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Кафедра иностранных языков

АНГЛИЙСКИЙ ЯЗЫК

Методическая разработка
для студентов-бакалавров
естественно-технического факультета
направления
«ЭЛЕКТРОНИКА И НАНОЭЛЕКТРОНИКА»

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Составлена для студентов-бакалавров 1–2 курсов естественно-технического факультета направления «Электроника и наноэлектроника», для ознакомления студентов с терминологий по специальности. В разработке использованы оригинальные тексты из современных источников. К текстам прилагаются практические упражнения на закрепление лексики и грамматики, а также формирования навыков критического мышления.

Данная разработка может быть использована как для аудиторной работы, так и для контроля самостоятельной работы студентов.

Unit 1

Text One

1. Pre-reading task. Answer the question before reading.
What is the main role of science and technology in present-day life?

2. Read and translate the text.

SCIENTIFIC AND TECHNOLOGICAL PROGRESS

It is difficult to overestimate the role of science and technology in our life Science accelerates the development of civilization and help us in our cooperation with nature. Scientists investigate the laws of the universe, discover the secrets of nature, and apply their knowledge in practice improving the life of people. Let's compare our life nowadays with the life of people at the beginning of the 20th century. It has been changed beyond recognition.

Our ancestors hadn't the slightest idea of the trivial things created by the scientific progress that we use in our every day life. It means refrigerators, TV sets, computers, microwave ovens, radio telephones, etc. They would seem miracles to them that made our life easier, more comfortable and pleasant. On the other hand, the great inventions of the beginning of the 20th century, it means radio, airplanes, combustion and Jet engines have become usual thing and we can't imagine our life without them. A century is a long period. Millions of investigations, the endless number of outstanding discoveries have been made. Our century has had several names that were connected with a certain era in science and technology.

At first if was called the atomic age due to the discovery of the splitting of the atom. Then it became the age of the conquest of space when for the first time in the history of mankind a man overcame the gravity and entered the Universe. And now we live in the information era when the computer network embraces the globe and connects not only the countries and space stations but a lot of people all over the world. All these things prove the power and the greatest progressive role of science in our life.

But every medal has its reverse. And the rapid scientific progress has aroused a number of problems that are a matter of our great concern. These are ecological problems, the safety of nuclear power stations, the nuclear war threat, and the responsibility of a scientist. But still we are grateful to the outstanding men of the past and the present who have courage and patience to disclose the secrets of the Universe.

Notes.

1. to overestimate – переоценивать, оценивать слишком высоко
2. to investigate – расследовать, собирать сведения
3. ancestor – предок, предводитель
4. invention – изобретение
5. combustion – горение, возгорание
6. outstanding – выдающейся, знаменитый
7. splitting – расщепление, раскалывание
8. mankind – человечество
9. nuclear – ядерный
10. threat – опасность, угроза

3. Answer the questions.

1. What makes us be closer to nature?
2. Name the category of people who deal with investigations in different fields of knowledge?
3. Has our life changed since the beginning of a new century?
4. Our ancestors hadn't the slightest idea of the trivial things we have today, had they?
5. Can we imagine our life today without household appliances?
6. What was the first name of our era?
7. Today we live in the information era, don't we?
8. Enumerate the things which prove the power of science?
9. Are there any negative sides of the rapid scientific progress?
10. Why do people still grateful to the outstanding people of the past and the present?

4. Find synonyms to the following words from the text.

1. to accelerate
2. an idea
3. comfortable
4. usual
5. nowadays

5. Find antonyms to the following words from the text.

1. to improve
2. slight
3. beginning
4. to overcome
5. outstanding

6. Put the proper words into the gaps:

to overestimate, to investigate, to discover, to improve, to change, to connect.

1. It is difficult _____ the role of science and technology in our life.
2. Scientists _____ the laws of universe, _____ the secrets of nature and apply their knowledge in practice _____ the life of people.
3. It has _____ beyond recognition.
4. Our century has had several names that were _____ with a certain era in science and technology.

7. Put the verbs into the correct tense forms.

1. And the we …... (to live) in the information era when the computer network …… (to connect) a lot of people over the world.
2. A century …….. (to be) a long period for scientific and technological progress.
3. It …… (to be, to change) beyond recognition.
4. The rapid scientific progress ……. (to be, to arise) a number of problems.
5. The great inventions of the beginning of the 20th century …….. (to be, to become) usual things to us.

8. Match the words with their definitions.

1. scientist	a. time span of 100 years
2. miracle	b. a thing which is hard to believe
3. outstanding	c. the highest class of creatures inhabiting the Earth
4. mankind	d. a person recognized for various achievements
5. century	e. a person engaged in research in various fields of science

9. Translate into English.

1. Давайте сравним нашу жизнь сегодня с жизнью людей в начале 20 века.
2. Но с другой стороны, великие изобретения начала 20 века, такие как радио, аэропланы, продукты горения, реактивные двигатели стали привычными вещами и мы не можем представить свою жизнь без них.
3. Все эти вещи доказали силу и величайшую прогрессивную роль науки в нашей жизни.

4. Но у медали 2 стороны.
5. Были проведены миллионы исследований и бесконечное количество выдающихся открытий.

10. Make a short summary of the text (8–10 sentences).

Text Two

1. Read and translate the text with the dictionary.

RESEARCHERS HALL ADVANCE IN NANOTECHNOLOGY BY CLIVE COOKSON IN WASHINGTON

Nanomachines devices that work on a molecular scale. Millions of times finer than a human hair-will be a practical proposition within a few years. The American Association for the Advancement of Science annual meeting heard yesterday.

Researchers from academic and industrial laboratories reported rapid progress in developing the components of nanomachines such as molecular motors and self-assembling materials.

Potential applications include ultra powerful computers. Information storage at densities 50.000 times greater than today's magnetic media, and smart membranes that would open and close their pores according to the identity of the molecules approaching them.

The US government's new Nanotechnology Initiative, with a proposed budget of $500m next year, would further accelerate the development of the field, speakers said.

The clear corporate leader of nanotechnology research is IBM. Thomas Theis, physical sciences director for IBM Research, said more than 100 scientists were working on nanotechnology at the company's research centre's in the US and Switzerland.

Jim Gimzewski a researcher at IBT's Zurich laboratory has taken the first step toward making a nanoscale motor. His team has produced a rotating molecule that could control the movement of fluids on solid surfaces. For instance, he said, millions of such rotors could be incorporated in a device that selectively pumped pollutants out of a liquid.

But IBM is developing nanotechnology above all as a way to revolutionize its mainstream computer business. So far the industry has increased performance by packing, more and more electronic components' on to a smaller and smaller area, but this approach is expected to reach the

fundamental physical limits of miniaturization within the next 20 years. “Nanotechnology is taking the opposite approach, starting from the atomic scale and building from the group up”, said Mr. Theis.

The ultimate physical limit for storing information by this approach, he said, would be to store bite of data on individual atoms. You could them “store a person’s entire life-history in a device the size of a wristwatch”.

Researchers told the meeting that mass-production of nanoscale devices would depend on “self-assembly – getting atoms and molecules to arrange themselves – rather than manipulating them individually into place”.

A pioneer of self-assembly research is Jeff Brinker of Sandia National Laboratory in New Mexico. He recently produced an ultra-thin coating with a huge surface area and a totally regular nanostructure: its pores are designed to admit molecules of a particular size. Its can be used as a chemical sensor to detect molecules 500 times more sensitively than conventional materials.

Now, such nanomaterials are passive structures, but Mr. Brinker plans to develop ones with active pores that open and close as conditions change.

Notes.

1. proposition – предложение, проект, план
2. self-assembling – собирающийся
3. density – плотность, концентрация
4. rotating – вращающийся, поворотный
5. fluid – подвижный, изменчивый
6. rotor – ротор, несущий винт, вихрь

Text Three

1. Read and translate the text with the dictionary.

THE VITAL IMPORTANCE OF SCIENCE EDUCATION IN TODAY'S WORLD

The importance of science and technology in today’s world is overhelming and therefore the education system throughout the world has to gear itself to provide the required training in scientific skills to meet this groving challenge.

Undoubtedly the application of science and technology have transformed the world through dramatic advances in almost all fields including medicine, engineering, aeronautics, etc, and in more recent times dramatic leaps in computer technology have revolutionized in particular the information and communication sectors.

The evidence of the correlation between science and technology and economic development is overhelming. In fact, many countries have transformed themselves from poor feudal type economies through the increasing application of science and technology.

What has been troubling is that the number of students at the secondary and tertiary levels pursuing science has been decreasing. At the University of Guyana, the Natural Sciences Faculty is tottering as few students graduate every year with degrees in physics and chemistry in particular.

One of the more recent trends has shown that many students switched from science to business studies pointing out that there is not much scope here for persons with qualifications in the science field.

The National Science Teachers of America supports the notion that inquiry science must be a basic in the daily curriculum of every elementary school student at every grade level. It added that in the last decade, numerous reports have been published calling for reform in education. Each report has highlighted the importance of early experiences in science to that students develop problem-solving skills that empower them to participate in an increasingly scientific and technological world.

Notes.

1. to overhelm – превосходить
2. gear – механизм, устройство
3. aeronautics – аэронавтика
4. tertiary – третий, относящийся к третьему классу
5. to totter – ковылять, идти дрожащей походкой, угрожать падением

Unit 2

Text One

1. Pre-reading task. Answer the question.

Can we imagine our present day medicine without special technical devices or robots? Why?

2. Read and translate the text.

NANOROBOTS

Nanorobots are theoretical Microscopic devices measured on the scale of nanometers (1nm equals one millionth of 1 millimeter). When Tully realized from the hypothetical stage, they would work of the atomic, molecular and cellular level to perform tasks in both the medical and Industrial fields that have heretofore been the stuff of science fiction.

A few generations from now someone diagnosed with cancer might be offered a new alternative to chemotherapy, the traditional treatment of radiation that kills not Just cancer cells but healthy human cells as well, causing hair loss, fatigue, nausea, depression, and a host of other symptoms.

