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L.Yu. Mirzoyeva, Zh.B. Erzhanova, Raiymkul Z.A.

PROFESSIONAL ORIENTED FOREIGN LANGUAGE

Study guide for students of speciality 5B071600 – Instrumentation for improvement on students' reading skills of scientific and technical texts

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Reviewers:
Doctor of Philology, associated professor, Suleyman Demirel University
M. S. Zholshaeva,
Candidate of philological sciences, associated professor, Kazakh National Pedagogical University named after Abay
M.K. Abayeva
Candidate of chemical sciences, associated professor, AUPET
G.S. Ospanova

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Mirzoyeva L.Yu., Erzhanova Zh.B., Raiymkul Z.A.
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This study guide is intended for intermediate students of English of the specialty 5B071600 "Instrumentation" for improvement on students' reading skills of scientific and technical texts.

The study guide deals with the basics of translation, lexical difficulties of translation of scientific and technical literature. Much attention is paid to the terminology, which makes it possible to increase the active vocabulary by specialty. It might be used in class with a teacher as well as a self-study book.

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Introduction

This study guide is intended for intermediate students of English of the specialty 5B071600 «Instrumentation». It might be used in class with a teacher as well as a self-study book.

There are two parts in this study guide. Each part looks at a particular area of instrumentation. The first part introduces a classical description of all the most important aspects of instrumentation, including the latest technological achievements in this field of study which actual nowadays, their names and their useful application we can meet everywhere. The second part touches history of invention of the well-known devices. From the second part students can learn about the people, the inventors of many machines and instruments we use in our daily life and in industry. That is very important as they should know the very beginning of all modern techniques, all the difficulties of their invention, the reasons why people so many years ago decided to have these devices and all the obstacles they met on that long way. This study guide introduces all the necessary terms and vocabulary modern engineer should be acquainted with working in the sphere of instrumentation, as sometimes and even more often students are informed about the process of work of these new devices and they are even surrounded by them wherever they go only there is a need of learning the terms in English.

This study guide can be very useful for students whose language of study is Kazakh. The vocabulary is built up in the alphabetical order, where students of Kazakh groups can also find the translation into two languages: Kazakh and Russian. This study guide is indispensable as a source for self-study assignments. Students can choose any text they like with the prepared vocabulary in three languages, this way their work will be more fruitful.

We hope that this study guide will help students to improve their English and broaden the number of terms for their future specialty.

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Part 1

Read and translate the text.

Flash memory

Electronic memory comes in a variety of forms to serve a variety of purposes. Flash memory is used for easy and fast information storage in such devices as digit cameras and home video game consoles. It is used more as a hard drive than as RAM. In fact, Flash memory is considered a solid state storage device. Solid state means that there are no moving parts – everything is electronic instead of mechanic.

Flash memory is a type of EEPROM chip. It has a grid of columns and rows with a cell that has two transistors at each intersection. The two transistors are separated from each other by a thin oxide layer. One of the transistors is known as a floating gate, and the other is the control gate. The floating gate’s only link to the row is through the control gate.

Flash memory is also known as Memory stick that is a small piece of equipment that you use for storing information or pictures from equipment such as a digital camera, a PDA, etc. Flash memory works much faster than tradition EEPROMs because instead of erasing one byte at a time, it erases a block or the entire chip, and then rewrites it.

There are several reasons to use Flash memory instead of a hard disk: Flash memory is noiseless, it allows faster access, it is smaller in size, it is lighter, and it has no moving parts. So why don’t we just use Flash memory for everything? We can’t do that, because the cost per megabyte for a hard disk is drastically cheaper, and the capacity is substantially more.

The solid-state floppy-disk card (SSFDC), better known as Smart Media, was originally developed by Toshiba. Smart Media cards are available in capacities ranging from 2 MB to 128 MB. The card itself is quite small, approximately 45 mm long, 37 mm wide and less than 1 mm thick. This is amazing when you consider what is packed into such a tiny package!

Smart Media cards erase, write and read memory in small blocks (256 or 512 byte increments). This approach means that they are capable of fast, reliable performance while allowing you to specify which data you wish to keep. They are less rugged than other forms of removable solid-state storage, so you should be very careful when handling and storing them.

Though standards are flourishing, there are many Flash memory products that are completely proprietary in nature, such as the memory cards in video game systems. But it is good to know that as electronic components become increasingly interchangeable and learns to communicate with each other (by way of technologies such as Bluetooth); standardized removable memory will allow you to keep your world close at hand.

Vocabulary.

Console - a surface on which you find the controls for a piece of electrical equipment or a machine (басқару пульті – basqary’ py’lti - пульт управления).

Drive - device for storing computer information (diskovod - дисковод).

EEPROM - a read-only memory whose contents can be erased and reprogrammed using a pulsed voltage (acronym from *electrically erasable programmable ROM*).

Electric field - a region around a charged particle or object within which a force would be exerted on other charged particles or objects (электр өрісі - elektr o’risi - электрическое поле).

Electron - an extremely small piece of matter with a negative electrical charge (electron - электрон).

Electronic - (of a device) having or operating with components such as microchips and transistors that control and direct electric currents (электрондық – elektrondyq - электронный).

Electronic memory - the part of a computer in which data or program instructions can be stored for retrieval (жады,есте сақтау құрылғысы - jady, este saqtay' qu'rylg'ysy - память, запоминающее устройство).

Flash memory - memory that retains data in the absence of a power supply.

Floating - not settled permanently; fluctuating or variable.

Floppy-disk card - a flexible removable magnetic disk (typically encased in a hard plastic shell) used for storing data (икімді диск - i'kimdi di'sk - гибкий диск).

Gate - an electric circuit with an output which depends on the combination of several inputs.

Hard drive - a disk drive used to read from and write to a hard disk (қатты диск - qatty di'sk - жесткий диск).

Video game - a game played by electronically manipulating images produced by a computer program on a television screen or display (бейне ойын- bei'ne oi'yn- видео игра).

Memory - the part of a computer in which information or programs are stored either permanently or temporarily, or the amount of space available on it for storing information (жады, есте сақтау құрылғысы - jady, este saqtay' qu'rylg'ysy - память, запоминающее устройство).

Memory Stick - a small piece of equipment that you use for storing information or pictures from equipment such as a digital camera, a PDA, etc. (жады картасы - jady kartasy - карта памяти).

Negative - containing, producing, or denoting the kind of electric charge carried by electrons.

RAM - random-access memory (Еркін іріктелген есте сақтау құрылғысы- Erkin iriktelgen este saqtay' qu'rylg'ysy - ЗУПВ запоминающее устройство с произвольной выборкой).

Oxide - a binary compound of oxygen with another element or group (тотығы - totyg'y-окись).

PDA - personal digital assistant (=a small computer that you can carry with you (КПК).

Sensor - a device which detects or measures a physical property and records, indicates, or otherwise responds to it (сенсор - sensor-датчик).

Transistor - a semiconductor device with three connections, capable of amplification in addition to rectification (tranzi'stor - транзистор).

Wiring - a system of wires providing electric circuits for a device or building ('электр сымдары - elektr symdary' - электропроводка).

Exercise 1. Answer the questions.

1. How do people use Flash Memory?
2. What is solid state?
3. What is EEPROM chip?
4. How do we call Flash Memory in other way?
5. Name all the advantages of using a Flash Memory.
6. Is it better using a Flash memory than a hard disk?
7. What is SSFDC?
8. Explain the work of Smart Media cards.
9. How do you understand ‘proprietary in nature’?
10. So why don’t we just use Flash memory for everything?

Exercise 2. Decide if the following statements are true or false.

1. Flash memory is considered a solid state storage device. T/F.
2. Flash memory is a type of EEPROM chip. T/F.
3. Flash memory is also known as Memory stick. T/F.
4. Flash Memory has no moving parts. T/F.
5. Flash Memory is noisy. T/F.
6. Smart Media was originally developed by Toshiba. T/F.
7. The card is rather big in size. T/F.
8. Smart Media cards are capable of fast, reliable performance. T/F.

Exercise 3. Find the synonyms in the following list of words.

Coat, monitoring, layer, control, site, removable, place, detachable.

Exercise 4. Find the antonyms in the following list of words:

Difficult, fast, easy, slow, heavy, precarious, lightweight, reliable.

Exercise 5. Give the translation of the following international words.

Information, video, transistor, control, system, disk, megabyte, chip, camera, computer, sensor, electronic, mechanic.

Read and translate the text.

Photoelectric sensor

A photoelectric sensor, or photo eye, is equipment used to discover the distance, absence, or presence of an object by using a light transmitter, often infrared, and a photoelectric receiver. They are largely used in industrial manufacturing. There are three different useful types: opposed (through beam), retro-reflective and proximity-sensing (diffused).

A self-contained photoelectric sensor contains the optics, along with the electronics. It requires only a power source. The sensor performs its own modulation, demodulation, amplification, and output switching. Some self-contained sensors provide such options as built-in control timers or counters. Because of technological progress, self-contained photoelectric sensors have become increasingly smaller.

Remote photoelectric sensors used for remote sensing contain only the optical components of a sensor. The circuitry for power input, amplification, and output switching are located elsewhere, typically in a control panel. This allows the sensor, itself, to be very small. Also, the controls for the sensor are more accessible, since they may be bigger.

A through beam arrangement consists of a receiver located within the line-of-sight of the transmitter. In this mode, an object is detected when the light beam is blocked from getting to the receiver from the transmitter.

A retro-reflective arrangement places the transmitter and receiver at the same location and uses a reflector to bounce the light beam back from the transmitter to the receiver. An object is sensed when the beam is interrupted and fails to reach the receiver.

A proximity-sensing (diffused) arrangement is one in which the transmitted radiation must reflect off the object in order to reach the receiver. In this mode, an object is detected when the receiver sees the transmitted source rather than when it fails to see it. As in retro-reflective sensors, diffuse sensor emitters and receivers are located in the same housing. But the target acts as the reflector, so that detection of light is reflected off the disturbance object. The emitter sends out a beam of light (most often a pulsed infrared, visible red, or laser) that diffuses in all directions, filling a detection area.

Vocabulary.

Arrangement - a group of objects that have been put in a particular order or position (орналасуы - ornalasuy' - расположение).

Circuit - a closed system of wires or pipes through which electricity or liquid can flow (тізбек, сызба - tizbek, syzba - цепь, схема).

Circuitry - the *circuits* that an electrical or electronic device contains, considered as a single system (сызба – syzba - схема).

Counter - a person or machine that counts (есептегіш – eseptegish - счетчик).

Demodulate - extract or separate (a modulating signal) from its carrier (демодуляциялау - demody'lyaci'lay' - демодулировать).

Diffuse - to (cause something) spread in many directions (таралуы –taraly'y - распространяться).

Electronics - the scientific study of electric current and the *technology* that uses it (электроника – elektronika - электроника).

Emit - produce and discharge (something, especially gas or radiation) (тарату, бөлу, шығару - taraty', bo'ly', shyg'ary' - излучать, выделять, издавать).

Emitter - a thing which emits something; in *electronics* it is the region in a bipolar transistor that produces carriers of current (emi'tter - эмиттер).

Housing - a rigid casing that encloses and protects a piece of moving or delicate equipment (korpy's - корпус).

Infrared - (of electromagnetic radiation) having a wavelength just greater than that of the red end of the visible light spectrum but less than that of microwaves. Infrared radiation has a wavelength from about 800 nm to 1 mm, and is emitted particularly by heated objects (инфрақызыл - infraqy'zy'l - инфракрасный).

Input- in *electronics* it is a place where, or a device through which, energy or information enters a system (кіріс деректері, кіріс сигналы, су асты қуаты - kiris -derekteri, kiris si'gnaly, sy' asty' qy'aty - входные данные, входной сигнал, подводимая мощность).

Modulate - alter the amplitude or frequency of (an electromagnetic wave or other oscillation) in accordance with the variations of a second signal, typically one of a lower frequency (модульдеу - mody'ldey'- модулировать).

Optics - the scientific study of sight and the behavior of light, or the properties of transmission and deflection of other forms of radiation (opti'ka-оптика).

Output - in *electronics* it is a place where power or information leaves a system (қуат, шығушы ақпарат-qy'at, shyg'y'shy' aqparat - мощность, выходящая информация).

Photoelectric - characterized by or involving the emission of electrons from a surface by the action of light (фотоэлектрлік – fotoelektlik - фотоэлектрический).

Proximity - nearness in space, time, or relationship (жақындық, көршілес - jaqyndyq, ko'rshiles - близость, соседство).

Receiver - a piece of radio or television apparatus that detects broadcast signals and converts them into visible or audible form (радио қабылдағыш -radi'o qabyldag'ysh - радио приемник).

Reflector - an object or device which reflects radio waves, seismic vibrations, sound, or other waves (reflector - рефлектор).

Remote - (of an electronic device) operating or operated at a distance by means of radio or infrared signals (шалғай - shalg'ai' - отдаленный).

Retro reflector - a device which reflects light back along the incident path, irrespective of the angle of incidence (ретро шағылыстырғыш - retro shag'ylysty'rg'y'sh - ретро отражатель).

Self-contained - (of a thing) complete, or having all that is needed, in itself (жеке – jeke - отдельный).

Sensor - a device which is used to record that something is present or that there are changes in something (сенсор - sensor-датчик).

Timer - an automatic mechanism for activating a device at a present time (уақыт белгісі, таймер - y'aqyt belgisi, tai'mer - отметчик времени, таймер).

Transmitter - a set of equipment used to generate and transmit electromagnetic waves carrying messages or signals, especially those of radio or television (таратқыш, таратушы радиостанция - taratqysh, taraty'shy radiostanci'ya - передатчик, передающая радиостанция).

Exercise 1. Answer the questions.

1. What is photoelectric sensor?
2. Photo eye and photoelectric sensor, are they the same?
3. What are the main components of photoelectric sensor?
4. What is the typical color of light transmitter?
5. Where do people use such equipment?
6. How many types of photoelectric sensors can you name?
7. Name the functions of self-contained photoelectric sensor.
8. What is special about remote photoelectric sensors?
9. How is a retro-reflective arrangement constructed?
10. What can you say about a proximity-sensing (diffused) arrangement?

Exercise 2. Find the nouns among this list of words.

Sensor, equipment, light, optics, electronics, modulation, amplification, perform, provide, progress, counter, timer, remote, smaller, power, input, output, accessible, transmitter, reflect, receiver, rather, emitter, reflector, detection.

Exercise 3. Decide if the following statements are true or false.

1. Photo eye is used to discover only the distance of an object. T/F.
2. Photo eye uses a light transmitter and photoelectric receiver. T/F.
3. A light transmitter is often infrared. T/F.
4. Timers and counters are self-contained sensors. T/F.
5. Remote photoelectric sensors are very small. T/F.
6. In a through beam arrangement the light beam is blocked. T/F.
7. In a retro-reflective arrangement the beam is interrupted. T/F.
8. In a proximity-sensing arrangement radiation reflects off the object. T/F.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. There was a striking arrangement of dried flowers on the table.
2. Television is a powerful means of diffusing knowledge.
3. The alarm emits infra-red rays which are used to detect any intruder.
4. The machine emits a high-pitched sound when you press the button.
5. Infrared optical system shows images clearly even at night.
6. Last year British manufacturing output fell by 14%.
7. Photocells are used in burglar alarms.
8. Her manner was remote and cool.
9. He set the timer on the oven to/for 20 minutes.

Read and translate the text.

Motion sensor

Motion sensor is a non-contact sensor that captures the movement of objects and uses them to monitor the environment or automatically trigger the necessary actions in response to moving objects.

The motion detector is a device or function of a television security system that generates an alarm when motion is detected in the field of view of the video camera.

Motion sensors are widespread, and analysts expect growth of their use by another 13% - 14% annually until 2020. The use of motion and presence sensors in homes and offices, as specialists predict, will grow at the same time by 20% per year, with the greatest growth expected in Europe and Russia, primarily in the field of protection from foreign intrusion and in other aspects of home automation.

Motion and presence sensors are widely used independently or as part of security systems to detect the penetration of buildings, as well as to automate lighting and climate technology (heating and air conditioning) in apartments, homes and commercial real estate.

The work of the motion sensor is based on the analysis of waves of various types (acoustic, optical or radio waves) coming to the sensor from the environment. Depending on the type of wave used, the motion sensors are divided into: infrared, ultrasonic, photovoltaic (in which conventional light is used), microwave, tomography (where radio waves are used).

Depending on whether the sensor itself initiates these waves and analyzes them after reflection or only receives waves from the outside world, the sensors are divided into: active, passive, combined (when one part of the sensor sends waves and separated from the second receives them).

Most existing motion sensors are a combination of these criteria, and sensors of the same type of waves typically use one mechanism for their creation and processing. The most common are: Passive Infrared Sensor (PIR), the most affordable and common motion sensor in principle, infrared sensors are about 50%

of the world’s motion sensors, active ultrasonic, microwave and tomography sensors, and combined photoelectric and infrared sensors.

We have to notice, that each mechanism has its own inaccuracies, from time to time allowing false alarms. To reduce the likelihood of false positives, sensors sometimes combine two technologies in one device (for example, infrared and ultrasonic). However, this in turn increases the sensitivity of the sensor, as it becomes less sensitive and may not work as a result even when it should.

Vocabulary.

Acoustic - relating to sound or hearing (дыбыстық -aky'sti'kalyq, dybystuq - акустический, звуковой).

Affordable - not expensive (құны бойынша қолайлы - qu'ny boi'ynsha qolai'ly - подходящий по стоимости).

Active - busy with or ready to perform a particular activity (белсенді – belsendi - активный).

Annual - happening once every year, or relating to a period of one year (жылдық – jyldyq - ежегодный).

Capture - to record or take a picture of something using a camera (камераға жазу - kamerag'a jazy'-записать на камеру).

Combine - to (cause to) exist together, or join together to make a single thing or group; to do two activities at the same time (біріктіру - biriktiry' - объединять, комбинировать, сочетать).

Inaccuracy - the quality or state of not being accurate; an aspect of something that is not accurate (дәлсіздік - da'lsizdik - неточность).

Likelihood - the chance that something will happen (ықтималдығы - yqti'maldyg'y - вероятность).

Microwave - a very short *electromagnetic* wave used for cooking food or for sending information by radio or *radar* (микротолқын – mi’krotolqyn - микроволна).

Passive - not acting to influence or change a situation; allowing other people to be in control (пассивтік – passi’vtik - пассивный).

Radio wave - an electromagnetic wave of a frequency between about 10^4 and 10^{11} or 10^{12} Hz, as used for long-distance communication (радиотолқын – radiotolqyn – радиоволна).

Tomography - a technique for displaying a representation of a cross section through a human body or other solid object using X-rays or ultrasound (tomografi’a - томография).

Trigger - cause (a device) to function (шақыру – s’aqyry’ - вызывать, влечь за собой).

Ultrasound - special sound waves used in such processes as examining organs inside the body and directing the path of *submarines*; an ultrasound *scan* (ультрадыбыс – ultradybys - ультразвук).

Wave - the pattern in which some types of energy, such as sound, light and heat, are spread or carried (толқын – tolqyn - волна).

Widespread - existing or happening in many places and/or among many people (кең тараған – ken’ tarag’an - распространенный).

Exercise 1. Answer the questions.

1. How do people use motion sensors?
2. What does the motion sensor consist of?
3. What is the purpose of the motion sensor?
4. Explain the work of the motion sensor.
5. Is it expected that there will be an increase of their use?
6. Are there any inaccuracies in their work?

Exercise 2. Find nouns in the following list of words.

Ultrasound, infrared, motion, wave, active, microwave, tomography, passive, radio wave, capture, alarm, widespread, detect, initiate, separate, combined, photoelectric, ultrasonic, affordable, device.

