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Санкт-Петербургский горный университет**

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ИНОСТРАННЫЙ ЯЗЫК

FOREIGN LANGUAGE

Методические указания к практическим занятиям для студентов магистратуры направления 11.04.04

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Методические указания предназначены для студентов направления подготовки 11.04.04 «Электроника и наноэлектроника» направленности «Промышленная электроника». Методические указания содержат аутентичные тексты, в которых освещаются основные этапы развития электроники, и разработанные к текстам упражнения, позволяющие обучить студентов умениям монологической речи по специальности «Электроника и наноэлектроника».

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Part 1. The story of electronics
Exercise 1. Translate words and collocations:

a lifeline to sth
a tangle of
charger
to be after the latest gadget
semiconductor pioneer
to twist sth up
a blip of
limited lifespan
global toxic emergency
assembly plant
PVC
mercury
solvent
flame retardant
to monitor
miscarridge
to reveal
to land
e-waste
to toss out
to throw away
to discard sth
to release toxics
to chuck sth
disposal
high-def flat screen
lead poisoning
to go to a landfill
a bunch of
protective gear
to recover valuable metal
well-hidden problem
human costs
environmental costs

out of sight
off accounting books
to externalize the cost of production
kidney cancer
brain cancer
extended producer responsibility
product takeback
to design longer-lasting products
to pile up
modular product
takeback law
to pop up (law)
to pass a law
to work on sb's side
brainiac
at a faster rate
to cut in half in
greener product
dump designer
to shop one's way out of the problem
to ban e-waste export
to be designed to last
to send sth to the dump
dump mentality

Exercise 2. Watch the documentary *The story of electronics.* Answer the questions:

1. What does 'designed for the dump' mean? Why is it an unsustainable approach?
2. What does the rule of production 'toxics in, toxics out' mean?
3. What does ‘takeback laws’ mean?
4. How does Europe move to greener electronic legislation?
5. Give an example of a toxic chemical.

Exercise 3. Analyse ing-forms in bold in the script of the video (Appendix 1). Decide if it is the gerund or the participle.

Exercise 4. Translate the text, use *Multitran* online dictionary. Do the translation within the allotted time given in brackets:

1. Many of these products are actually designed to break after a certain amount of time. This concept is known as "planned obsolescence" or "designed for the dump". Planned obsolescence is designing and producing products with limited lifespans – so that they stop **functioning** or become undesirable within a specific time period. And it isn't just electronics, products may be designed for obsolescence either through function, like a paper coffee cup or a machine with breakable parts, or through "desirability," like a piece of **clothing** made for this year's fashion and then replaced by something totally different next year. (628 characters, 25 minutes)

2. For many years, designers and consumers have advocated for electronic products that are truly modular, so that consumers can simply swap one "obsolete" part for a newer part without **having** to discard an entire product. While there has been some progress in this regard, such as hard drives and disk drives that are easier to replace, electronics companies have been wary of the "modular model" since they prefer to sell new, whole units. Likewise, many have advocated for a "thin client" model of information delivery, where consumers access data on the Internet – or "the cloud" – **using** quite simple hardware and software, but again, the large computer companies often see this model as a threat to their commodity sales. (726 characters, 29 minutes)

3. Most of our electronics contain precious metals and minerals, some of which are referred to as "conflict minerals". A particularly egregious example is coltan—or columbite-tantalite—a metallic ore that gets refined into tantalum, as well as tin, tungsten, and gold, all used in consumer electronics such as cell phones, DVD players, computers, and games consoles. The extraction and export of these four minerals from Africa have helped fuel environmental and social disruption, brutal violence and war in the Congo. (520 characters, 20 minutes)

4. Over 1,000 materials, including solvents, brominated flame retardants, PVC, heavy metals, plastics and gases, are used to make electronic products and their components—semiconductor chips, circuit boards, and disk drives. A clunky CRT monitor can contain between four and eight pounds of lead alone. Big screen CRT TVs contain even more

than that. Flat panel TVs and monitors contain less lead, but use lamps with mercury, which is very toxic in very small quantities. An EPA commissioned study noted that "approximately 70 percent of the heavy metals in municipal solid waste landfills are estimated to come from electronics discards. Heavy metals such as lead and mercury are highly toxic substances that can cause well documented adverse health effects, particularly to children and developing fetuses." (810 characters, 32 minutes)