A doctor practicing nanomedicine would offer the patient an infection of a special type of nanorobots that would seek out cancer cells and destroy them, dispelling the disease at the source, leaving healthy cells untouched. Nanomedicine’s nanorobots are so tiny that they can easily traverse the human body. Scientists report the exterior of a nanorobot will likely be constructed of carbon atoms in a diamondold structure because of its inert properties and strength. Super-smooth surfaces well lessen the likelihood of triggering the body’s immune system; allowing the nanorobots to go about their business unimpeded. Glucose or natural body sugars and oxygen might be a source for propulsion, and the nanorobot will have other biochemical or molecular parts depending on its task.

The first generation of nanorobots will likely fulfill very simple tasks, becoming more sophisticated as the science progresses. They will be controlled not only through limited design functionality but also through programming and the acoustic signaling, which can be used, notably, to turn nanorobots off.

Notes.

1. heretofore – прежде, до этого
2. cancer cells – раковые клетки

3. chemotherapy – химиотерапия
4. fatigue – усталость, утомление
5. nausea – тошнота
6. to dispel – разгонять
7. to traverse – пересекать, проходить
8. carbon atoms – атомы углерода
9. diamondoid – алмазный
10. triggering – запуск
11. propulsion – продвижение вперед
12. unimpeded – беспрепятственный

3. Answer the questions.

1. What are nanorobots?
2. In what area are nanorobots most often used?
3. What methods of cancer treatment offered to patients in the recent past?
4. Nanorobots play a very important role in today's medicine, don't they?
5. What do you know about the latest treatment?
6. The traditional treatment of radiation kills both cancer and healthy human cells, doesn't it?
7. Are nanorobots tiny or enormous?
8. Will nanorobots be likely constructed of carbon or oxygen atoms?
9. The biochemical and molecular parts of nanorobots will depend on their task, won't they?
10. With the help of what will the nanorobots be controlled?

4. Find synonyms to the following words from the text.

1. device
2. to perform
3. field
4. surface
5. to seek

5. Find antonyms to the following words from the text.

1. microscopic
2. to offer
3. unimpeded
4. to turn smth. off
5. smooth

6. Make active sentences passive and vice versa.

1. A few generations from now someone diagnosed with cancer might be offered a new alternative to chemotherapy.
2. A doctor practicing nanomedicine would offer the patient an in section of a special type of nanorobots.
3. Nanorobots are so tiny they can easily traverse the human body.
4. The first generation of nanorobots will likely fulfill very simple tasks.
5. The traditional treatment of radiation kills not only cancer cells but healthy human cells as well.

7. Find in the text appropriate English phrases for the following.

1. являться причиной выпадения волос
2. как в медицинской, так и в промышленной сфере
3. источник движения
4. оставить здоровые клетки нетронутыми
5. пресечь болезнь на корню

8. Put the proper words into the gaps:

to fulfill, the exterior, surfaces, natural, to measure, generation.

1. Super-smooth _____ will lessen the likelihood of triggering the body's immune system.
2. Nanorobots are theoretical microscopic devises _____ on the scale of nanometers.
3. The first _____ of nanorobots will likely _____ very simple tasks.
4. Glucose or _____ body sugars and oxygen might be a source for propulsion.
5. Scientists report _____ of a nanorobot will likely be constructed of carbon atoms.

9. Traslate into English.

1. Они будут работать на атомном, молекулярном и клеточном уровнях, с целью выполнения задач, как в медицинской, так и промышленной сферах.
2. Врач, практикующий наномедицину предложит пациенту инъекцию из нанороботов специального типа.
3. Нанороботы будут отыскивать раковые клетки и разрушать их, с целью пресечения болезни на корню.
4. Их можно будет контролировать не только за счёт ограниченной функциональности дизайна, но и посредством программирования и звуковыми сигналами.
5. Нанороботы настолько малы, что с легкостью могут передвигаться по человеческому телу.

10. Make a plan of the text. Retell the text.

Text Two

1. Read and translate the text with the dictionary.

NANOROBOTICS

Nanorobotics is the emerging technology field of creating machines or robots whose components are at or close to the microscopic scale of a nanometer. More specifically, nanorobotics refers to the nanotechnology engineering discipline of designing and building nanorobots, with devices ranging in size from 0,1–10 micrometers and constructed of nanoscale or molecular components.

The names nanobots, nanoids, nanomachines or nanomites have also been used to describe these devices currently under research and development. Nanomachines are largely in the research-and-development phase, but some primitive molecular machines have been tested. The first useful applications of nanomachines might be in medical technology, which could be used to identify and destroy cancer cells. Another potential application is the detection of toxic chemicals and the measurement of their concentrations in the environment. Recently, Rice University has demonstrated a single-molecule car developed by a chemical process and including Bucky balls for wheels. It is actuated by controlling the environmental temperature and by positioning a scanning-tunneling microscope trip.

Another definition is a robot that allows precision interactions with nanoscale objects, or can manipulate with nanoscale resolution. Such devices are more related to Microscopy.

Following the microscopy definition even a large apparatus such as an atomic force microscope can be considered a nanorobotic instrument when configured to performmanipulation.

Since nanorobots would be microscopic in size, if would be necessary for very large numbers of them to work together to perform microscopic and macroscopic tasks.

Notes.

1. emerging – развивающийся
2. currently – в настоящее время
3. measurement – измерение
4. precision – точность

Text Three

1. Read and translate the text with the dictionary.

CHEMISTS CREATE TWO-ARMED NANOROBOTIC DEVICE

Chemists at New York University and China's Nanjing University have developed a two-armed nanorobotic device that can manipulate molecules within a device built-from DNA. The device is described in the latest issue of the Journal Nature Nanotechnology. "The aim of nanotechnology is to put specific atomic and molecular species where we want them and when we want them there", said NYU. Chemistry Professor Nadrian Seeman, one of the so-authors. "This is a programmable unit that allows researchers to capture and maneuver patterns on a scale that is unprecedented".

The device is approximately 150×50×8 nanometers. A nanometer is one billionth of a meter. In another way, it a nanometer were the size of a normal apple, measuring approximately 10 centimeters in diameter, a normal apple, enlarged proportionally, would be roughly the size of the earth. The creation enhances Seeman's earlier work-a single nanorobotic arm, completed in 2006, marking the first time scientists had been able to employ a functional nanotechnology device within a DNA array. As with Seeman's previous creation, the two-armed nanorobotic device enables the creation of new DNA Structures, thereby potentially serving as a factory for assembling the building blocks of new materials. With this capability, if has the potential to develope new synthetic fibres and improve DNA-scaffolded computer assembly. The researches note that the device performs with 100 percent accuracy. Earlier trials revealed that it captured targeted molecules only to 80 percent of the time. But by heating the device in the presence of the correct species, they found that the arms captured the targeted molecules 100 percent of the time.

Notes.

1. DNA (deoxyribonucleic acid) – дезоксирибонуклеиновая кислота, ДНК
2. device – устройство
3. maneuver – маневр, маневрировать
4. approximately – приблизительно
5. unprecedented – беспрецедентный, беспримерный
6. fibre – волокно, ткань
7. scaffold – поддерживать, нести (на себе)

Unit 3

Text One

1. Pre-reading task. Answer the question.
Have you ever heard about science field like nanoscience?

2. Read and translate the text.

WHAT IS NANOTECHNOLOGY?

Nanotechnology is science, engineering, and technology conducted at the nanoscale, which is about 1 to 100 nanometers. Nanoscience and nanotechnology are the study and application of extremely small things and can be used across all other science field, such as chemistry, biology, physics, materials science and engineering. Nanotechnology is not Just a new field of science and engineering, but a new way of looking at and studying. The Ideas and concepts behind nanoscience and nanotechnology started with a talk entitled "There's Plenty of Room at the Bottom" by american physicist Richard Feyman at an American Physical Society meeting at the California Istitute of Technology on December 29,1959. It happened long before the term "nanotechnology" was used. In his talk, Feyman described a process in which scientists would be able to manipulate and control individual atoms and molecules it's hard to imagine Just how small nanotechnology is. One nanometer is a billionth of a meter, or 10–9 of a meter. For example, there are 25.400.000 nanometers in an inch. Nanoscience and nanotechnology involve the ability to see and to control individual atoms and molecules. Everything on the Earth is made up of atoms the food we eat, the clothes we wear, the buildings and houses we live in, and our bodies.

But something as small as an atom is impossible to see with the naked eye. In fact, it's impossible to see with the microscopes typically used in a high school classes. The microscopes needed to see things at the nanoscale were invented relatively recently – about 30 years ago. Once scientists had the right tools, such as the scanning tunneling microscope and the atomic force microscope and the age of nanotechnology was born.

Notes.

1. Nanoscience – нанонаука
2. application – применение, приложение
3. field – поле, сфера, область
4. to entitle – озаглавливать

5. to conduct – сопутствовать, проводить
6. nanoscale – наношкала; шкала измерения в нанометрах в соотношение 1 к 100
7. billionth of a meter – миллиардная часть метра
8. relatively – относительно
9. the atomic force microscope – атомно-силовой микроскоп
10. the scanning – tunneling microscope – сканирующе-туннельный микроскоп

3. Answer the questions.

1. What is nanotechnology?
2. What other fields of science does it deal with?
3. Who is the founder of nanotechnology?
4. How do you understand the word “nanoscale”?
5. Can we say that nanotechnology is a brand new field of science?
6. How many nanometers are in one inch?
7. Are there any differences between nanoscience and nanotechnology?
8. Is it possible to us to see an atom with the naked eye?
9. Did the meeting of American Physical Society take place in California or Carolina?
10. The microscopes play a very important role for nanotechnology, don’t they?
11. Can we say that our body is fully made of atoms?

