

Laser

МЕТОДИЧЕСКАЯ РАЗРАБОТКА

по дисциплине
«Иностранный язык»
(английский язык)

по теме «Лазер. Области применения и
возможности лазеров.»

для студентов V курса специальности
210308



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ФЕДЕРАЛЬНОЕ
ГОСУДАРСТВЕННОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ
СРЕДНЕГО ПРОФЕССИОНАЛЬНОГО ОБРАЗОВАНИЯ

«НОВОРОССИЙСКИЙ КОЛЛЕДЖ РАДИОЭЛЕКТРОННОГО ПРИБОРОСТРОЕНИЯ»

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Рецензенты:

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Аннотация

Настоящая учебно-методическая разработка «Лазер. Области применения и возможности лазеров» предназначена для работы студентов 5 курса специальности 210308. Взяты для разработки тексты из учебных пособий «Рассказы об электронике» Л.П. Зайцевой, О. Г. Чупрыной, из «Учебника английского языка для технических вузов и университетов» И.В. Орловской, Л.С. Самсоновой, А. И. Скубриевой, а также “Oxford English for Electrical and Mechanical Engineering”, Eric H. Glendinning, Norman Glendinning является основной частью учебного материала, изучаемого студентами по данной теме, и рассчитан на 8 часов (или на 4 учебные занятия). Так как упомянутые пособия предназначены для изучения на 5 курсе, поэтому считаю, что нижеуказанные тексты с последующими упражнениями соответствуют уровню подготовки студентов.

Начиная работу, хочу отметить, что тексты профессионально направлены, и, естественно, без знаний физики общеобразовательного курса и специальных предметов могут возникнуть языковые трудности и трудности перевода. Во избежание этих трудностей предусмотрена поэтапная работа с текстами, ряд упражнений и заданий для их последовательного разбора по частям, а также выявления сути и краткого изложения на изучаемом языке.

Учебно-методическое пособие включает в себя:

- тексты «Laser», «Lasers», «What is a laser?», «What is the laser used for?», «Holography», «Laser Technology», «Laser Propulsion»;
- список лексики, которую необходимо знать студентам и использовать в речи;
- грамматические упражнения;
- устно-речевые задания.

Послетекстовые задания частично составлены автором разработки. Применение данной разработки на практике помогает решить поставленные задачи, а именно:

- ✓ развивать навыки чтения текста и его понимание;
- ✓ использовать навык чтения изучающего и поискового характера;
- ✓ развивать диалогическую и монологическую речь;
- ✓ развивать логическое мышление студентов;
- ✓ закреплять грамматические навыки, полученные в процессе обучения.

Материал пособия рассчитан на среднего студента, а при надлежащем изучении доступен пониманию и мышлению каждого из студентов, находящемся на 5 курсе обучения в среднем профессиональном учебном заведении. Разработка соответствует установкам программы по английскому языку, а последовательность подобранных заданий имеет логическую направленность, соответствующую логике развития данной отрасли.

Преподаватель _____ Марарь М.А.

LASER

In the “War of Worlds” written before the turn of the last century H. Wells told a fantastic story of how Martians almost invaded our Earth. Their weapon was a mysterious “sword of heat”. Today Wells' sword of heat has come to reality in the laser. The name stands for light amplification by stimulated emission of radiation.

Laser, one of the most sophisticated inventions of man, produces an intensive beam of light of a very pure single color. It represents the fulfillment of one of the mankind's oldest dreams of technology to provide¹ a light beam intensive enough to vaporize the hardest and most heat-resistant materials. It can indeed make lead run like water, or, when focused, it can vaporize any substance on the earth. There is no material unamenable² to laser treatment and laser Mill become one of the main technological tools quite soon.

The applications of laser in industry and science are so many and so varied as to suggest magic³. Scientists in many countries are working at a very interesting problem: combining the two big technological discoveries of the second half of the 20th century — laser and thermonuclear reaction - to produce a practically limitless source of energy. Physicists of this country have developed large laser installations to conduct physical experiments in heating thermonuclear fuel with laser beams. There also exists an idea to use laser for solving the problem of controlled thermonuclear reaction. The laser beam must heat the fuel to the required temperature so quickly that the plasma does not have time to disintegrate. According to current estimates, the duration of the pulse has to be approximately a billionth of a second. The light capacity of this pulse would be dozens of times greater than the capacity of all the world's power plants. To meet such demands in practice, scientists and engineers must work hard as it is clear that a lot of difficulties⁴ are to be encountered on route⁴.