Exercise 3. Decide if the following statements are true or false.

1. Motion sensor is a non-contact sensor. T/F.
2. The motion detector is a device of a television security system. T/F.
3. Motion sensors are widespread. T/F.
4. The work of the motion sensor is based on the analysis of waves. T/F.
5. Motion sensors are divided into: infrared, ultrasonic, photovoltaic. T/F.
6. Sensors can also be divided into: active, passive and combined. T/F.
7. PIR means Passive Infrared Sensor. T/F.
8. Each mechanism has its own inaccuracies. T/F.
9. Sensors sometimes combine two technologies in one device. T/F.

Exercise 4. Find the right definition for the following terms: radio waves, microwaves, ultrasound, infrared radiation, motion sensor.

1. What device captures the movement of objects and uses them to monitor the environment or automatically triggers the necessary actions in response to moving objects?

2. How do we call a form of electromagnetic radiation with wavelengths ranging from one meter to one millimeter; with frequencies between 300 MHz (100 cm) and 300 GHz (0.1 cm)?

3. What radiation is invisible and extends from the nominal red edge of the visible spectrum at 700 nanometers (frequency 430 THz) to 1 mm (300 GHz)?

4. What waves have frequencies as high as 300 GHz to as low as 3 kHz and may include waves of any lower frequency?

5. What waves can have frequencies higher than the upper audible limit of human hearing?

Read and translate the text.

Multimeter

A multimeter is an electronic measuring instrument that combines several measurement functions in one unit. A typical multimeter can measure voltage, current and resistance. Analog multimeters use a micro ammeter with a moving pointer to display readings. Digital multimeters have a numeric display, and may also show a graphical bar representing the measured value. Digital multimeters are now far more common due to their cost and precision, but analog multimeters are still preferable in some cases, for example when monitoring a rapidly varying value.

A multimeter can be a hand-held device useful for basic fault finding and field service work, or a bench instrument which can measure to a very high degree of accuracy. They can be used to troubleshoot electrical problems in a wide array of industrial and household devices such as electronic equipment, motor controls, domestic appliances, power supplies, and wiring systems.

General properties of multimeters are very different. High quality analog (analogue) multimeters continue to be made by several manufacturers, including Chauvin Arnaux (France), Gossen Metrawatt (Germany), and Simpson and Triplett (USA).

Pocket watch style meters were in widespread use in the 1920s.The metal case was typically connected to the negative connection, an arrangement that caused numerous electric shocks. The technical specifications of these devices were often crude.

Vacuum tube voltmeters or valve voltmeters (VTVM, VVM) were used for voltage measurements in electronic circuits where high input impedance was necessary. The VTVM had fixed input impedance of typically 1 megohm or more, usually through use of a cathode follower input circuit, and thus did not significantly load the circuit being tested. VTVMs were used before the introduction of electronic high-impedance analog transistor and field effect transistor voltmeters (FETVOMs).

Additional scales such as decibels, and measurement functions such as capacitance, transistor gain, frequency, duty cycle, display hold, and buzzers which sound when the measured resistance is small have been included on many multimeters. While multimeters may be supplemented by more specialized equipment in a technician's toolkit, some multimeters include additional functions for specialized applications.

A multimeter is a combination of a multi-range DC voltmeter, multi-range AC voltmeter, multi-range ammeter, and multi-range ohmmeter. An un-amplified multimeter combines a meter movement, range resistors and switches; VTVMs are amplified analog meters and contain active circuitry.

For an analog meter movement, DC voltage is measured with a series resistor connected between the meter movement and the circuit under test. A switch (usually rotary) allows greater resistance to be inserted in series with the meter movement to read higher voltages. The product of the basic full-scale deflection current of the movement, and the sum of the series resistance and the movement's own resistance, gives the full-scale voltage of the range.

To measure alternating current, which changes up and down repeatedly a rectifier is inserted in the circuit so that each negative half cycle is inverted; the result is a varying and non-zero DC voltage whose maximum value will be half the AC peak to peak voltage, assuming a symmetrical waveform. Since the rectified average value and the root-mean-square value of a waveform are only the same for a square wave, simple rectifier-type circuits can only be calibrated for sinusoidal waveforms. Other wave shapes require a different calibration factor to relate RMS and average value. This type of circuit usually has fairly limited frequency range. Since practical rectifiers have non-zero voltage drop, accuracy and sensitivity is poor at low AC voltage values. To measure resistance, switches arrange for a small battery within the instrument to pass a current through the device under test and the meter coil. Since the current available depends on the state of charge of the battery which changes over time, a multimeter usually has an adjustment for the ohms' scale to zero it. In the usual circuits found in analog multimeters, the meter deflection is inversely proportional to the resistance, so full-scale will be 0 ohms, and higher resistance will correspond to smaller deflections. The ohms' scale is compressed, so resolution is better at lower resistance values.

Vocabulary.

Ammeter - a device for measuring the strength of an electric current in units called AMPS (амперметр – ampermetr - амперметр).

Capacitance - (in physics) the ability of a system to store an electric charge (сыйымдылық – si'ymydylyq - емкость).

Current - a movement of water, air or electricity, in a particular direction (ток – tok - ток).

Decibel - a unit for measuring the loudness of sound (децибел – dici'bel - децибел).

Deflection - a change of direction (ауытқу – ay'ytqy' - отклонение).

Inverse - opposite or contrary in position, direction, order, or effect (кері, қарама-қарсы – keri, qarama-qarsy - обратный, противоположный).

Invert - to turn something upside down or change the order of two things (аудару – ay'dary' - переворачивать).

Multimeter - an instrument designed to measure electric current, voltage, and usually resistance, typically over several ranges of value (мультиметр – my'lti'metr - мультиметр).

Rectifier - an electronic device for changing AC to DC (түзету – tuzety' - выпрямитель).

Troubleshoot - analyze and solve serious problems for a company or other organization; trace and correct faults in a mechanical or electronic system (жанжалдарды шешуге жауапты қызметкер – janjaldardy sheshy’ge jay’apty qyzmetker - уполномоченный по улаживанию конфликтов).

Value - the numerical amount denoted by an algebraic term: a magnitude, quantity, or number (шамасы – shamasy - величина).

Voltage - the force of an electric current, measured in volts (кернеуі – kerney’i - напряжение).

Exercise 1. Answer the questions.

1. What is a multimeter?
2. What types of multimeters can you name?
3. Were pocket watch style meters ideal in 1920s?
4. What is VTVM?
5. What is FETVOM?
6. What is a buzzer?
7. What important parts does a multimeter combine?
8. What are the functions of a rectifier?
9. How can we measure resistance?

Exercise 2. Give the translation of the following international words.

Multimeter, element, instrument, analog, type, electronics, style, metal, electric shock, transistor, voltmeter, product, cycle, battery.

Exercise 3. Decide if the following statements are true or false.

1. A multimeter combines several measurement functions in one unit. T/F.
2. A typical multimeter measures only voltage. T/F.
3. A multimeter is a hand-held device. T/F.
4. Pocket watch style meters appeared in 1920. T/F.
5. AC is an alternating current. T/F.
6. A multimeter usually has an adjustment for the ohms’ scale. T/F.
7. VTVMs are amplified analog meters. T/F.

*Exercise 4***.** Translate the following sentences using the key vocabulary above.

1. The second goal was from a deflection off the Liverpool captain.
2. Journalists were frustrated by her constant deflection of their questions.
3. The larger cars have bigger capacity engines (more powerful engines).
4. Cover the bowl with an inverted plate.
5. Every effort is made to rectify any errors before the book is printed.
6. What is the value of the prize?
7. The typical lawn mower makes about 90 decibels of noise.

Read and translate the text.

Transducer

A transducer is a device that converts energy from one form to another. Usually a transducer converts a signal in one form of energy to a signal in another. Transducers are often employed at the boundaries of automation, measurement, and control systems, where electrical signals are converted to and from other physical quantities (energy, force, torque, light, motion, position, etc.). The process of converting one form of energy to another is known as transduction.

Mechanical and electrical transducers are transducers that convert physical quantities into mechanical ones and are called mechanical transducers. Transducers that convert physical quantities into electrical are called electrical transducers. Examples are a thermocouple that changes temperature differences into a small voltage, or a linear variable differential transformer (LVDT) used to measure displacement.

What are sensors and actuators? Transducers can be categorized by which direction information passes through them. A *sensor* is a transducer that receives and responds to a signal or stimulus from a physical system. It produces a signal, which represents information about the system, which is used by some type of telemetry, information or control system.

An *actuator* is a device that is responsible for moving or controlling a mechanism or system. It is controlled by a signal from a control system or manual control. It is operated by a source of energy, which can be mechanical force, electrical current, hydraulic fluid pressure, or pneumatic pressure, and converts that energy into motion. An actuator is the mechanism by which a control system acts upon an environment. The control system can be simple (a fixed mechanical or electronic system), software-based (e.g. a printer driver, robot control system), a human, or any other input.

Bidirectional transducers convert physical phenomena to electrical signals and convert electrical signals into physical phenomena. An example of an inherently bidirectional transducer is an antenna, which can convert radio waves (electromagnetic waves) into an electrical signal to be processed by a radio receiver, or translate an electrical signal from a transmitter into radio waves. Another example is voice coils, which are used in loudspeakers to translate an electrical audio signal into sound and in dynamic microphones to translate sound waves into an audio signal.

Passive sensors require an external power source to operate, which is called an excitation signal. The signal modulated by the sensor produces an output signal. For example, a thermistor does not generate any electrical signal, but by passing an electric current through it, its resistance can be measured by detecting variations in the current or voltage across the thermistor.

Active sensors, in contrast, generate an electric current in response to an external stimulus, which serves as the output signal without the need of an additional energy source. Such examples are a photodiode, and a piezoelectric sensor, thermocouple.

Dynamic range denotes the ratio between the largest amplitude signal and the smallest amplitude signal the transducer can effectively translate. Transducers with larger dynamic range are more "sensitive" and precise.

Repeatability is the ability of the transducer to produce an identical output when stimulated by the same input.

Noise. All transducers add some random noise to their output. In electrical transducers, this may be electrical noise due to thermal motion of charges in circuits. Noise corrupts small signals more than large ones.

Hysteresis. The property in which the output of the transducer depends on is not only on its current input but also on its past input. For example, an actuator, which uses a gear train, may have some backlash, which means that if the direction of motion of the actuator reverses, there will be a dead zone before the output of the actuator reverses, caused by play between the gear teeth.

Vocabulary.

Actuate - make (a machine or device) operate (әрекет ету – a’reket ety’ – приводить в действие, побуждать).

Backlash - recoil arising between parts of a mechanism; degree of play between parts of a mechanism (реакция – reaktsiya – реакция).

Excitation - the application of a signal voltage to the control electrode of an electron tube or the base of a transistor (қозу – qozy’ – возбуждение).

Gear train - a system of gears which transmits motion from one shaft to another (редуктор – redy’ktor – зубчатая передача).

Hysteresis - (in Physics) the phenomenon in which the value of a physical property lags behind changes in the effect causing it, as for instance when magnetic induction lags behind the magnetizing force (гистерезис – gisterezis – гистерезис).

Inherent - existing in something as a permanent, essential, or characteristic attribute (тән – ta’n – свойственный, присущий, неотъемлемый).

Piezoelectricity - electric polarization in a substance (especially certain crystals) resulting from the application of mechanical stress. Piezoelectric substances are able to convert mechanical signals (such as sound waves) into electrical signals, and vice versa. They are therefore widely used in microphones, gramophone pickups, and earphones, and also to generate a spark for lighting gas (пьезоэлектрлік – pezoelektrlik – пьезоэлектричество).

Reverse - move backwards; (of an engine) work in a contrary direction (сақтық көшірмесін жасау – saqtyq ko’shi’rmesin jasay’ – давать задний ход).

Thermistor - an electrical resistor whose resistance is greatly reduced by heating, used for measurement and control (термистор – termistor – термистор).

Thermocouple - a thermoelectric device for measuring temperature, consisting of two wires of different metals connected at two points, a voltage being developed between the two junctions in proportion to the temperature difference (термопара – termopara – термопара).

Transducer - a device that converts variations in a physical quantity, such as pressure or brightness, into an electrical signal, or vice versa (түрлендіргіш – turlendirgish – преобразователь).

Torque - (in Mechanics) a force that tends to cause rotation (айналдырғыш – ai’naldyrgysh – вращающий момент).

Exercise 1. Answer the questions.

1. What is a transducer?
2. What are the functions of a transducer?
3. What are sensors and actuators?
4. What are the functions of bidirectional transducers?
5. What is an excitation signal?
6. What are the examples of active sensors?
7. Which transducers are more “sensitive” and precise?
8. What can you say about repeatability?
9. Can transducers cause noise?
10. Does noise corrupt signals?

Exercise 2. Find the nouns in the following list of words.

Signal, convert, transduction, generate, represent, displacement, control, dynamic, voltage, quantity, current.

Exercise 3. Decide if the following statements are true or false.

1. Transduction is converting of one form of energy to another. T/F.
2. LVDT is a linear variable differential transformer. T/F.
3. Sensor can receive and respond to a signal. T/F.
4. Actuator can move or control a mechanism or system. T/F.
5. Actuator helps a control system act upon an environment. T/F.
6. An antenna is an example of a bidirectional transducer. T/F.
7. The signal modulated by the sensor produces an output signal. T/F.
8. Not all transducers add some random noise to their output. T/F.
9. Noise corrupts small signals more than large ones. T/F.

Exercise 4. Translate the following sentences using the key vocabulary of the text.

1. What’s the formula for converting pounds into kilos?
2. It’s quality not quantity that really counts.
3. I’d never seen him in smart clothes before- it was quite a transformation.
4. The firework was a signal that the festival had started.

5. Flashing lights on a parked car usually signal a warning.
6. These automatic cameras have a special focusing mechanism.
7. Gravity is a natural phenomenon.
8. Using a single chip reduces noise on the output signal by 90%.
9. When you start a car you need to be in first/low gear.

Read and translate the text.

Sensor

In the broadest definition, a sensor is a device, module, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor. A sensor is always used with other electronics, whether as simple as a light or as complex as a computer.

Sensors are used in everyday objects such as touch-sensitive elevator buttons (tactile sensor) and lamps which dim or brighten by touching the base, besides innumerable applications of which most people are never aware. With advances in micro machinery and easy-to-use microcontroller platforms, the uses of sensors have expanded beyond the traditional fields of temperature, pressure or flow measurement, for example into MARG sensors. Moreover, analog sensors such as potentiometers and force-sensing resistors are still widely used. Applications include manufacturing and machinery, airplanes and aerospace, cars, medicine, robotics and many other aspects of our day-to-day life.

A sensor's sensitivity indicates how much the sensor's output changes when the input quantity being measured changes. For instance, if the mercury in a thermometer moves 1 cm when the temperature changes by 1 °C, the sensitivity is 1 cm/°C. Some sensors can also affect what they measure; for instance, a room temperature thermometer inserted into a hot cup of liquid cools the liquid while the liquid heats the thermometer. Sensors are usually designed to have a small effect on what is measured; making the sensor smaller often improves this and may introduce other advantages. Technological progress allows more and more sensors to be manufactured on a microscopic scale as micro sensors using MEMS technology. In most cases, a micro sensor reaches a significantly higher speed and sensitivity compared with macroscopic approaches. There are several paths to determining a fan design for an application. For industries where the application requirements do not vary greatly and applicable fan designs have diameters of around 4 feet (1.2 meters) or less, a standard or pre-engineered design might be selected. All living organisms contain biological sensors with functions similar to those of the mechanical devices described. Most of these are specialized cells that are sensitive to: light, motion, magnetic fields, gravity, humidity, moisture, vibration, pressure, electrical fields, sound, and other physical aspects of the external environment, physical aspects of the internal environment, such as stretch, motion of the organism, environmental molecules, including toxins, nutrients, and pheromones, estimation of bio molecular interaction and some kinetics parameters, internal metabolic indicators, such as glucose level, oxygen level, signal molecules, such as hormones, neurotransmitters, and cytokines.

A chemical sensor is a self-contained analytical device that can provide information about the chemical composition of its environment, that is, a liquid or a gas phase. The information is provided in the form of a measurable physical signal that is correlated with the concentration of a certain chemical species. Two main steps are involved in the functioning of a chemical sensor, namely, recognition and transduction. In the recognition step, analyte molecules interact selectively with receptor molecules or sites included in the structure of the recognition element of the sensor. Consequently, a characteristic physical parameter varies and this variation is reported by means of an integrated transducer that generates the output signal. A chemical sensor based on recognition material of biological nature is a biosensor. However, as synthetic biomimetic materials are going to substitute to some extent recognition biomaterials, a sharp distinction between a biosensor and a standard chemical sensor is superfluous. Typical biomimetic materials used in sensor development are molecularly imprinted polymers and aptamers.

In biomedicine and biotechnology, sensors which detect analytes thanks to a biological component, such as cells, protein, nucleic acid or biomimetic polymers, are called biosensors. Whereas a non-biological sensor, even organic (=carbon chemistry), for biological analytes is referred to as sensor or nanosensor. This terminology applies for both in-vitro and in vivo applications. The encapsulation of the biological component in biosensors, presents a slightly different problem that ordinary sensors; this can either be done by means of a semi permeable barrier, such as a dialysis membrane or a hydrogel, or a 3D polymer matrix, which either physically constrains the sensing macromolecule or chemically constrains the macromolecule by bounding it to the scaffold.

Vocabulary.

Biomimetic - relating to or denoting synthetic methods which mimic biochemical processes.

Biosensor - a device which uses a living organism or biological molecules, especially enzymes or antibodies, to detect the presence of chemicals (биодатчик-bi’odatchi’k - биодатчик).

Constrain - compel or force (someone) to follow a particular course of action (мәжбүрлеу,күштеу,шектету – ma’jbirley’,kushtey’, shektety’ - принуждать, заставлять, вынуждать, ограничивать).

Dialysis - (in Chemistry) the separation of particles in a liquid on the basis of differences of their ability to pass through a membrane (диализ – di’ali’z - диализ).

Hydrogel - a gel in which the liquid component is water (гидрогель – gi’drogel - гидрогель).

Permeable - (of a material or membrane) allowing liquids or gases to pass through it (өткізкіш – o’tkizkish - проницаемый).

Polymer - (in Chemistry) a substance which has a molecular structure built up chiefly or completely from a large number of similar units bonded together, e.g. many synthetic organic materials used as plastics or resins (полимер – poli’mer - полимер).

Recognition - the action or process of recognizing or being recognized, in particular; identification of a thing or person from previous encounters or knowledge (тану – tany’ - опознавание).

Scaffold - a raised wooden platform used formerly for the public execution of criminals; a temporary structure on the outside of a building, made of wooden planks and metal poles, used by workmen while building, repairing, or cleaning the building (эшафот, орманмен құру – eshafot, ormanmen qury’ - эшафот, обстраивать лесами).

Sensor - a device which detects or measures a physical property and records, indicates, or otherwise responds to it (датчик – datchi’k - датчик).

Superfluous - unnecessary, especially through being more than enough (артық – artyq - излишний).

Tactile - of or connected with the sense of touch; designed to be perceived by touch (сезетін, тактикалық – sezetin, takti’kaly’q - осязательный, тактильный).

Exercise 1. Answer the questions.

1. What is sensor?
2. How do people use sensors?
3. What is sensor’s sensitivity?
4. Are there natural sensors?
5. What is a chemical sensor?
6. In what other fields do people apply sensors?
7. Do you use sensors in your life? How?

Exercise 2. Decide if the following statements are true or false.