4. Find synonyms to the following words from the text.

1. to conduct
2. field
3. to happen
4. small
5. to wear

5. Find antonyms to the following words from the text.

1. to tack
2. to start
3. individual
4. bottom
5. impossible

6. Put the proper words into the gaps:

field, concepts, tack, atoms, ability.

1. Nanotechnology is not just a new _____ of science and engineering.
2. The ideas and _____ behind nanoscience and nanotechnology started with a _____ entitled “There’ Plenty of Room at the Bottom”.
3. Everything on the Earth is made up of _____.
4. Nanotechnology involves the _____ to see and control individual atoms.

7. Find in the text appropriate English phrases for the following.

1. увидеть невооруженным глазом –
2. это случилось задолго до того –
3. связаны с возможностью –
4. область науки –
5. электрические свойства –

8. Match the following words with their definitions.

1. nanoscale	a. the smallest particle of a substance
2. nanotechnology	b. the unit of length equals to 1/12 ft=2,54 sm
3. inch	c. the branch of technology shat deals with dimensions and tolerances of less than 100 nanometres
4. microscope	d. the device for the consideration of the smallest particles
5. atom	e. a scale of 10^{-9} metre, having or involving dimensions of less than 100 nanometres

9. Translate into English.

1. Один нанометр равен миллиардной части метра.
2. Нанонаука и нанотехнология дают возможность увидеть и проконтролировать индивидуальные атомы и молекулы.
3. Все на Земле состоит из атомов – еда, которую мы едим, дома, в которых живем, а также наше тело.
4. Но что-то такое-же маленькое как атом невозможно увидеть невооруженным взглядом.
5. Это произошло задолго до того, как стали использовать термин «нанотехнология».

10. Make a short summery of the text (8–10 sentences).

Text Two

1. Read and translate the text with the dictionary.

THE HISTORY OF NANOTECHNOLOGY

Nanotechnology – the word that has changed the world in a dramatic way – did not evolve accidentally it was the outcome of several years of successive enhancements and accomplishments in the field of science, engineering and technology. The history of Nanotechnology goes back to our ancestors. It is believed that it was being practiced by several of our ancestors in some or other forms of nanotechnology. But little they did know that the field that they were working out would go into an enormous branch of science and take the world by storm.

The word Nanotechnology is believed to take its existence from the Greek word “Nano”. Nano in Greek is considered as “One billionth part”. The history of Nanotechnology can be traced back to the 16th century. The existence of this technology was first traced by the famous physicist Richard Feyman. He is found to be the first person to research things from their very basic structures- atoms by atoms. When he happened to research the basic components of a material, he surprisingly came out with a theory stating that there is undeniably a possibility in manipulating any particle atom by atom. He proposed that tinier things can be made even tinier till to their atomic levels. Developing their research on this theory, successive researchers became successful in bringing out the discovery of carbon Nanotubes. Carbon Nanotubes of this Nanotechnology are believed to have electrical properties that have the potential in designing nanoelectronic computers, sensors and other devices.

Notes.

1. to evolve – развивать, выводить (теорию)
2. enhancement – повышение, прирост, увеличение
3. to trace (back) – прослеживать
4. tiny – крошечный
5. nanotube – нанотрубка

Text Three

1. Read and translate the text with the dictionary.

WHAT IS NANOTECHNOLOGY USED FOR TODAY?

Have you ever caught yourself wondering just what is nanotechnology used for today?

Nanotechnology controls matter on an atomic level, modifying its effects to achieve desired results its uses are therefore extremely numerous. Any substance in existence can be broken into molecules and tampered with in order to give it different properties and abilities.

The universality of nanotechnology means that it is being applied to almost every faced of modern life. Miraculous effects can be achieved by engineering nanoparticles: for example, researches have already developed wool and silk that can clean themselves because altered particles “eat” stains.

Self-cleaning household products are also being developed.

The time is not far distant when you’ll be able to spray a nanochemical onto the grime in your kitchen and watch it disappear and practically never come back. Researchers have also developed a cluster of nanoparticles from different elements that can, among other things, solve the pollution problem. The Pacific Northwest National laboratory, for example, has discovered how to alter silica particles so that they attract and capture toxic particles in water.

This could go a long way towards removing and reducing water pollution in several ways, and since water pollution is one of mankind’s most pressing modern problems, that’s saying a lot.

Nanotechnology will also revolutionize the medical field, and has begun to do so already. Scientists have developed a type of synthetic bone based on nanoparticles simply by engineering the components that real bone is made of.

Notes.

1. property – собственность, свойство
2. facet – грань, сторона, аспект
3. nanoparticle – наночастица
4. stain – пятно, которое трудно удалить
5. grime – глубоко въевшаяся грязь
6. to alter – изменять

Unit 4

Text One

1. Pre-reading task. Answer the question.
What are the main components of nanoelectronics?

2. Read and translate the text.

NANOELECTRONICS

In 1965 Gordon Moore observed that silicon transistors were undergoing a continual process of scaling downward, an observation which was later codified as Moore's law. Since his observation transistor minimum feature sizes have decreased from 10 micrometers to the 22–28 nm range in 2011. The field of nanoelectronics aims to enable the continued realization of this law by using new methods and materials to build electronic devices with feature sizes on the nanoscale. The volume or an object decreases as the third power of its linear dimensions, but the surface area only decreases as its second power. This somewhat subtle and unavoidable principle has huge ramifications. For example, the power of a drill (or any other machine) is proportional to the volume, while the friction of the drill's bearings is proportional to their surface area.

Nanoelectronics refers to the use of nanotechnology on electronic components especially transistors. The term nanotechnology is generally defined as utilizing technology less than 100 nm in size. Nanoelectronics often refers to transistor devices that are small that inter-atomic interactions and quantum mechanical properties need to be studied extensively. As a result, present transistors do not fall under this category, even though these devices are manufactured with 45 nm, 32 nm, or 22 nm technology. Nanoelectronics is sometimes considered as disruptive technology because present elements are significantly different from traditional transistors. Nanoelectronics holds the promise of making computer processors more powerful than are possible with conventional semiconductor fabrication techniques. A number of approaches are currently being researched, including new forms of nanolithography, as well as the use of nanomaterials.

Notes.
1. downward – спускающийся к низу
2. linear – линейный
3. dimension – размер, измерение
4. subtle – нежный

5. ramification – разветвление, сложные последствия
6. drill – дрель
7. friction – трение
8. gear – механизм, устройство
9. transistor – транзистор
10. disruptive – разрушительный
11. semiconductor – полупроводник
12. nanolithography – нанолитография

3. Read the text and answer the following questions.
1. What is the main idea of Moore's law?
2. Who firstly observed the movement of silicon transistors?
3. The field of nanoelectronics aims to enable the continued realization of Moor's law, doesn't it?
4. What is the size of the transistor minimum feature today?
5. What does nanoelectronics refer to?
6. Can you point out the main sizes of the modern transistors?
7. How do you understand the term "disputive technology"?
8. Does nanoslectronics mainly deal with circuits or transistors?
9. Will our computers be more powerful thanks to nanoelectronic technologies?
10. Today the usage of nanomaterials is really enormous, isn't it?

4. Find synonyms to the following words.
1. to observe
2. to enable
3. huge
4. property
5. aim

5. Find antonyms to the following words.
1. to decrease
2. power
3. unavoidable
4. traditional
5. often

6. Find in the text appropriate English phrases for the following.
1. длительный процесс
2. который был позже кодифицирован в …
3. это как правило определяется …

4. существенно отличаются
5. направлено на создание возможностей
6. даже если

7. Put the proper words into the gaps:

field, enable, consider, significantly, power, fall under, volume, observation.

1. The _____ of nanoelectronics aims to _____ the continued realization of this law.
2. Nanoelectronics are sometimes _____ as disputive technology because present candidates are _____ different from traditional transistors.
3. The _____ of an object decreases as the third _____ of its linear dimensions.
4. As a result, present transistors do not _____ this category.
5. Since his _____ transistor minimum feature sizes have decreased from 10 micrometers to the 22–28 nm range.

8. Make active sentences passive and vice versa.

1. In 1965 Gordon Moore observed that silicon transistors were undergoing a continual process.
2. The term nanotechnology is generally defined as utilizing technology.
3. A number of approaches are currently being researched, including new forms of nanolithography.
4. This observation was later codified as Moor's law.

9. Translate into English.

1. Сфера деятельности наноэлектроники направлена на продолжение реализации этого закона с помощью новых методов и материалов.
2. В наноэлектронике используются нанотехнологии электронных компонентов, особенно транзисторов.
3. В результате, современные транзисторы не попадают под эту категорию, хотя эти устройства производятся по 45-нм, 32-нм или 22-нм технологии.
4. Наноэлектроника обещает создание более мощных компьютерных процессоров.
5. Например, мощность сверла дрели (или любой другой машины) пропорциональна объему, а трение сверла пропорционально площади поверхности.

10. Make a short summary of the text (8–10 sentences).

Text Two

1. Read and translate the text with the dictionary.

FUTURE NANOELECTRONICS MAY FACE OBSTACLES

Combining ordinary electronics with light has been a potential way to create minimal computer circuits with super fast information transfer. Researchers at Umea University in Sweden and the University of Maryland in the U.S. are now showing that there is a limit.

When the size of the components approaches the nanometer level, all information will disappear before it has time to be transferred. The electronics we know in our computers today is, as the name suggests, based on the transfer of information with the help of electrons. Using electrons has allowed us to shrink the size of computer circuits without losing efficacy. At the same time, communication with the help of electrons represents a rather slow means of transmission.

To alleviate this problem, light can be used instead of electrons. This is the basis of so-called photonic components. While the transfer speed in photonics is extremely high, the size of the components cannot be shrunk to the same level as "ordinary" electronics. For a number of years, so-called plasmonic components have proven to be possible way around the dilemma of electronics and photonics. By combining photonics and electronics, scientists have shown that information can be transferred with the help of so-called plasmons. Plasmons are surface waves, like waves in the ocean, but here consisting of electrons, which can spread at extremely high speeds in metals.