5.These toxicants are released during the production, use, and disposal of electronic products, with the greatest impact at end-of-life, particularly when they are exported to developing nations. Harmful chemicals released from incinerators and leached from landfills can contaminate air and groundwater. The **burning** of plastics at the waste stage releases dioxins and furans, known developmental and reproductive toxins that persist in the environment and concentrate up the food-chain. Some of the worst end-of-life toxic impacts occur when e-waste is exported to developing nations, where crude, unsafe "**processing**" methods result in significant exposures. The plastics are burned in uncontrolled outdoor waste piles, **emitting** dioxin into residential areas; circuit boards are "cooked" to melt the lead solder, emitting toxic lead fumes; and acids are used to extract precious metals. During the use phase, electronics can off-gas brominated flame retardants (BFRs), a group of toxic chemicals added to plastic **casings**. (1022 characters, 40 minutes)

6. Most electronics are manufactured in Asia, not by the companies whose brand names you know and go on the products, but by many contract **manufacturing** firms, sometimes called Electronics Manufacturing Services. Some of the largest of these include Foxconn, Flextronics, Quanta, Sanmina-SCI, Solectron, Celestica, and Jabil Circuit. There are also thousands of component manufacturers that make the individual components that get assembled into the final products. It's practically impossible for any brand name company to provide any significant oversight of the workplace or environmental conditions in this complex supply chain. Many companies in the electronics industry support a voluntary code of conduct for workplace and environmental conditions, created by a group called the Electronics Industry Citizenship

Coalition, or EICC. But **working** conditions at contract giant Foxconn's plant in Shenzen, China, are so bad that 13 employees committed suicide in 2010 alone; mostly by jumping from the windows of the plant or dormitories. The company's response was to install "anti-suicide nets" around the plant. (1117 characters, 40 minutes)

7. When the semiconductor industry emerged in the 1970's in Silicon Valley, it was touted as a new, clean industry. But over time, it came to light that these companies were using very toxic chemicals, like the solvent TCE, to produce computer chips. These chemicals were sometimes dumped, or leaked out of underground storage tanks, into the groundwater. The polluted water led to exposure of the **surrounding** communities and resulted in miscarriages and birth defects. Now, most of these companies have moved their production offshore to **developing** nations, leaving behind polluted "Superfund" sites that will cost millions to clean up. Silicon Valley is home to 29 toxic EPA "Superfund" sites – the highest concentration in the country. (739 characters, 29 minutes)

8. For decades IBM kept its own Corporate Mortality File (CMF), a concealed database **tracking** cause of death of all its employees. IBM workers were unaware of the CMF or what was in it until a lawsuit by IBM workers led to its release in 2000. Dr. Richard Clapp, from the Boston University School of Public Health, analyzed the data, and concluded that IBM workers involved in **manufacturing** (where they were exposed to solvents and other chemicals) have an increased risk of dying of cancer, especially cancers of the brain, blood, and kidneys. Over 300 IBM workers in the US, who were exposed to toxic chemicals at work, sued IBM and its chemical suppliers **alleging** their chemical exposures caused cancers, birth defects in offspring, and other chronic diseases. All but two of these claims were settled prior to trial under confidentiality orders that were insisted upon by IBM and the chemical companies. Two claims went to trial by IBM workers sick with cancer. Despite the fact that the trial was about fraudulent concealment claims, the judge did not allow the jury to hear any mention of IBM's Corporate Mortality File, let alone Dr. Clapp's analysis of its contents. The trial ended with no **finding** at all on the cause of the two workers' cancers. (1257 characters, 50 minutes)

9. **Attending** a recent meeting on occupational health and safety issues in Asia, science writer Elizabeth Grossman described the following scene: Women from China who have worked at a plant assembling cell phones - **producing** as many as 300 to 400 an hour - report that miscarriages and menstrual problems are common among their colleagues. We hear the same from Indonesian and Korean women. Similar stories come from the Philippines. Men who work in factories **assembling** automotive electronics and DVD players report co-workers who have died of cancer - lung cancer and brain tumors. Two young Indonesian women who work in electronics factories ask me if chemicals related to their work or perhaps to the "instant food" they all eat may have caused their co-workers' breast cancers. Occupational health advocates working on behalf of Samsung workers in Korea have now documented 96 cases of cancer - about a third of these fatal - among employees of the company's semiconductor plants. Many of these are young people. (1019 characters, 40 minutes)

10. Brominated flame retardants (BFRs) are in a considerable percentage of electronics. Whereas flame resistant products save lives and prevent property damage, there are **increasing** concerns about the environmental and health effects of flame retardants such as BFRs. Overall, the available literature on BFR toxicology is incomplete. Based on the available data, however, we know that BFRs are associated with several health effects in animal studies, including neurobehavioral toxicity, thyroid hormone disruption, and possibly cancer. Additionally, there are data gaps but some evidence that BFRs can cause developmental effects, endocrine disruption, immunotoxicity, reproductive, and long-term effects, including second-generation effects. (744 characters, 29 minutes)