The laser's most important potential may be its use in communications. The intensity of a laser can be rapidly changed to encode very complex signals. In principle, one laser beam, vibrating a billion times faster than ordinary radio waves, could carry the radio. TV and telephone messages of the world simultaneously In just a fraction of a second, for example, one laser beam could transmit the entire text of the Encyclopedia Britannica.

Besides, there are projects to use lasers for long distance communication and for transmission of energy to space stations, to the surface of the Moon or to planets in the Solar system. Projects have also been suggested to place lasers aboard Earth satellites nearer to the Sun in order to transform the solar radiation into laser beams, with this transformed energy subsequently transmitted to the Earth or to other space bodies. These projects have not yet been put into effect⁵, because of the great technological difficulties to be overcome and, therefore, the great cost involved. But there is no doubt that in time⁶ these projects will be realized and the laser beam will begin operating in outer space as well.

Notes to the Text

1. to provide — получать
2. unamenable — неподдающийся
3. as to suggest magic — можно принять за чудо
4. on route — на пути
5. put into effect — осуществлять
6. in time - со временем

Vocabulary

amplification *n* — усиление

heat *v* — нагревать

as well *adv* — также

approximately *adv* — почти, приблизительно

heating *n* - нагрев

heat-resistant *a* - теплостойкий

capacity *n* — мощность

the rapidly *adv* - быстро

entire *a* — полный, целый

represent *v* — представлять, олицетворять

stimulate *v* — возбуждать, индуцировать

single *a* — один, одиночный

suggest *v* — предлагать, советовать

indeed *adv* — на самом деле, действительно

conduct *v* — вести, проводить

cost *n* - стоимость

duration *n* — продолжительность

involved *Part.II* — связанный, рассматриваемый

enough *adv* — достаточно, довольно

treatment *n* — обработка

fulfillment *n* — выполнение, осуществление, исполнение

vary *v* — меняться, изменять(ся)

tool *n* — инструмент, орудие, средство

weapon *n* — оружие

to meet the demands, requirements — удовлетворять требованиям

in order to — для того чтобы

power plant — силовая установка, электростанция

TASKS

I. Look through the text and answer the questions:

1. What is this text about?
2. What does the word "laser" mean?
3. What is the laser, is it a device or some phenomenon?
4. Who was the first to write about lasers?
5. What writer from this country wrote a book about a laser?
6. What can a laser do?
7. Where can it be used?
8. What other uses do you know?

II. Say what sentences are True and what are False. Correct the False ones.

1. Laser means "light amplification by stimulated emission of radiation".
2. Laser produces an intensive beam of light.
3. In the next few years laser will become one of the main technological tools.
4. Martians almost invaded the Earth before the turn of the last century.
5. Laser and thermonuclear reaction can produce a limited source of energy.
6. The laser beam heats the fuel so quickly that the plasma disintegrates.
7. There are projects to transform lunar radiation into beams.
8. The laser beam will begin operating in outer space.

III. Find the sentences with Infinitive constructions and translate them.

1. To design, construct and operate a laser system is a great technological achievement.
2. To protect the water resources, forests and atmosphere, several laws were passed in Russia in the 1970s.
3. A very interesting problem is to produce a practically limitless source of energy.
4. There are projects to use lasers for long distance communication.
5. Automation makes it possible to obtain and develop new sources of energy.
6. To combine laser and thermonuclear reaction is a very interesting problem for the scientists in many countries.
7. To conduct physical experiments with laser beams, Russian physicists have developed large laser installations.
8. Some Western experts consider that it is practically impossible to protect big cities from pollution.
9. Lasers to be placed on Earth satellites will transform solar radiation into laser beams.
10. A special design bureau in St. Petersburg was the first in the world to develop production of superlong escalators.
11. To put some projects with lasers in operation, great technological difficulties must be overcome.
12. One of the ways to make planes as economical as possible is to lighten the aircraft by using new composite materials.
13. Signals to be measured must be strong enough.