The findings now being presented by the Swedish-American research team show that difficulties arise when the size of such components is reduces to the nanometer level.

Notes.

1. circuit – схема, цепь
2. efficacy – эффективность
3. photonic – фотонный, световой
4. to shrink – сокращать, сжимать
5. surface – поверхность

Text Three

1. Read and translate the text with the dictionary.

NANOELECTRONIC DEVICES: PAPER BATTERY MAY POWER ELECTRONICS IN CLOTHING AND PACKAGING MATERIAL

Imagine a gift wrapped in paper you really to treasure and want to carefully fold and save. That's because the wrapping paper lights up with words like "Happy Birthday", thanks to a built-in battery-an amazing battery made out of paper. That's one potential application of a new battery made of cellulose, the stuff of paper.

Albert Mihrayan and collegues note in the report that scientists are trying to develop light, ecofriendly, inexpensive batteries consisting entirely of nonmetal parts. The most promising materials include so-called conductive polymers or "plastic electronics". One conductive polymer, polypyrrole (PPy), shows promise, but was often regarded as too inefficient for commercial batteries. The secret behind the performance of this battery is the presence of the homogeneous, uninterrupted, nanothing coating-about 1/50,000th the thickness of a human hair-of PPy on individual cellulose fibers which in turn can be molded into paper sheets of exceptionally high internal porosity. It was special cellulose, extracted from a certain species of green algae, with 100 times the surface area of cellulose found in paper. That surface area was key to allowing the new device to hold and discharge electricity very efficiently.

The innovative design of the battery cell was surprisingly simple. The battery recharched faster than conventional rechargeable batteries and appears well-suited for applications involving flexible electronics, such as clothing and packaging.

Alternatively, low-cost very large energy storage devices having electrodes of several square yards in size could potentially be made in the future.

Notes.

1. homogeneous – однородный, гомогенный
2. green algae – зеленые водоросли
3. fiber – волокно, клетчатка
4. rechargeable – перезаряжаемый
5. porosity – пористость, пористая структура

Unit 5

Text One

1. Answer the following question.

What do you know about the latest ways of packaging (for example, in medicine or food-industry)?

2. Read and translate the text.

THE WONDERS OF NANOTECHNOLOGY

Nanotechnology is concerned with the production and control of materials and objects on a nano-scale, which is, to say the least, small is set to change the face of food processing sector in the near future. Nanopackaging will be able to maintain the products' freshness while nanoencapsulation technology will allow us to do something to release the core or inner material. This technology is used in food, medicine, fragrance and stretches the snip products to protect the inner content just as an eggshell protects the inner contents. The use of nano-capsule can improve taste with their flavour burst contents or enhance the nutritional value of food through releasing vitamins. The same approach is possible in medicine. Drugs can be encapsulated or coated either to ensure their timed release or to prevent them being dissolved until they reach the target site. One nanometer is the same as one millionth of a millimeter. The attraction of the technology is that new materials and processes, with functions and properties that cannot be achieved otherwise, can in principle be made through the accurate control at this atomic and molecular level. A recent study, which looked into nanotechnology in the food industry, estimated that the world nano-food market will surge from US $20.4 billion in 2010, as the industry begins to realize the potential benefits. Globally, more than 180 applications are in different developing stages and a few of them are in the market already. The nano-food market is expected to surge US $7 billion in the current year. By 2014, Asia with more than 50 per cent of the world population will be the biggest market for nano-food, led by China.

Notes.

1. to maintain – поддерживать, сохранять, обслуживать
2. nano-encapsulation – нано-инкапсуляция, герметизация
3. core – центр, сердцевина
4. snip – клочок, кусок

5. nutritional value – питательная ценность
6. to dissolve – растворять, таять
7. otherwise – иначе, иным способом
8. surge – рост, подъем
9. to estimate – производить оценку, приблизительно подсчитывать
10. content – содержание

3. Answer the questions.

1. What field of technology deals with the production and control of materials on a specific scale?
2. Nanopackaging will be able to provide the products' freshness, won't it?
3. What is the main target or nano-encapsulation?
4. The use of nano-capsule is directed to the improving of products' colour, isn't it?
5. In what fields can we find the implementation of nano-encapsulation?
6. What is a nanometer?
7. How many billions of dollars have been spent on nano-food market for the last years?
8. The nano-food market is expected to surge 7 or 9 billion of dollars in the current year?
9. Point out two main levels of the nano-encapsulation technology?
10. What will the biggest market for nano-food be by 2014?

4. Find synonyms to.

1. to concern with
2. freshness
3. inner
4. content
5. otherwise

5. Find antonyms to.

1. to improve
2. to maintain
3. possible
4. recent
5. to surge

6. Match the words with their definitions.

1. enhance	a. all the substances (mainly of food) which help you to remain healthy
2. fragrance	b. cut something with scissors or shears, typically with small quick strokes
3. nutritional	c. a pleasant, sweet smell
4. snip	d. break open or apart suddenly and violently, especially as a result of an impact or internal pressure
5. burst	e. consisting of uncombined atoms rather than molecules
6. atomic	f. to intensify or increase in qualify, value, power, etc

7. Put the proper words into the gaps:

nano-food, concerned, nanopackaging, maintain, nano-capsule, nanometer.

1. Nanotechnology is _____ with the production and control of materials and objects on a nano-scale.
2. _____ will be able to _____ the products' freshness.
3. One _____ is the same as one millionth of a millimeter.
4. The use of _____ can improve taste with their flavour burst contents.
5. The _____ market is expected to surge $7 billion in the current year.

8. Make active sentences passive and vice versa.

1. This technology is used in food, medicine, fragrance and stratches the snip products to protect the inner content.
2. The use of nano-capsule can improve taste with their flavour burst contents.
3. Drugs can be encapsulated or coated either to ensure their timed release.
4. The nano-food market is expected to surge US $7 billion in the current year.

9. Translate into English.

1. К 2014 году, Азия с более чем 50 процентным населением планеты, будет крупнейшим рынком для наномодифицированной продукции, во главе с Китаем.
2. Более чем 180 смежных приложений находятся на разных стадиях развития во всем мире, и некоторые из них уже на рынке.

3. Использование нано-капсулы может улучшить вкус и аромат содержимого или повысить питательную ценность пищи.

4. Недавние исследования в области нанотехнологии, в пищевой промышленности показали, что вклад во всемирный рынок нано-продукции сегодня возрос на 2.6 миллиарда американских долларов.

10. Make a short summary of the text (8–10 sentences).

Text Two

1. Read and translate the text and make up five questions to it.

DO NANOPARTICLES IN FOOD POSE A HEALTH RISK?

A new study reveals that nanoparticles are being used in everything from beer to baby drinks despite a lack of safety information. Plastic imbued with clay nanoparticles helps make Miller Breeving Co. beer bottles less likely to break as well as improves how long the brew lasts in storage.

The U.S. Food and Drug Administration (FDA) currently does not specifically require nanoparticles to be proved safe but does require manufacturers to provide tests showing that the food goods employing them-be it beer or baby products-are not harmful.

"Industry would bear the burden of demonstrating the safety of the material under it intended conditions of Use", says FDA spokesperson Christopher Kelly. "Nanoparticle versions of [FDA-approved] materials may well be new materials" that would trigger new investigations", and this is considered on a case-by-case basis". To date, there are few published Industry, government or scientific studies on the health and environmental impacts of nanoparticles. Futher complicating the matter is the fact that nanoparticles have been in the food supply for years. For example, it remains unclear whether nanoparticles used in food packaging might migrate or leach into food or beverages. And it is completely unknown what impact a wide variety of these nanoparticles might have on human health. The federal government spent more than $1.4 billion on nanotechnology research last year as a part of the National Nanotechnology initiative, a joint effort of 25 federal agencies investigating the promise and potential perils of the emerging technology.

Notes.

1. to pose – представлять собой, являться
2. to imbue – пропитывать, проникать
3. burden – ноша, бремя
4. to leach – выщелачивать, вымывать
5. beverage – напиток
6. peril – опасность, риск

Text Three

1. Read and translate the text and make up five questions to it.

NANOTECHNOLOGY: A FOOD PRODUCTION REVOLUTION IN WAITING

Nanotechnology offers food production many potential benefits, but its development must be guided by appropriate safety assessments and regulation if risks are to be minimized, according to a UK report.

The study, commissioned by the UK government and carried out the Royal Society and the Royal Academy of Engineering, considered current and future developments in nanotechnology. It identified a range of potential benefits to be gained from nanoscience and nanotechnologies including new materials, more powerful computers and revolutionary medical techniques. Already, more than 200 companies around the world active in research and development. The USA is the leader followed by Japan and China. In the future, the science may be used in food production, and to detect how fresh food is. Researchers in the UK were recently awarded a $1.4 million government grant to develop a new generation of micro Rheometers to help characterise and develop liquid based products.

The ability to manipulate the molecules and the atoms of food will allow the food industry to design food with much more capability and precision and help to lower costs, claims the study. This will make products cheaper, production more efficient and more sustainable through using less water and chemicals. Producing less wastes and using less energy is a central concern of food manufacturers, and the drive towards production efficiency is likely to continue to boost nanotechnology funding. The main source of increasing the speed for these technologies within the next years are climate change, cost efficiency and population growth, but also new applications using food as drugs and nutrition.

Notes.

1. assessment – оценка (качества, эффективности)
2. liquid based products – жидкие продукты
3. capability – возможность
4. rheometers – реометры
5. to boost – повышать

Unit 6

Text One

1. Read the text.

APPLICATIONS OF NANOTECHNOLOGY

Applications of nanotechnology include nanoparticles, nanocrystals, nanocomposites, nanotubes, and nanodevices. Nanoparticles are 1 to 100 nanometers in diameter. Common compounds used in nanoparticles include alumina, zinc oxide, magnesium oxide, silica, and titanium dioxide. Nanoparticles are used in sunscreen to scatter ultraviolet rays, in food packaging to reduce spoilage, and in fabrics to resist stains and to destroy bacteria. Nanoparticles are also used in coatings, pigments, and flame retardants, and as photocatalysts, substances that use light to speed a chemical reaction. Photocatalysts are often used to render harmless certain dangerous substances, such as mold or air pollutants.

