехнические сооружения
4) traffic pattern	d) условия окружающей среды
5) environmental condition	e) схема движения
6) impact	f) чертеж
7) construction activities	g) предел прочности фундамента
8) quantity	h) асфальт
9) project feasibility	i) труд, рабочая сила
10) project site	j) влияние, воздействие
11) equipment	k) производственный персонал
12) labor (Am) = labour (Br)	l) количество
13) safety and sanitation standards	m)акт осмотра и экспертизы
14) hydraulic systems and structures	n)бетон
	o)аэрофотосъемка
	p) модификация, видоизменение

15) modifications 16) soil 17) strength of foundations 18) concrete 19) asphalt 20) industrial personnel	q) строительство r) правила техники безопасности s) осуществимость проекта t) строительная площадка

Activity 4 **1.Fill in the gaps using the words in the box.**

safety and sanitation standards, construction, hydraulic systems, program modifications, soil, aerial photography, labour, environmental conditions equipment, blueprints

Occupation Specific Tasks:

-Analyze survey reports, maps, drawings, _____, _____ and other topographical or geological data to plan projects.

-Conduct studies of traffic patterns or_____ to identify engineering problems and assess the potential impact of projects.

-Estimate quantities and cost of materials _____ and _____ to determine project feasibility.

-Inspect project sites to monitor progress and design _____.

-Plan and design transportation or _____ and structures, following construction and government standards.

-Provide technical advice regarding design, construction, or _____ to industrial and managerial personnel.

-Direct _____ activities at project site.

-Test _____ and materials to determine the strength of foundations, concrete, asphalt or steel.

2. The following verbs all relate to civil engineering tasks and activities. Cross out the word / phrase which cannot go with the verb:

to determine – project/a position/soil

to estimate – quantity/cost/size/asphalt

to identify – labour/problems/quantity/impact

to direct – a research project/construction activities/feasibility/design

to provide – technical advice/building materials/impact

to inspect – project site/work/quantity

to monitor – concrete/ progress/sanitation standards/labor costs

to plan – a hydraulic structure/topographical data/to work on …

to design – a building/a transportation system/progress/a project

to test – strength of foundation/a design/soil/equipment

to conduct studies – industrial personnel/of environmental conditions/ of traffic patterns

Activity 5 **1.Structural engineering is one of civil engineering specialties which have different tasks. What do you think they do? Read the text and learn more about them.**

Structural engineering focuses on the framework of structures. Structures must be able to **withstand the stresses** and pressures of their environment and remain safe, stable and secure throughout their use. In other words, structural engineers make sure that buildings don't fall down and bridges don't **collapse**. For example, a house in Canada must have a roof that can bear the weight of heavy snow and a stadium in California must be able to withstand earthquakes, for example. When building bridges, designers must **take into account** the conditions of **terrain**, wind, water and traffic volume. Structural engineers consider all of these factors and provide technical advice about the project. Structural engineers **battle gravity**, wind, snow and rain every day to provide the world with outstanding structures. So, they must know the properties of

various materials, such as their **density**, hardness, tensile strength, **bulk modulus** and bending strength. They need to be able to calculate how different materials will perform under stresses such as compression, **tension**, **bending** and **twisting**, as well as under various environmental conditions of temperature, pressure, corrosive gases and liquids, and even radiation. They have to predict how the materials will perform over an extended period of time. They must know how to:

1. Describe the design criteria and loading conditions for buildings;
2. Develop conceptual designs of floors using different floor systems;
3. Develop conceptual designs of lateral load resisting systems for buildings;
4. Calculate dynamic wind loads on tall buildings using the dynamic response factor approach;
5. Interpret wind tunnel test results to obtain equivalent wind loads;
6. Understand the concepts behind perception of motion, calculate the serviceability acceleration levels in tall buildings responding to wind loading;
7. Develop approximate models for analyzing structural systems in buildings;
8. Develop computer models for analyzing structural systems in buildings;
9. Develop conceptual designs of foundation systems for different buildings and soil types;
10. Identify different facade systems commonly used in building structures;
11. Identify and analyze different structural systems using case study buildings.

2.Translate the words in bald in the text into Russian.

3.Look through the sentences above describing tasks once again, find English equivalents to the following Russian words and expressions.

1	перечень критериев для разработки проекта; расчётные критерии	
2	условия (режим) нагружения	
3	концептуальный проект, концептуальное проектирование	
4	конструкция перекрытий	
5	система сопротивления поперечной нагрузки	
6	расчет аэродинамических нагрузок	
7	результаты испытаний в аэродинамической	

	трубе	
8	восприятие движения	
9	эксплуатационная пригодность	
10	методы анализа конструкций	
11	фасадная система	
12	анализ зданий и сооружений, в основе которого лежит изучение конкретных построек	

4.Find in the text the words which refer to stresses and environmental conditions. Arrange them into two columns.

Stresses	Environmental conditions

Activity 6 **1.In addition to your education and an aptitude for math and science, you need certain soft skills, or personal qualities, to succeed in this occupation**.

Skills

Active Learning: You must be able to incorporate new findings into your work.

Active Listening and Verbal Communication: These communication skills are essential for working on teams.

Reading Comprehension: You must have the ability to understand written documentation.

Critical Thinking: You will need to use logic when testing products and solving problems. Critical skills that a person needs in structural engineering include an in-depth understanding of physics and mathematics.

Structural engineers rely increasingly on computer-aided design (CAD) systems, so proficiency with computers is essential. In addition to speeding up the drafting process, CAD systems allow for quick and easy modifications of designs and three-dimensional (3D) visualization of finished parts and assemblies.

2.Complete the definitions of abilities using the verbs from the box.

to come up with	to recognize	to see (*2)
to listen	to arrange	to speak
to remember	to quickly respond	to communicate

Abilities

Oral Expression: The ability _____ information and ideas in speaking so others will understand.