IV. Say what kind of attribution it is and translate the sentences.

1. The new system developed increased the safety and efficiency of a car.
2. The laser's most important potential use may be its long distance communication applications.
3. Provided the problems of using laser for controlled thermonuclear reaction were solved, the capacity of the pulse received would be much greater than that of all the world's power plants.
4. All a pilot needs to do is to tune to radio transmitters and he will get direction signals he needs.
5. One of the problems scientists are working at is to transmit energy to space stations by using lasers.
6. Laser provides a light beam

intensive enough to vaporize the hardest and most heat-resistant materials 7. A hypersonic aircraft will require complicated cooling measures because of the extreme temperatures involved. 8. A new electronic device to be installed in the car's panel will calculate how far one can drive on the fuel left. 9. The hardest materials a laser beam is aimed at vaporize within a fraction of a second. 10. Aircraft designers are interested in all kinds of new materials that are strong enough to be used for high-speed airliners. 11. Noise and vibration are also the problems to be faced by designers of hypersonic crafts. 12. Besides, there is one more problem to be studied - that of surface cooling. 13. The ordinary aircraft windows would make the future superliner structure too weak to withstand great stresses developed. 14. Every student of Cambridge is to go to his tutor once a week to discuss with him the work done.

V. Define the Parts of Speech, paying attention to prefixes and suffixes.

Encode, capacity, disintegrate, emission, widen, intensive, incredible, defence, stranger, reality, strengthen, fulfillment, indestructible, amplification, substance, entirely, vaporize.

VI. Write the derivations from the next words:

Limit, transmit, approximate, success, science, relate.

VII. Find the Russian equivalent to the English one.

устанавливать — installment, installation, install;

различие, разница — differ, difference, different;

распасться — disintegrator, disintegration, disintegrate;

применимый — application, applicable, apply;

укреплять — strong, strength, strengthen;

эффективно — efficient, efficiency, efficiently;

усилитель - amplification, amplifier, amplify

VIII. Find:

a) Synonyms

rapidly, sophisticated, to conduct, demand, almost, quickly, to carry out, approximately, opportunity, requirement, also, use, to fulfill, complex, as well, to realize, application, possibility;

b) Antonyms

further, integrate, cooling, outside, powerless, uncontrolled, limited, disintegrate, nearer, capable, limitless, controlled, incapable, powerful, heating, inside.

LASERS

I. Define the meanings of the next words:

Laser, ruby, xenon, coherent, stimulate, stimulation, stimulated, emit, emission, emitted, excite, excitation, excited.

II. From the international words below first write out a) the words resemble Russian ones by meaning; b) the words having the same writing form, but unlike by meaning:

Quantum, generation, radio, molecular, electronic, to concentrate, intense, to stimulate, emission, radiation, ordinary, extremely, cylinder, synthetic, orbit, to stop, pulse, monochromatic, coherent, protection, compact, to absorb.

III. Form Nouns with the help of suffix *-ion / - (at)ion* and translate them:

To generate, to concentrate, to stimulate, to emit, to radiate, to excite, to absorb, to form.

IV. Look through the text and do the next tasks:

- name the laser inventors;
- find the sentence about the meaning of the word “l a s e r”;
- say of what laser is made.

TEXT 1

WHAT IS A LASER?

Laser is a wonder child¹ of quantum physics. Quantum physics came into being in 1954 when Soviet scientists Alexander Prokhorov and Nikolai Basov in the USSR and Charles Towns in New York simultaneously and independently discovered the generation of radio waves in molecular beams.

A laser is a quantum electronic device. It is a machine for making and concentrating light waves into a very intense beam. The letters LASER stand for Light Amplification by Stimulated Emission of Radiation. The light made by a laser is much more intense than ordinary light. *With ordinary light, all the light waves are of different lengths. With lasers, all the light waves are of the same length, and this increases the intensity.* Laser is an extremely, simple-looking device. It is nothing more than a cylinder of synthetic ruby about 1/4 inches in diameter and 1 1/2 inches long mounted in the centre of a spiral coil of glass. The coil is a xenon-filled flash tube, very much like the ones used by photographers for taking flash pictures.

At one end of the tube there is a mirror, and at the other end of the tube there is a partial mirror.