1. Sensor is always used with other electronics. T/F.
2. Analog sensors are still widely used. T/F.
3. Potentiometers, force-sensing resistors are types of analog sensors. T/F.
4. Some sensors can also affect what they measure. T/F.
5. All living organisms contain biological sensors. T/F.
6. A chemical sensor is a biosensor. T/F.
7. Non-biological sensor is nanosensor. T/F.

Exercise 3. Translate the following sentences using the key words from the text above.

1. The sensitivity of the machine provides us with extremely accurate data.
2. Her paintings have a very tactile quality.

3. Modern technology is amazing, isn't it?
4. One of the side effects of the drug is an increased sensitivity to sunlight.
5. The country's progress was constrained by its leader.
6. Certain types of sandstone are permeable to water.
7. Chalk has a high permeability (=liquids easily pass through it).

Read and translate the text.

Optical sensor

Optical sensors are small-sized electronic devices capable of applying a single or a set of signals to the input of the recording or control system under the influence of electromagnetic radiation in the visible, infrared and ultraviolet ranges. Optical sensors react to opaque and translucent objects, water vapor, smoke, aerosols.

Optical sensors are a type of non-contact sensors, since there is no mechanical contact between the sensor's sensitive area (sensor) and the affected object. This property of optical sensors determines their wide application in automated control systems. The range of optical sensors is much greater than that of other types of contactless sensors.

Optical sensors are also called optical proximity switches, photo sensors, and photoelectric sensors. Here are some device types and operating principles of sensors. By type of device optical sensors are divided into mono-block and two-block. The mono-block emitter and receiver are in the same housing. Two-block sensors have a radiation source and an optical signal receiver located in separate buildings.

The sensors of the barrier type emitter and receiver are in separate cases, which are installed opposite each other on the same axis. The range of separation of buildings can reach 100 meters. An object that has fallen into the active zone of the optical sensor interrupts the passage of the beam. The change is recorded by the receiver; the signal after processing is fed to the controlled device.

Sensors of reflex type contain in one case both the transmitter of an optical signal, and its receiver. Sensors of this type are actively used on the conveyor to count the number of products. A polarizing filter is used to detect objects with a mirror reflecting metal surface in reflex sensors. The range of the reflex type sensors can reach up to 8 meters.

In diffusion reflectance sensors, the optical signal source and receiver are in the same enclosure. The receiver takes into account the intensity of the beam reflected by the controlled object. The background suppression function can be activated in sensors of this type for accuracy. The range depends on the reflective properties of the object, can be determined by a correction factor, and when using a standard target can reach 2 meters.

Optical sensors have an indicator of the operating state and, as a rule, a sensitivity control that allows you to adjust the response to an object located on an unfavorable background.

The output of the optical sensor is a transistor PNP-or NPN-type with an open collector. The load is connected between the output and depending on the transistor type, the common negative or positive wire. If the load is connected in the initial state, the opening contact function is performed and vice versa.

Optical sensors as an integral part of automated control systems are widely used to determine the presence and quantity of objects, the presence on their surface of labels, positioning and sorting of objects. With the help of optical sensors, you can control the distance, size, level, color and transparency. They are installed in automatic lighting control systems, remote control devices, used in security systems.

Vocabulary.

Conveyor - a person or thing that transports or communicates something (конвейер белдеуі, транспортер – konvtei’er beldey’i, transporter - конвейер, транспортер).

Emitter - a thing which emits something; in electronics it is the region in a bipolar transistor that produces carriers of current (шығарушы – shyg’ary’sy’ - эмиттер).

Enclosure - an area that is surrounded by a barrier (қоршау – qorshay’ – огораживание, ограждение).

Opaque - not able to be seen through; not transparent (түссіз – tussiz – непрозрачный, темный).

Polarize - (in Physics) restrict the vibrations of (a transverse wave, especially light) wholly or partially to one direction; cause (something) to acquire polarity; divide or cause to divide into two sharply contrasting groups or sets of opinions or beliefs (полярлық – polyarlyq – поляризоваться).

Proximity - nearness in space, time, or relationship (жақындық– jaqyndyq – близость, соседство).

Reflex - a thing which is determined by and reproduces the essential features or qualities of something else (рефлекс – refleks – рефлекс, рефлекторный).

Suppression - the action of suppressing something such as an activity or publication (басу – basy’ – подавление, сдерживание, запрещение).

Translucent - (of a substance) allowing light, but not detailed shapes, to pass through; semi-transparent (мөлдір – mol’dir – просвечивающий, полупрозрачный).

Unfavorable - expressing or showing a lack of approval or support; likely to lead to an adverse outcome (қолайсыз – qolai’syz – неблагоприятный).

Exercise 1. Answer the questions.

1. What is an optical sensor?

2. What is the property of optical sensors?
3. How optical sensors are also called?
4. Name the operating principles of sensors.
5. Which sensors can be installed opposite each other on the same axis?
6. How far can be the range of separation of buildings?
7. What sensors are used on the conveyor to count the number of products?
8. Why do we need an indicator of the operating state?
9. What is the output of the optical sensor?
10. How do people use optical sensors?

Exercise 2. Find the opposites.

Small, invisible, transparent, two-block, narrow, the same, large, visible, wide, opaque, active, favorable, mono-block, opposite, passive, unfavorable, closed, negative, opened, positive.

Exercise 3. Decide if the following statements are true or false.

1. Optical sensors are small-sized electronic devices. T/F.
2. Optical sensors react only to opaque and translucent objects. T/F.
3. Optical sensors are a type of non-contact sensors. T/F.
4. Optical sensors are also called optical proximity switches. T/F.
5. The range of the reflex type sensors can reach up to 8 meters. T/F.
6. Optical sensors have an indicator of the operating state. T/F.
7. The output of the optical sensor is transistors PNP-or NPN-type. T/F.
8. Optical sensors as an integral part of automated control systems. T/F.
9. With the help of optical sensors, you can only control distance. T/F.
10. Optical sensors can be used in security systems. T/F.

Exercise 4. Translate the following sentences using the key words from the vocabulary above.

1. The comet should be visible to the naked eye.
2. I find her poetry rather opaque.
3. This china is so fine and delicate that it's translucent.
4. Delia's skin has a translucent quality.
5. The best thing about this house is its proximity to the town centre.
6. He doesn't like enclosed spaces.
7. The enclosed card is for Julia.

Read and translate the text.

New range finding methods

Active methods use unilateral transmission and passive reflection. Active range finding methods include laser, radar, sonar, lidar and ultrasonic range finding. Other devices measure distance using trigonometry (stadia metric and parallax, or coincidence rangefinders). Older methodologies that use a set of known information usually distance or target sizes, to make the measurement, have been in regular use since the 18th century.

Special ranging makes use of actively synchronized transmission and travel time measurements. Hence the time difference between several received signals is used to determine exact distances. This principle is used with SatNav, the Satellite Navigation class of systems. In conjunction with a standardized model of the Globe surface a certain location on the Globe may be determined with high accuracy. Ranging methods without accurate time synchronization of the receiver are called pseudo range, used, e.g. in GPS positioning.

With other systems ranging is obtained from passive radiation measurements only. Hence the noise or radiation signature of the object is generating the signal that is computed for range. However such asynchronous method requires multiple measurements to obtain range by taking multiple bearings instead of appropriate scaling of active pings, otherwise the system is just capable to provide a simple bearing from any sole measurement.

Ranging is the term merely applying for distance metering with moving objects. Combining several metering results in a time sequence leads to tracking and tracing. A commonly used term for residing terrestrial objects is surveying.

Applications include surveying, navigation, to assist focusing in photography, choosing a golf club according to distance, and correcting aim of a projectile weapon for distance.

Golf. Laser rangefinders are used for many things today, including golf. People can use this technology not only to measure the yardage of a particular shot but to gauge slope and wind as well. The technology makes it very simple to obtain yardage. In a typical rangefinder, one aims the reticle at the flagstick and presses a button to get the yardage. There has been debate over whether they should be allowed in tournaments. While their use is banned on the professional level, they are becoming widely used on the amateur level.

Ballistics. Rangefinders may be used by users of firearms over long distances, to measure the distance to a target to allow for projectile drop. The laser rangefinder displays a luminous dot that may alert a target. Until the development of electronic means of measuring range during the Second World War, warships used very large optical rangefinders—with a baseline of many meters—to measure range for naval gunnery.

Forestry. Rangefinders are used for surveying in forestry. Special devices with anti-leaf filters are used.

Virtual reality. Since the 1990s, rangefinders have been used in virtual reality systems to detect operator movements and locate objects.

Vocabulary.

Asynchronous - not existing or occurring at the same time; (of a machine or motor) not working in time with the alternations of current (асинхронды – asi'nhrondy - асинхронный).

Ballistics - the science of projectiles and firearms; the scientific study of the effects of being fired on a bullet, cartridge, or gun (баллистикалық – balli'sti'kalyq - баллистика).

Gauge - an instrument that measures and gives a visual display of the amount, level, or contents of something; a tool for checking the conformity of something to a desired dimension (өлшем, өрнек – o'lshem, o'rnek - размер, шаблон, лекало, эталон).

In conjunction - together (бірге, біреуге айта – birge, birey'ge ai'ta - совместно, сообща с чем-то).

Lidar - a detection system which works on the principle of radar, but uses light from a laser.

Parallax - the effect whereby the position or direction of an object appears to differ when viewed from different positions, e.g. through the viewfinder and the lens of a camera; the angular amount of this in a particular case, especially that of a star viewed from different points in the earth's orbit (параллакс – parallaks - параллакс).

Ping - an abrupt high-pitched ringing sound (қоңырау – qon'yray' - звон).

Rangefinder - an instrument for estimating the distance of an object, especially for use with a camera or gun (алыстан өлшегіш – alystan o'lshegish - дальномер).

Reticle - graticule - a series of fine lines or fibers in the eyepiece of an optical device, such as a microscope, or on the screen of an oscilloscope, used as a measuring scale or an aid in locating objects (тор – tor - сетка).

Sonar - a system for the detection of objects under water by emitting sound pulses and detecting or measuring their return after being reflected (гидролокатор, сонар – gidrokator, sonar - гидролокатор, сонар).

Unilateral - (of an action or decision) performed by or affecting only one person, group, or country involved in a situation, without the agreement of another or the others (бір жақты – bir jaqty - односторонний).

Yardage - a distance or length measured in yards (аудан немесе көлем – ay'dan nemese ko'lem - площадь или объем).

Exercise 1. Answer the questions.

1. What do active range finding methods include?
2. How long do we use distance or target sizes, to make the measurement?
3. From what special ranging makes use of?
4. What is SatNav?
5. What is pseudo range and where is it used?
6. What is ranging?

7. What is a commonly used term for residing terrestrial objects?
8. How do people use laser rangefinders for golf?
9. How are rangefinders used by users of firearms over long distances?
10. How do people use rangefinders for surveying in forestry?
11. How are rangefinders used in virtual reality?

Exercise 2. Decide if the following statements are true or false.

1. Active methods use unilateral transmission and passive reflection. T/F.
2. Pseudo range is used in GPS positioning. T/F.
3. Ranging is the term merely applying for distance metering. T/F.
4. Combining metering results in a time sequence leads to tracking. T/F.
5. Laser rangefinders for golf are banned on the professional level. T/F.
6. Though they are becoming widely used on the amateur level. T/F.
7. Rangefinders may be used by users of firearms over long distances. T/F.
8. The laser rangefinder displays a luminous dot that may alert a target. T/F.
9. Rangefinders are used for surveying in forestry. T/F.
10. Special devices with anti-leaf filters are used in forestry. T/F.
11. Since the 1990s, rangefinders have been used in virtual reality. T/F.
12. They are used to detect operator movements and locate objects. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. Trigonometry concerns the functions of angles: sine, cosine, tangent.
2. The machine makes thousands of measurements every day.
3. His greatest ambition is to sail round the globe.
4. She spun the globe, and pointed to the Solomon Islands.
5. We hope to become more accurate in predicting earthquakes.
6. We heard a small stone ping against our window.
7. The electricity meter is under the stairs.
8. Britain's water companies are planning to meter water consumption.
9. He got out of the car to survey the damage.
10. Use a thermometer to gauge the temperature.
11. He was found guilty of possessing an unlicensed firearm.
12. I had four shots but I didn't even hit the target.
13. Any major airport or station is potentially a terrorist target.
14. Some sounds cannot be detected by the human ear.
15. Radar equipment is used to detect (=find the position of) enemy aircraft.

Read and translate the text.

Ammeter

An ammeter (from Ampere Meter) is a measuring instrument used to measure the current in a circuit. Electric currents are measured in amperes (A), hence the name. Instruments used to measure smaller currents, in the milliampere or microampere range, are designated as *milliammeters* or *microammeters.* Early ammeters were laboratory instruments which relied on the Earth's magnetic field for operation. By the late 19th century, improved instruments were designed which could be mounted in any position and allowed accurate measurements in electric power systems. It is generally represented by letter 'A' in a circle.

And now let us remind you some words of history. The relation between electric current, magnetic fields and physical forces was first noted by Hans Christian Orsted who, in 1820, observed a compass needle was deflected from pointing North when a current flowed in an adjacent wire. The tangent galvanometer was used to measure currents using this effect, where the restoring force returning the pointer to the zero position was provided by the Earth's magnetic field. This made these instruments usable only when aligned with the Earth's field. Sensitivity of the instrument was increased by using additional turns of wire to multiply the effect - the instruments were called "multipliers".

And now let us examine the types. Moving-coil or the D'Arsonval galvanometer is a moving coil ammeter. It uses magnetic deflection, where current passing through a coil placed in the magnetic field of a permanent magnet causes the coil to move. The modern form of this instrument was developed by Edward Weston, and uses two spiral springs to provide the restoring force. The uniform air gap between the iron core and the permanent magnet poles make the deflection of the meter linearly proportional to current. These meters have linear scales. Basic meter movements can have full-scale deflection for currents from about 25 microamperes to 10 milliamperes.

Moving magnet ammeters operate on essentially the same principle as moving coil, except that the coil is mounted in the meter case, and a permanent magnet moves the needle. Moving magnet ammeters are able to carry larger currents than moving coil instruments, often several tens of Amperes, because the coil can be made of thicker wire and the current does not have to be carried by the hairsprings. Indeed, some Ammeters of this type do not have hairsprings at all, instead using a fixed permanent magnet to provide the restoring force.

An electrodynamic movement uses an electromagnet instead of the permanent magnet of the d’Arsonval movement. This instrument can respond to both alternating and direct current and also indicates true RMS for AC.

Moving iron ammeters use a piece of iron which moves when the electromagnetic force of a fixed coil of wire acted upon. The moving-iron meter was invented by Austrian engineer Friedrich Drexler in 1884. This type of meter responds to both direct and alternating currents (as opposed to the moving-coil ammeter, which works on direct current only). The iron element consists of a moving vane attached to a pointer, and a fixed vane, surrounded by a coil. As alternating or direct current flows through the coil and induces a magnetic field in both vanes, the vanes repel each other and the moving vane deflects against the restoring force provided by fine helical springs. The deflection of a moving iron meter is proportional to the square of the current. Consequently, such meters would normally have a nonlinear scale, but the iron parts are usually modified in shape to make the scale fairly linear over most of its range. Moving iron instruments indicate the RMS value of any AC waveform applied. Moving iron ammeters are commonly used to measure current in industrial frequency AC circuits.

In a hot-wire ammeter, a current pass through a wire which expands as it heats. Although these instruments have slow response time and low accuracy, they were sometimes used in measuring radio-frequency current. These also measure true RMS for an applied AC current.

In much the same way as the analogue ammeter formed the basis for a wide variety of derived meters, including voltmeters, the basic mechanism for a digital meter is a digital voltmeter mechanism, and other types of meter are built around this.

There is also a range of devices referred to as integrating ammeters. In these ammeters the current is summed over time, giving as a result the product of current and time; which is proportional to the electrical charge transferred with that current. These can be used for metering energy (the charge needs to be multiplied by the voltage to give energy) or for estimating the charge of a battery or capacitor.

Vocabulary.

Ammeter - an instrument for measuring electric current in amperes (амперметр – ampermetr - амперметр).

Capacitor - a device used to store an electric charge, consisting of one or more pairs of conductors separated by an insulator (конденсатор – kondensator - конденсатор).

Circuit - a system of electrical conductors and components forming an electrical circuit (тізбек, сұлба – tizbek, sulba - цепь, схема).

Current - a flow of electricity which results from the ordered directional movement of electrically charged particles (ток – tok - ток).

Deflect - cause (something) to change direction; turn aside from a straight course (ауытқу – ay’ytqy’ - отклоняться, отклониться).

Galvanometer - an instrument for detecting and measuring small electric currents (гальванометр – galvanometer - гальванометр).

Hairspring - a slender flat coiled spring regulating the movement of the balance wheel in a watch (толқын серіппесі – tolqyn serippesi - волосковая пружина).

Helical - having the shape or form of a helix; spiral (спиралды, орам – spi’raldy, oram - спиральный, витой).

Milliammeter - an instrument for measuring electric current in milliamperes (миллиамперметр – mi’lli’ampermetr - миллиамперметр).

Milliampere - one thousandth of an ampere, a measure for small electric currents (миллиампер – mi’lli’amper - миллиампер).

Multiplier- a device for increasing by repetition the intensity of an electric current, force, etc. to a measurable level (көбейткіш – ko’bei’tkish - множитель).

Repel - (of a magnetic pole or electric field) force (something similarly magnetized or charged) away from itself (итеру – itery’ – оттолкнуть, отталкивать).

Tangent - a straight line or plane that touches a curve or curved surface at a point, but if extended does not cross it at that point (жанасу, тангенс- janasy’, tangens - касательная, тангенс).

Vane - a broad blade attached to a rotating axis or wheel which pushes or is pushed by wind or water and forms part of a machine or device such as a windmill, propeller, or turbine (пышақ – py’shaq - лопасть).

Voltmeter - an instrument for measuring electric potential in volts (вольтметр – voltmeter - вольтметр).

Exercise 1. Answer the questions.

1. What is ammeter?
2. How are electric currents measured?
3. How was the tangent galvanometer used?
4. How sensitivity of the instrument was increased?
5. Who invented moving-coil or the D'Arsonval galvanometer?
6. How do moving magnet ammeters operate?
7. Who invented the moving-iron meter?
8. How does a hot-wire ammeter operate?
9. What can you say about integrating ammeters?

Exercise 2. Decide if the following statements are true or false.

1. An ammeter an instrument used to measure the current in a circuit. T/F.
2. Electric currents are measured in amperes (A). T/F.
3. The D'Arsonval galvanometer is a moving coil ammeter. T/F.
4. Moving magnet ammeters are able to carry large currents. T/F.
5. Moving iron ammeters use a piece of iron which moves. T/F.
6. The basic mechanism for a digital meter is a digital voltmeter. T/F.

*Exercise 3***.** Translate the following sentences using the key vocabulary above.

1. Switch off the electric current before touching that machine.
2. A defect was found in the water-cooling/electrical circuit.
3. The machine makes thousands of measurements every day.
4. The crowd cheered as the goalkeeper deflected the shot.
5. Similar poles of magnets repel each other, and opposite poles attract.
6. A coil of rope lay on the beach.

7. A coil of thick blue smoke rose up from his pipe.
8. Don’t touch those wires whatever you do.
9. These automatic cameras have a special focusing mechanism.

Read and translate the text.

Light-emitting diode

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm^2) and integrated optical components may be used to shape the radiation pattern.

Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared light. Infrared LEDs are still frequently used as transmitting elements in remote-control circuits, such as those in remote controls for a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Modern LEDs are available across the visible, ultraviolet, and infrared wavelengths, with very high brightness.

Early LEDs were often used as indicator lamps for electronic devices, replacing small incandescent bulbs. They were soon packaged into numeric readouts in the form of seven-segment displays and were commonly seen in digital clocks. Recent developments have produced LEDs suitable for environmental and task lighting. LEDs have led to new displays and sensors, while their high switching rates are useful in advanced communications technology.