Problem Sensitivity: The ability _____ when something is wrong or there is a problem but it does not involve solving it.

Near Vision: The ability _____ details at close range (within a few feet of the observer).

Oral Comprehension: The ability to _____ and understand information and ideas presented through spoken words and sentences.

Information Ordering: The ability _____ things or actions in a certain order according to a specific rule.

Speech Clarity: The ability _____ clearly so others can understand you.

Originality: The ability _____ unusual or clever ideas, or to develop creative ways to solve a problem.

Far Vision: The ability _____ details at a distance.

Memorization: The ability _____ information such as words, numbers, pictures and procedures.

Reaction Time: The ability _____ to a signal (sound, light, picture) when it appears.

In addition, an expert in this particular field is supposed to have such abilities as:

- Ability to conduct an engineering project.
- Ability to utilize a systems approach to complex problems, to design and operational performance.

- Ability to apply knowledge of science and engineering fundamentals.
- Ability to communicate effectively, with the engineering team and with the community at large.
- Proficiency in engineering design.
- Capacity for creativity and innovation.
- Capacity for lifelong learning and professional development.

3.Work in pairs. Mark the above mentioned skills and abilities according to the table.

	Not Important	Somewhat Important	Important	Very Important	Extremely Important
Skills					
Abilities					

Activity 7

1.What subjects are the most important to study if you want to become a civil engineer? Why?

2.Read what students from Leigh Academy said and compare with your answers.

What subjects should I study?

If you're thinking about a career in civil engineering, there are various paths you could follow. This page explains why certain subjects are important and which qualifications you'll need.

Students at the Leigh Academy. Find out more about the subjects you need to be a civil engineer.

Civil engineers need a wide range of expertise. So if you're interested in becoming a civil engineer, you should try to get good skills in science, technology, engineering and maths (STEM subjects).

Why are maths and science so important?

Most civil engineering projects **need to be able** to stand up to natural forces (like wind and water), and man-made forces (like vehicles, equipment and people). For example, civil engineers:

- Design roads so they don't sink into the ground when heavy lorries drive along them.
- Build flats so they don't fall over when the wind blows.
- Construct tunnels so they don't flood when it rains.

You need to be able to understand and measure forces and movement, and to calculate the strength of the structures you're designing. What you learn in maths and science – especially physics – will help you do this.

The structures that civil engineers design and build are mainly on the ground and have to be supported by the soil and rocks underneath them. The strength of the ground varies from place to place, and different rocks and soil have different properties (e.g. how quickly water drains through them). If you don’t want your structure to sink into the mud, you **have to know** about the various types of ground and design the right kind of foundations for the site. For this reason, studying geography or geology is also good idea.

As designers and innovators, civil engineers create things that didn’t exist before and do things in ways that haven’t been done before. They try to make our environment as attractive as possible by designing things that are interesting and pleasant to look at. They also make sure that these things blend in well with their surroundings. So if you're creative and enjoy art and design and technology, these would be good subjects to study too.

3.Find in the text English equivalents to the following words and word combinations.

1	Затоплять	
2	Противостоять	
3	Тонуть	
4	Просачиваться	
5	под, внизу	
6	Опрокидываться	
7	Гармонировать	
8	измерять, оценивать	

Activity 8

1.To find out how exciting and rewarding a career in civil engineering is, you'd have to ask some real civil engineers.

Read what they say about their job and responsibilities.
Which of them

1. cares about clients?
2. needs to have good interpersonal skills?
3. has changed his/her responsibilities?
4. must be good at computers?
5. doesn’t work alone?
6. considers both strength and appearance of the building?

Oliver Robinson

As a CAD technician, I create virtual drawings and models of buildings using computer software. This process is called 'computer aided design', or CAD.

Oliver Robinson

To do this I work closely with the architects and other engineers on the project. We constantly share information between us as the design of our structure develops. Because I'm a senior technician, I also manage the work of a team.

One of the most important skills I use every day is understanding the computer design software, which needs good ability in maths and IT.

Communicating with other people is also a key part of my job. This helps me to make sure my team understands the projects they are working on.

The CAD technician role I have, designing and modelling the details of structures, helps to create projects which lots of people benefit from. My work gives my company’s clients good value. It does this by being careful so a design doesn’t use more material than it needs, or doesn't cost more than it should to build.

I also help communities by designing new facilities, like schools and hospitals, which are ready to use and will last a long time.

Sarisha Harrychund

As a consulting civil engineer, my job is to design structures that meet the needs of my company's clients – and people like you and me who'll use them once they're finished.

Sarisha Harrychund

We work through a 'design process'. First I meet with the client (this could be a government body or private developer) who wants the structure built. I also meet with the architect and other engineers to agree how the finished structure will work.

Using my maths skills, and with the help of design software, I come up with a design for the structural details of the building. The design must be safe, but also look nice and be as easy as possible to build and maintain.

Finally, I produce drawings and a list of everything needed to build the project. This helps to guide the other engineers and workers who will turn my design into a real thing.

Being an engineer always involves being part of a team. Communicating with other people involved in the project – from a client who is paying for the building, to a technical team building it – is a vital skill.

My work has a great impact on local communities and the wider world. Civil engineering projects help to create economic growth and make our towns and cities more sustainable – which is always good for people living there.

Alex Heward

Alex Heward

My role as a site engineer involves managing several projects at once. I do lots of different tasks like being responsible for teams, and making sure we're spending the right amount of money.

I'm also often in the field overseeing the construction, writing reports or meeting with clients.

Many people will tell you that engineering is a very technical profession and you need to be highly academic. But I've found that there's one main skill a good engineer needs and that's the ability to communicate with people on all levels.

You can be as smart as you want, but if you can't let other people know what you want them to do your project will never get built.

This profession is all about teamwork. In my role, I sit between government, high profile clients and the technical and academic community.