Nanocrystals are nanoparticles whose atoms are arranged in orderly patterns that form distinct shapes. Nanocrystals have unusual optical, electronic, and magnetic properties. For example, certain types of nanocrystals emit light when they absorb energy. But the color of the light depends on the crystal's size and shape. Another type of nanocrystal can change from a conductor of electric current to an insulator at constant temperature and pressure without any change in chemical makeup.

Scientists have produced nanocomposites by combining nanoparticles or other nanoscale objects with such materials as metal, plastic, or ceramics. Nanocomposites can be stronger, lighter, and longer-lasting than the original materials. For example, exterior car parts made with plastic nanocomposites may be more resistant to scratches and dents than conventional parts.

Nanotubes are tubular structures of carbon atoms several nanometers in diameter and of several thousand nanometers in length. Each nanotube is actually a single carbon molecule. Nanotubes are about 100 times stronger than steel. Some serve as conductors of electric current.

Many scientists and engineers believe that nanotechnology may someday create nanodevices so small that they could be seen only with powerful microscopes. Today, nanotechnology is often incorporated into microelectomechanical systems (MEMS) and other larger devices.

2. Study the following words and phrases.

1. compound – строение, структура, смесь
2. alumina – окись алюминия
3. magnesium oxide – оксид магния
4. silica – кварц, кремний
5. to scatter – рассеивать
6. resist stains – устойчивый к пятнам
7. flame retardant – огнезащитный состав
8. mold – плесень
9. to absorb – поглощать
10. insulator – диэлектрик, изолятор
11. dent – вмятина

3. Answer the questions.

1. What do applications of nanotechnology include?
2. How are nanoparticles measured?
3. What are the differences between nanocrystals and nanocomposites?
4. Do certain types of nanocrystals emit light?
5. Who has produced nanocomposites?
6. Nanocomposites are stronger, lighter and longer lasting, aren't they?
7. What example do scientist give with nanocomposites?
8. What are nanotubes?
9. Are nanotubes stronger than steel?
10. Why is nanotechnology very important nowadays?

4. Make active sentences passive and vice versa.

1. Certain types of nanocrystals emit light when they absorb energy.
2. Scientists have produced nanocomposites by comhining nanoparticles.
3. Nanodevices could be seen only with powerful microscopes.
4. Exterior car parts made with plastic nanocomposites may be more resistant to scratches and dents.
5. Common compounds used in nanoparticles include alumina, zinc oxide, magnesium oxide, silica, and titanium dioxide.

6. Match words or notions.

a. spoilage	1. a narrow beam of light, heat or other energy
b. scatter	2. the decay of food which means it can longer be used
c. ray	3. a type of solid, liquid or gas that has particular qualities
d. substance	4. to throw or drop things in different directions
e. compound	5. to take in a liquid, gas or other substance from surface or space around
f. absorb	6. a fine soft green, grey or black substance like fur that grows on old food or objects that all left in warm wet air
g. mold	7. the art of making and decorating ceramics
h. ceramics	8. a substance formed by a chemical reaction of two or more elements in fixed amounts relative to each other

6. Put the proper words into the gaps (properties, compounds, emit light, nanodevices, nanoparticles).

1. Nanocrystals have unusual optical, electronic, and magnetic …
2. … are 1 to 100 nanometers in diameter.
3. Certain types of nanocrystals … … when they absorb energy.
4. Nanotechnology may someday create … so small that they could be seen with powerful microscopes.
5. Common … used in nanoparticles include alumina, zinc oxide, silica, titanium dioxide.

7. Complete the sentences.

1. Many scientist and engineers believe that …
2. Exterior car parts made with …
3. Nanocomposites can be …
4. Nanoparticles are also used in coating …
5. Another type of nanocrystal can change from …

8. Translate the sentences from Russian into English.

1. У нанокристаллов есть необычные оптические, электронные и магнетические свойства.
2. Внешние части машины изготавливаются из пластмассовых нанокомпонентов, которые могут быть более устойчивыми к царапинам, вмятинам, чем обычные части.
3. Цвет света зависит от размера и формы кристалла.
4. Ученые разработали нанокомпоненты, соединив наночастицы или наномагнитные предметы с такими веществами как метал, пластик или керамика.
5. Наночастицы используются в солнцезащитных экранах, которые рассеивают УФ-лучи.
6. Нанотрубки – это трубчатые структуры атомов углерода, которые состоят из нескольких нанометров в диаметре и нескольких тысяч нанометров в длину.
7. Многие ученые и инженеры считают, что нанотехнология может создавать наноустройства такими маленькими, что их можно увидеть только в мощный микроскоп.

10. Make a short summary of the text.

11. Say what you would do if you created nanodevices.

Text Two

1. Read the text and translate it with dictionary.

APPLICATIONS

One of the major applications of nanotechnology is in the area of nanoelectronics with MOSFET's being made of small nanowires – 10 nm in length. Here is a simulation of such a nanowire.

As of August 21, 2008, the Project on Emerging Nanotechnologies estimates that over 800 manufacturer-identified nanotech products are publicly available, with new ones hitting the market at a pace of 3–4 per week. The project lists all of the products in a publicly accessible online database. Most applications are limited to the use of "first generation" passive nanomaterials which includes titanium dioxide in sunscreen, cosmetics, surface coatings, and some food products; carbon allotropes used to produce gecko tape; silver in food packaging, clothing, disinfectants and household

appliances; zinc oxide in sunscreens and cosmetics, surface coatings, paints and outdoor furniture varnishes; and cerium oxide as a fuel catalyst.

Further applications allow tennis balls to last longer, golf balls to fly straighter and even bowling balls to become more durable and have a harder surface. Trousers and socks have been infused with nanotechnology so that they will last longer and keep people cool in the summer. Bandages are being infused with silver nanoparticles to heal cuts faster. Cars are being manufactured with nanomaterials so they may need fewer metals and less fuel to operate in the future. Video game consoles and personal computers may become cheaper, faster, and contain more memory thanks to nanotechnology. Nanotechnology may have the ability to make existing medical applications cheaper and easier to use in places like the general practitioner's office and at home.

Future nanotechnology applications:

Desk-top sized nanoparticle 'factories' are able to create customised molecules for a wide range of applications.

Customised medical products target specific diseases and viruses.

Specialised nano-additives for food that will prevent growth of harmful bacteria.

Biomedical tools are capable for repairing many types of molecular and cellular damage.

Nanoparticles are used to enhance people's physical characteristics or change the way they look.

Nanocomposites can absorb radioactivity.

High-efficiency lighting products, improved solar cells and many other energy industry applications.

Notes.

1. additive – добавка
2. MOSFET – Моп-транзистор
3. to infuse – вымачивать, замачивать

Text Three

1. Read the text and retell.

NANOMATERIALS AND NANOPARTICLES

Area of concern is the effect that industrial-scale manufacturing and use of nanomaterials would have on human health and the environment, as suggested by nanotoxicology research. For these reasons, groups such as the

Center for Responsible Nanotechnology advocate that nanotechnology can be regulated by governments. The others counter that overregulation would stifle scientific research and the development of beneficial innovations.

Some nanoparticle products may have unintended consequences. Researchers have discovered that bacteriostatic silver nanoparticles used in socks to reduce foot odor are being released in the wash. These particles are then flushed into the waste water stream and may destroy bacteria which are critical components of natural ecosystems, farms, and waste treatment processes.

Public deliberations on risk perception in the US and UK carried out by the Center for Nanotechnology in Society found that participants were more positive about nanotechnologies for energy applications than for health applications, with health applications raising moral and ethical dilemmas such as cost and availability.

Researchers have found that when rats breathed in nanoparticles, the particles settled in the brain and lungs, which led to significant increases in biomarkers for inflammation and stress response and that nanoparticles induce skin aging through oxidative stress in hairless mice.

Nanotechnology suggests some forms of carbon nanotubes – a poster child for the "nanotechnology revolution" – could be as harmful as asbestos if inhaled in sufficient quantities. Anthony Seaton of the Institute of Occupational Medicine in Edinburgh, Scotland, who contributed to the article on carbon nanotubes said "We know that some of them probably have the potential to cause mesothelioma. So those sorts of materials need to be handled very carefully". In the absence of specific regulation forthcoming from governments, Paull and Lyons have called for an exclusion of engineered nanoparticles in food. A newspaper article reports that workers in a paint factory developed serious lung disease and nanoparticles were found in their lungs.

Notes.

1. to stifle – удерживать, отговаривать
2. skin aging – старение кожи
3. mesothelioma – мезотелиома, цепотелиома

Unit 7

Text One

1. Read the text.

NANOMAGNETS COULD REPLACE SEMICONDUCTORS

A University of Houston professor has developed a similar ‘disruptive technology,’ using magnetic cellular networks, that could yield such benefits as increased computing power that rivals what is possible with semiconductor integrated circuits.

Integrated circuits, which are a microscopic array of electronic circuits and components that have been implanted on the surface of a single chip of semiconducting material, have become the principal components of almost all electronic devices. Compared to the vacuum tubes and transistors that preceded them, integrated circuits have provided a low-cost, highly reliable way for computers to respond to a wider range of input and produce a wider range of output.

Dmitri Litvinov, associate professor of electrical and computer engineering and of chemical and biomolecular engineering in the Cullen College of Engineering at UH, is working with specially arranged assemblies of nanomagnets, or magnetic cellular networks, to replace conventional circuitry and significantly improve computing operations. His research involves a system of interacting magnetic nanocells that could combine logic, random access memory and data storage in a single nanomagnetic computing system.