LEDs have many advantages over incandescent light sources, including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching. Light-emitting diodes are used in applications as diverse as aviation lighting, automotive headlamps, advertising, general lighting, traffic signals, camera flashes, lighted wallpaper and medical devices. They are also significantly more energy efficient and, arguably, have fewer environmental concerns linked to their disposal.

Unlike a laser, the color of light emitted from a LED is neither coherent nor monochromatic, but the spectrum is narrow with respect to human vision, and for most purposes the light from a simple diode element can be regarded as functionally monochromatic.

The first commercial LEDs were commonly used as replacements for incandescent and neon indicator lamps, and in seven-segment displays, first in expensive equipment such as laboratory and electronics test equipment, then later in such appliances as TVs, radios, telephones, calculators, as well as watches (see list of signal uses). Until 1968, visible and infrared LEDs were extremely costly, in the order of US$200 per unit, and so had little practical use. The Monsanto Company was the first organization to mass-produce visible LEDs, using gallium arsenide phosphide (GaAsP) in 1968 to produce red LEDs suitable for indicators. Hewlett-Packard (HP) introduced LEDs in 1968, initially using GaAsP supplied by Monsanto. These red LEDs were bright enough only for use as indicators, as the light output was not enough to illuminate an area. Readouts in calculators were so small that plastic lenses were built over each digit to make them legible. Later, other colors became widely available and appeared in appliances and equipment. In the 1970s commercially successful LED devices at less than five cents each were produced by Fairchild Optoelectronics. These devices employed compound semiconductor chips fabricated with the planar process invented by Dr. Jean Hoerni at Fairchild Semiconductor. The combination of planar processing for chip fabrication and innovative packaging methods enabled the team at Fairchild led by optoelectronics pioneer Thomas Brandt to achieve the needed cost reductions. LED producers continue to use these methods.

In 2001 and 2002, processes for growing gallium nitride (GaN) LEDs on silicon were successfully demonstrated. In January 2012, Osram demonstrated high-power InGaN LEDs grown on silicon substrates commercially, and GaN-on-silicon LEDs are in production at Plessey Semiconductors. As of 2017, some manufacturers are using SiC as the substrate for LED production, but sapphire is more common, as it has the most similar properties to that of gallium nitride, reducing the need for patterning the sapphire wafer. (Patterned wafers are known as epi wafers.) Samsung, the University of Cambridge, and Toshiba are performing research into GaN on Silicon LEDs. Toshiba has stopped research, possibly due to low yields. Some opt towards epitaxy, which is difficult on silicon, while others, like the University of Cambridge, opt towards a multi layer structure, in order to reduce (crystal) lattice mismatch and different thermal expansion ratios, in order to avoid cracking of the lead chip at high temperatures (e.g. during manufacturing), reduce heat generation and increase luminous efficiency. Epitaxy (or patterned sapphire) can be carried out with Nanoimprint lithography.

The first white LEDs were expensive and inefficient. However, the light output of LEDs has increased exponentially, with a doubling occurring approximately every 36 months since the 1960s (similar to Moore's law).

Vocabulary.

Electroluminescence – (Chemistry) luminescence produced electrically, especially by the application of a voltage (электролюминесценция – elektrolyumi’nescenci’ya - электролюминесценция).

Epitaxy – (Crystallography) the natural or artificial growth of crystals on a crystalline substrate that determines their orientation (эпитаксиялар – emi’taksi’yalar - эпитаксии).

Exponential – (of an increase) becoming more and more rapid (экспонциалды, көрсеткіштік – eksponci’aldy, ko’rsetkishtik - экспоненциальный, показательный).

Incandescent bulb – (of an electric light) containing a filament which glows white-hot when heated by a current passed through it (қызған, қыздырылған, қыздыру шамы - qyzg’an, qyzdyrylg’an, qyzdyry’ shamy - накаленный, раскаленный, лампа накаливания).

Lead – a wire that conveys electric current from a source to an appliance, or that connects two points of a circuit together.

LED – светодиод

Legible – (of handwriting or print) clear enough to read (түсінікті – tu’sinikni - разборчивый).

Light-emitting diode - a semiconductor diode which glows when a voltage is applied (жарық түсіретін диод – jaryq tu’siretin di’od - светоизлучающий диод).

Planar – (Mathematics) relating to or in the form of a plane (жазық – jazyq - плоскостный).

Read-out – a visual record or display of the output from a computer or scientific instrument.

Substrate – a material which provides the surface on which something is deposited or inscribed, for example the silicon wafer used to manufacture integrated circuits (төсегіш – to’segush - подложка).

Wafer – (Electronics) a very thin slice of a semiconductor crystal used as the substrate for solid-state circuitry.

Yield – an amount produced of an agricultural or industrial product (кіріс, аулау – kiris, ay’lay’ - доход, улов).

Exercise 1. Answer the questions.

1. What is LED?
2. Explain how it operates.
3. What is a typical size of a LED?
4. What can you say about the earliest LEDs?
5. Where did people use early LEDs?
6. What are their advantages?
7. What can you say about the color of light emitted from a LED?
8. How the first commercial LEDs were commonly used?
9. What can you say about the first white LEDs?
10. Has light output of LEDs increased exponentially?

Exercise 2. Find the adjectives in the following list of words.

Current, lead, color, practical, low, infrared, remote, visible, light, digital, many, consumption, narrow, coherent, expensive, suitable, legible, successful, difficult, luminous.

Exercise 3. Decide if the following statements are true or false.

1. LED is a light-emitting diode. T/F.
2. LEDs are typically small. T/F.
3. First visible-light LEDs were of low intensity and limited to red. T/F.
4. LEDs have many advantages over incandescent light sources. T/F.
5. The first white LEDs were expensive and inefficient. T/F.
6. The light output of LEDs has increased exponentially. T/F.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. Semiconductors are used for making integrated circuits and computers.
2. The machine emits a high-pitched sound when you press the button.
3. The mountain's snow-white peak was incandescent against the sky.
4. Her beauty had an incandescent quality to it.
5. We are looking for exponential growth in our investment.
6. There was an exponential increase in the world population this century.
7. Coal power stations release sulphur dioxide into the atmosphere.
8. Existing methods of production are expensive and inefficient.
9. Sound and pictures can be stored digitally.

Read and translate the text.

Transistor

Semiconductor transistors are radio-electronic components of semiconductor material, typically a three-terminal incapable of a small input signal to control a significant current in the output circuit, which makes it suitable for amplification, generating, switching, and converting electrical signals . At present, the transistor is the basis of the circuitry of the vast majority of electronic devices and integrated microcircuits. Transistors are also called discrete electronic devices, which, in the function of a single transistor, have many elements in their structure, being an integral circuit, for example, a compound transistor or many high-power transistors.
Transistors in structure, principle of action and parameters are divided into two classes - bipolar and field (unipolar). In a bipolar transistor , semiconductors with both types of conductivity are used, it works by the interaction of two p-n junctions closely located on the crystal and is controlled by a change in the current through the base-emitter junction, with the emitter terminal always being common for the control and output currents. In the field-effect transistor, only one type of conductivity is used, located in the form of a thin channel, which is acted upon by an electric field isolated from the shutter channel '31, the control is performed by changing the voltage between the gate and the source. A field-effect transistor, unlike a bipolar transistor, is controlled by voltage, not current. Currently, analog

bipolar transistors (BT, BIT, bipolar junction transistor) dominate in analog technology. In digital technology, as part of chips (logic, memory, processors, computers, digital communication, etc.), on the contrary, bipolar transistors are almost completely replaced by field transistors. In the 1990s, a new type of hybrid bipolar-field-effect transistors was designed - IGBT which are now widely used in power electronics.

In 1956, for the invention of a bipolar transistor, William Shockley, John Bardeen and Walter Brattein received the Nobel Prize in Physics. By the 1980s, transistors, due to their small size, economy, resistance to mechanical influences and low cost, almost completely replaced the electronic lamps from low-voltage electronics. Due to its ability to operate at low voltages and significant currents, transistors have reduced the need for electromagnetic relays and mechanical switches in equipment and thanks to its miniaturization and integration capabilities, it has been possible to create integrated circuits, laying the foundations of microelectronics. Since the 1990s, in connection with the appearance of new powerful transistors, transformers, electromechanical and thyristor keys in power electrical engineering have been actively replaced by electronic devices the frequency-controlled drive and inverter voltage converters have started to develop actively.

In principle, the transistor is referred to as "VT" or "Q". Until the 1970s, the Russian-language literature and documentation also used the notation "T", "PP" (semiconductor device) or "PT" (semiconductor triode).

Below is a formal classification of current transistors, where the working medium is a stream of current carriers, and the states between which the device switches are determined by the magnitude of the signal: a small signal is a large signal; a closed state is an open state on which the binary logic of the transistor is realized. Modern technology can operate not only with electric charge, but also with magnetic moments, the spin of an individual electron, photons and light quanta, quantum states in the general case.

Vocabulary.

Circuitry – electric circuits collectively (сұлба – sulba - схема).

Converter – a device for altering the nature of an electric current or signal, especially from AC to DC or vice versa, or from analogue to digital or vice versa (түрлендіргіши – tu’rlendirgish - преобразователь).

Inverter – (Electronics) a device that converts either of the two binary digits or signals into the other (инвертор- inventor - инвертор).

Junction – (Electronics) a region of transition in a semiconductor between a part where conduction is mainly by electrons and a part where it is mainly by holes (қосылу, тиісу – qosyly’, tii’sy’ - соединение, стык).

Magnitude – the great size or extent of something; great importance; the degree of brightness of a star, as represented by a number on a logarithmic scale (шамасы, маңызы – shamasy, man’yzy - величина, важность).

Quantum – (Physics) a discrete quantity of energy proportional in magnitude to the frequency of the radiation it represents (кванттық секіру, секіру – kvanttyq sekiry’ - квантовый скачок, скачок).

Thyristor – (Electronics) a four-layered semiconductor rectifier in which the flow of current between two electrodes is triggered by a signal at a third electrode (тиристор – ti’ri’stor - тиристор).

Transistor – a semiconductor device with three connections, capable of amplification in addition to rectification (транзистор – transistor - транзистор).

Exercise 1. Answer the questions.

1. What are semiconductor transistors?
2. What is the other name of transistors?
3. Name the two classes of transistors.
4. Who invented a bipolar transistor? When? Were they awarded?
5. What did people use before transistors?
6. How is the transistor referred to?

Exercise 2. Decide if the following statements are true or false.

1. Transistor is the basis of the vast majority of electronic devices. T/F.
2. Transistors are also called discrete electronic devices. T/F.
3. Transistors are divided into two classes - bipolar and field (unipolar). T/F.
4. IGBTs are now widely used in power electronics. T/F.
5. Transistors have reduced the need for electromagnetic relays. T/F.
6. The transistor is referred to as "VT" or "Q". T/F.
7. Modern technology can operate not only with electric charge. T/F.
8. Modern technology can operate with magnetic moments. T/F.
9. Modern technology can operate with photons and light quanta. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. He was swept out to sea by the strong current.
2. Switch off the electric current before touching that machine.
3. A defect was found in the water-cooling/electrical circuit.
4. The town’s modern architecture is very well integrated with the old.
5. You should slow down as you approach the junction.
6. There’s a service station at the next motorway junction.
7. They don’t seem to grasp the magnitude of the problem.

Read and translate the text.

Force-sensing resistor

A force-sensing resistor is a material whose resistance changes when a force, pressure or mechanical stress is applied. They are also known as "force-sensitive resistor" and are sometimes referred to by the initialism “FSR”.

And now some words of history. The technology of force-sensing resistors was invented and patented in 1977 by Franklin Eventoff. In 1985 Eventoff founded Interlink Electronics, a company based on his force-sensing-resistor (FSR). In 1987, Eventoff was the recipient of the prestigious international IR 100 award for the development of the FSR. In 2001 Eventoff founded a new company, Sensitronics that he currently runs.

Properties: force-sensing resistors consist of a conductive polymer, which changes resistance in a predictable manner following application of force to its surface. They are normally supplied as a polymer sheet or ink that can be applied by screen printing. The sensing film consists of both electrically conducting and non-conducting particles suspended in matrix. The particles are sub-micrometer sizes, and are formulated to reduce the temperature dependence, improve mechanical properties and increase surface durability. Applying a force to the surface of the sensing film causes particles to touch the conducting electrodes, changing the resistance of the film. As with all resistive based sensors, force-sensing resistors require a relatively simple interface and can operate satisfactorily in moderately hostile environments. Compared to other force sensors, the advantages of FSRs are their size (thickness typically less than 0.5 mm), low cost and good shock resistance. A disadvantage is their low precision: measurement results may differ 10% and more. Force-sensing capacitors offer superior sensitivity and long term stability, but require more complicated drive electronics.

Current research trends in FSRs: although the above model is unable to describe the undesired phenomenon of sensitivity degradation, the inclusion of rheological models has predicted that drift can be reduced by choosing an appropriate sourcing voltage; this statement has been supported by experimental observations. Another approach to reduce drift is to employ non-aligned electrodes so that the effects of polymer creep are minimized. There is currently a great effort placed on improving the performance of FSRs with multiple different approaches: in-depth modeling of such devices in order to choose the most adequate driving circuit, changing the electrode configuration to minimize drift and/or hysteresis, investigating on new materials type such as carbon nanotubes, or solutions combining the aforesaid methods.

Uses: force-sensing resistors are commonly used to create pressure-sensing "buttons" and have applications in many fields, including musical instruments, car occupancy sensors, artificial limbs, foot pronation systems and portable electronics. They are also used in Mixed or Augmented Reality systems as well as to enhance mobile interaction.

Vocabulary.

Augmented reality – reality not physically existing as such but made by software to appear to do so and having been made greater in size or value (толықтырылған шындық- tolyqtyrylg'an shyndyq - дополненная реальность).

Car occupancy sensor – датчик занятости автомобиля.

Capacitor – a device used to store an electric charge, consisting of one or more pairs of conductors separated by an insulator (конденсатор –kondensator - конденсатор).

Drift – be carried slowly by a current of air or water; move passively, aimlessly, or involuntarily into a certain situation or condition (дрейфтау, байланыстыру – drei'ftay', bai'lanystyry' - дрейфовать, относить).

Force-sensing resistor – сенсорный резистор.

Initialism – an abbreviation consisting of initial letters pronounced separately (аббревиатура – abbrevi'aty'ra - аббревиатура).

Interface – a device or program enabling a user to communicate with a computer; a device or program for connecting two items of hardware or software so that they can be operated jointly or communicate with each other; in computing connect with (another computer or piece of equipment) by an interface (интерфейс – I'nterfei's - интерфейс).

Non- aligned electrodes – conductors through which electricity enters or leaves an object, substance, or region and they are not aligned with something else (түзелмеген электрондар – tu'zelmegen elektrondar -невыровненные электроды).

Pressure-sensing – давление зондирования.

Pronation system – система пронации.

Rheological – the branch of physics that deals with the deformation and flow of matter, especially the non-Newtonian flow of liquids and the plastic flow of solids (реологиялық – reologi'yalyq - реологический).

Sub-micrometer size – (субмикрометр өлшемі – sy'bmi'krometr o'lshemi - размер субмикрометра).

Exercise 1. Answer the questions.

1. What is a force-sensing resistor?
2. How can it be called in other way?
3. What do you know from its history?
4. What are its properties?
5. What is its disadvantage?
6. What is FSR?
7. What are its uses?

*Exercise 2.*Find adjectives in the following list of words.

Force, pressure, stress, prestigious, international, new, current, predictable, conductive, resistive, sensing, hostile, moderate, complicated, superior, experimental, appropriate, different, multiple, improving, commonly, portable, interaction, enhance.

Exercise 3. Decide if the following statements are true or false.

1. A force-sensing resistor is a material. T/F.
2. In 2001 Eventoff founded a new company. T/F.
3. Force-sensing resistors consist of a conductive polymer. T/F.
4. They are normally supplied as a polymer sheet. T/F.
5. Force-sensing resistors require a relatively simple interface. T/F.
6. A disadvantage is their low precision. T/F.
7. Force-sensing capacitors require more complicated drive electronics. T/F.
8. Force-sensing resistors have applications in many fields. T/F.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. These gas pipes withstand higher pressures.
2. The gas is stored under pressure.
3. Teachers are under increasing pressure to work longer hours.
4. He was a powerful force in British politics during the war years.
5. You can't force her to make a decision.
6. She forced her way through the crowds.
7. I forgot my key, so I had to force a window.
8. The car's speed was reduced by air/wind resistance.
9. Copper has a low resistance.
10. We are invstigating how an error like this could have occured.
11. We can only find the best solution by experiment.
12. The school is experimenting with new teaching methods.

Read and translate the text.

Oscilloscope

An oscilloscope, previously called an oscillograph, and informally known as a scope or o-scope, CRO (for cathode-ray oscilloscope), or DSO (for the more modern digital storage oscilloscope), is a type of electronic test instrument that allows observation of varying signal voltages, usually as a two-dimensional plot of one or more signals as a function of time. Other signals (such as sound or vibration) can be converted to voltages and displayed.

Oscilloscopes are used to observe the change of an electrical signal over time, such that voltage and time describe a shape which is continuously graphed against a calibrated scale. The observed waveform can be analyzed for such properties as amplitude, frequency, rise time, time interval, distortion and others. Modern digital instruments may calculate and display these properties directly. Originally, calculation of these values required manually measuring the waveform against the scales built into the screen of the instrument.

The oscilloscope can be adjusted so that repetitive signals can be observed as a continuous shape on the screen. A storage oscilloscope allows single events to be captured by the instrument and displayed for a relatively long time, allowing observation of events too fast to be directly perceptible.

Oscilloscopes are used in the sciences, medicine, engineering, automotive and the telecommunications industry. General-purpose instruments are used for maintenance of electronic equipment and laboratory work. Special-purpose oscilloscopes may be used for such purposes as analyzing an automotive ignition system or to display the waveform of the heartbeat as an electrocardiogram.

Early oscilloscopes used cathode ray tubes (CRTs) as their display element (hence they were commonly referred to as CROs) and linear amplifiers for signal processing. Storage oscilloscopes used special storage CRTs to maintain a steady display of a single brief signal. CROs were later largely superseded by digital storage oscilloscopes (DSOs) with thin panel displays, fast analog-to-digital converters and digital signal processors. DSOs without integrated displays (sometimes known as digitisers) are available at lower cost and use a general-purpose digital computer to process and display waveforms.

The basic oscilloscope is typically divided into four sections: the display, vertical controls, horizontal controls and trigger controls. The display is usually a CRT (historically) or LCD panel which is laid out with both horizontal and vertical reference lines referred to as the graticule. CRT displays are additionally equipped with three controls: focus, intensity, and beam finder.

The vertical section controls the amplitude of the displayed signal. This section carries a Volts-per-Division (Volts/Div) selector knob, an AC/DC/Ground selector switch and the vertical (primary) input for the instrument. Additionally, this section is typically equipped with the vertical beam position knob.

The horizontal section controls the time base or "sweep" of the instrument. The primary control is the Seconds-per-Division (Sec/Div) selector switch. Also included is a horizontal input for plotting dual X-Y axis signals. The horizontal beam position knob is generally located in this section.

The trigger section controls the start event of the sweep. The trigger can be set to automatically restart after each sweep or it can be configured to respond to an internal or external event. The principal controls of this section will be the source and coupling selector switches. An external trigger input (EXT Input) and level adjustment will also be included.

In addition to the basic instrument, most oscilloscopes are supplied with a probe as shown. The probe will connect to any input on the instrument and typically has a resistor of ten times the oscilloscope's input impedance. This results in a 1 (-10X) attenuation factor which helps to isolate the capacitive load presented by the probe cable from the signal being measured. Some probes have a switch allowing the operator to bypass the resistor when appropriate.