Since I moved from site-based work to more of a research role, the impact of my work on the wider community has changed. I now focus on looking into how we can be innovative, build faster, cleaner and with different materials.

Civil engineers design and build infrastructure projects, such as bridges and dams.

2.Whose responsibilities appeal to you most?

3.Read the text again and mark sentences as true or false.

a) Oliver's job involves working on computers.

b) Sarisha works only with individuals.

c) In spite of being a site engineer Alex must be good at communicating with people.

d) Only Alex and Oliver must work in a team.

e) Alex is still working on a construction site.

4.Which word combinations with "skills" can you find in the text?

Activity 9 **Grammar: Modal Verbs**

Very often modal verbs are used to describe responsibilities and abilities of people.

1. Look through the text again and find modal verbs.

1	CAN	умение, возможность что-то сделать
2	BE ABLE TO	заменяет глагол CAN в будущем времени
3	MUST	Долженствование
4	HAVE TO/ NEED	необходимость что-то сделать
5	MAY/MIGHT/ COULD	возможность и вероятность совершения действия в настоящем и будущем

2. Complete the sentences with the necessary modal verbs.

1. Most civil engineering projects _____ to stand up to natural forces.
2. Site engineers _____ write reports or meet with clients.
3. You _____ be as smart as you want, but if you _____let other people know what you want them to do your project will never get built.
4. Structural engineers _____ about the various types of ground and design the right kind of foundations for the site.
5. Engineers _____ have the ability to understand written documentation.

6. If you study civil engineering you _____ learn how to use maths and science.

7. In future civil engineers _____ organize and supervise the workforce, plant and materials.

3.Now you know enough what civil engineers do.

Discuss with your partner:

1) how you would explain your choice of profession.
2) what your career plans are.

Unit 2

The essence of high-rise and large-span buildings and structures

Lead-in	**From the previous unit you have learnt a lot about the profession of civil engineers. But you are not just a civil engineer, your responsibilities will be beyond constructing a residential house, you will construct high-rise buildings and long-span constructions. Do you know what it means and what you will be involved in?**

Activity 1	**1.You are going to read the text describing this job. Before reading match the words from the box A with the words from the box B.**

A	fundamentally	peculiarities	collation	rapidly

B	fast	classification	completely	features

2.Read the text and find the answers to the questions in Lead-in section.

Construction of high-rise and large-span buildings and constructions

Design and construction of high-rise buildings and long-span structures is a special sphere of construction fundamentally different from the conventional construction of buildings. With the development of building science and technology around the world the number of constructed high-rise buildings and long-span structures is growing rapidly and their design and construction require special engineering training.

A graduate in "Construction of unique buildings and structures" manages the collection, collation and analysis of baseline data for the design, calculates unique buildings and structures using the most advanced computer programs, develops projects and prepares documentation, registration of complete design and engineering work.

First of all, it is a very highly skilled designer that can perform various kinds of activities. The main subjects in the learning process are the subjects related to architecture, theory of structures, structural design, organization and management of construction, economy of construction. In the foreground there are peculiarities of construction in the northern areas, the issue of strength, reliability and adaptability of buildings and structures as well as other actual problems of capital construction.

3.What are the differences between the work of a civil engineer and an engineer of unique buildings and structures?

Activity 2 **1.Apart from a residential house, a high-rise building has its special features.**

Read the text and complete the table with Russian equivalents (where necessary).

Career Information

Elements of high-rise building design: structural floor, framing and foundation systems, wind loading including wind tunnel testing and earthquake loading, analysis techniques including computer-aided analysis, vertical movements and second order effects, facade design, construction methods, sustainability concepts and a review of case study buildings.

Fundamental structural engineering knowledge learnt together with other structural engineering electives provide students with basic expertise related to structural engineering design skills.

structural engineering	проектирование зданий и сооружений
high-rise building design	
structural floor	несущее перекрытие
framing and foundation system	каркасная и фундаментная системы
wind loading	
wind tunnel testing	испытание в аэродинамической трубе

earthquake loading	
analysis techniques	методы анализа
computer-aided analysis	анализ с применением ЭВМ
vertical movements and second order effects	вертикальное смещение и эффекты второго порядка
facade design	
construction methods	технологии строительства
sustainability concepts	принципы и требования «устойчивого» строительства
review of case study buildings	исследования, основанные на изучении частных случаев
architectural aspects	
floor system	конструкция перекрытий
lateral load	
design criteria	перечень критериев для разработки проекта; расчётные критерии

2.Make up sentences using these phrases.

Activity 3

1.From the previous text you learned that your job will be connected with construction of high-rise and large-span construction. Can you guess what they mean? And what are they built for?

2. You are going to read the text about these two types of constructions.
Before reading match the following expressions in English with their Russian equivalents.

1) residential apartments	a) качательное движение
2) facilities	b) балка с защемлённым концом
3)exposed rock	c) нагрузка от собственного веса
4)bear	d) отклонение
5) caisson column	e)оборудование, оснащение
6) floating foundation	f) жилые квартиры
7) gravity loads	g) свободный
8) twofold	h)опираться
9) cantilever beam	i) пролёт
10) deflection	j) свая
11) swaying motion	k) плавающий фундамент

12) unobstructed	l) обнажённая порода
13) span	m) двукратный

3.Read the text and mark the statement true (T) of false (F).

1. High-rise buildings have numerous uses.
2. High-rise buildings preform different functions at the same time.
3. Foundation only for high-rise buildings is used.
4. Wind force on tall buildings doubles.
5. There is only one criterion that high-rise buildings meet.
6. Flexibility is important in stadiums and auditoriums.

High-rise buildings

The high-rise building is generally defined as one that is taller than the maximum which people are willing to walk up; it thus requires mechanical vertical transportation. This includes a rather limited range of building uses, primarily residential apartments, hotels and office buildings, though occasionally including retail and educational facilities.