*The laser beam is made by exciting the atoms of a suitable material — ruby is one — until most of the atoms have electrons orbiting in a higher energy level than usual. The excitation is then stopped and all the excited electrons fall back together, to their normal orbits, each one emitting a pulse of light of the same energy. In this way an

intense beam of light is generated for a very short time.* And every pulse or wave-train in this beam is in step with² every other pulse. In this way a beam of light is obtained which is both monochromatic and coherent and easy to focus. The mirror at one end of the tube reflects this light. It can only escape at the other end of the tube.

Laser beams carry surprisingly intense amounts of energy and so they can be dangerous to living tissue.³ It is therefore necessary to protect the human eye, when laser beams are being used. The damage can be done very quickly, so protection from accident is very necessary.

A laser beam carries its energy in a compact form, until it is absorbed when it strikes something opaque.

Notes to Text1

1 . a wonder child — чудо, необычное порождение

2 . to be in step with — соответствовать

3 . tissue - ткань

V. Translate the sentences marked with a sign *.

VI. Translate the next sentences taking into consideration the Nominative Absolute Participial Construction:

Model:

1) Silver being a conductor, it is widely used in electronics. — Так как (поскольку, если) серебро – проводник, оно широко используется в электронике.

2) All metals are conductors, silver being the best. - Все металлы – проводники, а (но, и, причем) серебро – лучший.

1. The excitation being stopped, all the excited electrons fall back together. 2. The laser beam being so small, it is used in eye operations. 3. Laser beams carrying intense amounts of energy, it is necessary to protect the human eye. 4. Light being reflected by the mirror at one end of the tube, it can only escape at the other end of the tube. 5. Laser being a multi-purpose tool, it is widely used.

VII. Translate the next sentences:

1. Laser is a wonder child of quantum physics. 2. The laser beam is made by exciting the atoms of a suitable material. 3. Laser is an extremely simple-looking device. 4. It is necessary to protect the human eye, when laser beams are used. 5. A laser beam carries its energy in a compact form. 6. Laser is a multi-purpose tool. 7 Alexander Prokhorov and Nikolai Basov in the USSR and Charles Towns in New York simultaneously and independently discovered the generation of radio waves in molecular beams.

TEXT 2

WHAT IS THE LASER USED FOR?

1. *The range of the lasers use is expanding with every passing year. The use of picosecond laser pulses will help to build faster and more powerful microchips, information circuits and computers by mapping more exactly the routes electrons take through semiconductor materials, the rates they travel and the effects of impurities.*

New lasers will help research on interactions among molecules in liquids.

Lasers are widely used in medicine. In Moscow an All Union Centre for Using Lasers in Surgery has been set up. Professor A. Vlishnevsky who used a small-capacity laser in stallation experimenting on animals made the first step in 1970.

Soviet scientists have produced Scalpel-1 installation which is widely used in our country and is exported to many other countries.

Lasers are used in biology and in agriculture. Soviet scientists, have developed a new instrument - the laser projection microscope (the work received the USSR State Prize). The tremendous brightness of laser radiation makes it possible to project clear images of microobjects onto large screens, magnified 15,000 times.

2. The high stability of any Edinburgh Instruments laser are highly desirable characteristics for infra-red interferometers used in testing distortion and deformation of transmitting materials, lenses and optical surfaces.

The PL series can be used in long term studies of atmospheric conditions, they are particularly suitable for pollution detection and monitoring.

Laser applications in industry are centered around cutting, drilling, welding and soldering operations. Lasers have many advantages over conventional machine tools. Laser machining is a non-contact process. This means that there is no material distortion, there are no tooling costs and no cutting fluid requirements, which means cleaner work areas and less time required for cleaning finished parts. There is no swarf,² since the material is evaporated and can be removed with an extractor fan. The excellent beam quality ensures the laser output can be focused to a small diameter spot (less than 50 microns) giving extremely high, localized intensities. Wastage is, eliminated by ensuring that a minimum of material is removed during machining operation.

A wide range of functions can be performed by the same laser, by using it in any of its three modes of operation: continuous beam, chopped or pulsed.