Vocabulary.

Attenuate – reduce the force, effect, or value of; reduce the amplitude of (a signal, electric current or other oscillation) (әлсірету – a'lsirety' - ослаблять, ослабить).

Bypass – a secondary channel, pipe or connection to allow a flow when the main one is closed or blocked (айналып өту – ai'nalyp o'ty' - объезд, обход, обходить).

Cathode ray tube – a high-vacuum tube, in which cathode rays produce a luminous image on a fluorescent screen, used in televisions and computer terminals (электронды-сәулелі түтік –elektrondy-say'leli tu'tik – электронно-лучевая трубка).

Graticule – a series of fine lines or fibers in the eyepiece of an optical device, such as a microscope, or on the screen of an oscilloscope, used as a measuring scale or an aid in locating objects (масштабты тор – masshtabty tor – масштабная сетка, сетка координат).

Knob – a round button for adjusting or controlling a machine (түйме – tu'i'me – кнопка).

Linear amplifier – линейный якорь

Oscillograph – a device for recording oscillations, especially those of an electric current (осциллограф – ostsilograf – осциллограф).

Oscilloscope – a device for viewing oscillations by a display on the screen of a cathode ray tube (осциллоскоп – осциллоскоп – ostsilloskop).

Probe – explore or examine (something) (зерттеу – zerttey' – исследовать).

Supersede – take the place of (a person or thing previously in authority or use); supplant (ауыстыру – ay'ystyry' – сменять, заменять).

Sweep – Electronics the movement of a beam across the screen of a cathode ray tube (қозғалыс – qozg'alys – охват, движение).

Exercise 1. Answer the questions.

1. What is an oscilloscope?
2. How is it called in other way?
3. What is CRO?
4. What is DSO?
5. What are oscilloscopes used for?
6. In what spheres of science are oscilloscopes used?
7. What are the four sections of the basic oscilloscope?
8. How are the most oscilloscopes supplied?

Exercise 2. Decide if the following statements are true or false.

1. An oscilloscope was previously called an oscillograph. T/F.

2. Oscilloscopes observe the change of an electrical signal over time. T/F.
3. Early oscilloscopes used cathode ray tubes. T/F.
4. The basic oscilloscope is typically divided into four sections. T/F.
5. The vertical section controls the amplitude of the displayed signal. T/F.
6. The horizontal section controls the time base of the instrument. T/F.
7. The trigger section controls the start event of the sweep. T/F.
8. EXT is an external trigger input. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. Radiation from the sun is attenuated by the Earth's atmosphere.
2. We were in a hurry so we decided to bypass.
3. They bypassed the committee and went straight to senior management.
4. Most of the old road has been superseded by the great highways.
5. Broad sweep of flat countryside stretched to the horizon in all directions.

Read and translate the text.

Dual and multiple-trace oscilloscopes

Oscilloscopes with two vertical inputs, referred to as dual-trace oscilloscopes, are extremely useful and commonplace. Using a single-beam CRT, they multiplex the inputs, usually switching between them fast enough to display two traces apparently at once. Less common are oscilloscopes with more traces; four inputs are common among these, but a few (Kikusui, for one) offered a display of the sweep trigger signal if desired. Some multi-trace oscilloscopes use the external trigger input as an optional vertical input, and some have third and fourth channels with only minimal controls. In all cases, the inputs, when independently displayed, are time-multiplexed, but dual-trace oscilloscopes often can add their inputs to display a real-time analog sum. (Inverting one channel provides a difference, provided that neither channel is overloaded. This difference mode can provide a moderate-performance differential input.)

Switching channels can be asynchronous, that is, free-running, with trace blanking while switching, or after each horizontal sweep is complete. Asynchronous switching is usually designated "Chopped", while sweep-synchronized is designated "Alternate". A given channel is alternately connected and disconnected, leading to the term "chopped". Multi-trace oscilloscopes also switch channels either in chopped or alternate modes.

In general, chopped mode is better for slower sweeps. It is possible for the internal chopping rate to be a multiple of the sweep repetition rate, creating blanks in the traces, but in practice this is rarely a problem; the gaps in one trace are overwritten by traces of the following sweep. A few oscilloscopes had a modulated chopping rate to avoid this occasional problem. Alternate mode, however, is better for faster sweeps.

True dual-beam CRT oscilloscopes did exist, but were not common. One type (Cossor, U.K.) had a beam-splitter plate in its CRT, and single-ended deflection following the splitter. Others had two complete electron guns, requiring tight control of axial (rotational) mechanical alignment in manufacturing the CRT. Beam-splitter types had horizontal deflection common to both vertical channels, but dual-gun oscilloscopes could have separate time bases, or use one time base for both channels. Multiple-gun CRTs (up to ten guns) were made in past decades. With ten guns, the envelope (bulb) was cylindrical throughout its length.

Vocabulary.

Alignment – arrangement in a straight line or in correct relative positions (выравнивание).

Asynchronous – not existing or occurring at the same time; (Computing and Telecommunications) controlling the timing of operations by the use of pulses sent when the previous operation is completed rather than at regular intervals; (of a machine or motor) not working in time with the alternations of current (асинхронный).

Beam-splitter plate – a device for dividing a beam of light or other electromagnetic radiation into two or more separate beams (разделитель луча).

Deflection – the action or process of deflecting or being deflected (отклонение).

Dual-trace oscilloscopes – двухканальный осциллограф.

Exercise 1. Answer the questions.

1. What can you say about multi-trace oscilloscopes?
2. What can you say about switching channels?
3. How is asynchronous switching usually designated?
4. How is sweep-synchronized switching designated?
5. Do multi-trace oscilloscopes switch both channels?
6. Why chopped mode is better for slower sweeps?
7. What mode is better for faster sweeps?
8. Are dual-beam oscilloscopes in common use?

Exercise 2. Decide if the following statements are true or false.

1. Less common are oscilloscopes with more traces. T/F.
2. Some multi-trace oscilloscopes use the external trigger input. T/F.
3. Switching channels can be asynchronous. T/F.
4. Asynchronous is free-running, with trace blanking. T/F.
5. Multi-trace oscilloscopes also switch channels. T/F.
6. Alternate mode, however, is better for faster sweeps. T/F.
7. True dual-beam CRT oscilloscopes did exist, but were not common. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. They swept his doubts and objections aside.
2. I didn’t have much input into the project.
3. The power input will come largely from hydroelectricity.
4. Some people find that certain foods trigger their headaches.
5. Can you flip the switch?

Read and translate the text.

Electrical meter

An electricity meter, electric meter, or energy meter is a device that measures the amount of electric energy consumed by a residence, a business, or an electrically powered device.

Electric utilities use electric meters installed at customers' premises for billing purposes. They are typically calibrated in billing units, the most common one being the kilowatt hour (kWh). They are usually read once each billing period. When energy savings during certain periods are desired, some meters may measure demand, the maximum use of power in some interval. "Time of day" metering allows electric rates to be changed during a day, to record usage during peak high-cost periods and off-peak, lower-cost, periods. Also, in some areas meters have relays for demand response load shedding during peak load periods.

Direct current. An Aron type DC electricity meter showing that the calibration was in charge consumed rather than energy As commercial use of electric energy spread in the 1880s, it became increasingly important that an electric energy meter, similar to the then existing gas meters, was required to properly bill customers, instead of billing for a fixed number of lamps per month.

DC meters measured charge in ampere-hours. Since the voltage of the supply should remain substantially constant, the reading of the meter was proportional to actual energy consumed. For example, if a meter recorded that 100 ampere-hours had been consumed on a 200-volt supply, then 20 kilowatt-hours of energy had been supplied.

Many experimental types of meter were developed. Thomas Edison at first worked on a direct current (DC) electromechanical meter with a direct reading register, but instead developed an electrochemical metering system, which used an electrolytic cell to totalize current consumption. At periodic intervals the plates were removed and weighed, and the customer billed. The electrochemical meter was labor-intensive to read and not well received by customers.

An early type of electrochemical meter used in the United Kingdom was the 'Reason' meter. This consisted of a vertically mounted glass structure with a mercury reservoir at the top of the meter. As current was drawn from the supply, electrochemical action transferred the mercury to the bottom of the column. Like all other DC meters, it recorded ampere-hours. Once the mercury pool was exhausted, the meter became an open circuit. It was therefore necessary for the consumer to pay for a further supply of electricity, whereupon, the supplier's agent would unlock the meter from its mounting and invert it restoring the mercury to the reservoir and the supply.

In 1885 Ferranti offered a mercury motor meter with a register similar to gas meters; this had the advantage that the consumer could easily read the meter and verify consumption. The first accurate, recording electricity consumption meter was a DC meter by Dr Hermann Aron, who patented it in 1883. Hugo Hirst of the British General Electric Company introduced it commercially into Great Britain from 1888. Aron's meter recorded the total charge used over time, and showed it on a series of clock dials.

Vocabulary.

Ampere hour – a unit of electric current equal to a flow of one coulomb per second (ампер сағат – amper sag’at – ампер час).

Charge – store electrical energy in (a battery or battery-operated device) (зарядтау – zaryadtay’ – заряд, заряжание).

Clock dial – tsiferblat – циферблат

DC meters – ток өлшегіш – toq o’lshey’ish – измерители постоянного тока

Electric meter –электресептегіш – eletreseptegish – электросчетчик

Electrolytic cell –электірлі жәшік – eleltrli jashik – электролитическая ячейка

Mercury motor meter – сынап мотометрі – synap motometri – ртутный мотоpомер

Mercury pool – сынап бассейні – synap bassei’ni – ртутный бассейн

Utility – the state of being useful, profitable, or beneficial; useful, especially through being able to perform several functions (пайдалылық – pai’dalylyq – полезность, практичностье pu выгодность).

Exercise 1. Answer the questions.

1. What is an electric meter?
2. How do people call it in another way?
3. What is the purpose of using electric meters?
4. Explain the short history of electric meters.
5. What is special about DC meters?
6. What type of electric meter did Thomas Edison at first work on?
7. Name it.
8. In what country was it first used?
9. Describe its structure.

10. Who offered a mercury motor meter? When?

Exercise 2. Decide if the following statements are true or false.

1. Electric meter measures the amount of electric energy. T/F.
2. DC meters measured charge in ampere-hours. T/F.
3. Thomas Edison on a direct current (DC) electromechanical meter. T/F.
4. An early type of electrochemical meter was the 'Reason' meter. T/F.
5. In 1885 Ferranti offered a mercury motor meter. T/F.

Read and translate the text.

Water metering

Water metering is the process of measuring water use. In many developed countries water meters are used to measure the volume of water used by residential and commercial buildings that are supplied with water by a public water supply system. Water meters can also be used at the water source, well, or throughout a water system to determine flow through a particular portion of the system. In most of the world water meters measure flow in cubic metres (m^3) or litres but in the USA and some other countries water meters are calibrated in cubic feet ($ft.^3$) or US gallons on a mechanical or electronic register. Some electronic meter registers can display rate-of-flow in addition to total usage.

There are several types of water meters in common use. The choice depends on the flow measurement method, the type of end user, the required flow rates, and accuracy requirements.

In North America, standards for manufacturing water meters are set by the American Water Works Association. There are two common approaches to flow measurement, displacement and velocity, each making use of a variety of technologies. Common displacement designs include oscillating piston and nutating disc meters. Velocity-based designs include single- and multi-jet meters and turbine meters.

There are also non-mechanical designs, for example electromagnetic and ultrasonic meters, and meters designed for special uses. Most meters in a typical system are designed to measure cold potable water only. Specialty hot water meters are designed with materials that can withstand higher temperatures. Meters for reclaimed water have special lavender register covers to signify that the water should not be used for drinking.

Additionally, there are electromechanical meters, like prepaid water meters and automatic meter reading meters. The latter integrates an electronic measurement component and a LCD with a mechanical water meter. Mechanical water meters normally use a reed switch, hall or photoelectric coding register as the signal output.

After processing by the microcontroller unit (MCU) in the electronic module, the data are transmitted to the LCD or output to an information management system.

Water meters are generally owned, read and maintained by a public water provider such as a city, rural water association or private water company. In some cases an owner of a mobile home park, apartment complex or commercial building may be billed by a utility based on the reading of one meter, with the costs shared among the tenants based on some sort of key (size of flat, number of inhabitants or by separately tracking the water consumption of each unit in what is called sub metering).

Vocabulary.

Displacement design – аралас дизайн – aralas dizai’n – дизайн смещения

End user – соңғы пайдаланушы – son’g’y pai’dalany’shy – конечный пользователь

Lavender register covers –лаванда қақпағы – lavanda qaqpag’y – лавандовые обложки

LCD – liquid crystal display (сұйыққристалды экран – sui’yqkristaldy ekran – жидкокристаллический экран).

Nutating disc meter –өлшеуіш диск –o’lshey’ish disk – измерительный диск

Oscillating piston – бұрмалы поршень – burmaly porshen – качающийся поршень

Potable – safe to drink; drinkable (ішетін – ishetin – питьевой).

Photoelectric coding register –фотоэлектрлік кодтау тіркеуі – fotoelektrlik kodtay’ tirkey’i – регистр фотоэлектрического кодирования

Rate-of-flow – қуат ағыны – qy’at ag’yny – мощность потока

Reclaimed water – қалпына келтірілген су – qalpyna keltirilgen sy’ – восстановленная вода

Reed switch –қамыс қосқышы – qamys qosqyshy – геркон

Exercise 1. Answer the questions.

1. Explain the process of water metering.
2. How do people use water meters?
3. Are there other ways of using water meters?
4. Is there only one type of water meters?
5. Give some examples of such new ways.
6. Are there also non-mechanical designs?
7. What is MCU?

Exercise 2. Match the chemicals with the definitions: Aluminum (Al), Carbon dioxide (CO_2), Carbon monoxide (CO), Hydrogen (H), Methane (CH_4), Oxygen (O), Silicon (Si), Uranium (U), Zinc (Zn).

1. This light metal is used to make things like planes.

2. This gas can kill you.
3. This is a fuel in a nuclear power station.
4. This is the lightest gas and the smallest atom.
5. This is a gas which people use to cook.
6. This gas is made when things burn.
7. This gas is something we need to live.
8. This metal is found in your body and used in batteries.
9. This is used to make an important computer part.

Exercise 3. Decide if the following statements are true or false.

1. Water metering is the process of measuring water use. T/F.
2. Water meters can also be used at the water source. T/F.
3. In most of the world water meters measure flow in cubic metres (m^3). T/F.
4. There are two common approaches to flow measurement. T/F.
5. Meters for reclaimed water have special lavender register covers. T/F.
6. Water meters are generally owned by a public water provider. T/F.

Part 2

Read and translate the text.

History of instrumentation (part one)

The history of instrumentation can be divided into several phases. Pre-industrial phase: elements of industrial instrumentation have long histories. Scales for comparing weights and simple pointers to indicate position are ancient technologies. Some of the earliest measurements were of time. One of the oldest water clocks was found in the tomb of the ancient Egyptian pharaoh Amenhotep I, buried around 1500 BCE. Improvements were incorporated in the clocks. By 270 BCE they had the rudiments of an automatic control system device.

In 1663 Christopher Wren presented the Royal Society with a design for a "weather clock". A drawing shows meteorological sensors moving pens over paper driven by clockwork. Such devices did not become standard in meteorology for two centuries. The concept has remained virtually unchanged as evidenced by pneumatic chart recorders, where a pressurized bellows displaces a pen. Integrating sensors, displays, recorders and controls was uncommon until the industrial revolution, limited by both need and practicality. And now some words about the evolution of analogue control loop signaling from the pneumatic era to the electronic era. Early systems used direct process connections to local control panels for control and indication, which from the early 1930s saw the introduction of pneumatic transmitters and automatic 3-term (PID) controllers.

The ranges of pneumatic transmitters were defined by the need to control valves and actuators in the field. Typically a signal ranged from 3 to 15 psi (20 to 100kPa or 0.2 to 1.0 kg/cm^2) as a standard, was standardized with 6 to 30 psi occasionally being used for larger valves. Transistor electronics enabled wiring to replace pipes, initially with a range of 20 to 100mA at up to 90V for loop powered devices, reducing to 4 to 20mA at 12 to 24V in more modern systems. A transmitter is a device that produces an output signal, often in the form of a 4–20 mA electrical current signal, although many other options using voltage, frequency, pressure, or ethernet are possible. The transistor was commercialized by the mid-1950s.

Instruments attached to a control system provided signals used to operate solenoids, valves, regulators, circuit breakers, relays and other devices. Such devices could control a desired output variable, and provide either remote or automated control capabilities.

Each instrument company introduced their own standard instrumentation signal, causing confusion until the 4-20 mA range was used as the standard electronic instrument signal for transmitters and valves. This signal was eventually standardized as ANSI/ISA S50, “Compatibility of Analog Signals for Electronic Industrial Process Instruments", in the 1970s. The transformation of instrumentation from mechanical pneumatic transmitters, controllers, and valves to electronic instruments reduced maintenance costs as electronic instruments were more dependable than mechanical instruments. This also increased efficiency and production due to their increase in accuracy. Pneumatics enjoyed some advantages, being favored in corrosive and explosive atmospheres.

In the early years of process control, process indicators and control elements such as valves were monitored by an operator that walked around the unit adjusting the valves to obtain the desired temperatures, pressures, and flows. As technology evolved pneumatic controllers were invented and mounted in the field that monitored the process and controlled the valves. This reduced the amount of time process operators were needed to monitor the process. Later years the actual controllers were moved to a central room and signals were sent into the control room to monitor the process and outputs signals were sent to the final control element such as a valve to adjust the process as needed. These controllers and indicators were mounted on a wall called a control board. The operators stood in front of this board walking back and forth monitoring the process indicators. This again reduced the number and amount of time process operators were needed to walk around the units. The most standard pneumatic signal level used during these years was 3-15 psig.

Process control of large industrial plants has evolved through many stages. Initially, control would be from panels local to the process plant. However this required a large manpower resource to attend to these dispersed panels, and there was no overall view of the process. The next logical development was the transmission of all plant measurements to a permanently-manned central control room. Effectively this was the centralization of all the localized panels, with the advantages of lower manning levels and easier overview of the process. Often the controllers were behind the control room panels, and all automatic and manual control outputs were transmitted back to plant.

However, whilst providing a central control focus, this arrangement was inflexible as each control loop had its own controller hardware, and continual operator movement within the control room was required to view different parts of the process. With coming of electronic processors and graphic displays it became possible to replace these discrete controllers with computer-based algorithms, hosted on a network of input/output racks with their own control processors. These could be distributed around plant, and communicate with the graphic display in the control room or rooms. The distributed control concept was born.

The introduction of DCSs and SCADA allowed easy interconnection and re-configuration of plant controls such as cascaded loops and interlocks, and easy interfacing with other production computer systems. It enabled sophisticated alarm handling, introduced automatic event logging, removed the need for physical records such as chart recorders, allowed the control racks to be networked and thereby located locally to plant to reduce cabling runs, and provided high level overviews of plant status and production levels.

In some cases the sensor is a very minor element of the mechanism. Digital cameras and wristwatches might technically meet the loose definition of instrumentation because they record and/or display sensed information. Under most circumstances neither would be called instrumentation, but when used to measure the elapsed time of a race and to document the winner at the finish line, both would be called instrumentation.

Vocabulary.

Actuator – жетектеу – jetektey’ – привод

Analogue control loop signaling – аналогты цикл дабылды басқару – analogty tsikl dabyldy basqary’ – аналоговая петля управления сигнализацией

Automatic 3-term controllers – автоматты үшмерзімді контроллер – avtomatty u’shmerzimdi kontroller – автоматические 3-х семестровые контроллеры

BCE – before the Common Era (used of dates before the Christian era, especially by non-Christians (біздің заманымызға дейін – bizdin’ zamanymyzga dei’in – до нашей эры).