A type that has appeared recently is the mixed-use building, which contains varying amounts of residential, office, hotel, or commercial space. High-rise buildings are among the largest buildings built, and their unit costs are relatively high; their commercial and office functions require a high degree of flexibility.

The foundations of high-rise buildings support very heavy loads, but the systems developed for low-rise buildings are used, though enlarged in scale. These include concrete caisson columns bearing on rock or building on exposed rock itself. Bearing piles and floating foundations are also used.

The structural systems of tall buildings must carry vertical gravity loads, such as those due to wind and earthquakes, are also a major consideration. The effect of wind forces on tall buildings is twofold. A tall building may be thought of as a cantilever beam with its fixed end at the ground; the pressure of the wind on the building causes it to bend with the maximum deflection at the top. Thus under

wind forces there are several performance criteria that a high-rise structure must meet (stability, deflection, swaying motion).

Long-span buildings

Long-span buildings create unobstructed, column-free spaces greater than 30 meters (100 feet) for a variety of functions. These include activities where visibility is important for large audiences (auditoriums and covered stadiums), where flexibility is important (exhibition halls and certain types of manufacturing facility), and where large movable objects are housed (aircraft hangars).

In the late 20th century, durable upper limits of span have been established for these types: the largest covered stadium has a span of 204 meters (670 feet), the largest exhibition hall has a span of 216 meters (710 feet), and the largest commercial fixed-wing aircraft has a wingspread of 66.7 meters and a length of 69.4 meters, requiring a 75-80 meter span hangar. In these buildings the structural system needed to achieve these spans is a major concern.

4.Can you give any examples of high-rise and long-span constructions?

Activity 4	**Pronunciation: Tick the sound, according to the pronunciation of the letters in bold. Which word doesn't belong to any column?**

	[ʌ]	[i]	[ou]	[ai]	[ə:]
V**er**tical					
Str**u**cture					
B**ui**lding					
Exp**o**sed					
P**i**le					
Comm**er**cial					
Var**i**ety					
Th**u**s					
Fac**i**lities					
Cr**i**terion					
Constr**u**ction					
Conc**e**rn					

Desire to build higher

Cultural significance and prestige

Technological achievements

Economic growth

Innovations in structural systems

Increasing demand for business and residential space

Scarcity of land in urban areas

L**oa**d					
F**u**nction					
High					
Earthquake					
Unobstr**u**cted					
Fl**oa**ting					

Activity 5 **Why do you think there is a demand for high-rise buildings? Discuss with your partner ideas below, put them in order of importance and explain the reason of your choice.**

Activity 6 **Have you ever thought why high-rise buildings are called *skyscrapers?***

1.Read the text and find when this word appeared for the first time and what it meant.

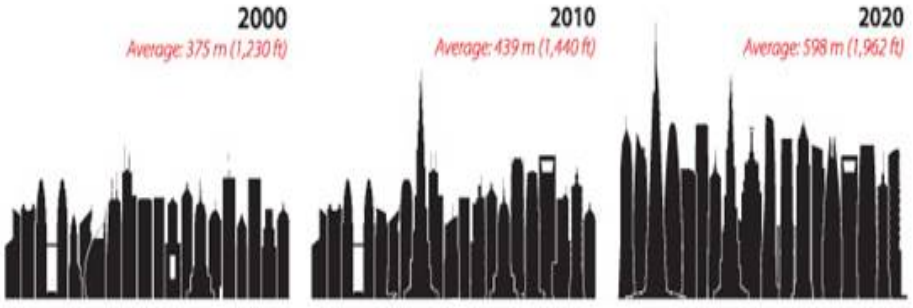
2.What is the reason for construction of high-rise buildings mentioned in this text? Can you find the same idea in Activity 4?

"Before skyscraper was used for buildings with an exciting height, the word was already in use for things sticking into the air, such as a triangular sky-sail (first recorded use in 1794), a high-standing horse (1788), a very tall man (1857), a rider on one of the very high cycles formerly in use (1892) or an tall hat or bonnet, (1800)."As a word for a very tall man, Gerard Peet points out that the Italian word grattacielo, meaning: scraping the sky and the modern day Italian word for a skyscraper, was in

use since the early 13th century and suggested that as a loan-translation from Italian, it made its way into the English language.

The first high-rise buildings were constructed in the United States in the 1880s. They arose in urban areas where increased land prices and great population densities created a demand for buildings that rose vertically rather than spread horizontally, thus occupying less precious land area. High-rise buildings were made practicable by the use of steel structural frames and glass exterior sheathing. By the mid-20th century, such buildings had become a standard.

3.Look at the pictures and comment on the changes of high-rise construction.



Activity 7 **Grammar review: Present Continuous**

We use the Present Continuous to show that something is changing, growing or developing.

1.Look through the text quickly and find examples of the Present Continuous.

The 20 tallest buildings in the decade

Next to the rapid change in standards for height, dominant locations of super tall buildings are also shifting. Asia accounts the majority of new super tall constructions. Prominently, China is the country where the development of super tall buildings is increasing the most. The city of Guangzhou accounts already for10 super tall buildings, some of which are among the world-wide tallest buildings; such as the CITIC Plaza (390 meters), the currently under construction CTF Guangzhou (Chow

Tai Fook Centre, 530 meters), the Guangzhou International Finance Center (430 meters), the Pinnacle (360 meters) and others.