Working from logic gates, which are at the heart of a computer’s ability to add, subtract, multiply and divide, Litvinov wants to demonstrate that the magnetization of adjacent magnets is possible and can be used to perform specific logic and computing operations, reversing the repulsive and attractive poles of magnets.

“The significance is potentially ultra-high density of magnetic computing components for significantly higher computing power beyond what is expected to be achievable with semiconductor integrated circuits,” said Litvinov, who also is the director of the Center for Nanomagnetic Systems at UR. “Additional benefits include potential integration with magnetic random access memory that would result in all-magnetic computing, as well as extreme robustness, or resilience, against radiation that could be critical for space missions or military applications.”

2. Study the following words and phrases.

1. to yield – приносить доход
2. array – набор
3. circuitry – схема, диаграмма
4. adjacent – смежный
5. to reverse – менять
6. repulsive – отталкивающий
7. robustness – устойчивость
8. resilience – эластичность

3. Answer the questions.

1. What has Professor Litvinov developed?
2. Could magnetic cellular networks yield such benefits as increased computing power?
3. What is an integrated circuit?
4. Are integrated circuits a low-cost or high-cost?
5. What does Litvinov’s research involve?
6. How does he demonstrate logic gates?
7. How can the magnetization of adjacent magnets be used?
8. Did he want to replace conventional circuitry or not?
9. What is the significance of magnetic computing components?
10. Could extreme robustness be critical for space missions?

4. Refer back to the text and find synonyms (i.e. words with a similar meaning) for the following words.

1. alike
2. to produce
3. elasticity
4. colleague

Now refer back to the text and find antonyms (i. e. words with an opposite meaning) for the following words.

1. different
2. input
3. unusual
4. loss

5. Understanding the passage.

Decide whether the following statements are true or false (T/F) by referring to the information in the text. Then make the necessary changes so that the false statements become true.

T	F	
☐	☐	1. Integrated circuits are a microscopic array of electronic circuits and components.
☐	☐	2. He is not working with assemblies of nanomagnets.
☐	☐	3. His research involves a system of integrated circuits.
☐	☐	4. He demonstrates that the magnetization of adjacent magnets isn't possible.
☐	☐	5. There are no additional benefits in potential integration with magnetic random access memory.

6. Content review.

Match the following words in column A with the statement in column B.

A	B
1. circuit	a. a number of computers and other devices that are connected together so that equipment and information can be shared
2. memory	b. the complete path of wires and equipment along which an electric current flows
3. component	c. the amount of space in a computer for storing information
4. network	d. one of several parts of which something is made

7. Complete the sentences.

1. Using magnetic cellular networks that could yield such benefits as …
2. Integrated circuits have provided a low-cost, highly reliable way for computers …
3. A system of interacting magnetic nanocells could combine logic, …
4. Logic gates are at the heart of a computer's ability to …
5. Additional benefits include …

8. Translate the sentences from Russian into English.

1. Интегральная схема – это микроскопический набор электронных схем и компонентов, находящихся на поверхности одного чипа полупроводникового вещества.
2. Его исследовательская работа включает систему взаимодействующих магнитных наноклеток, которая может соединить логическую схему, ОЗУ и хранение данных на одной наномагнитной вычислительной системе.
3. Наномагниченность смежных магнитов сможет показать логические и вычислительные операции, изменяя полюсы магнитов.
4. Сильная устойчивость или эластичность под воздействием радиации может быть необходимой для военных применений.

9. Make up a plan.

10. Retell the text.

Text Two

1. Read the text and translate with a dictionary.

NIST AND THE NATIONAL NANOTECHNOLOGY INITIATIVE

As the nation's premier measurement laboratory, NIST is a key contributor to the National Nanotechnology Initiative (NNI), a long-term federal effort to speed the advance of the emerging fields of nanoscale science, engineering, and technology. In 2010, NIST funding for nanotechnology-related projects in the NIST laboratories totaled almost $40 million.

Development of instrumentation and standards – essential building blocks of a nanotechnology infrastructure-is one of the NNI's top priorities. NIST leads efforts to address two of the NNI's "Grand Challenges": one on instrumentation and metrology (measurement science) and, with the National Science Foundation, one on manufacturing processes. It also contributes significantly to work on materials, electronics and optoelectronics, and elements of other initiative grand challenges.

In all these areas, measurement advances are key to achieving the understanding needed to harness nanoscale properties and quantum phenomena. Likewise, new measurement tools enable the process and control capabilities necessary for cost-effective production of high-quality nanotechnology products.

For fiscal year 2010, the President has requested a funding increase of $5.2 million to further NIST's nanotechnology efforts. The President also has proposed an additional $3 million to accelerate and intensify NIST's globally recognized work in quantum information science. This work aims to exploit the peculiar quantum behavior of molecules, atoms, and subatomic particles and to pave the way for enormously powerful quantum computers and perfectly secure communications systems.

Even before nanotechnology became a buzzword, NIST scientists and engineers were moving to address the inevitable need to measure and control processes at molecular levels. The scale and pace of these efforts have grown in response to increasing industrial and scientific demand. As a result NIST's penchant for precision and accuracy must rise to new levels. After all, when working in the nanoscale realm, pinpoint accuracy only gets you in the general neighborhood, a hair's breadth is a cavernous space, and a split second might as well be aneon.

Notes.

1. NIST – National Institute Standards and Technology – Национальный Институт стандартов и технологий США
2. buzzword – специальный термин
3. aneon – бесконечность
4. to harness – использовать в определенных целях

Text Three

1. Translate the text with a dictionary.

NANOSCALE ELECTRONICS, OPTOELECTRONICS, AND MAGNETICS

Demand for faster, more powerful information technology will not abate. Nor will the unrelenting space crunch in data storage ease any time soon. Down the road, when current manufacturing methods are extended to their limit, nanotechnology – in the forms of molecular electronics and spintronic devices that manipulate the spins of electrons – could provide the answer to both challenges.

Besides providing chipmakers and their suppliers with essential tools to meet today's severe process-control and quality requirements, NIST also is looking several generations beyond current integrated circuit technology. For example, a collection of molecular electronics projects has the overall aim of developing the measurement science base that will enable industry to, quite

literally, make a quantum leap in the design and fabrication of electronic devices.

NIST measurement support is credited with helping the U.S. data storage industry develop more sensitive read heads that capitalize on the giant magnetoresistance (GMR) effect, discovered in the late 1980s. Exploited in commercial technology less than a decade later, the quantum phenomenon enabled the industry to continue its trend of increasing data storage capacity by more than 40 percent annually.

Ongoing NIST projects aim to extend measurement and imaging capabilities in support of industry efforts to develop more powerful and more versatile magnetic devices, such as magnetic random access memories, which retain data even when power is interrupted, and tunable spintronic microwave devices that would increase storage capacity vastly.

The NIST laboratories also help to further industry efforts to design and manufacture affordable integrated circuits that combine, on a single chip, devices that control electrons with those that manipulate light, such as lasers, filters, amplifiers, and switches. Today, photonic and electronic devices are packaged as discrete components, linked by optical fiber. Although these hybrid packages are the lifeblood of advanced telecommunication technologies, nanotechnology techniques will enable integrated optoelectronic circuits that deliver higher performance and new capabilities at a lower cost.

Unit 8

Text One

1. Read the text.

RUSNANO

Rusnano (formerly Russian Corporation of Nanotechnologies) is a joint-stock company created and owned by the government of Russia and aimed at commercializing developments in nanotechnology. Rusnano's task is to create by 2015 a nano-industry in the country that will make marketable products worth 900 billion rubles ($29 billion).

One hundred percent of the shares in RUSNANO have become the property of the government. At this moment, the Board of Directors and the Auditing Commission have been formed; the chairman of the Executive Board has been appointed – Anatoly Chubais. During its first meeting, the Board of Directors of RUSNANO formed the Executive Board of the company.

A law (On the Russian Nanotechnology Corporation) which resulted in the creation of "Russian Corporation of Nanotechnologies" was proposed by several members of the United Russian party in June 2007. The proposal passed its first reading in the State Duma on June 14 and final reading on July 4. The upper house, the Federation Council, approved it on July 6. Initially organized as a state corporation, the company was re-registered on March 11, 2011 as open joint stock company RUSNANO.

In 2009 the Russian Corporation of Nanotechnologies received 634 requests for project cofinancing. The projects have been aggregated budgets of 1.355 trillion rubles of which 712.3 billion rubles were requested from the corporation. A significant percentage of the requests was for new production or modernization of existing processes and fixed assets.

All requests that enter the corporation go through a multi-staged system of expert evaluation. The Supervisory Council of the corporation approved 54 projects during 2009, projects in solar energy, mechanical engineering, metalwork, nanoelectronics, medicine, and venture financing. The total budget for these projects is 181.6 billion rubles of which 86.6 billion rubles were requested from the corporation. Fifty-three projects that have passed all evaluation steps and the Science and Technology Board will be brought to the Supervisory Council in the first half of the year.

All Rusnano projects can be grouped into 6 clusters:

1. solar energy and energy saving;
2. nanostructured materials;

3. medicine and biotech;
4. mechanical engineering and metal working;
5. optoelectronics and nanoelectronics;
6. infrastructure projects.

2. Study the following words and phrases.

1. joint-stock company – акционерное общество
2. marketable – товарный, рыночный
3. auditing commission – ревизионная комиссия
4. initially – в начале
5. aggregate – составлять в сумме; собирать в одно целое
6. significant – значительный, важный
7. fixed assets – основные средства
8. evaluation – оценка, определение стоимости
9. venture – предприятие, фирма
10. cluster – группа

3. Answer the questions.

1. What is Rusnano?
2. What are aims of Rusnano?
3. How many percent of the shares are there in Rusnano?
4. Who has been appointed to a position of the chairman of the Executive Board?
5. Was the company re-registered on March 11, 2011 or on July, 2011?
6. How many projects were approved in 2009 ?
7. What were their projects?
8. How much money did they need for these projects?
9. When will the Science and Technology Board be brought to the Supervisory Council?
10. How many clusters can all Rusnano projects be grouped?