11.We are exposed to BFRs in many ways. We ingest it via meat and dairy products, where it's been absorbed into the food chain and is found widely in the environment and animal tissues. Also, many studies have found BFRs in samples of household dust and indoor air, **suggesting** that some of the BFRs found in our bodies comes from **inhaling** it in dust. Because BFRs are used in multiple products, such as electronics, furniture and textiles, some studies have not attributed each product's contribution to the totals found. One dust study in Indonesia found that BFR levels were higher in **living** rooms with computers than in living rooms without computers. (653 characters, 25 minutes)

12. E-waste is growing two to three times faster than other types of municipal waste. While most e-waste in the US still goes into the trash, the amount **going** to recyclers is increasing. However, 50 to 80 per cent of the e-waste that is collected by recyclers is shipped overseas to developing countries in Asia and Africa where our outdated electronics are creating a global toxic emergency. Once exported, e-waste is typically smashed and burned in backyard operations with little to no health and safety precautions. The **burning** and **dismantling** of toxic electronic products under these conditions has led to widespread air and water pollution from toxic metals, dioxins, and other serious health hazards. Scientists have documented high levels of these pollutants in the local environments, and they have also found them in test samples from children and other residents of these communities. For example, health researchers showed that children living in Guiyu had significantly higher blood lead levels than those **living** in another community that was not polluted from e-waste 25 million metric tonnes per year or, in US measurement, roughly 27 tons. (1156 characters, 41 minutes)

13. Extended Producer Responsibility (EPR, also called "Producer Takeback") is a product and waste management system in which manufacturers – not the consumer or government – take responsibility for the collection and environmentally safe management of their product when it is no longer useful or is discarded. When manufacturers take responsibility for the **recycling** of their own products they no longer pass the cost of disposal on to the government and taxpayer, but build it into the price of the product (**internalizing** the cost). This gives them a financial incentive to use environmentally safer materials in the production process; design the product to be more recyclable; create safer **recycling** systems; and to keep waste costs down. (744 characters, 29 minutes)

14. Electronics manufacturer ASUS developed a prototype for a modular computer a few years ago, that was like a shelf onto which you stack modules (hard drive, battery, card reader, etc) the size of CDs. But the parts – motherboards, CPU's, energy supplies - that would need to be upgraded to keep up with technology – like new software, faster

processors, energy **savings** – were not designed to be simple to replace for average computer user (making it a computer-geek-only option). Currently, the release of a new **operating** system is what prompts many PC users to purchase their next computer, since the existing design of these electronics makes it easier to replace an entire computer rather than **upgrading** it. Adopting modular design elements that make it easy to upgrade a computer in order to keep up with **advancing** technology would exponentially prolong its lifespan and keep these electronics out of the dump and on our desks. Europe has led the way with the passage of the Waste Electrical and Electronic Directive in 2003, which established the first major takeback requirements throughout Europe. Other countries have followed suit, including Japan and China. (1175 characters, 41 minutes)

15. Some leading companies have been working with their suppliers to find safer alternatives to bromine and chlorine. High volume uses of bromine and chlorine in flame retardants and plastic resins like polyvinyl chloride (PVC) gained worldwide attention when scientific studies documented their link to the formation of dioxin, one of the most toxic chemicals around. Dioxins and other harmful chemicals are released into the environment during the **burning** and **smelting** of electronic waste. Even the most sophisticated incineration facilities generate low levels of dioxin, but the most significant dioxin contribution occurs in **developing** countries whose facilities are not designed to handle toxic materials. Apple has phased out the use of brominated and chlorinated flame retardants, in addition to PVC, mercury, arsenic, and lead. All new models of Nokia mobile phones are free of PVC, brominated and chlorinated compounds and antimony trioxide. New Sony Ericsson products are 99.9% free from all halogenated flame retardants. (1033 characters, 41 minutes)

Exercise 5. Analyse ing-forms in bold in Exercise 4. Decide if it is the gerund or the participle.

Part 2. A short history of electronics

Exercise 6. Look at the chronological order of electronics development. Make up sentences about the main inventions mentioning the year and the event:

1875	Selenium diode	
	Electric light bulb	
	Vacuum Diode	John Flaming
1906	Triode	Lee De Forrest
1927	(AT&T) Long distance telephone	
1935	Commercial selenium rectifiers and photodiodes	
1946	Mini vacuum tubes ENIAC - First computer	
1947	First transistor - ATT Bell Laboratories	
		John Bardeen Walter Brattain William Shockley
1949	Single crystal transistor	Gordon Teal
1951	Production of point contact transistors (Westinghouse, Allentown, PA)	
1954	Silicon junction transistor (Texas Instruments)	
1958	Integrated Circuit - (Texas Instruments)	Jack Kilby
1959	Commercial IC (Fairchaild Semiconductors)	Robert Noyce
1968	Founding of INTEL	Gordon Moore and Robert Noyce
1971	Microprocessor (INTEL)	
1978	APPLE 2	
1981	IBM PC	