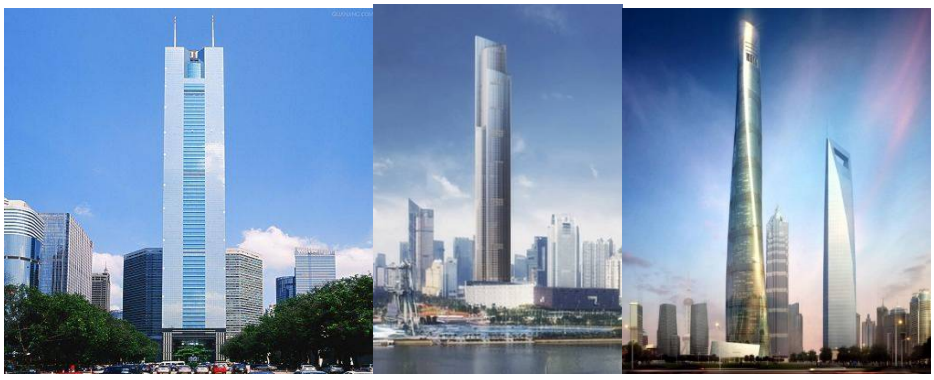
2.Translate sentences from Russian into English.

1) Профессия инженера становится всё более востребованной в наше время.
2) Вкусы людей постоянно меняются, и мы должны адаптироваться к их требованиям.
3) Мои знания английского улучшаются, и я надеюсь успешно сдать экзамены.
4) В нашей стране уменьшается количество безработных.
5) Знания и навыки инженеров с каждым годом развиваются, т.к. появляются всё более современные технологии.

Activity 8	**In the picture there are three of the tallest buildings in the world.** **Guess their names or find them in the internet. Choose one of the buildings and prepare a short presentation.**

See *Language Box* to help you to describe.

It is one of the tallest/highest …
… easy to recognize by …
… is considered to be …
There is no doubt that …
Absolutely amazing/magnificent



Activity 9	**1.Today, the public is more likely to remember the names of great civil engineering projects than the names of the engineers who designed and built them. Do you agree?**

2.Do you know who constructed:

- Brooklyn Bridge
- Hoover Dam
- Panama Canal
- Golden Gate Bridge

3. Do you know this building? And who is the architect?

4. Skim the text and answer the questions.

1) Who is the architect?
2) What is this building used for?

The Sydney Opera House is Australia's most recognizable building and is an icon of Australia's creative and technical achievements. Since its completion in 1973 it has attracted worldwide acclaim for its design and construction, enhanced by its location on Bennelong Point within a superb harbour setting.

The design of the building, with its soaring white roof shell shaped sails atop a massive red granite platform, has been internationally acclaimed as an architectural icon of the 20th century. As a dominant sculptural building that can be seen and experienced from all sides, it is the focal point of Sydney Harbour and a reflection of its character.

It is placed right at the end of Bennelong Point, juxtaposed to the harbour and completely to scale in relation to the Harbour Bridge, the sandstone cliff face, Macquarie Street and Circular Quay. Viewed from a ferry, from the air, or by approach on foot, the vision is dramatic and unforgettable. *(Sydney Opera House construction, 1964, image by Max Dupain, courtesy of State Library of New South Wales.)*

It took 16 years to build. Constructed between 1957 and 1973, is a masterpiece of modern architectural design, engineering and construction technology in Australia. It exhibits the creative genius of its designer, the Pritzker Prize winner Danish architect Jørn Utzon, the successful engineering by the Danish firm Ove Arup and Partners, and the Australian building contractors MR Hornibrook. The completion of the project was overseen by the architects Hall, Todd and Littlemore, and the story of its construction was one of great controversy.

Complex engineering problems and escalating costs made it a source of great public debate that only subsided when the beauty and achievement of the completed building placed it on the world stage.

The technical challenge of how to construct the roof sails took four years to solve. The roof sails were based on the geometry of the sphere and Utzon used this to demonstrate the creative potential and the assembly of prefabricated, repeated components. It was seen as a structure at the leading edge of endeavour.

Today the Sydney Opera House is a national cultural centre that has gained widespread recognition and respect as a performing arts venue, and includes a concert hall, opera and drama theatres, a playhouse and a studio. It is a fitting showcase for many of the world's leading performers. As Utzon envisioned, the Sydney Opera House reflects its pivotal place in Australia's creative history ‘an individual face for Australia in the world of art' (Frampton and Cava, 1995 in Statement of Values for Sydney Opera House National Heritage Listing).

5. Now scan the text and find the answers to the following questions.

1) What made Sydney Opera House popular?

2) How can this building be observed?

3) How many engineers took part in the construction?

4) Why was this project very debatable?

5) What are the special features of the roof?

6) How did Utzon see the role of Sydney Opera House in Australian history?

6. Give Russian equivalents to the following words and word combinations and use them in the sentences of your own.

Architectural icon, enhance, focal, masterpiece, controversy, endeavor, venue, pivotal, gain widespread recognition.

Activity 10 **Grammar: Passive Voice**

We often prefer to use the Passive Voice when describing landmarks and other constructions.

Sydney Opera House was built by Jorn Utzon.

This is a passive sentence. We form the Passive Voice the following way:

	INDEFINITE	CONTINUOUS	PERFECT
PRESENT	am / is / are + V3	am / is / are + being + V3	have / has + been + V3
	Usually houses are built 8 months.	This house is being built now.	This house has been already built.
	Обычно дома строят 8 месяцев.	*Этот дом строится сейчас.*	*Этот дом уже построен.*
PAST	was / were + V3	was / were + being + V3	had + been + V3
	This house was built last year.	When I came last year this house was being built.	This house had been built before I came.
	Этот дом был построен в прошлом году.	*Когда я в прошлом году приехал, этот дом строился.*	*Этот дом был построен до того, как я приехал.*
FUTURE	will + be + V3	x	will + have + been + V3
	This house will be built next year.		This house will have been already built by January.
	Этот дом будет построен в следующем году.		*Этот дом уже будет построен к Январю.*

When we want to change active construction into passive, note the following:

- the object of the active sentence becomes the subject of the passive sentence;

- the subject of the active sentence becomes the object of the passive sentence with the preposition *by* (or is dropped).

Compare: Jorn Utzon built Sydney Opera House. (active)

Sydney Poera House was built *by* Jorn Utzon. (passive)

1.Find all example of passive form in the text above.