Notes to Text 2

1 . **Edinburgh Instruments** - (название фирмы)

2 . **swarf** — мелкая металлическая стружка

I. Translate the sentences marked with a sign *.

II. a) Give the Russian equivalents to the next terminal word combinations:

tuning range, frequency stability, high resolution molecular spectroscopy, double resonance, spin resonance, continuous beam

диапазон настройки, стабильность частоты, высоко разрешающая спектроскопия, двойной резонанс, непрерывный луч, резонансный спин

b) Translate the next attributive word combinations:

lasers produced, interferometers used, laser applications centered around, output focused, time required, material removed, function performed, material machined, wastage eliminated

III. a) What of listed methods refer to: 1) high resolution molecular spectroscopy, 2) solid body spectroscopy:

double resonance, spin resonance, magneto-optics, optical bistability, matrix isolation technique, non-linear optics, mixing, magnetic resonance, spin flip Raman scattering

b) Write in English the list of materials which can be laser processed.

HOLOGRAPHY

Lasers are also used in holography. A hologram is a three-dimensional image, a bit like a photograph. It's different from a photograph because it looks solid. As you walk round a hologram, it changes, as if it were real: objects seem to flow in space. Holography was discovered by Dennis Gabor in 1948, but until lasers were invented, Gabor did not have a strong enough light to make good holograms.

Now holography is used for testing engineering ideas. An engineer can use a hologram to build up and check a new building such as a bridge. He can find out all about it before he builds it. Structural engineers have been using holographic images to locate and measure stress flaws¹ in industrial parts such as aircraft engine turbine blades. First, a holographic image of the part is made under normal conditions. Then, after testing, a second hologram is compared with the original to indicate microscopic strains caused by heat, pressure, vibration or wear.

Notes to Text

1. stress flaws - трещины, вызванные напряжением

I. Read the text and give the title to it:

Projects are now being discussed in scientific literature of using high-power lasers for long-distance space communications, to the surface of the Moon and for the transmission of energy to space stations, to the surface of the Moon or to planets in the solar system. Projects have also been suggested of placing lasers aboard¹ artificial Earth satellites or on planets nearer to the Sun in order to transform the solar radiation into laser beams then transmitting this transformed energy to the Earth or to other space bodies.

FIAN's² station in the Crimea has built laser range-finding complexes. They measure the distances to the Moon with an error of not more than one or two centimeters. This precision has allowed the laser measurement of distances to the Moon to become a new method for exploring the Earth-Moon system.

Laser radiation has the property of selective excitation of atoms and molecules enabling laser isolation of isotopes. The first successful experiment in separating isotopes by laser was performed in the Soviet Union, at the Institute of Spectroscopy of the USSR Academy of Sciences, in 1972. This work was regarded by specialists as highly promising for power engineering and production of extra pure materials. Our country is in the lead of³ these new scientific and technical areas of laser applications headed by Academician Basov, Lenin and Nobel Prize winner.

Scientists in many countries now are working on a very interesting problem: combining the two biggest technological discoveries of the second half of the century - the laser and thermonuclear reaction — to produce a practically limitless source of energy. Laser can contribute to solving the problem of controlled thermonuclear reactions, even though⁴ it is evident that a lot of difficulties are to be encountered.

Notes to Text

1. **aboard** — на борту
2. **FIAN** — Физический институт, ФИАН
3. **is in the lead of** — занимает ведущее положение в
4. **even though** - даже если

II. a) Find in the text international words and translate them; b) form Nouns from Verbs:

to react, to communicate, to suggest, to transform, to explore, to separate, to select, to discuss

c) Reform the attributive clauses into Noun + Participle II combinations:

energy which is transformed = energy transformed

atom which transmits electron = atom transmitting electron

the work which specialists regard as highly promising

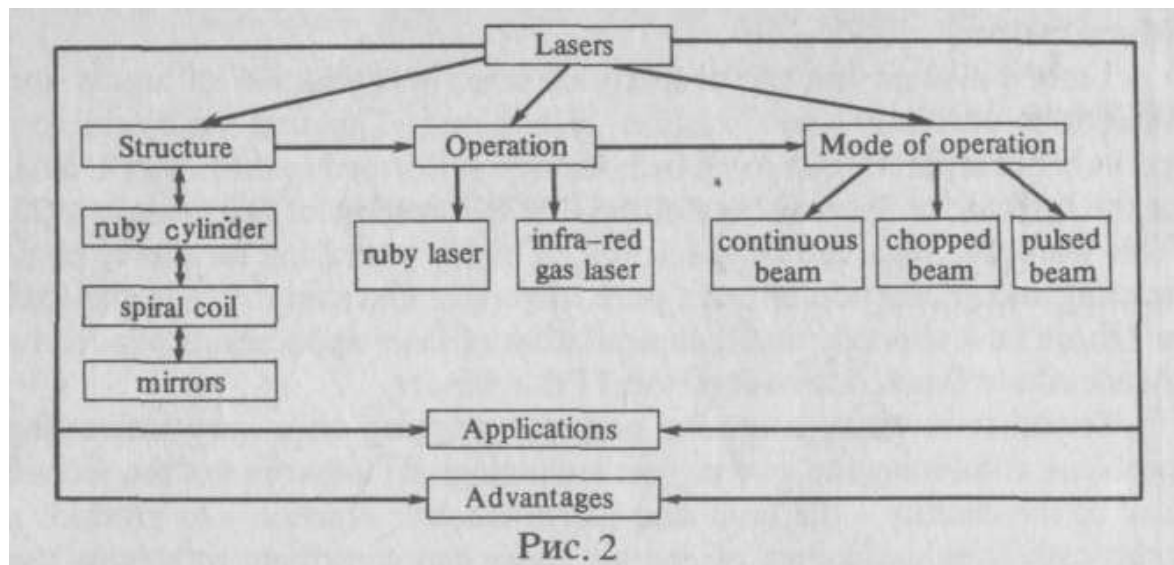
a new method which explores the Earth-Moon system

projects which are now discussed

distances which scientists measured

laser complexes which measure the distance to the Moon
 molecules which enables laser isolation of isotopes
 scientists which work on very interesting problem

III. Using the information from the text add and finish the table:



IV. Using the scheme, tell what you learnt about Lasers.

V. Translate the next extracts from laser documentation:

A. Specifications

Voltage 208 + 10%; 3 phase with ground Current 15 A per leg Water Service

Flow Rate, Min	9.5 l/min
Pressure, Min	2 kg/cm-
Pressure, Max	7 kg/cm ²
Temperature, Max	27 degrees C
Shipping Weight	164 kg

B. Danger!

visible and/or invisible laser radiation — avoid eye or skin exposure to direct or scattered radiation

C. Warranty.¹

Spectra Physics² products are protected by a one-year warranty except as noted below. All mechanical, electronic, and optical parts and assemblies are unconditionally warranted to be free from defects in workmanship³ and material for the first year following delivery.⁴ Spectra Physics will correct, either by repair or replacement, any defect in material or workmanship that develops in the crystal and the arc lamp within 90 days after delivery. The crystal will be repaired or replaced under warranty only after investigation and inspection by Spectra Physics has proven that the problem occurred during normal and proper use.

Lasers

Tuning-in

Task 1 What are lasers? List any applications you know for lasers.

Reading

Task 2 Read this text to check your answers to Task 1.

Lasers (Light Amplification by Stimulated Emission of Radiation) are devices which amplify light and produce beams of light which are very intense, directional, and pure in color. They can be solid state, gas, semiconductor, or liquid.

5 When lasers were invented in 1960, some people thought they could be used as 'death rays'. In the 1980s, the United States experimented with lasers as a defence against nuclear missiles. Nowadays, they are used to identify targets. But apart from military uses, they have many applications in engineering,

10 communications, medicine, and the arts.

In engineering, powerful laser beams can be focused on a small area. These beams can heat, melt, or vaporize material in a very precise way. They can be used for drilling diamonds, cutting complex shapes in materials from plastics to steel, for spot welding **15** and for surfacing techniques, such as hardening aircraft engine turbine blades. Laser beams can also be used to measure and align structures.

Lasers are ideal for communications in space. Laser light can carry many more information channels than microwaves because of its

20 high frequency. In addition, it can travel long distances without losing signal strength. Lasers can also be used for information recording and reading. Compact discs are read by lasers.

25 In medicine, laser beams can treat damaged tissue in a fraction of a second without harming healthy tissue. They can be used in very precise eye operations.

In the arts, lasers can provide fantastic displays of light. Pop concerts are often accompanied by laser displays.