Exercise 7. Translate words and expressions:

photometry, high-voltage alternating current, two-electrode radio rectifier, thermionic valve, vacuum diode, kenotron, thermionic tube, to augment, amplifier grid, multielectrode vacuum tubes

Exercise 8. Translate the text about John Ambrose Fleming:

After studying at University College, London, and at Cambridge University under James Clerk Maxwell, Fleming became a consultant to the *Edison Electric Light Company* in London, an adviser to the *Marconi Wireless Telegraph Company*, and a popular teacher at University College (1885–1926), where he was the first to hold the title of professor of electrical engineering. Early in his career Fleming investigated photometry, worked with high-voltage alternating currents, and designed some of the first electric lighting for ships. He is best remembered as the inventor of the two-electrode radio rectifier, which he called the thermionic valve; it is also known as the vacuum diode, kenotron, thermionic tube, and Fleming valve. This device, patented in 1904, was the first electronic rectifier of radio waves, converting alternating-current radio signals into weak direct currents detectable by a telephone receiver. Augmented by the amplifier grid invented in 1906 by Lee De Forest of the United States, Fleming's invention was the ancestor of the triode and other multielectrode vacuum tubes. Fleming was the author of more than a hundred scientific papers and books, including the influential *The Principles of Electric Wave Telegraphy* (1906) and *The Propagation of Electric Currents in Telephone and Telegraph Conductors* (1911). He was knighted in 1929.

Exercise 9. Translate words and expressions:

frugal, to supplement, slim allowance, menial job, electromagnetic-wave propagation, dynamo department, electrolytic detector, Hertzian waves, alternating-current transmitter, wireless telegraphy, insolvent, to be squeezed out of operation, reception of wireless signals, carborundum, a thermionic grid-triode vacuum tube, to be indicted, to be acquitted, to amplify high-frequency radio signals, self-regenerating oscillation, crude transmitter, long-distance repeater circuits, sound-on-film optical recording system, diathermy machines

Exercise 10. Translate the text about Lee de Forest:

American inventor of the Audion vacuum tube, which made possible live radio broadcasting and became the key component of all radio, telephone, radar, television, and computer systems before the invention of the transistor in 1947. Although de Forest was bitter over the financial exploitation of his inventions by others, he was widely honoured as the "father of radio" and the "grandfather of television." He was supported strongly but unsuccessfully for the Nobel Prize for Physics. His father had planned for him a career in the clergy, but Lee insisted on science and, in 1893, enrolled at the Sheffield Scientific School of Yale University, one of the few institutions in the United States then offering a first-class scientific education. Frugal and hardworking, he supplemented his scholarship and the slim allowance provided by his parents by working at menial jobs during his college years, and, despite a not-too-distinguished undergraduate career, he went on to earn the Ph.D. in physics in 1899. By this time he had become interested in electricity, particularly the study of electromagnetic-wave propagation, then being pioneered chiefly by the German Heinrich Rudolf Hertz and the Italian Guglielmo Marconi. De Forest's doctoral dissertation on the "*Reflection* *of Hertzian Waves from the Ends of Parallel Wires*" was possibly the first doctoral thesis in the United States on the subject that was later to become known as radio. His first job was with the *Western Electric* Company in Chicago, where, beginning in the dynamo department, he worked his way up to the telephone section and then to the experimental laboratory. While working after hours on his own, he developed an electrolytic detector of Hertzian waves. The device was modestly successful, as was an alternating-current transmitter that he designed. In 1902 he and his financial backers founded the *De Forest Wireless Telegraph* Company. In order to dramatize the potential of this new medium of communication, he began, as early as 1902, to give public demonstrations of wireless telegraphy for businessmen, the press, and the military.