4. Put the verbs into the correct form.

1. One hundred percent of the shares in Rusnano (to become) the property of the government.
2. The Board of Directors of Rusnano (to form) the Executive Board of the company.
3. The proposal (to pass) its first reading in the State Duma on June 14.
4. A significant percentage of the requests (to be) for new production.

5. The total budget for these projects (to be) 181.6 billion rubles of which 86.6 billion rubles (to request) from the corporation.

5. Refer back to the text and find synonyms (i.e. words with a similar meaning) for the following words.

1. to get through
2. essential
3. claim
4. to assign

Now refer back to the text and find antonyms (i.e. words an opposite meaning) for the following words.

1. discharge
2. refusal
3. unimportant
4. beginning

6. Match words or notions.

1. share	a. the group of people who are responsible for controlling a country or a state
2. government	b. the person in charge of a committee, a company, etc.
3. chairman	c. any of the units of equal value into which a company is divided and sold to raise money
4. corporation	d. a company that is owned by all the people who have shares in it
5. budget	e. an organization or a group of organizations that is recognized by law as a single unit
6. venture	f. having a value in money
7. worth	g. the money that is available to a person or an organization and a plan of how it will be spent over a period of time
8. joint-stock company	h. a business project or activity, especially one that involves taking risks

7. Translate the sentences from Russian into English.

1. Роснано – это акционерное общество, созданое правительством России и нацелено на развитие прибыли в нанотехнологии.
2. А. Чубайс был назначен на должность председателя исполнительного органа.
3. 100% акций в Роснано стали собственностью правительства.
4. В 2009 Российская корпорация нанотехнологий получила 634 запроса на проект совместного финансирования.
5. Все запросы, которые вошли в корпорацию, имели многоступенчатую систему квалифицированной оценки.
6. Проекты составили в сумме 1.3 триллиона рублей, из которых 712.3 миллиарда рублей было взяты из корпорации.
7. Все проекты Роснано могут быть подразделены на 6 групп.

8. Prearrange the plan according to the text.

1. Activities
2. History
3. The definition of Rusnano

9. Make a short summary of the text (8–10 sentences).

10. Retell the text.

Text Two

1. Read the text.

NANOSTRUCTURED MATERIALS (NM)

The topic of nanostructured materials (NM) is now very popular in the world as well as in Russia. The great attention to NM has occurred for at least two reasons. First, researchers hope to realize the unique mechanical, physical, and chemical properties of the nanocrystalline (NC) state and therefore achieve enhanced material performance properties as well. Second, researchers plan to fill the many gaps not only in the understanding of this state, but also in realizing its technological promise. The known results of Gleiter and his associates (Birringer et al.) have had an important impact on NM research and development. But this impact has been anticipated by many years of study in the fields of ultrafine powders (UFP), colloids, clusters, dusts, metal strengthening, metallic glasses, films, catalysts, etc. All these

scientific directions have developed intensively in the countries of the former Soviet Union and in Russia in particular. It is possible to list many fundamental Russian books devoted to these problems that are not always well known to Western scientists (e.g., Natanson, Palatnik, Andrievski, Levlev and others). So the current studies have a good base. Nevertheless, there are known difficulties in conducting R&D in Russia and in this connection, international cooperation is very desirable NM can be classified into three groups: particulate materials, materials obtained by controlled crystallization from the amorphous state, and materials obtained from films. Using these classifications, the remainder of this presentation will describe the main research groups in the field of NM in Russia.

Notes.

1. amorphous – некристальный, бесструктурный
2. enhance – улучшать
3. colloid – коллоид
4. cluster – кисть, концентрация, группа
5. catalyst – катализатор

Text Three

1. Read the text and retell.

ENERGY IN RUSSIA

Renewable energy in Russia mainly consists of hydroelectric energy. The country is the fifth largest producer of renewable energy in the world, although it is 56th when hydroelectric energy is not taken into account. Some 179 TWh of Russia's energy production comes from renewable energy sources, out of a total economically feasible potential of 1823 TWh. 16% of Russia's electricity is generated from hydropower, and less than 1% is generated from all other renewable energy sources combined. Roughly 68% of Russia's electricity is generated from thermal power and 16% from nuclear power.

While most of the large hydropower plants in Russia date from the Soviet era, the abundance of fossil fuels in the Soviet Union and the Russian Federation has resulted in little need for the development of other renewable energy sources. There are currently plans to develop all types of renewable energy, which is strongly encouraged by the Russian government. Russian President Dmitry Medvedev has called for renewable energy to have a larger

share of Russia's energy output, and has taken steps to promote the development of renewable energy in Russia since 2008.

Solar energy

Solar energy is virtually nonexistent in Russia, despite its large potential in the country. The first Russian solar plant was opened in Belgorod Oblast in November 2010. Russia has a total theoretical potential of 2,213 TWh/yr for solar energy, with an economically feasible amount of 101 TWh. The southern parts of Russia, especially the North Caucasus, have the greatest potential for solar energy. Russia plans to set up an overall solar capacity of 150 MW by 2020.

Plans for the construction of a new solar plant on the Black Sea have been announced and the plant is expected to begin operations by 2012. This plant, which will have a capacity of 12.3 MW, is being built by Rusnano and Renova. Solar Wind LLC and Rusnano are building a plant that will produce double-sided solar panels, which will be able to collect solar energy from both sides. Construction is expected to finish in early 2011 and the plant will have an annual manufacturing capacity of 30 MW. Nitol Solar is the largest Russian company in the area of scientific development and manufacture of products used to generate solar energy. Russia and India are currently discussing the possibility of a joint venture to produce silicon wafers for the creation of photovoltaic cells.

Notes.

1. feasible – выполнимый, годный
2. wafers – плата
3. fossil fuels – ископаемое топливо
4. TWh-tension watt hour – напряжение (ватт/вас)

Unit 9

Text One

1. Read the text.

THE TYPES OF NANOTECHNOLOGY

Nanotechnology attracts around $15 billion in investments each year – in the fields of electronics, medicine, energy, materials and environment – and scientists say it has the potential to change society in ways that we can't even begin to imagine. But what exactly is it? And what are the risks? For many people, the word 'nanotechnology' conjures up science-fiction visions of billions of tiny little self-replicating robots taking over the world. But the reality is not nearly so mysterious or sinister. Nanotechnology is just given the name to the science of working with materials at a molecular level – something mankind has been doing for thousands of years, albeit unknowingly. Indeed, we use many products in everyday life – including steel, rubber, paint, ceramics and plastics – apply nanotechnology concepts. Nanoparticles get their name from their extremely small size, which are measured in millions of millimetre otherwise known as nanometres (10–9 of a metre). Meanwhile, the first identified nanoparticle – a stable spherical molecule of 60 interlinked carbon atoms – was discovered in 1985. This particle was called a buckminsterfullerene (usually shortened to 'buckyball'), after architect R. Buckminster Fuller who designed a spherical building for the 1967 World Exhibition using a similar structure. The scientists who discovered it were awarded the Nobel Prize for Chemistry in 1996 for their work. Not surprisingly, the first industry to embrace the science of working on a nano-scale was electronics, which was faced with the problem of how to put more and more transistors on a silicon 'chip' to make them work faster. As the science took hold, transistors became smaller and smaller, rapidly getting down to sizes where you needed a microscope to see them. The technology has certainly come a long way. Nanoparticles are being used to make products more effective, make objects stronger and lighter, and even change the properties of existing materials (e.g. make them scratchproof, anti-static, waterproof, UV-resistant etc). There are already hundreds of products on the market that utilize nanotechnology, including:

– dirt and stain-resistant fabrics;

– the sunscreens are clear because they contain nano-sized particles of zinc and titanium oxide;

– graphite products infused with nanomolecules to make them very lighter, stronger than steel;

– engine oils containing copper nanoparticles to help to reduce engine wear;

– fabric dyes that are more resistant to fading when exposed to the sun.

2. Study the following words.

1. to conjure up – вызывать в воображении
2. to replicate – повторять, моделировать
3. sinister – предвещающий несчастье, злой
4. albeit – хотя (и)
5. to embrace – избирать, включать, содержать
6. to take hold – получать распространение
7. to utilize – использовать, употреблять

3. Answer the questions.

1. In what fields can we use nanotechnology?
2. What nanaproducts can be used in everyday life?
3. Are nanoparticles small or large?
4. When was the first nanoparticle discovered?
5. How was this particle called?
6. What prize were the scientists awarded?
7. What problem did they see in transistors?
8. Are nanoparticles being used to make products more effective, make objects stronger and lighter?
9. Do copper nanoparticles reduce engine wear?

4. Put the proper words into the gaps:

to attract, indeed, to get, to discover, to utilize.

1. There are hundreds of products on the market that _____ nanotechnology.
2. Nanotechnology _____ around $15 billion in investments each year.
3. Nanoparticles _____ their name from their extremely small size.
4. The first nanoparticle _____ in 1985.
5. _____, many products we use in everyday life.

5. Make active sentences passive and vice versa.

1. Indeed, we use many products in everyday life.
2. The scientists discovered this particle.
3. Nanoparticles get their name from their extremely small size.
4. An architect R. Buchminster Fuller designed a spherical building.

6. Translate into English.

1. Наночастицы измеряются в миллионных миллиметрах, иначе известны как нанометры.
2. Наночастицы используются, чтобы изготавливать продукты более эффективными, делать вещи более прочными и легкими.
3. Первая распознанная наночастица была открыта в 1985.
4. Нанотехнологию применяют в таких отраслях, как электроника, медицина, энергетика.
5. Ученые, которые обнаружили эту наночастицу, были награждены Нобелевской премией в области химии.

7. Agree or disagree with the following.

1. Nanotechnology has advantages and disadvantages.
2. Nanotechnology is just given the name to the science of working with materials at a molecular level.
3. The first industry to embrace the science of working on a nanoscale was electronics.
4. The technology has come a short way.
5. We can do without nanotechology.