2.Transform the sentences, using Passive Voice.

1) Today the Sydney Opera House has gained widespread recognition and respect.
2) A professional civil engineer usually adds several years of practical training and experience to the theoretical basis.
3) Structural engineers provide technical advice on the project.
4) Nowadays the new technologies inevitably influence architectural form.
5) People who live in cities often separate their entrances.
6) John Smeaton designed and built the famous Eddystone Lighthouse.
7) The architect must always keep in mind the function of the futured building.
8) Utzon used geometry to demonstrate creative potential.
9) Asia accounts for the majority of new super tall constructions.

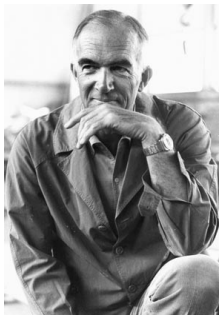
3. Use the information below to write the description of the Empire State Building.

Record height	
Tallest in the world from 1931 to 1970[I]	
Preceded by	Chrysler Building
Surpassed by	World Trade Center (Twin Towers)
General information	
Type	Office building;observation deck
Architectural style	Art Deco
Location	350 Fifth Avenue Manhattan, New York 10118[note 1]
Construction started	March 17, 1930; 86 years ago[1]
Completed	April 11, 1931; 85 years ago[2][3]
Opening	May 1, 1931; 85 years ago
Cost	$40,948,900[4] ($637 million in 2016 dollars[5])
Owner	Empire State Realty Trust
Height	
Architectural	1,250 ft (381.0 m)[6][7]
Tip	1,454 ft (443.2 m)[7]
Roof	1,250 ft (381.0 m)
Top floor	1,224 ft (373.1 m)[7]
Observatory	1,224 ft (373.1 m)[7]
Dimensions	
Other dimensions	length (east-west) 424 ft (129.2 m) width (north-south) 187 ft (57.0 m)[8]
Technical details	
Floor count	102[7][8][9][note 2]
Floor area	2,248,355 sq ft (208,879 m²)[7]
Lifts/elevators	73[7]
Design and construction	
Architect	Shreve, Lamb and Harmon
Developer	John J. Raskob
Structural engineer	Homer Gage Balcom[10]
Main contractor	Starrett Brothers and Eken

4. Now write a description of your favourite landmark.

Activity 11	**1. Now you know the name of the architect who designed and constructed one of the world's famous landmarks Sydney Opera House.** **Read his biography and say what other buildings he was involved in.**

Jørn Utzon



Jørn Utzon (born in 1918) was probably the most important of 20th-century Danish architects. He derived his earliest inspiration from foreign architects such as Alvar Aalto and Frank Lloyd Wright, whose organic conception of architecture was of great significance for Utzon's own expressive and sculptural nature-inspired architecture.

Utzon experienced his international breakthrough in 1957 when he rather surprisingly won the worldwide competition to build an opera house in Sydney in Australia, a visionary building project with a roof consisting of 60-metre-high concrete shells opening out towards the harbour like billowing sails.

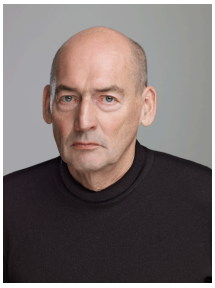
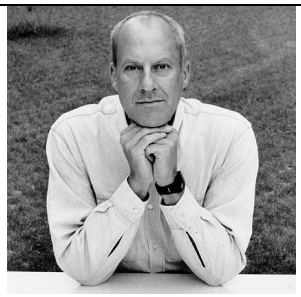
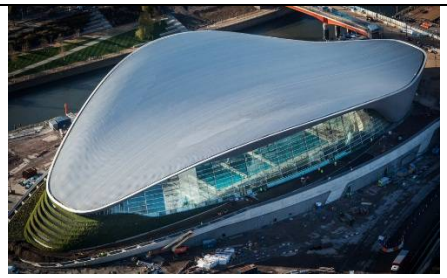
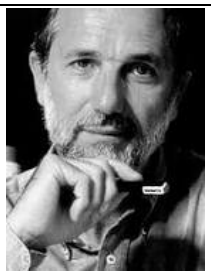
For various reasons, Utzon resigned as architect to the project in 1966, but the Opera House, which is considered to be one of the most important 20th-century works of architecture, made Utzon world-famous and resulted in his being given commissions far and wide, including the Melli Bank in Teheran (1963) and the parliament building in Kuwait (1978-85).

In Denmark Utzon has only been responsible for a small number of buildings: in addition to some of the country's earliest high density low buildings from around 1960, there was Bagsværd Church (1977) and Paustian's furniture store (1987) in the Nordhavn district of Copenhagen. In April 1998 Utzon received the Sonning Award and in May 2003 he won the Pritzker Prize.

2. Do you know other architects?

3.Match the architects with their masterpieces.

3.Choose anyone of them and find additional information.

 **Guggenheim Bilbao Museum**	 **Rem Koolhaas**
 **St. Mary Axe**	 **Zaha Hadid**
 **Pompidou Centre**	 **Frank Gehry**
 **CCTV Headquarters**	 **Norman Foster**
 **London Aquatics Centre**	 **Renzo Piano**

4.Make a presentation in Power Point, considering the following aspects.