Invention Of The Audion Tube

A poor businessman and a poorer judge of men, de Forest was defrauded twice by his own business partners. By 1906 his first company was insolvent, and he had been squeezed out of its operation. But in 1907 he patented a much more promising detector (developed in 1906), which he called the *Audion*; it was capable of more sensitive reception of wireless signals than were the electrolytic and carborundum types then in use. It was a thermionic grid-triode vacuum tube—a three-element electronic "valve" similar to a two-element device patented by the Englishman Sir John Ambrose Fleming in 1905. In 1907 de Forest was able to broadcast experimentally both speech and music to the general public in the New York City area. A second company, the *De Forest Radio Telephone* Company, began to collapse in 1909, again because of some of his partners. In the succeeding legal confusion, de Forest was indicted in 1912 but later acquitted of federal charges of using the mails to defraud by seeking to promote a "worthless device"—the Audion tube. In 1910 he broadcast a live performance by Enrico Caruso at the Metropolitan Opera in order to popularize the new medium further. In 1912 de Forest conceived the idea of "cascading" a series of Audion tubes so as to amplify high-frequency radio signals far beyond what could be accomplished by merely increasing the voltage on a single tube. He fed the output from the plate of one tube through a transformer to the grid of a second, the output of the second tube's plate to the grid of a third, and so forth, which thereby allowed for an enormous amplification of a signal that was originally very weak. This was an essential development for both radio and telephonic long-distance communication. He also discovered in 1912 that by feeding part of the output of his triode vacuum tube back into its grid, he could cause a self-regenerating oscillation in the circuit. The signal from this circuit, when fed to an antenna system, was far more powerful and effective than that of the crude transmitters then generally employed and, when properly modulated, was capable of transmitting speech and music. When appropriately modified, this single invention was capable of either transmitting, receiving, or amplifying radio signals. Throughout de Forest's lifetime, the originality of his more important inventions was hotly contested by both scientists and patent attorneys. In time, realizing that he could not succeed in business or manufacturing, he reluctantly sold his patents to major communications firms for commercial development. Some of the most important of these sales were made at very low prices to the *American Telephone & Telegraph* Company, which used the Audion as an essential amplification component for long-distance repeater circuits.

Other Inventions

In 1920 de Forest began to work on a practical system for recording and reproducing sound motion pictures. He developed a sound-on-film optical recording system called Phonofilm and demonstrated it in theatres between 1923 and 1927. Although it was basically correct in principle, its operating quality was poor, and he found himself unable to interest film producers in its possibilities. Paradoxically, within a few years' time, the motion-picture industry converted to talking pictures by using a sound-on-film process similar to de Forest's. During the 1930s de Forest developed Audion-diathermy machines for medical applications, and during World War II he conducted military research for Bell Laboratories.

Exercise 11. Translate words and expressions:

superconductivity, electron-conducting properties of semiconductors, to usher in the electronic revolution, to miniaturize the electronic switch, to resume research

Exercise 12. Translate the text about John Bardeen:

American physicist who was cowinner of the Nobel Prize for Physics in both 1956 and 1972. He shared the 1956 prize with William B. Shockley and Walter H. Brattain for their joint invention of the transistor. With Leon N. Cooper and John R. Schrieffer he was awarded the 1972 prize for development of the theory of superconductivity. Bardeen earned bachelor's and master's degrees in electrical engineering from the University of Wisconsin (Madison) and obtained his doctorate in 1936 in mathematical physics from Princeton University. A staff member of the University of Minnesota, Minneapolis, from 1938 to 1941, he served as principal physicist at the U.S. Naval Ordnance Laboratory in Washington, D.C., during World War II. After the war Bardeen joined (1945) the *Bell Telephone Laboratories* in Murray Hill, N.J., where he, Brattain, and Shockley conducted research on the electron-conducting properties of semiconductors. On Dec. 23, 1947, they unveiled the transistor, which ushered in the electronic revolution. The transistor replaced the larger and bulkier vacuum tube and provided the technology for miniaturizing the electronic switches and other components needed in the construction of computers. In the early 1950s Bardeen resumed research he had begun in the 1930s on superconductivity, and his Nobel Prize-winning investigations provided a theoretical explanation of the disappearance of electrical resistance in materials at temperatures close to absolute zero. The BCS theory of superconductivity (from the initials of Bardeen, Cooper, and Schrieffer) was first advanced in 1957 and became the basis for all later theoretical work in superconductivity. Bardeen was also the author of a theory explaining certain properties of semiconductors. He served as a professor of electrical engineering and physics at the University of Illinois, Urbana-Champaign, from 1951 to 1975.

Exercise 13. Translate words and expressions:

properties, bulky vacuum, forerunner, surface properties of solids, solid-state physics

Exercise 14. Translate the text about H. Brattain:

Walter Houser Brattain, American scientist who, along with John Bardeen and William B. Shockley, won the Nobel Prize for Physics in 1956 for his investigation of the properties of semiconductors—materials of which transistors are made—and for the development of the transistor.

The transistor replaced the bulkier vacuum tube for many uses and was the forerunner of microminiature electronic parts. Brattain earned a Ph.D. from the University of Minnesota, and in 1929 he became a research physicist for Bell Telephone Laboratories. His chief field of research involved the surface properties of solids, particularly the atomic structure of a material at the surface, which usually differs from its atomic structure in the interior. He, Shockley, and Bardeen invented the transistor in 1947. After leaving *Bell Laboratories* in 1967, Brattain served as adjunct professor at Whitman College, Wash. (1967–72), then was designated overseer emeritus. He was granted a number of patents and wrote many articles on solid-state physics.