Task 3 Complete this table of laser applications using information from the text

opposite. You may also add any applications you know of which are not included in the text.

Military	Engineering	Communications	Medicine	Arts
_____	drilling diamonds	_____	treating damaged	
_____			tissue	
	cutting complex shapes	information recording & reading		

Language study *used to/for*

Study these examples of laser applications:

- 1 Laser beams can be *used to measure* and align structures.
- 2 They can be *used for drilling* diamonds.
- 3 They can be *used for* light displays.

We can describe applications with *used to + infinitive* or *used for + -ing* or noun.

Task 4 Describe the applications of lasers using the information in your table in Task 3 and the structures given above.

Word Study *Noun + noun compounds*

We can use adjectives to describe an object in greater detail. For example:

light	<i>electric light</i>
a motor	<i>an electric motor</i>
steel	<i>stainless steel</i>
gears	<i>helical gears</i>

We can also use nouns. For example:

light	<i>laser light</i>
a motor	<i>an air motor</i>
steel	<i>carbon steel</i>
gears	<i>titanium gears</i>

Many relationships are possible in noun compounds. For example:

an air motor a motor which uses air
 carbon steel steel which contains carbon
 titanium gears gears made of titanium

Task 5 Put each of these examples in the correct column.

carbon blocks a power tool
 aluminum alloy a ball bearing
 carbon fibre a concrete beam
 a gas burner a diesel boat
 roller bearings a spring balance
 a circuit board a plastic tube
 a plastic pipe steel sheets
 magnesium alloy

uses	is made of	contains

Task 6 What new relationships can you find in the examples below?

Rewrite each compound to show the relationship. For example:

a foot pump *a pump which is operated by foot*
 a ribbon cable *a cable which is like a ribbon*
 a gear lever *a lever for operating gears*

- | | |
|--------------------------|----------------------------|
| 1 chain wheel | 6 college lecturer |
| 2 disc wheel | 7 toe-clip |
| 3 foot brake | 8 boiler thermostat |
| 4 a hand throttle | 9 safety helmet |
| 5 strain gauge | 10 aircraft engine |

Writing *Describing a process, 1: sequence*

When we write about a process, we have to:

- 1** Sequence the stages
- 2** Locate the stages
- 3** Describe what happens at each stage
- 4** Explain what happens at each stage

In this unit, we will study how to sequence the stages.

Consider these stages in the operation of a washing machine.

- 1** The drum is filled with water.
- 2** The water is heated to the right temperature.
- 3** Soap is added.
- 4** The drum is rotated slowly
- 5** The dirty water is pumped out.
- 6** Clean water is added.
- 7** The drum is rotated much faster and the water pumped out.
- 8** The clean clothes are removed.

Instead of numbers, we can show the correct order using sequence words.

First the drum is filled with water.

Then the water is heated to the right temperature.

Next soap is added.

After that, the drum is rotated slowly

Next the dirty water is pumped out.

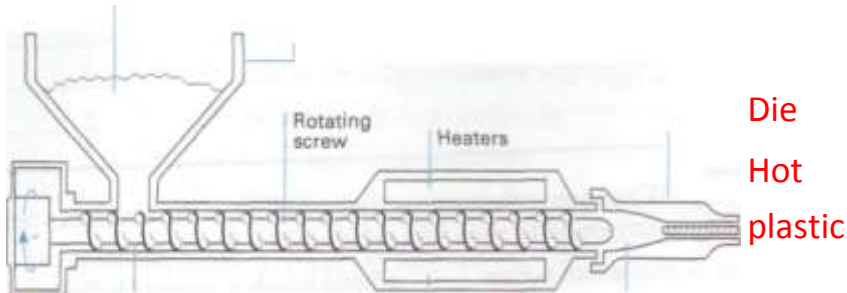
Then clean water is added.

After that, the drum is rotated much faster and the water pumped out.

Finally, the clean clothes are removed.

Study this diagram. It shows an extruder for forming plastic pipes. Describe the extruder.

Plastic granules Hopper



Plastic being forced into an extrusion die

Heaters

Die
Hot
plastic

Task 8

Now put these stages in the process in the correct sequence.