- Biography
- Trends in architecture
- Creations

Unit 3

The ABCs of Construction



Lead in **1.Building a house is a long process. Do you know what stages it involves?**

2. Discuss your ideas with your partner.

3. What professions are necessary for construction?

Activity 1 **1.Read the text quickly and find all the words related to people involved in the construction. Can you add any others?**

2. Guess the meaning of these jobs and match them with their descriptions.

a joiner	Runs wires and make connections all through the house
a bricklayer	Puts plaster or cement over all the walls and ceilings and makes them smooth
an electrician	Builds the walls and other parts made of brick
a plasterer	Makes wooden doors, window frames

Activity 2 **1.Match the words with the definitions.**

Beam	A substance used for building that is made by mixing sand, very small stones, cement, and water
Pipe	A firm structure that holds something, such as window or door
Frame	A room under a house or other building
Concrete	To make sth smaller in size
Furnace	A long heavy piece of wood or metal used in building houses, bridges etc.
Wire	It supports a building so it is raised above ground or water level

Slanted	A rule or system that limits or controls
Cellar	Tube through which water or gas flow
Stilt	Sloping to one side
Reduce	A large container in which a very hot fire is made to produce power or heat
Restriction	A long thin piece of metal through which electricity flows

Activity 3 **1.Read the text "Building a house" and fill in the gaps with the words from the box.**

Heating, frame, concrete, foundation, decorated, restrictions, furnace, rainfall, piece of land, horizontal, flat, interior, cellar, frost line, stilts, wires, size , cool down

Building a house

Before you actually build a house there is a lot of things you must do first. You must have a _____ on which your house can be built, then you should ask an architect or builder to find out if there are any _____ or limitations on building in the area. A construction drawing of the house shows the _____, order of the rooms, where doors and windows are and other details. Then you usually need a building permit to start building your house.

A building permit is an official approval to proceed with a construction project. It is intended to ensure that the project plans comply with local standards for land use, zoning and construction. These standards are intended to ensure the safety of current and future owners and occupants and enforcement of zoning and land use policies.

The _____ supports your house. Construction workers start digging holes for the footings, which support the walls of the house. They are made by pouring _____ into forms that reach down below the _____ so that the house cannot move when it freezes in winter. The area that is below the ground is called the basement or _____. Many basements have extra rooms that are used for the house's heating or for storage. Not all houses have basements, those in wet regions are often put on _____.

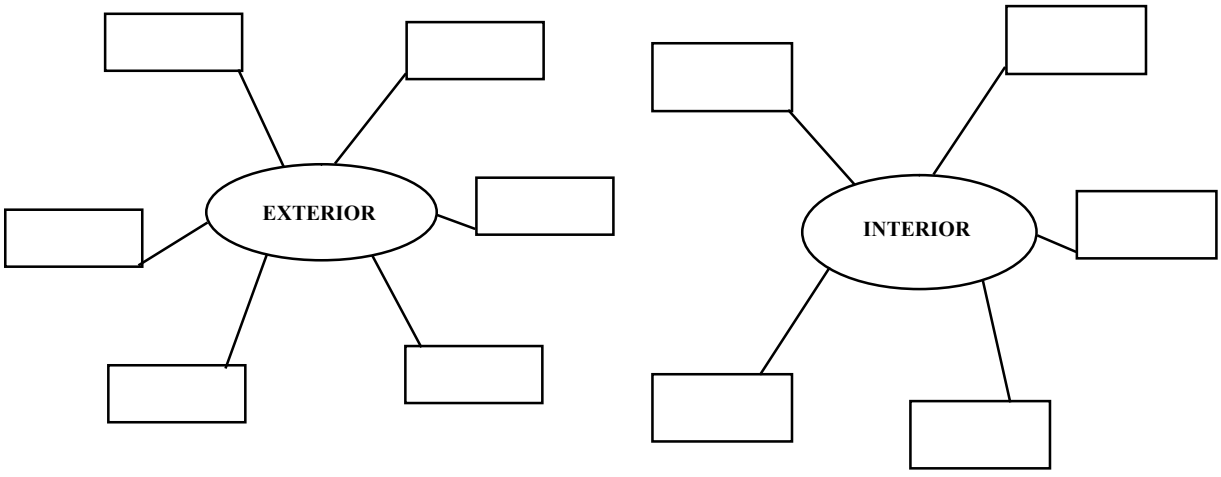
The _____ is the skeleton around which the rest of the house is built. Workers put _____ into the foundation that support the outside walls. Slabs are the _____ parts of the frame that separate the floors. When the frame is finished the walls are raised.

The roof protects the house from rain and sun. Some roofs are _____ others are slanted to lead rain and snow down. They are built of different materials, depending on the climate and amount of _____.

When the outside of the house is finished you must start working on the _____. Windows, doors have to be built into the frame. _____ must be laid for electricity and power. Plumbers install the pipes through which water flows through. A new house has to be insulated in order to reduce _____ costs and to save money. Most houses have central heating system. A _____ or boiler, mostly in the basement, warms up the water which then leads through pipes through the whole house. Cold water returns through the pipes and into the furnace where it is heated up again. More and more houses install air conditioning to _____ in the summer months. Finally, the walls are painted and the rooms _____.

Activity 4

1.Find the words in the text which belong either to exterior or to interior works.



Activity 5 **Shapes**



1. What shapes do you know? Why are shapes important in engineering? What does the choice of shapes depend on?

2. Read the text and compare your answers with it.

Some shapes are stronger than others or are appropriate in particular situations because they can bear a particular load more easily. Arches are stronger than square shapes when compressed and better suited in engineering applications such as tunnels, whereas other shapes may be better to resist loads that cause an engineering structure (such as a bridge) to twist.

Engineers use a wide range of shapes to construct buildings. Square and rectangle shapes are very common in modern buildings, perhaps because of the availability of reinforced materials. In older structures columns and arches were much more common than perhaps they are nowadays, although many modern bridges use arches or elliptical shapes in their construction.

Shapes are important nowadays as they add support, structure and style to modern architecture.

3. Underline all the words which mean shapes.

4. Think of as many derivatives of the given words as you can and complete the table.

NOUN	VERB	ADJECTIVE/ PARTICIPLE II
		compressed
Application		
	resist	
Availability		

		supported

Activity 6

Materials

1.Read the text and answer the questions.