Exercise 15. Translate words and expressions:

to usher in, amplifier, controller, point-contact transistor

Exercise 16. Translate the text about William B. Shockley:

American engineer and teacher, cowinner (with John Bardeen and Walter H. Brattain) of the Nobel Prize for Physics in 1956 for their development of the transistor, a device that largely replaced the bulkier and less-efficient vacuum tube and ushered in the age of microminiature electronics. Shockley studied physics at the California Institute of Technology (B.S., 1932) and at the Massachusetts Institute of Technology (Ph.D., 1936). He joined the technical staff of the Bell Telephone Laboratories in 1936 and there began experiments with semiconductors that ultimately led to the invention and development of the transistor. During World War II, he served as director of research for the Antisubmarine Warfare Operations Research Group of the U.S. Navy. After the war, Shockley returned to *Bell Telephone* as director of its research program on solid-state physics. Working with Bardeen and Brattain, he resumed his attempts to use semiconductors as amplifiers and controllers of electronic signals. The three men invented the point-contact transistor in 1947 and a more effective device, the junction transistor, in 1948. Shockley was deputy director of the *Weapons Systems Evaluation* Group of the Department of Defense in 1954–55. He joined *Beckman Instruments*, Inc., to establish the Shockley Semiconductor Laboratory in 1955. In 1958 he became lecturer at Stanford University, California, and in 1963 he became the first Poniatoff professor of engineering science there (emeritus, 1974). He wrote *Electrons and Holes in Semiconductors* (1950).

Exercise 17. Translate words and expressions:

integrated circuit, to enroll, to design miniaturized electronic circuits, germanium-based transistors, hearing aids, planar manufacturing process, to evaporate lines of conductive metal, a silicon chip, IC-powered experimental computer, semiconductor-based thermal printer, slide rule

Exercise 18. Translate the text about Jack Kilby:

Education And Early Career

Kilby was the son of an electrical engineer and, like many inventors of his era, got his start in electronics with amateur radio. His interest began while he was in high school when the *Kansas Power* Company of Great Bend, Kansas, of which his father was president, had to rely on amateur radio operators for communications after an ice storm disrupted normal service. After serving as an electronics technician in the U.S. Army during World War II, Kilby enrolled in the electrical engineering program at the University of Illinois in Urbana-Champaign.After graduation Kilby joined the Centralab Division of Globe Union, Inc., located in Milwaukee, Wisconsin, where he was placed in charge of designing and developing miniaturized electronic circuits. He also found time to continue his studies at the University of Wisconsin, Milwaukee Extension Division. In 1952 Centralab sent Kilby to Bell Laboratories' headquarters in Murray Hill, New Jersey, to learn about the transistor, which had been invented at Bell in 1947 and which Centralab had purchased a license to manufacture. Back at Centralab, Kilby began working on germanium-based transistors for use in hearing aids. He soon realized, however, that he needed the resources of a larger company to pursue the goal of miniaturizing circuits, and in 1958 he switched to another *Bell* licensee, *Texas Instruments* Incorporated of Dallas, Texas. Shortly after his arrival at *Texas Instruments*, Kilby had his epoch-making "monolithic idea." Kilby realized that, instead of connecting separate components, an entire electronic assembly could be made as one unit from one semiconducting material by overlaying it with various impurities to replicate individual electronic components, such as resistors, capacitors, and transistors. Soon Kilby had a working postagestamp-size prototype manufactured from germanium, and in February 1959 TI filed a patent application for this "miniaturized electronic circuit"—the world's first integrated circuit. Four months later, Robert Noyce of *Fairchild Semiconductor* Corporation filed a patent application for essentially the same device, but based on a different manufacturing procedure. Ten years later, long after their respective companies had cross-licensed technologies, the courts gave Kilby credit for the idea of the integrated circuit but gave Noyce the patent for his planar manufacturing process, a method for evaporating lines of conductive metal (the "wires") directly onto a silicon chip. Although the original integrated circuit (IC) was Kilby's most important invention, it was only one of more than 50 patents that he was awarded. Many of those patents concerned improvements in IC design and manufacturing, including those for the first IC-powered experimental computer that TI built for the U.S. Air Force in 1961 and for the ICs that TI designed and delivered to the Air Force in 1962 for use in the Minuteman ballistic missile guidance system. In 1965 Kilby invented the semiconductor-based thermal printer. In 1967 he designed the first IC-based electronic calculator, the *Pocketronic*, gaining himself and TI the basic patent that lies at the heart of all pocket calculators. The *Pocketronic* required dozens of ICs, making it too complicated and expensive to manufacture for consumers, but by 1972 TI had reduced the number of necessary ICs to one. The introduction in that year of the TI Datamath pocket calculator marked the beginning of the IC's integration into the very fabric of everyday life. By 1976 the pocket calculator had made the slide rule a museum piece.