Cabling run –кабельдік маршрут – kabeldik marshry’t – кабельная трасса

Circuit breakers – сақтандырғыштар – saqtandyrg’yshtar – предохранители

Control rack –басқару тетігі – basqary tetigi – стойка управления

DCS – digital cellular system (сандық ұялы жүйе – sandyq uialy ju’i’e – цифровая сотовая система).

Interfacing – жұптастыру – juptastyry' – сопряжение

Interlock –бұғаттау – bug'attay' – блокировка

PID – the dependable sensor for VOCs (VOS үшін сенімді сенсор – VOS u'shin senimdi sensor – надежный датчик для ЛОС).

Psi – pounds per square inch (фунтты дюймге айналдыру – fy'ntty diiymge ai'naldyry' – фунтов на квадратный дюйм).

Pneumatic chart recorders – пневматикалық магнитофондар – pnevmatikalyq magnitofondar – ппневматические самописцы

Pneumatic transmitters –пневматикалық таратқыштар – pnevmatikalyq taratqyshtar – пневматические передатчики

Pressurized bellows –қысым соққысы – qysym soqqysy – сильфон давления

Rudiment – an elementary or primitive form of (something) (ry'diment – рудимент).

SCADA – supervisory control and data acquisition (супервайзерді бақылау жəне деректерді жинау – supervai'zerdi baqylay' ja'ne derekterdi ji'nay' – контроль супервизора и сбор данных).

Sensed information –құпия ақпарат – qupi'ia aqparat – чувствительная информация

Solenoid – a cylindrical coil of wire acting as a magnet when carrying electric current (solenoi'd – соленоид).

Exercise 1. Answer the questions.

1. Can we divide the history of instrumentation into several phases?
2. What can you say about pre-industrial phase?
3. What is a “weather clock”?
4. Who invented a “weather clock”?
5. Can you explain the evolution of analogue control loop signaling?
6. What can you say about pneumatic controllers?
7. What were their advantages and disadvantages?
8. What can you say about process control of large industrial plants?
9. Why did it become possible to replace those discrete controllers?

Exercise 2. Decide if the following statements are true or false.

1. The history of instrumentation can be divided into several phases. T/F.
2. Scales for comparing weights are ancient technologies. T/F.
3. In 1663 Christopher Wren presented a design for a "weather clock". T/F.
4. Such devices did not become standard for two centuries. T/F.
5. A transmitter is a device that produces an output signal. T/F.
6. The transistor was commercialized by the mid-1950s. T/F.
7. Process control of large plants has evolved through many stages. T/F.
8. It required a large manpower resource. T/F.
9. Introduction of DCSs allowed easy interconnection of plant controls. T/F.

10. In some cases sensor is a very minor element of the mechanism. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. A detonator contains an explosive that is actuated by heat or electricity.
2. Over time, driving just becomes automatic.
3. The camera adjusts the lens aperture and shutter speed automatically.
4. The road has been dug up in order to lay cables.
5. This channel is only available on cable.

Read and translate the text.

History of instrumentation (part two)

A very simple example of an instrumentation system is a mechanical thermostat, used to control a household furnace and thus to control room temperature. A typical unit senses temperature with a bi-metallic strip. It displays temperature by a needle on the free end of the strip. It activates the furnace by a mercury switch. As the switch is rotated by the strip, the mercury makes physical (and thus electrical) contact between electrodes.

Another example of an instrumentation system is a home security system. Such a system consists of sensors (motion detection, switches to detect door openings), simple algorithms to detect intrusion, local control (arm/disarm) and remote monitoring of the system so that the police can be summoned. Communication is an inherent part of the design. Kitchen appliances use sensors for control. A refrigerator maintains a constant temperature by measuring the internal temperature. A microwave oven sometimes cooks via a heat-sense cycle until sensing done. An automatic ice machine makes ice until a limit switch is thrown. Pop-up bread toasters can operate by time or by heat measurements. Some ovens use a temperature probe to cook until a target internal food temperature is reached.

Modern automobiles have complex instrumentation. In addition to displays of engine rotational speed and vehicle linear speed, there are also displays of battery voltage and current, fluid levels, fluid temperatures, distance traveled and feedbacks of various controls (turn signals, parking brake, headlights, transmission position). Cautions may be displayed for special problems (fuel low, check engine, tire pressure low, door ajar, seat belt unfastened). Problems are recorded so they can be reported to diagnostic equipment. Navigation systems can provide voice commands to reach a destination. Automotive instrumentation must be cheap and reliable over long periods in harsh environments. There may be independent airbag systems which contain sensors, logic and actuators. Anti-skid braking systems use sensors to control the brakes, while cruise control affects throttle position.

Early aircraft had a few sensors. "Steam gauges" converted air pressures into needle deflections that could be interpreted as altitude and airspeed. A magnetic compass provided a sense of direction. The displays to the pilot were as critical as the measurements. A modern aircraft has a far more sophisticated suite of sensors and displays, which are embedded into avionics systems. The aircraft may contain inertial navigation systems, global positioning systems, weather radar, autopilots, and aircraft stabilization systems. Redundant sensors are used for reliability. A subset of the information may be transferred to a crash recorder to aid mishap investigations. Modern pilot displays now include computer displays including head-up displays.

Air traffic control radar is distributed instrumentation system. The ground portion transmits an electromagnetic pulse and receives an echo (at least). Aircraft carry transponders that transmit codes on reception of the pulse. The system displays aircraft map location, an identifier and optionally altitude. The map location is based on sensed antenna direction and sensed time delay. The other information is embedded in the transponder transmission.

Among the possible uses of the term is a collection of laboratory test equipment controlled by a computer through an IEEE-488 bus (also known as GPIB for General Purpose Instrument Bus or HPIB for Hewlitt Packard Instrument Bus). Laboratory equipment is available to measure many electrical and chemical quantities. Such a collection of equipment might be used to automate the testing of drinking water for pollutants.

Vocabulary.

Actuator – something which makes (a machine or device) operate (жетектеу – jetektey’ – привод).

Anti-skid braking systems –анти-тежегіш жүйе – anti-tejegish ju’i’e – противоскользящая тормозная система

Automatic ice machine – автоматты мұз машинасы – avtomatty mu’z mashinasy – автоматический льдогенератор

Avionics systems – авионика жүйелері – avionika ju’i’eleri – системы авионики

Bi-metallic strip – биметалды жолақ – bi’mealdy jolaq – биметаллическая полоса

Cruise control –круиздік бақылау – kry’izdik baqylay’ – круиз-контроль

Ground portion –жер бөлігі – jer bo’ligi – наземная часть

Headlight – a powerful light at the front of a motor vehicle or railway engine (фар – far – фара).

Head-up displays –head-di’splei’ – head-дисплеи

Household furnace –тұрмыстық пеш – turmystyq pesh – бытовая печь

Mechanical thermostat – a device that automatically regulates temperature, or that activates a device when the temperature reaches a certain point (механикалық термостат – mehani’kalyq termostat – механический термостат).

Mercury switch – сынап қосқышы – synap qosqyshy – ртутный выключатель

Mishap investigations – сәтсіз тергеулер – sa’tsiz tergey’ler – неудачные расследования

Needle deflections –көрсеткіш ауытқулары – ko’rsetkish ay’ytqy’lary – отклонения стрелки

Parking brake – қол тежегіші – qol tejegishi – ручной тормоз

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Pop-up bread toasters – қалқымалы поппури – qalqymaly poppy’ri’ – всплывающие тостеры

Redundant sensors – артық сенсорлар – artyq sensorlar – избыточные датчики

Steam gauges –бу датчиктері – by’ datchikteri – паровые датчики

Target internal food temperature – тағамның ішкі температурасы – tag’amnyn’ ishki temperaty’rasy – целевая внутренняя пищевая температура

Temperature probe –температура датчигі – temperaty’ra datchi’gi – датчик температуры

Throttle position –дроссель күйі – drossel kui’i – положение дроссельной заслонки

Transmission position – беріліс жағдайы – berilis jagdai’y – положение передачи

Transponder – a device for receiving a radio signal and automatically transmitting a different signal (trransponder – транспондер).

Exercise 1. Answer the questions.

1. What is a very simple example of an instrumentation system?
2. How does it display temperature?
3. How does it activate the furnace?
4. What parts does a home security system consist of?
5. What do kitchen appliances use for control?
6. What kitchen appliances can you name?
7. What kind of instrumentation do modern automobiles have?
8. What problems can be with them?
9. What is very necessary to have in modern automobiles?
10. What is special about modern pilot nowadays?
11. Is air control radar rarely used?
12. Explain traffic how such system works.
13. How is the map location based?
14. Where is the other information embedded?
15. How can people use laboratory equipment?

Exercise 2. Decide if the following statements are true or false.

1. Mechanical thermostat is used to control a household furnace. T/F.

2. Mechanical thermostat is used to control room temperature. T/F.
3. It activates the furnace by a mercury switch. T/F.
4. A refrigerator maintains a constant temperature. T/F.
5. A microwave oven sometimes cooks via a heat-sense cycle. T/F.
6. An automatic ice machine makes ice until a limit switch is thrown. T/F.
7. Some ovens use a temperature probe. T/F.
8. Automotive instrumentation must be cheap and reliable. T/F.
9. A modern aircraft has a far more sophisticated suite of sensors. T/F.
10. Air traffic control radar is distributed instrumentation system. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. By the 1960s, most households had a TV.
2. There has been a sudden rise in temperature over the past few days.
3. Can you flip the switch?
4. Security device has a heat sensor which detects the presence of people.
5. Air traffic control has given us clearance to land in 20 minutes.
6. I could see a car's headlights coming towards me.
7. It was foggy, and all the cars had their headlights on.

Read and translate the text.

Instrumentation engineering

Instrumentation engineering is the engineering specialization focused on the principle and operation of measuring instruments that are used in design and configuration of automated systems in electrical, pneumatic domains etc. and the control of quantities being measured. They typically work for industries with *automated* processes, such as chemical or manufacturing plants, with the goal of improving system productivity, reliability, safety, optimization and stability. To control the parameters in a process or in a particular system, devices such as microprocessors, microcontrollers or PLCs are used, but their ultimate aim is to control the parameters of a system.

Instrumentation engineering is loosely defined because the required tasks are very domain dependent. An expert in the biomedical instrumentation of laboratory rats has very different concerns than the expert in rocket instrumentation. Common concerns of both are the selection of appropriate sensors based on size, weight, cost, reliability, accuracy, longevity, environmental robustness and frequency response. Some sensors are literally fired in artillery shells. Others sense thermonuclear explosions until destroyed. Invariably sensor data must be recorded, transmitted or displayed. Recording rates and capacities vary enormously. Transmission can be trivial or can be clandestine, encrypted and low-power in the presence of jamming.

Displays can be trivially simple or can require consultation with human factors experts. Control system design varies from trivial to a separate specialty.
Instrumentation engineers are responsible for integrating the sensors with the recorders, transmitters, displays or control systems, and producing the Piping and instrumentation diagram for the process. They may design or specify installation, wiring and signal conditioning. They may be responsible for calibration, testing and maintenance of the system.

In a research environment it is common for subject matter experts to have substantial instrumentation system expertise. An astronomer knows the structure of the universe and a great deal about telescopes - optics, pointing and cameras (or other sensing elements). That often includes the hard-won knowledge of the operational procedures that provide the best results. For example, an astronomer is often knowledgeable of techniques to minimize temperature gradients that cause air turbulence within the telescope.

Instrumentation technologists, technicians, and mechanics specialize in troubleshooting, repairing, and maintaining instruments and instrumentation systems.

Ralph Müller (1940) stated, that the history of physical science is largely the history of instruments and their intelligent use is well known. The broad generalizations and theories which have arisen from time to time have stood or fallen on the basis of accurate measurement, and in several instances new instruments have had to be devised for the purpose. There is little evidence to show that the mind of modern man is superior to that of the ancients. His tools are incomparably better.

Davis Baird has argued that the major change associated with Floris Cohen's identification of a "fourth big scientific revolution" after World War II is the development of scientific instrumentation, not only in chemistry but across the sciences. In chemistry, the introduction of new instrumentation in the 1940s was "nothing less than a scientific and technological revolution" in which classical wet-and-dry methods of structural organic chemistry were discarded, and new areas of research opened up.

As early as 1954, W. A. Wildhack discussed both the productive and destructive potential inherent in process control. The ability to make precise, verifiable and reproducible measurements of the natural world, at levels that were not previously observable, using scientific instrumentation, has "provided a different texture of the world". This instrumentation revolution fundamentally changes human abilities to monitor and respond, as is illustrated in the examples of DDT monitoring and the use of UV spectrophotometry and gas chromatography to monitor water pollutants.

Vocabulary.

Actuator – something which makes (a machine or device) operate (жетектеу – jetektey’ – привод).

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Transponder – a device for receiving a radio signal and automatically transmitting a different signal (trransponder – транспондер).

Exercise 1. Answer the questions.

1. What do you understand by instrumentation engineering?

2. What are instrumentation engineers responsible for?
3. What they design?
4. What is common for subject matter experts?
5. Explain the sphere of work of astronomers.
6. Who repairs and maintains instruments?
7. Can we say the mind of modern man is superior to that of the ancients?
8. Explain the meaning of the fourth big scientific revolution.
9. What has "provided a different texture of the world"?

Exercise 2. Decide if the following statements are true or false.
1. Instrumentation engineering is loosely defined. T/F.
2. Control system design varies from trivial to a separate specialty. T/F.
3. An astronomer is often knowledgeable of techniques. T/F.
4. Technicians specialize in repairing instruments. T/F.
5. The "fourth big scientific revolution" was after World War II. T/F.
6. It is the development of instrumentation across the science. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.
1. Which instrument do you play?
2. The engineer is coming to repair our phone tomorrow morning.
3. Richard studied engineering at Manchester University.
4. Massive investment is needed to automate the production process.
5. She is an expert at dressmaking.
6. What is your expert opinion?
7. Space travel is one of the marvels/wonders of modern science.

Read and translate the text.

History of hygrometers

A hygrometer is an instrument used for measuring the water vapor in the atmosphere. Humidity measurement instruments usually rely on measurements of some other quantity such as temperature, pressure, mass or a mechanical or electrical change in a substance as moisture is absorbed. By calibration and calculation, these measured quantities can lead to a measurement of humidity. Modern electronic devices use temperature of condensation (the dew point), or changes in electrical capacitance or resistance to measure humidity differences.

The first crude hygrometer was invented by the Italian Renaissance polymath Leonardo da Vinci in 1480 and a more modern version was created by Swiss polymath Johann Heinrich Lambert in 1755.

And now some words about ancient hygrometers. Prototype hygrometers were devised and developed during the Western Han dynasty in Ancient China to study weather. The Chinese used a bar of charcoal and a lump of earth: its dry weight was taken and then compared with its damp weight after being exposed in the air. The differences in weight were used to tally the humidity level.

The metal-paper coil hygrometer is very useful for giving a dial indication of humidity changes. It appears most often in very inexpensive devices, and its accuracy is limited, with variations of 10% or more. In these devices, water vapor is absorbed by a salt-impregnated paper strip attached to a metal coil, causing the coil to change shape. These changes (analogous to those in a bimetallic thermometer) cause an indication on a dial.

Now let us talk about hair tension hygrometers. These devices use a human or animal hair under tension. The hair is hygroscopic (tending toward retaining moisture); its length changes with humidity, and the length change may be magnified by a mechanism and indicated on a dial or scale. In the late 1700s, such devices were called by some scientists as hygroscopes; that word is no longer in current use, but hygroscopic and hygroscopy, which derive from it, still are.

However, there can be difficulty of accurate humidity measurement. Humidity measurement is among the more difficult problems in basic meteorology. According to the WMO Guide, the achievable accuracies for humidity determination refer to good quality instruments that are well operated and maintained.

Vocabulary.

Bar of charcoal – көмір – ko’mir – древесный уголь

Bimetallic thermometer – биметалды термометр – bimetaldy termometr – биметаллический термометр

Crude hygrometer – шикі гигрометр – shi’ki gigrometr – сырой гигрометр

Damp weight –дымқыл салмақ – dymqyl salmaq – влажный вес

Dew point –шық нүктесі – shyq nu’ktesi – точка росы

Dial indication – теру көрсеткіші – tery’ ko’rsetkishi – индикация набора

Electrical capacitance – электрсыйымдылығы –elektr syi’ymdylyg’y – электрическая емкость

Hair tension hygrometers – шашты тарту гигрометрлері – shashty tarty’ gigrometrleri – гигрометры натяжения волос

Hygrometer – an instrument for measuring the humidity of the air or a gas (gigrometr – гигрометр).

Hygroscope – an instrument which gives an indication of the humidity of the air (gigroskop – гигроскоп).

Humidity measurement instruments –ылғалдылықты өлшейтін аспаптар – ylg’aldylyqty o’lshei’tin aspaptar – приборы для измерения влажности

Italian Renaissance – the revival of European art and literature under the influence of classical models in the 14^{th}-16^{th} centuries (италяндық ренессанс – I’tali’ialyq renessans – итальянский ренессанс).

Lump of earth – жер телімі – jer telimi – кусок земли

Metal-paper coil hygrometer – қағаз орамының гигрометрі – qag’az oramynyn’ gigrometri – металлобумажный рулонный гигрометр

Moisture – water or other liquid diffused in a small quantity as vapor, within a solid, or condensed on a surface (ылғалдылық – ylg’aldylyq – влажность).

Polymath – a person of wide knowledge or learning (ery’di’t – эрудит).

Prototype hygrometers –гигрометрдің прототипі – gigrometrdin’ prototi’pi – прототип гигрометров

Retaining moisture – ылғалды сақтау – ylg’aldy saqtay’ – сохраняя влагу

Salt-impregnated paper strip – тұзды сіңдірген қағаз жолағы – tuz sin’dirgen qag’az jolag’y – пропитанная солью бумажная полоса

Tally – agree or correspond; calculate the total number of (санау – sanay’ – число, подсчитать).

Under tension – қуатталған – qy’attalg’an – под напряжением

Water vapor – су буы – sy by’y – водяной пар

WMO Guide – World Meteorological Organization Guide (Дүниежүзілік Метереологиялық Ұйымның Басшылығы – Du’ni’eju’zilik Metereologi’ialyq Ui’ymnyn’ Basshylyg’y – Руководство Всемирной Метеорологической Организации).

Exercise 1. Answer the questions.

1. What is a hygrometer?
2. What do humidity measurement instruments usually rely on?
3. What do modern electronic devices use?
4. Who invented the first crude hygrometer and when?
5. Who invented a more modern version and when?
6. Who devised and developed ancient hygrometers?
7. Explain the process of usage.
8. What was used to tally the humidity level?
9. What gives a dial indication of humidity changes?
10. Where does it appear most often?
11. Explain the process of work of hair tension hygrometers.
12. Is the word hygroscope in modern use?
13. Is humidity measurement always accurate?
14. Why is it among the more difficult problems in basic meteorology?

Exercise 2. Decide if the following statements are true or false.

1. A hygrometer is an instrument used for measuring the water vapor. T/F.
2. Modern electronic devices use temperature of condensation. T/F.
3. The first hygrometer was invented by Leonardo da Vinci in 1480. T/F.
4. Prototype hygrometers were devised in Ancient China. T/F.
5. The Chinese used a bar of charcoal and a lump of earth. T/F.
6. Water vapor is absorbed by a salt-impregnated paper strip. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. The hollow glass tank contains hot mercury vapor.
2. The machine makes thousands of measurements every day.
3. Can you work well under pressure?
4. These plants need a rich soil, which retains moisture.
5. New York is very hot and humid in the summer.
6. We get a lot of condensation on the walls in the winter.
7. What weight can this lorry safely carry?
8. I lift weights twice a week at the gym.