8. Speak on:

1. Nanoparticles in science.
2. Current application of nanoparticles.
3. Products in everyday life – how we apply nanotechnology concepts.

9. Make a short summary of the text (7–9 sentences).

10. Find some additional information about advantages and disadvantages of nanotechnology.

Text Two

1. Read the text and translate with a dictionary.

BENEFITS AND RISKS

In theory, applied nanotechnology could lead to people being healthier and living longer, improve the supply of clean water around the world, increase the food supply by enhancing agriculture, reduce our dependence on

fossil fuels by advancing renewable energy technology, reduce environmental damage, and advance the electronic age through the development of powerful miniature devices.

Lighter weight packaging will reduce freight costs and cut fuel consumption.

High strength composites will change transport, making cars and planes lighter but even stronger than they are today.

Longer lasting materials will cut waste and reduce the amount of landfill.

Synthetic medicines, tailored to the patient’s physiology, could be manufactured to treat specific illnesses and diseases.

The list of potential applications and benefits is probably only limited by our imaginations.

Is there a downside to nanotechnology?

Some people already fear that nanoparticles in products such as sunscreens will find their way through the skin and cause as undetermined effects on users.

While a review of research by Australia’s Therapeutic Goods Administration has indicated that these sunscreens are not a problem (as the material remains on the ‘dead’ surface layer of the skin), the potential long-term effects of many other nanotechnology products is still not so cut and dried.

Are the health and environmental regulations in the workplace adequate to cover these risks in companies and research organizations involved in the production or use of nanomaterials? It is likely that current Occupational Health and Safety regulations will have to be revised to cope with the widespread introduction of nanotechnology. In turn, the impact on people and the environment through the whole life cycle of these particles still needs to be evaluated in detail. If they are to be used safely, we need to gain a better understanding of the potential hazards involved in their production, storage, distribution, use (and potential abuse) and disposal.

For some industries, nanotechnology could have negative commercial consequences. For example, dirt and wrinkle resistant clothing may be a great step forward for consumers, but some industries could find demand for their products and services rapidly declining (e.g. manufacturers of detergents and stain removers, washing machines and electric irons; dry-cleaners etc).

This simple application of nanotechnology is just one example of developments that could threaten the livelihood of some of our largest companies in the nearest future and change the face of the corporate world.

Unit 10

Text One

1. Read the text.

NANOTUBES AND THEIR APPLICATIONS

The properties of nanotubes have caused researchers and companies to consider using them in several fields. For example, because carbon nanotubes have the highest strength to weight ratio of any known material, researchers at NASA are combining carbon nanotubes with other materials into composites that can be used to build lightweight spacecraft. Another property of nanotubes is that they can easily penetrate membranes such as cell walls. In fact, nanotubes are long, narrow shape that makes them look like miniature needles, so it makes sense that they can function like a needle at the cellular level. Medical researchers are using this property by attaching molecules that are attracted to cancer cells to nanotubes to deliver drugs directly by diseased cells. Another interesting property of carbon nanotubes is that their electrical resistance changes significantly when other molecules attach themselves to the carbon atoms. Companies are using this property to develop sensors that can detect chemical vapors such as carbon monoxide or biological molecules. These are just a few of the potential uses of carbon nanotubes. The following survey of carbon nanotube applications introduces these and many other uses.

A survey of carbon nanotube applications under development:

Researchers and companies are working to use carbon nanotubes in various fields. Nanotubes bound to an antibody that is produced by chickens have been shown to be useful in lab tests to destroy breast cancer tumors. The antibody carrying nanotubes are attracted to proteins produced by one type of breast cancer cell. Then the nanotubes absorb light from an infrared laser, incinerating and the tumor they are attached to.

Researchers are developing materials, such as a carbon nanotube based composite developed by NASA that bends with when a voltage is applied, that will need only an electrical voltage to change the shape (morphing) of aircraft wings and other structures.

Longer lasting concrete, researchers have found that carbon nanotubes can fill the voids that occur in conventionial concrete. Because these voids that allow water to penetrate into concrete, resulting in the formation of cracks; including nanotubes in the mix stops the cracks from forming.

2. Study the following words.

1. significant – значительный, важный
2. survey – обзор, проверка
3. composite – смесь, композит
4. application – применение
5. cell wall – стенка клетки
6. vapor – пар, испарения
7. to occur – происходить
8. tumor – неоплазма, опухоль
9. protein – протеин, белок
10. incinerate – сжигать
11. void – вакуум, пусто

3. Answer the questions.

1. What properties do carbon nanotubes have?
2. What do nanotubes look like?
3. How are medical researchers using nanotubes?
4. What are companies using this property for?
5. Do the nanotubes absorb light from an infrared laser?
6. What do researchers use when they want to change the shape of aircraft wings?
7. Can carbon nanotubes fill the voids?
8. Do nanotubes stop the cracks from forming?

4. Make up questions using the answers.

1. The properties of nanotubes have caused researchers and companies to consider using them in several fields.
2. Another property of nanotubes is that they can easily penetrate membranes such as cell walls.
3. The antibody carrying nanotubes are attracted to proteins produced by one type of breast cancer cell.
4. Companies are using this property to develop sensors that can detect chemical vapors.
5. The nanotubes absorb light from an infrared laser.

5. Find synonyms to:

1. investigator
2. compound
3. neoplasm
4. evaporation

Find antonyms to:

1. narrow
2. create
3. maintain
4. faulty

6. Translate from Russian into English.

1. Углеродные нанотрубки имеют самую высокую прочность из всех известных материалов.
2. Еще одно свойство нанотрубок – это то, что они могут легко проходить через такую мембрану, как например стенки клеток.
3. Ученые медики используют это свойство, чтобы ввести лекарство в болезнетворные клетки.
4. Нанотрубки поглощают свет из инфракрасного лазера, уничтожая опухоль, на которую они направлены.
5. Исследователи и компании работают над использованием углеродных нанотрубок в различных областях.

7. Make up a dialogue on the following situation and act it out:

You are talking with a doctor about the properties of nanotubes in medicine.

8. Decide in pairs: You are discussing with your friend which of properties of nanotubes are more useful in our time and which are not.

9. Agree or disagree with the following.

1. Nanotubes can be used in various fields.
2. The medical researchers cannot destroy cancer cells with the help of nanotubes.
3. Companies are using this property to develop sensors that can detect chemical vapors.
4. Carbon nanotubes don't have the highest strength to weight ratio of any known material.
5. Nanotubes are widely used in the field of medicine.

10. Make up a plan.

11. Retell the text.

Text Two

1. Read the text and translate in with a dictionary.

NANOTUBES

"Conceptually, single-wall carbon nanotubes (SWCNTs) can be considered to be formed by the rolling of a single layer of graphite (called a graphene layer) into a seamless cylinder. A multiwall carbon nanotube (MWCNT) can similarly be considered to be a coaxial assembly of cylinders of SWCNTs, like a Russian doll, one within another; the separation between tubes is about equal to that between the layers in natural graphite. Hence, nanotubes are one-dimensional objects with a well-defined direction along the nanotube axis that is analogous to the in-plane directions of graphite." Carbon nanotubes were discovered in 1991 by Sumio Iijima resembling rolled up graphite, although they cannot really be made that way. Depending on the direction that the tubes appear to have been rolled (quantified by the 'vector'), they are known to act as conductors or semiconductors. Nanotubes are evidence to be useful as molecular components for nanotechnology.

Strictly speaking, any tube with nanoscale dimensions, but generally used to refer to carbon nanotubes, which are sheets of graphite rolled up to make a tube. A commonly mentioned non-carbon variety is made of boron nitride, another is silicon. These noncarbon nanotubes are most often referred to as nanowires. The dimensions are variable (down to 0.4 nm in diameter) and you can also get nanotubes within nanotubes, leading to a distinction between multi-walled and single-walled nanotubes. Apart from remarkable tensile strength, nanotubes exhibit varying electrical properties (depending on the way the graphite structure spirals around the tube, and other factors, such as doping), and can be superconducting, insulating, semiconducting or conducting (metallic).

Nanotubes can be either electrically conductive or semiconductive, depending on their helicity, leading to nanoscale wires and electrical components. These one-dimensional fibers exhibit electrical conductivity as high as copper, thermal conductivity as high as diamond, strength 100 times greater than steel at one sixth the weight, and high strain to failure.

Notes.

1. coaxial – коаксиальный, имеющий общую ось
2. to roll up – закручивать
3. boron nitride – нитрид бора
4. doping – наложение защитных покрытий

Text Three

1. Read and retell the text.

CARBON NANOTUBE

Carbon nanotubes possess many unique properties which make them ideal AFM probes. Their high aspect ratio provides faithful imaging of deep trenches, while good resolution is retained due to their nanometer-scale diameter. These geometrical factors also lead to reduced tip-sample adhesion, which allows gentler imaging. Nanotubes elastically buckle rather than break when deformed, which results in highly robust probes. They are electrically conductive, which allows their use in STM and EFM (electric force microscopy), and they can be modified at their ends with specific chemical or biological groups for high resolution functional imaging.

Carbon Nanotube Transistors exploit the fact that nm- scale nanotubes (NT) are ready-made molecular wires and can be rendered into a conducting, semiconducting, or insulating state, which make them valuable for future nanocomputer design. Carbon nanotubes are quite popular now for their prospective electrical, thermal, and even selective-chemistry applications.

Many potential applications have been proposed for carbon nanotubes, including conductive and high-strength composites; energy storage and energy conversion devices; sensors; field emission displays and radiation sources; hydrogen storage media; and nanometer-sized semiconductor devices, probes. Some of these applications are now realized in products. Others are demonstrated in early to advanced devices, and one, hydrogen storage, is clouded.

Notes.

1. to buckle – сгибаться, гнуться
2. STM – модуль самотестирования

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