Honours And Awards

Kilby began a leave of absence from TI in 1970 to pursue independent research, particularly in solar power generation, although he continued as a semiconductor consultant on a part-time basis. He also served (1978–84) as a professor of electrical engineering at Texas A&M University in College Station. Among his many honours, Kilby was awarded the National Medal of Science in 1969, the Charles Stark Draper Medal in 1989, and the National Medal of Technology in 1990. In 1997 TI dedicated its new research and development building in Dallas, the Kilby Center. The Royal Swedish Academy of Sciences, breaking with a trend of recognizing only theoretical physicists, awarded half of the 2000 Nobel Prize for Physics to Kilby for his work as an applied physicist.

Exercise 19. Translate words and expressions:

circuitry, integrated circuit, information storage, information processing, planar process, to see further, silicon wafer, to jump at opportunity, a layer of silicon oxide, to seal out contaminant, to solder, to step down, to keep sth at the forefront

Exercise 20. Translate the text about Robert Noyce:

Founder of Intel

In 1939 the Noyce family moved to Grinnell, Iowa, where the father had accepted a position as a Congregational minister and where the son began to demonstrate the traits of an inventor and tinkerer. Noyce majored in physics at Grinnell College (B.A., 1949) and earned a doctorate in solid state physics from the Massachusetts Institute of Technology (MIT; Ph.D., 1953), for a dissertation related to the technology he found most fascinating, the transistor.

Shockley Semiconductor Laboratory

Developed at *Bell Laboratories* in 1947, the transistor had figured in Noyce's imagination since he saw an early one in a college physics class. In 1956, while working for *Philco* Corporation, Noyce met William Shockley, one of the transistor's Nobel Prize-winning inventors. Shockley was recruiting researchers for Shockley Semiconductor Laboratory, a company that he had started in Palo Alto, California, to produce high-speed transistors. Noyce jumped at the opportunity, renting a house in Palo Alto even before his official job interview. By early 1957, however, engineers at the new company had rebelled and attempted to force Shockley out of his management position, arguing that his poor management delayed production and adversely affected morale. Noyce and seven colleagues, among them Gordon Moore, resigned after failing to remove Shockley. With Noyce as their leader, the group—labeled the "traitorous eight" by Shockley—successfully negotiated with the *Fairchild Camera and Instrument* Company to form a new company, *Fairchild Semiconductor Corporation*, located in Santa Clara.

Fairchild Semiconductor Corporation and the Integrated Circuit

In 1958 Jean Hoerni, another *Fairchild Semiconductor* founder, engineered a process to place a layer of silicon oxide on top of transistors, sealing out dirt, dust, and other contaminants. For Noyce, Hoerni's process made a fundamental innovation possible. At that time, Fairchild produced transistors and other elements on large silicon wafers, cut the components out of the wafer, and later connected individual components with wires. However, as the number of connections increased, it became progressively more difficult to solder in ever smaller spaces. Noyce realized that cutting the wafer apart was unnecessary; instead, he could manufacture an entire circuit—complete with transistors, resistors, and other elements—on a single silicon wafer, the integrated circuit (IC). In this sense, Noyce and coinventor Jack Kilby, who was working at *Texas Instruments Incorporated*, thought along similar lines. They both saw the importance of the wafer, and each of their companies received patents on various aspects of IC design and manufacture. But Noyce saw further. Noyce saw that the solution to the problem of connecting the components was to evaporate lines of conductive metal (the "wires") directly onto the silicon wafer's surface, a technique known as the planar process. Kilby and Noyce share credit for independently inventing the integrated circuit. However, after much litigation, *Fairchild Semiconductor* was granted the patent on the planar process, the basic technique used by subsequent manufacturers. The patent made both Noyce and Fairchild wealthy.

Intel Corporation

In 1968 Noyce and Moore left *Fairchild Semiconductor* to start their own company. Soon they were joined by Andrew Grove, another *Fairchild* colleague, and formed *Intel Corporation*. In 1971 Intel introduced the first microprocessor, which combined on a single silicon chip the circuitry for both information storage and information processing. Intel quickly became the leading producer of microprocessor chips. Noyce served as president of Intel until 1975 and then as chairman of the board of directors before stepping down in 1978 to become chairman of the *Semiconductor Industry Association (SIA)*. The SIA was formed to address the growing economic concerns of the American semiconductor industry, especially with respect to foreign competition. Noyce played an important role in establishing *Sematech*, a joint industry-government consortium formed with sometimes conflicting goals - research to keep the American semiconductor industry at the forefront and efforts to maintain a domestic semiconductor manufacturing capacity. Noyce became *Sematech Inc.'s* first president in 1988. Noyce held 16 patents and was awarded the National Medal of Science in 1979. A lifelong swimmer and former Iowa state diving champion, Noyce died of a heart attack following a morning swim in 1990.