Read and translate the text.

History of barometers

A barometer is a scientific instrument used in meteorology to measure atmospheric pressure. Pressure tendency can forecast short-term changes in the weather. Numerous measurements of air pressure are used within surface weather analysis to help find surface troughs, high-pressure systems and frontal boundaries.

Barometers and pressure altimeters (the most basic and common type of altimeter) are essentially the same instrument, but used for different purposes. An altimeter is intended to be transported from place to place matching the atmospheric pressure to the corresponding altitude, while a barometer is kept stationary and measures subtle pressure changes caused by weather. The main exception to this is ships at sea, which can use a barometer because their elevation does not change.

The concept that decreasing atmospheric pressure predicts stormy weather, postulated by Lucien Vidi, provides the theoretical basis for a weather prediction device called a "weather glass" or a "Goethe barometer" (named for Johann Wolfgang Von Goethe, the renowned German writer and polymath who developed a simple but effective weather ball barometer using the principles developed by Torricelli). The French name, le barometre Liegeois, is used by some English speakers.

A mercury barometer has a glass tube closed at one end with an open mercury- filled reservoir at the base. The weight of the mercury creates a vacuum in the top of the tube known as Torricellian vacuum. Mercury in the tube adjusts until the weight of the mercury column balances the atmospheric force exerted on the reservoir. High atmospheric pressure places more force on the reservoir, forcing mercury higher in the column.

An aneroid barometer is an instrument for measuring pressure as a method that does not involve liquid. Invented in 1844 by French scientist Lucien Vidi, 1151 the aneroid barometer uses a small, flexible metal box called an aneroid cell (capsule), which is made from an alloy of beryllium and copper. The evacuated capsule (or usually several capsules, stacked to add up their movements) is prevented from collapsing by a strong spring.

Vocabulary.

Altimeter – an instrument for determining altitude attained, especially a barometric or radar device fitted in an aircraft (алтиметр – altimetr – высотомер).

Aneroid barometer – анероидтық барометр – aneroidtyq barometr – анероидный барометр

Aneroid cell – анероидты жасуша - aneroidty jasy’s’a – анероидная клетка

Barometer – an instrument measuring atmospheric pressure, used especially in forecasting the weather and determining altitude (barometr – барометр).

Beryllium – the chemical element of atomic number 4, a hard grey metal; it is the lightest of alkaline earth metals, and its chief source is the mineral beryl. It is used in the manufacture of light corrosion-resistant alloys and in windows in X-ray equipment (beriliy – бериллий).

Exert – apply or bring to bear (a force, influence, or quality) (әсер ету – a’ser ety’ – напрягать).

Stack up – form or cause to form a large quantity; build up; cause (an aircraft) to fly in circles while waiting for permission to land at an airport (жинақтау – Jinaqtay’ – складывать).

Trough – an elongated region of low barometric pressure (қуыс – qy’ys – впадина).

Weather ball barometer – ауа райы барометрі – ay’a rai’y barometri – погодный шаровой барометр

Exercise 1. Answer the questions.

1. How old is the history of using natural gas?
2. How did people use it in the past?
3. How do people use it today?
4. Why is natural gas considered as the cleanest fossil fuel?
5. Which countries send natural gas?
6. How do they get the gas from these places?
7. What is the other way of delivering natural gas?
8. Where is a lot of the world’s natural gas found?
9. Is it difficult and expensive to get natural gas nowadays?
10. What is the new way nowadays and is it safe?
11. Does shale gas bring only good things for people?
12. Can fossil fuels help people to live a very comfortable life?
13. Will they destroy that life one day too?

Exercise 2. Decide if the following statements are true or false.

1. A hygrometer is an instrument used for measuring the water vapor. T/F.
2. Modern electronic devices use temperature of condensation. T/F.

3. The first hygrometer was invented by Leonardo da Vinci in 1480. T/F.
4. Prototype hygrometers were devised in Ancient China. T/F.
5. The Chinese used a bar of charcoal and a lump of earth. T/F.
6. Water vapor is absorbed by a salt-impregnated paper strip. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. This survey is considered to be a reliable barometer of public opinion.
2. Accurate meteorological records began 100 years ago.
3. Plants are the main source of atmospheric oxygen.
4. I quite like fog because it is atmospheric.
5. The weather forecast said it was going to rain later today.
6. Snow has been forecast for tonight.
7. These pipes can withstand higher pressures.

Read and translate the text.

History of multimeters

The first moving-pointer current-detecting device was the galvanometer in 1820. These were used to measure resistance and voltage by using a Wheatstone bridge, and comparing the unknown quantity to a reference voltage or resistance. While useful in the lab, the devices were very slow and impractical in the field. These galvanometers were bulky and delicate.

The D'Arsonval/Weston meter movement uses a moving coil, which carries a pointer and rotates on pivots or a taut band ligament. The coil rotates in a permanent magnetic field and is restrained by fine spiral springs, which also serve to carry current into the moving coil. It gives proportional measurement rather than just detection, and deflection is independent of the orientation of the meter. Instead of balancing a bridge, values could be directly read off the instrument's scale, which made measurement quick and easy.

The basic moving coil meter is suitable only for direct current measurements, usually in the range of 10 microamperes to 100 mA. It is easily adapted to read heavier currents by using shunts (resistances in parallel with the basic movement) or to read voltage using series resistances known as multipliers. To read alternating currents or voltages, a rectifier is needed. One of the earliest suitable rectifiers was the copper oxide rectifier developed and manufactured by Union Switch Signal Company in 1927.

Multimeters were invented in the early 1920s as radio receivers and other vacuum tube electronic devices became more common. The invention of the first multimeter is attributed to British Post Office engineer, Donald Macadie, who became dissatisfied with the need to carry many separate instruments required for maintenance of telecommunications circuits. Macadie invented an instrument, which could measure amperes (amps), volts, and ohms, so the multifunctional meter was then named Avometer.

Vocabulary.

Copper oxide rectifier – мыс оксидінің түзеткіші – mys oksi'dinin' tu'zetkis'i – выпрямитель на основе оксида меди

Deflection – the action or process of deflecting or being deflected (ауытқу – ay'ytqy' – прогиб).

Galvanometer – an instrument for detecting and measuring small electric currents (galvanometr – гальванометр).

Moving-pointer – көрсеткіштің қозғалысы – ko'rsetkis'tin' kozg'alysy – перемещение указателя

Multimeter – an instrument designed to measure electric current, voltage, and usually resistance, typically over several ranges of value (my'ltimetr – мультиметр).

Multiplier – a device for increasing by repetition the intensity of an electric current, force, etc. to a measurable level (көбейткіш – ko'bei'tkis' – мультипликатор).

Pivot – the central point, pin, or shaft on which a mechanism turns or oscillates (өзек – o'zek – стержень).

Pointer – a long, thin piece of metal on a scale or dial which moves to indicate a figure or position (көрсеткіш – ko'rsetkis' – указатель).

Rectifier – an electrical device, which converts an alternating current into a direct one by allowing a current to flow through it in one direction only (түзеткіш – ty'zetkis' – выпрямитель).

Reference voltage – аңықтамалық кернеу – anyqtamalyq kerney' – опорное напряжение

Shunt – an electrical conductor joining two points of a circuit, through which more or less of a current may be diverted (s'y'nt – шунт).

Taut band ligament – тығыз байланыс – tyg'yz bai'lanys – тугая связка

Wheatstone bridge – мост Уитстона

Exercise 1. Answer the questions.

1. What was the first moving-pointer current-detecting device?
2. What were they used to?
3. What were their disadvantages?
4. Explain the process of work of the D'Arsonval/Weston meter.
5. For what measurements is the basic moving coil meter suitable?
6. What was one of the earliest suitable rectifiers?
7. What company manufactured it and when?
8. When were multimeters invented?
9. What was the period then?
10. Who was the inventor of the first multimeter?

11. Explain the history of calling the multifunctional meter as Avometer.

Exercise 2. Decide if the following statements are true or false.

1. The first moving-pointer device was the galvanometer. T/F.
2. It was used to measure resistance and voltage. T/F.
3. The device was very slow and impractical in the field. T/F.
4. It was bulky and delicate. T/F.
5. D'Arsonval meter gives proportional measurement. T/F.
6. Deflection is independent of the orientation of the meter. T/F.
7. Values could be directly read off the instrument's scale. T/F.
8. Moving coil meter is suitable for direct current measurements. T/F.
9. To read alternating currents or voltages, a rectifier is needed. T/F.
10. The earliest suitable rectifiers were the copper oxide rectifiers. T/F.
11. The multifunctional meter was then named Avometer. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. The car's speed was reduced by air/wind resistance.
2. Copper has a low resistance.
3. Electricity in Britain is 240 volts, AC.
4. Over the years the mattress has lost its spring.
5. A coil of rope lay on the beach.
6. A coil of thick blue smoke rose up from his pipe.
7. A rectifier is an electronic device for changing AC to DC.

Read and translate the text.

From the history of telescopes

Telescopes are optical instruments that make distant objects appear magnified by using an arrangement of lenses or curved mirrors and lenses, or various devices used to observe distant objects by their emission, absorption, or reflection of electromagnetic radiation. The first known practical telescopes were refracting telescopes invented in the Netherlands at the beginning of the 17th century, by using glass lenses. They found use in both terrestrial applications and astronomy.

The reflecting telescope, which uses mirrors to collect and focus light, was invented within a few decades of the first refracting telescope. In the 20th century, many new types of telescopes were invented, including radio telescopes in the 1930s and infrared telescopes in the 1960s. The word telescope now refers to a wide range of instruments capable of detecting different regions of the electromagnetic spectrum, and in some cases other types of detectors.

Etymology of the word telescope is (from the ancient Greek τῆλε, tele "far" and σκοπεῖν, skopein "to look or see"; τηλεσκόπος, teleskopos "far-seeing") was coined in 1611 by the Greek mathematician Giovanni Demisiani for one of Galileo Galilei's instruments presented at a banquet at the Accademia dei Lincei. In the Starry Messenger, Galileo had used the term ‘perspicillum’.

Now some words of history of telescopes. The "onion" dome at the Royal Observatory, Greenwich housing a 28-inch refracting telescope with a remaining segment of William Herschel's 120-centimeter (47 inches) in diameter reflecting telescope (called the "40-foot telescope" due to its focal length) in the foreground.

The earliest existing record of a telescope was a 1608 patent submitted to the government in the Netherlands by Middelburg spectacle maker Hans Lippershey for a refracting telescope. The actual inventor is unknown but word of it spread through Europe. Galileo heard about it and, in 1609, built his own version, and made his telescopic observations of celestial objects.

The idea that the objective, or light-gathering element, could be a mirror instead of a lens was being investigated soon after the invention of the refracting telescope. The potential advantages of using parabolic mirrors—reduction of spherical aberration and no chromatic aberration—led to many proposed designs and several attempts to build reflecting telescopes. In 1668, Isaac Newton built the first practical reflecting telescope, of a design, which now bears his name, the Newtonian reflector.

The invention of the achromatic lens in 1733 partially corrected color aberrations present in the simple lens and enabled the construction of shorter, more functional refracting telescopes. Reflecting telescopes, though not limited by the color problems seen in refractors, were hampered by the use of fast tarnishing speculum metal mirrors employed during the 18th and early 19th century—a problem alleviated by the introduction of silver-coated glass mirrors in 1857, and aluminized mirrors in 1932. The maximum physical size limit for refracting telescopes is about 1 meter (40 inches).

The 20th century also saw the development of telescopes that worked in a wide range of wavelengths from radio to gamma-rays. Since then, a large variety of complex astronomical instruments have been developed.

Vocabulary.

Achromatic lens –акроматикалық линза – akromati’kalyq linza – ахроматическая линза

Alleviate – make (suffering, deficiency, or a problem) less severe (жұмсарту – jumsarty’ – смягчать).

Aluminized mirrors – Жарықтандырылған айна – Jaryqtandyrylg’an ai’na – Алюминированные зеркала

Arrangement of lenses – линзаларды орналастыру – linzalardy ornalastyry’ – расположение линз

Curved mirrors – қисық айналар – qi’syq ai’nalar – кривые зеркала

Fast tarnishing speculum metal mirrors – тез күңгірт металл айналар – tez ku’n’girt metell ai’nalar – быстро тускнеющие металлические зеркала

Focal length – фокустық қашықтық – foky’styq qas’yqtyq – фокусное расстояние

Foreground – the part of a view that is nearest to the observer, especially in a picture or photograph; the most prominent or important position or situation (алдыңғы қатарда – aldyng’y qatarda – передний план).

Gamma-rays – penetrating electromagnetic radiation of shorter wavelength than X-rays (гамма сәулелері – gamma sa’y’leleri – гамма лучи).

Glass lenses – шыны линзалар – s’yny linzalar – стеклянные линзы

Hamper – hinder or impede the movement or progress of (қиындату – qi’yndaty’ – затруднять).

No chromatic aberration – хроматикалық аберрация жоқ – hromati’kalyq aberraci’a joq – нет хроматической аберрации

Refracting telescopes – сынғыш телескоптар – syng’ys’ teleskoptar – преломляющие телескопы

Refractor – a lens or other object which causes refraction; a refracting telescope (refraktor – рефрактор).

Parabolic mirrors – параболалық айналар – parabolalyq ai’nalar – параболические зеркала

Spherical aberration – сфералық аберрация – sferalyq aberraci’a – сферическая аберрация

Telescope – an optical instrument designed to make distant objects appear nearer, containing an arrangement of lenses, or of curved mirrors and lenses, by which rays of light are collected and focused and the resulting image magnified (teleskop – телескоп).

Exercise 1. Answer the questions.

1. What are the functions of telescopes?
2. When was the first telescope invented?
3. What types of telescopes appeared in the 20th century?
4. What does the word ‘telescope’ now refer to?
5. What is the origin of the word ‘telescope’?
6. Where is the "onion" dome situated?
7. Who was the actual inventor of a telescope?
8. When did Isaac Newton build the first practical reflecting telescope?
9. Is it the end of telescope era?

Exercise 2. Find the words of opposite meaning.

Distant, end, near, beginning, wide, unknown, narrow, known, disadvantage, increase, advantage, simple, reduction, complex.

Exercise 3. Decide if the following statements are true or false.

1. Telescopes are optical instruments. T/F.
2. The first practical telescopes were invented in the Netherlands. T/F.

3. They found use in both terrestrial applications and astronomy. T/F.
4. The earliest existing record of a telescope was a 1608 patent. T/F.
5. Galileo made his telescopic observations of celestial objects in 1609. T/F.
6. In 1668, Isaac Newton built the first practical reflecting telescope. T/F.
7. This design now bears his name, the Newtonian reflector. T/F.
8. Invention of the achromatic lens in 1733 corrected color aberrations. T/F.
9. A few complex astronomical instruments have been developed. T/F.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. We had to telescope five visits into two days.
2. The movie is a mirror of daily life in wartime Britain.
3. Our newspaper aims to mirror the opinions of ordinary people.
4. Her on-screen romances seem to mirror her experiences in her private life.
5. Low test scores are a sad reflection on our school system.
6. The alarm emits infra-red rays which are used to detect any intruder.
7. The machine emits a high-pitched sound when you press the button.
8. The glass prism refracted the white light into the colors of the rainbow.
9. Financial experts detected that the economy is beginning to improve.
10. High levels of lead were detected in the atmosphere.
11. Radar equipment is used to detect enemy aircraft.
12. The Earth is not perfectly spherical.
13. In a moment of aberration, she agreed to go with him.
14. I had a mental aberration and forgot we had a meeting today.
15. The drugs did nothing to alleviate her pain/suffering.
16. Cover the fish with aluminum foil and cook over a low heat.

Read and translate the text.

From the history of broadcasting

Broadcasting is the distribution of audio or video content to a dispersed audience. Broadcasting began with AM radio, which came into popular use around 1920 with the spread of vacuum tube radio transmitters and receivers. Before this, all forms of electronic communication (early radio, telephone, and telegraph) were one-to-one, with the message intended for a single recipient. The term broadcasting evolved from its use as the agricultural method of sowing seeds in a field by casting them broadly about. It was later adopted for describing the widespread distribution of information by printed materials or by telegraph. Examples applying it to "one-to-many" radio transmissions of an individual station to multiple listeners appeared as early as 1898.

Over the air broadcasting is usually associated with radio and television, though in recent years both radio and television transmissions have begun to be distributed by cable (cable television). The receiving parties may include the general public or a relatively small subset; the point is that anyone with the appropriate receiving technology and equipment (e.g., a radio or television set) can receive the signal. The field of broadcasting includes both government-managed services such as public radio, community radio and public television, and private commercial radio and commercial television. The U.S. Code of Federal Regulations, title 47, part 97 defines "broadcasting" as "transmissions intended for reception by the general public, either direct or relayed". Private or two-way telecommunications transmissions do not qualify under this definition. For example, amateur ("ham") and citizens band (CB) radio operators are not allowed to broadcast. As defined, "transmitting" and "broadcasting" are not the same.

Transmission of radio and television programs from a radio or television station to home receivers by radio waves is referred to as "over the air" (OTA) or terrestrial broadcasting and in most countries requires a broadcasting license. Transmissions using a wire or cable, like cable television (which also retransmits OTA stations with their consent), are also considered broadcasts, but do not necessarily require a license (though in some countries, a license is required). In the 2000s, transmissions of television and radio programs via streaming digital technology have increasingly been referred to as broadcasting as well.

The earliest broadcasting consisted of sending telegraph signals over the airwaves, using Morse code, a system developed in the 1830s by Samuel F. B. Morse, physicist Joseph Henry and Alfred Vail. They developed an electrical telegraph system which sent pulses of electric current along wires which controlled an electromagnet that was located at the receiving end of the telegraph system. A code was needed to transmit natural language using only these pulses, and the silence between them. Morse therefore developed the forerunner to modern International Morse code. This was particularly important for ship-to-ship and ship-to-shore communication, but it became increasingly important for business and general news reporting, and as an arena for personal communication by radio amateurs. Audio broadcasting began experimentally in the first decade of the 20th century. By the early 1920s radio broadcasting became a household medium, at first on the AM band and later on FM. Television broadcasting started experimentally in the 1920s and became widespread after World War II, using VHF and UHF spectrum. Satellite broadcasting was initiated in the 1960s and moved into general industry usage in the 1970s, with DBS (Direct Broadcast Satellites) emerging in the 1980s.

Originally all broadcasting was composed of analog signals using analog transmission techniques but in the 2000s, broadcasters have switched to digital signals using digital transmission. In general usage, broadcasting most frequently refers to the transmission of information and entertainment programming from various sources to the general public.

The world's technological capacity to receive information through one-way broadcast networks more than quadrupled during the two decades from 1986 to 2007, from 432 exabytes of (optimally compressed) information, to 1.9 zettabytes.

This is the information equivalent of 55 newspapers per person per day in 1986, and 175 newspapers per person per day by 2007.

There have been several methods used for broadcasting electronic media audio and video to the general public: Telephone broadcasting (1881–1932): the earliest form of electronic broadcasting (not counting data services offered by stock telegraph companies from 1867, if ticker-tapes are excluded from the definition). Telephone broadcasting began with the advent of Théâtrophone ("Theatre Phone") systems, which were telephone-based distribution systems allowing subscribers to listen to live opera and theatre performances over telephone lines, created by French inventor Clément Ader in 1881. Telephone broadcasting also grew to include telephone newspaper services for news and entertainment programming which were introduced in the 1890s, primarily located in large European cities. These telephone-based subscription services were the first examples of electrical/electronic broadcasting and offered a wide variety of programming.