1) What does the choice of material depend on?
2) What did people in the past use to build homes with?
3) What are the main kinds of building materials?
4) What material is the most durable?
5) What natural disaster makes people build sound constructions?

Engineers decide what kind of materials to use. Their client may wish to have a particular material used – for example many businesses like to have headquarters that feature lots of glass. Cost always plays a major part. The materials chosen must fit within the client's budget. Special local factors will also influence an engineer's choice of materials. In areas where earthquakes are common it will be appropriate to use reinforced materials e.g. steel reinforced concrete.

Houses are built of different materials **depending** on the climate of the area you live in.

Long ago, people built homes with whatever building materials they had. In Africa and some islands of the South Pacific they used grass or leaves that grew nearby. In the south-western part of the United States the Pueblo Indians used sun-dried bricks to build their houses.

Even though today you can transport materials all over the world, it is still easier and cheaper to use the materials that are at hand. There are four basic kinds of materials that are used today.

In the northern part of North America and in northern Europe wood has been the main building material for many centuries. Early settlers in America built log cabins and in Scandinavia people designed wooden houses with large beams and balconies.

Brick is among the oldest and most popular building materials. It lasts long and is easy to get. Brick is often used to build row houses. Early Dutch settlers brought bricks across the Atlantic to build their first houses.

Stone is the longest lasting of all building materials. Weather cannot destroy it very much and insects and animals cannot bore into it as they can into wood. Stone has been used for many centuries because it cannot be destroyed by fire. It has been used for all sorts of houses, from palaces to farmers' cottages.

In modern buildings we use concrete instead of stone and brick. It is cheaper and can be produced almost everywhere. Concrete is a mixture of sand, broken stones, water and other materials. Cement is added to hold it together. Steel rods are often put into the concrete to hold it together when buildings get higher.

2.Different materials have different properties. Match them with suitable material.

Properties	wood 	brick 	stone 	concrete 
Brittle				
Sound				
Rough				
Hard				
Light				

Heavy				
Waterproof				
Durable				
Fire resistant				
Insulator				
Bendy				
Tensile				
Stretching				
Strong				

Activity 7 **Grammar: Comparatives and superlatives**

	Adjective	**Comparative**	**Superlative**
one-syllable	Hard	harder than	the hardest
two or more syllables	Tensile	more tensile than	the most tensile
irregular forms	Little	less than	the least

1.Find examples of comparatives and superlatives in the texts *Shapes* and *Materials*.

2.Open the brackets and use the proper form of the adjectives.

1) A building may be made (fire resistant) by using suitable materials.
2) Wood is (light) stone.
3) Stone belongs to one of (old) building materials used by a man.
4) Plastic is (bendy) steel.

3.What materials are there in your house?

Activity 8	**1.Why do you think circular and square shapes were popular in the past?**

2.Read the text and compare your answers with the information from the text. Fill in the gaps using prepositions from the box.

to (2), for, beyond, up, in (3), from, at, in

From ancient times there were two fundamental shapes of dwellings – circular and square.

The preference for the cave can be accounted ___ by the fact that a circular allows maximum usable space to be created with the minimum of building materials. The rectangle corresponds ___ the space taken up by an ancient man lying stretched on the ground.

Wood as a building material required straight walls, perpendicular ___ the ground. ___ other words they could not be curved ___ the form of a dome. Wood is the most suitable material for a type of a roof that rests on top of the walls of a house as an independent unit. This kind of the roof can be flat or gently sloping on two or four sides. It can project beyond the walls to protect them ___ rain and snow, or to be extended ___ the front to form a sheltered veranda.

As tools improved in quality the possibilities of the builder expanded, both technically and stylistically. The man acquired a sense of design. Of course, this "design" was never put down on paper, nor elaborated in every detail. Nevertheless, at this point we can at last begin to talk about "style" – the expression of a certain intellectual and spiritual state of a creator. If you asked an artist HOW he works, his answer would be very curious. Squares and rectangles, polygons, circles, stone, wood, clay, brick, cement, metal and glass; stucco and paint – all make ___ the ingredients of any given style.

Yet, without inspiration, when there is nothing "in the air", when the creative spark is missing, nothing can be done with those ingredients.

3.Read the last sentence, what does "creative spark" mean?

Activity 9 **Arch, square, rectangle, column, ellipse are all shapes used in architecture. What constructions have these shapes? Choose one building and explain why it has such a shape, using phrases with prepositions from the text.**

Activity 10 **1.Discuss the questions.**

1)What area do you live in?

2)What is your house like?

3)What houses are there in your neighborhood?

2. Read the text and learn more about dwellings.

Home styles around the world are different because of culture and tradition. They are slowly replacing traditional houses in the Middle East and Asia. In big cities where there is not enough space people often live in apartments. They appear in all kinds of sizes and forms – from one-room apartments to apartments with balconies or terraces or even penthouses. Town and row houses are often found in cities. They have separate street entrances but often share the same walls.

Many suburban residents live in single-family houses with their own yards and gardens. Sometimes they are built in groups that are owned and sold by a company. In rural areas farmhouses usually stand alone, surrounded by fields, barns and huts.

In some parts of the world people don't always live in the same place. They move their homes constantly. The Plains Indians in America took their tepees with them when they were following buffalo herds. In Central Asia nomads live in tents which they carry with them. In other countries people live in houseboats on rivers. Mobile homes are becoming more and more popular, especially in America. They can be loaded onto a truck and towed from one place to another.

3.Find the definitions to the underlined words in the text and fill in the table.

1	A member of a tribe that travels from place to place, especially to find grass for their animals	
2	A large farm building for storing crops or for keeping animals	
3	A very expensive and comfortable apartment	
4	Connected with a countryside	
5	To pull a vehicle with a help of a rope	
6	A simple building with one or two rooms	

4.Speak about your dream house, mentioning shape, material and place.

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HIGHRISE CONSTRUCTION

Учебно-методическое пособие

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