- The hot plastic is forced through the die to form a continuous length of pipe.
- The rotating screw forces the plastic past heaters.
- The plastic granules are mixed and placed in the hopper
- The pipe is cooled and cut to suitable lengths.
- The plastic melts.

Task 9

Describe the correct order using sequence words. Add to your description of the process your description of the extruder from Task 7 Form your text into a paragraph.

Technical reading *Laser cutting*

Task 10

Engineers have to read sales literature describing the products and services companies. Read the following sales literature to answer these questions:

- Who is this text for?
- What service does the company provide?
- What are the design benefits of laser cutting?
- Can lasers cut non-metals?
- What limitations are there on the service they provide?
- How does the service cut lead time?

Frustrated?

- By having to restrict designs to suit manufacturing processes?
- By the difficulty and high cost of producing accurate prototypes?
- By the high cost and lengthy lead times associated with press tools?
- By the high stock levels necessitated by minimum batch sizes?

If your answer to any of the above is yes ...

WE HAVE THE SOLUTION!

OUR NEW 1500 WATT CNC-CONTROLLED LASER CUTTER IS AT YOUR DISPOSAL.

■ The Process

Laser technology is not new, but it is only recently that the full benefits have become available to manufacturers.

Taking light and passing it through a series of lenses makes the light source so great that its power density is several million times that of the sun – this laser energy is then used to cut almost any material.

The light is directed down towards a CNC-controlled table making it very easy to produce accurate complicated shapes without distortion, giving burr-free, smooth, and perfectly square edges.

■ The Materials

The laser is suitable for cutting:

- All types of steel including stainless and spring steel.
- Most non-ferrous metals.
- Plastics, wood, fibreglass, and almost any other material you care to mention!

■ The Capacity

Carbon Steel – up to 13 mm

Stainless Steel – up to 10 mm

Plastics – up to 40 mm

Wood – up to 40 mm

Rubber – up to 40 mm

Table movement 1650 mm x 1250 mm

■ The Advantages

Short lead time

No tooling costs

Low set-up costs

Extremely accurate

Highest quality

Minimal heat affected zones

Design flexibility

Laser Technology

In the last decade there was outstanding progress in the development of laser technology and its application in science, industry and commerce. Laser cutting, welding and machining are beginning to be big business. The market for laser systems represents around 2.5 % of the world machine tool market.

Which country is the biggest producer and consumer of lasers? Why, Japan, naturally: Japan produced 46 % of world's lasers in 1989, while figures for Europe and the USA are 32 % and 22 %. Japan is building 1,200 to 2,000 CO₂ lasers per year of which some 95 % are over 500 W power and 80 % of them are used for cutting operations.

Europe is the second largest user and the third largest producer. In 1990 Europe's market for lasers was \$128 million, of which Germany consumed about \$51 million, and Italy — \$12 million. The Germany met 90 % of its demands through domestic producers. Growth rate of the European market is estimated at 10 to 15 % per year.

In the future the main trend influencing the industry will be laser source prices. The prices are dropping. There appear lasers of modular construction. The complexity of laser machines is rising. Multi-axes systems are in more use now. Recently a 7-axis CNC laser machining center has been introduced. In addition to X,Y and Z axes, there are two rotary axes, A and C, and two more linear axes, U and V, to give a trepanning (прорезать большие отверстия) motion to the laser.

Laser Propulsion

Another approach is to absorb laser light in a plasma «flame» sustained by laser light focused in the center of a flowing stream of propellant gas. Thrust levels as high as 10,000 N with a specific impulse (удельный импульс) of 1,000 sec appear achievable using hydrogen as the propellant gas. Laser power as low as 1 MW would be useful for low Earth orbit launching without relay optics. 10—100 MW lasers can launch small payloads from the ground. With up to 100 launches a day, a 20 MW launcher weighing 20 kg could place several hundred tons in orbit per year. Low-gigawatt lasers could launch multi-ton spacecraft with the same ease that present multi-gigawatt chemical rockets do. Laser rockets will have much better payload fraction since the heavy power plant is left on the ground and the higher specific impulse results in lower propellant fraction. Although gigawatt lasers are not off-the-shelf items, there is no doubt they could be built if the need were strong enough.

Read the text and try to understand the meaning of the word combination off-the-shelf item. Give the explanation to this term.