Radio broadcasting (experimentally from 1906, commercially from 1920); audio signals sent through the air as radio waves from a transmitter, picked up by an antenna and sent to a receiver. Radio stations can be linked in radio networks to broadcast common radio programs, either in broadcast syndication, simulcast or subchannels.

Television broadcasting (telecast), experimentally from 1925, commercially from the 1930s: an extension of radio to include video signals.
Cable radio (also called "cable FM", from 1928) and cable television (from 1932): both via coaxial cable, originally serving principally as transmission media for programming produced at either radio or television stations, but later expanding into a broad universe of cable-originated channels.

Direct-broadcast satellite (DBS) (from 1974) and satellite radio (from 1990): meant for direct-to-home broadcast programming (as opposed to studio network uplinks and downlinks), provides a mix of traditional radio or television broadcast programming, or both, with dedicated satellite radio programming.

Webcasting of video/television (from 1993) and audio/radio (from 1994) streams: offers a mix of traditional radio and television station broadcast programming with dedicated Internet radio and Internet television.

There are several means of providing financial support for continuous broadcasting: commercial broadcasting: for-profit, usually privately owned stations, channels, networks, or services providing programming to the public, supported by the sale of air time to advertisers for radio or television advertisements during or in breaks between programs, often in combination with cable or pay cable subscription fees.

Public broadcasting: usually non-profit, publicly owned stations or networks supported by license fees, government funds, grants from foundations, corporate underwriting, audience memberships, contributions or a combination of these.

Community broadcasting: a form of mass media in which a television station, or a radio station, is owned, operated or programmed, by a community group to provide programs of local interest known as local programming. Community stations are most commonly operated by non-profit groups or cooperatives; however, in some cases they may be operated by a local college or university, a cable company or a municipal government.

Broadcasters may rely on a combination of these business models. For example, in the United States, National Public Radio (NPR) and the Public Broadcasting Service (PBS, television) supplement public membership subscriptions and grants with funding from the Corporation for Public Broadcasting (CPB), which is allocated bi-annually by Congress. US public broadcasting corporate and charitable grants are generally given in consideration of underwriting spots which differ from commercial advertisements in that they are governed by specific FCC restrictions, which prohibit the advocacy of a product or a "call to action".

A television studio production control room in Olympia, Washington, August 2008. On Air sign illuminated usually in red while recording or broadcasting. The first regular television broadcasts started in 1937. Broadcasts can be classified as "recorded" or "live". The former allows correcting errors, and removing superfluous or undesired material, rearranging it, applying slow-motion and repetitions, and other techniques to enhance the program. However, some live events like sports television can include some of the aspects including slow-motion clips of important goals/hits, etc., in between the live television telecast. American radio-network broadcasters habitually forbade prerecorded broadcasts in the 1930s and 1940s requiring radio programs played for the Eastern and Central time zones to be repeated three hours later for the Pacific time zone (See: Effects of time on North American broadcasting). This restriction was dropped for special occasions, as in the case of the German dirigible airship Hindenburg disaster at Lakehurst, New Jersey, in 1937. During World War II, prerecorded broadcasts from war correspondents were allowed on U.S. radio. In addition, American radio programs were recorded for playback by Armed Forces radio stations around the world.

A disadvantage of recording first is that the public may know the outcome of an event from another source, which may be a "spoiler". In addition, prerecording prevents live radio announcers from deviating from an officially approved script, as occurred with propaganda broadcasts from Germany in the 1940s and with Radio Moscow in the 1980s. Many events are advertised as being live, although they are often "recorded live" (sometimes called "live-to-tape"). This is particularly true of performances of musical artists on radio when they visit for an in-studio concert performance. Similar situations have occurred in television production ("The Cosby Show is recorded in front of a live television studio audience") and news broadcasting.

A broadcast may be distributed through several physical means. If coming directly from the radio studio at a single station or television station, it is simply sent through the studio/transmitter link to the transmitter and hence from the television antenna located on the radio masts and towers out to the world. Programming may also come through a communications satellite, played either live or recorded for later transmission. Networks of stations may simulcast the same programming at the same time, originally via microwave link, now usually by satellite. Distribution to stations or networks may also be through physical media, such as magnetic tape, compact disc (CD), DVD, and sometimes other formats. Usually these are included in another broadcast, such as when electronic news gathering (ENG) returns a story to the station for inclusion on a news program.

The final leg of broadcast distribution is how the signal gets to the listener or viewer. It may come over the air as with a radio station or television station to an antenna and radio receiver, or may come through cable television or cable radio (or "wireless cable") via the station or directly from a network. The Internet may also bring either internet radio or streaming media television to the recipient, especially with multicasting allowing the signal and bandwidth to be shared. The term "broadcast network" is often used to distinguish networks that broadcast an over-the-air television signals that can be received using a tuner (television) inside a television set with a television antenna from so-called networks that are broadcast only via cable television (cablecast) or satellite television that uses a dish antenna. The term "broadcast television" can refer to the television programs of such networks.

Vocabulary.

Bi-annual – occurring twice a year (жылына екі рет – jylyna eki ret – два раза в год).

Broadcast – transmit (a program or some information) by radio or television; take part in a radio or television transmission (хабар тарату – habar taraty’ – трансляция, радиопередача, телепередача, транслировать, передавать по радио, телевидению; распространять; вести радиопередачу, телепередачу; выступать по радио, телевидению).

Broadcast syndication – синдикаттық тарату – si’ndi’kattyq taraty’ – трансляция синдикации

Coaxial cable – коаксиалды кабель – koaksi’aldy kabel – коаксиальный кабель

Forerunner – a person or thing that precedes the coming or development of someone or something else; a sign or warning of something to come (әуен – a’y’en – предвестник).

Network uplinks and downlinks – желілік қосылыстар мен қиғаштар – jelilik qosylystar men qig’as’tar – сетевые восходящие и нисходящие ссылки

Quadruple – consisting of four parts or elements; consisting of four times as much or as many as usual; increase or be increased fourfold (төртбұрыш – to’rtburys’ – четверной).

Simulcast – a simultaneous transmission of the same program on radio and television, or on two or more channels.

Subset – a part of a larger group of related things (ішкі бөлім – is’ki bo’lim – подмножество).

Subchannel – ішкі каналдар – is’ki kanaldar – подканалов

Superfluous – unnecessary, especially through being more than enough (артық – artyq – излишний).

Ticker-tapes – телеграф таспасы – telegraf taspasy – телеграфная лента

Exercise 1. Answer the questions.

1. What is broadcasting?
2. Say some words of its history.
3. How is it usually associated?
4. What was referred to as "over the air"?
5. How did the earliest broadcasting look like?
6. What change happened in the 2000s?
7. Explain the history of development of telephone broadcasting.
8. Explain the history of development of radio broadcasting.
9. How is broadcasting supported financially?
10. Explain the term "broadcast network".

Exercise 2. Find the words of opposite meaning.

Transmitter, begin, receiver, end, increase, single, reduce, multiple, several, first, one, last, narrow, common, wide, special, prohibit, allow, undesired, slow, desired, fast, outside, similar, different, inside.

Exercise 3. Decide if the following statements are true or false.

1. Broadcasting is the distribution of audio or video content. T/F.
2. Broadcasting began with AM radio in 1920. T/F.
3. The air broadcasting is usually associated with radio and television. T/F.
4. Satellite broadcasting was initiated in the 1960s. T/F.
5. Broadcasts can be classified as "recorded" or "live". T/F.
6. A broadcast may be distributed through several physical means. T/F.
7. Distribution to stations or networks may be through physical media. T/F.
8. The Internet may bring internet radio to the recipient. T/F.
9. The Internet may bring streaming media television to the recipient. T/F.
10. The term "broadcast network" is used to distinguish networks. T/F.
11. The term "broadcast television" can refer to the television programs. T/F.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. Radio Caroline used to broadcast from a boat in the North Sea.
2. The tennis championship is broadcast live to several different countries.
3. Huge amounts of money are spent on sports broadcasting.
4. We watched a live broadcast of the concert.
5. The information is transmitted electronically to the central computer.
6. Television is an increasingly important means of communication.

Read and translate the text.

From the history of television

A television set or television receiver, more commonly called a television, TV, TV set, or telly, is a device that combines a tuner, display, and loudspeakers for the purpose of viewing television. Introduced in the late 1920s in mechanical form, television sets became a popular consumer product after World War II in electronic form, using cathode ray tubes. The addition of color to broadcast television after 1953 further increased the popularity of television sets in the 1960s, and an outdoor antenna became a common feature of suburban homes. The ubiquitous television set became the display device for the first recorded media in the 1970s, such as Betamax, VHS and later DVD. It was also the display device for the first generation of home computers (e.g., Timex Sinclair 1000) and video game consoles (e.g., Atari) in the 1980s. In the 2010s flat panel television incorporating liquid-crystal displays, especially LED-backlit LCDs, largely replaced cathode ray tubes and other displays. Modern flat panel TVs are typically capable of high-definition display and can also play content from a USB device. Mechanical televisions were commercially sold from 1928 to 1934 in the United Kingdom, United States, and Soviet Union. The earliest commercially made televisions were radios with the addition of a television device consisting of a neon tube behind a mechanically spinning disk with a spiral of apertures that produced a red postage-stamp size image, enlarged to twice that size by a magnifying glass. The Baird "Televisor" (sold in 1930–1933 in the UK) is considered the first mass-produced television, selling about a thousand units.

In 1926, Kenjiro Takayanagi demonstrated the first TV system that employed a cathode ray tube (CRT) display, at Hamamatsu Industrial High School in Japan. This was the first working example of a fully electronic television receiver. His research toward creating a production model was halted by the US after Japan lost World War II.

A television testing laboratory. The first commercially made electronic televisions with cathode ray tubes were manufactured by Telefunken in Germany in 1934, followed by other makers in France (1936), Britain (1936), and America (1938). The cheapest model with a 12-inch (30 cm) screen was $445 (equivalent to $7,736 in 2017). An estimated 19,000 electronic televisions were manufactured in Britain, and about 1,600 in Germany, before World War II. About 7,000–8,000 electronic sets were made in the U.S. before the War Production Board halted manufacture in April 1942, production resuming in August 1945. Television usage in the western world skyrocketed after World War II with the lifting of the manufacturing freeze, war-related technological advances, the drop in television prices caused by mass production, increased leisure time, and additional disposable income. While only 0.5% of U.S. households had a television in 1946, 55.7% had one in 1954, and 90% by 1962. In Britain, there were 15,000 television households in 1947, 1.4 million in 1952, and 15.1 million by 1968. By the late 1960s and early 1970s, color television had come into wide use. In Britain, BBC1, BBC2 and ITV were regularly broadcasting in color by 1969. During the first decade of the 21st century, CRT "picture tube" display technology was almost entirely supplanted worldwide by flat panel displays. By the early 2010s, LCD TVs, which increasingly used LED-backlit LCDs, accounted for the overwhelming majority of television sets being manufactured.

Display device television sets may employ one of several available display technologies. As of the mid-2010s, LCDs overwhelmingly predominate in new merchandise, but OLED displays are claiming an increasing market share as they become more affordable and DLP technology continues to offer some advantages in projection systems. The production of plasma and CRT displays has been almost completely discontinued.

Vocabulary.

Affordable – inexpensive; reasonably priced (қол жетімді – qol jetimdi – доступный).

Cathode ray tube – a high-vacuum tube, in which cathode rays produce a luminous image on a fluorescent screen, used in televisions and computer terminals (катодты сәулелік түтік – katodty ca’y’lelik tu’tik – электронно-лучевая трубка).

Disposable income – таза кіріс – taza kiris – чистый доход

Entirely supplanted – толығымен толықтырылған – tolyg’ymen tolyqtyrylg’an – полностью вытеснены

Merchandise – goods to be bought and sold; promote the sale of (goods), especially by their presentation in retail outlets; promote or publicize (an idea or person) (тауар – tay’ar – товар).

Overwhelming – very great in amount; (especially of an emotion) very strong (басым – basym – подавляющий).

Predominate – be the strongest or main element; be greater in number or amount; have or exert control or power (үстемдік ету – u’stemdik ety’ – господствовать).

Skyrocket – a rocket designed to explode high in the air as a signal or firework; (of a price, rate, or amount) increase very steeply or rapidly (алау – alay’ – сигнальная ракета).

Spiral of apertures – тесік спираль – tesik spi’ral – спираль отверстий

Video game consoles – ойын консольдері – oi’yn konsoldary – игровые приставки

Ubiquitous television set – жергілікті теледидар – jergilikti teledi’dar – вездесущий телевизор

Exercise 1. Answer the questions.

1. What is a television set?
2. How do people call it in other way?
3. When it was first introduced?
4. When did it become more popular?
5. What are the functions of modern flat panel TVs?
6. What countries sold mechanical televisions from 1928 to 1934?
7. What were the earliest commercially made televisions?
8. What can you say about the Baird "Televisor"?
9. What was the first example of an electronic television receiver?
10. What company manufactured the first electronic televisions?
11. What was television usage in the western world?
12. When had color television come into wide use?

Exercise 2. Find adjectives among the following list of words.

Telly, television, overwhelming, affordable, suburban, broadcast, recorded, media, ubiquitous, incorporating, commercially, mechanically, spinning, enlarged, magnifying, increased, leisure, time, worldwide.

*Exercise 3.*Decide if the following statements are true or false.

1. TV set is a device that combines a tuner, display, and loudspeakers. T/F.
2. It was introduced in the late 1920s. T/F.
3. At first it was introduced in mechanical form. T/F.
4. It became a popular product after World War II in electronic form. T/F.
5. The addition of color increased the popularity of TV in the 1960s. T/F.
6. Outdoor antenna became a common feature of suburban homes. T/F.
7. Flat panel television with liquid-crystal displays appeared in 2010. T/F.
8. Modern flat panel TVs are capable of high-definition display. T/F.
9. Modern flat panel TVs can also play content from a USB device. T/F.
10. Display device TVs employ several available display technologies. T/F.
11. LCDs predominate in new merchandise in the mid-2010s. T/F.
12. The production of plasma displays is our future. T/F.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. Could you turn the television down?
2. Is there anything interesting on television tonight?
3. Clare has worked in television since she left college.
4. Your problem is that you watch too much television.

5. What's on the tube this weekend?
6. Do you like this plasma screen TV?

Exercise 5. Rewrite these untrue sentences to make them true.
1. A television is a device that combines a tuner and display.
2. Modern flat panel TVs cannot play content from a USB device.
3. Mechanical televisions were commercially sold only in Britain.
4. The first TVs with cathode ray tubes were manufactured in France.
5. Display device TVs don't employ any device technologies.

Read and translate the text.

From the history of light-emitting diodes

Let us first examine discoveries and early devices. Electroluminescence as a phenomenon was discovered in 1907 by the British experimenter H. J. Round of Marconi Labs, using a crystal of silicon carbide and a cat's-whisker detector. Russian inventor Oleg Losev reported creation of the first LED in 1927. His research was distributed in Soviet, German and British scientific journals, but no practical use was made of the discovery for several decades.

In 1936, Georges Destriau observed electroluminescence could be produced when zinc sulphide (ZnS) powder is suspended in an insulator and an alternating electrical field is applied to it. In his publications, Destriau often referred to luminescence as Losev-Light. Destriau worked in the laboratories of Madame Marie Curie, also an early pioneer in the field of luminescence with research on radium.
Kurt Lehovec, Carl Accardo, and Edward Jamgochian explained these first light-emitting diodes in 1951 using an apparatus employing crystals with a current source of battery or pulse generator and with a comparison to a variant, pure, crystal in 1953.

Rubin Braunstein of the Radio Corporation of America reported on infrared emission from gallium arsenide and other semiconductor alloys in 1955. Braunstein observed infrared emission generated by simple diode structures using gallium antimonite, indium phosphide, and silicon-germanium alloys at room temperature and at 77 Kelvin.

In 1957, Braunstein further demonstrated that the rudimentary devices could be used for non-radio communication across a short distance. As noted by Kroemer Braunstein had set up a simple optical communications link. Music emerging from a record player was used via suitable electronics to modulate the forward current of a gallium arsenide diode. The emitted light was detected by a diode some distance away. Gallium arsenide signal was fed into an audio amplifier and played back by a loudspeaker. Intercepting the beam stopped the music. We had a great deal of fun playing with this setup." This setup presaged the use of LEDs for optical communication applications.

The first visible-spectrum (red) LED was developed in 1962 by Nick Holonyak, while working at General Electric. Holonyak first reported his LED in the journal Applied Physics Letters on December 1, 1962. M. George Craford, a former graduate student of Holonyak, invented the first yellow LED and improved the brightness of red and red-orange LEDs in 1972. In 1976, T. P. Pearsall created the first high-brightness, high-efficiency LEDs for optical fiber telecommunications by inventing new semiconductor materials specifically adapted to optical fiber transmission wavelengths.

Vocabulary.

Electroluminescence – (in Chemistry) luminescence produced electrically, especially by the application of a voltage (e'lektrolyumi'nescenci'ya – электролюминесценция).

Gallium antimonite – галлий антимониті – galli'i' antimoni'ti – галлиевый антимонит

Gallium arsenide –галлий арсениді – galli'i' arseni'di – арсенид галлия

Gallium arsenide diode – галлий арсенидті диод – galli'i' arseni'dti di'od – арсенид-галлиевый диод

Indium phosphide – индий фосфиді – indi'i' fosfi'di – фосфид индия

Intercept – obstruct (someone or something) so as to prevent them from continuing to a destination; chiefly (in Physics) cut off or deflect (light or other electromagnetic radiation) (ұстап алу – ustap aly' – перехват).

Presage – be a sign or warning of (an imminent event, typically an unwelcome one) (алдын алу – aldyn aly' – предвещать).

Rudimentary devices – қарапайым құрылғылар – qarapai'ym qurylg'ylar – элементарные устройства

Set-up – the way in which something, especially an organization or equipment, is organized, planned, or arranged (орнату – ornaty' – настроить).

Exercise 1. Answer the questions.

1. When was electroluminescence discovered as a phenomenon?
2. Who made this discovery?
3. What equipment did he use to achieve that?
4. Who reported creation of the first LED? When?
5. Was it used in practice immediately?
6. Who observed infrared emission? When?
7. What was demanded temperature?
8. What was demonstraed in 1957?
9. Could you describe the process in details?
10. What was followed as a result of this?
11. When was the first visible-spectrum (red) LED developed?

Exercise2. Decide if the following statements are true or false.

1. Electroluminescence as a phenomenon was discovered in 1907. T/F.
2. Electroluminescence was discovered by the British experimenter. T/F.
3. Electroluminescence was discovered by H. J. Round. T/F.
4. Russian inventor Oleg Losev reported creation of the first LED. T/F.
5. Rubin Braunstein on infrared emission from gallium arsenide. T/F.
6. Rubin Braunstein on infrared emission in 1955. T/F.
7. Braunstein demonstrated rudimentary devices across short distance. T/F.
8. The first visible-spectrum (red) LED was developed in 1962. T/F.
9. The first spectrum (red) LED was developed by Nick Holonyak. T/F.
10. In 1976, T. P. Pearsall created the first high-brightness. T/F.
11. Pearsall created the first LEDs for optical fiber telecommunications. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.
1. Cirrus clouds are composed of ice crystals.
2. The evidence is now crystal clear.
3. This alarm clock takes two medium-sized batteries.
4. I think the battery is gone.
5. The pilots are guided by an infrared optical system at night.
6. The alarm emits infra-red rays which detect any intruder.
7. The machine emits a high-pitched sound when you press the button.

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Mirzoyeva Leila Yurievna
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Raiymkul Zarina Abdikamalkyzy

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