Exercise 23. Translate words and expressions:

solid rocket propellants, antiaircraft missiles

Exercise 24. Translate the text about Gordon Moore:

Gordon Moore, in full Gordon E. Moore, born January 3, 1929, San Francisco, California, U.S., American engineer and cofounder, with Robert Noyce, of Intel Corporation. Moore studied chemistry at the University of California, Berkeley in 1950, and in 1954 he received a Ph.D. in chemistry and physics from the California Institute of Technology (Caltech), Pasadena. After graduation, Moore joined the Applied Physics Laboratory at Johns Hopkins University in Laurel, Maryland, where he examined the physical chemistry of solid rocket propellants used by the U.S. Navy in antiaircraft missiles.

APPENDIX 1

The story of electronics

The other day, I couldn't find my computer charger. My computer is my lifeline to my work, my friends, my music. So I looked everywhere, even in that drawer where this lives. I know you have one too, a tangle of old chargers, the sad remains of electronics past. How did I end up with so many of these things? It's not like I'm always after the latest gadget. My old devices broke or became so obsolete I couldn't use them anymore. And not one of these old chargers fits my computer. This isn't just bad luck. It's bad design. I call it "designed for the dump." "Designed for the dump" sounds crazy, right? But when you're trying to sell lots of stuff, it makes perfect sense. It's a key strategy of the companies that make our electronics. In fact it's a key part of our whole unsustainable materials economy. Designed for the dump means **making** stuff to be thrown away quickly. Today's electronics are hard to upgrade, easy to break, and impractical to repair. My DVD player broke and I took it to a shop to get fixed. The repair guy wanted $50 just to look at it! A new one at Target costs $39. Not just DVD players—it's this way with all sorts of electronic gadgets. Think about that printer cartridge replacement that costs more than a new printer, the iPod battery that you can't replace, the cell phone charger that snaps. The list of electronics that are prohibitively expensive to upgrade or just plain impossible to repair goes on and on.

In the 1960s, Gordon Moore, the giant brain and semiconductor pioneer, predicted that electronics designers could double processor speed every 18 months. So far he's been right. This is called Moore's Law. Moore's Law is named after Intel co-founder Gordon Moore. In 1965, he stated that the number of transistors that can be placed on a computer chip will double every year. This translates into increases in processor speed, more memory, and other performance improvements. In 1975, Moore revised it to doubling every 2 years. Over time, the concept was shortened from 2 years to 18 months by others at Intel. This trend has continued for over 40 years.

But somehow the bosses of these genius designers got it all twisted up. They seem to think Moore's Law means every 18 months we have to throw out our old electronics and buy more. Problem is, the 18 months that we use these things are just a blip in their entire lifecycle. And that's where these dump designers aren't just causing a pain in our wallets. They're creating a global toxic emergency! See, electronics start where most stuff starts, in mines and factories. Many of our gadgets are made from more than 1,000 different materials, shipped from around the world to assembly plants. The production phase of electronics is the most chemically intensive, particularly in the manufacture of semiconductors and other components, which use very toxic solvents such as methylene chloride, toluene, glycol ethers, xylene and trichloroethylene (TCE), which have been linked to elevated rates of cancers, including blood cancers, brain cancers, reproductive problems and birth defects among electronics workers and their offspring.

There, workers turn them into products, **using** loads of toxic chemicals, like PVC, mercury, solvents and flame retardants. Today this usually happens in far off places that are hard to monitor. But it used to happen near my home, in Silicon Valley, which thanks to the electronics industry is one of the most poisoned communities in the U.S. IBM's own data revealed that its workers **making** computer chips had 40% more miscarriages and were significantly more likely to die from blood, brain and kidney cancer. The same thing is starting to happen all around the world. Turns out the high tech industry isn't as clean as its image. So, after its toxic trip around the globe, the gadget lands in my hands. I love it for a year or so and then it starts **drifting** further from its place of honor on my desk or in my pocket. Maybe it spends a little time in my garage before **being tossed out**. Consumers typically use cell phones for an average of 18 months before disposing of them, a much shorter period than the lifecycle of older phones. According to the EPA, laptops are used for only 2 to 3 years by the initial purchasers.

And that brings us to disposal, which we think of as the end of its life. But really it's just moved on to become part of the mountains of e-waste we make every year. In the US alone, we chuck over 400 million electronic gadgets in a single year and that number is continuing to grow.

Remember how these devices were packed with toxic chemicals? Well there's a simple rule of production: toxics in, toxics out. Computers, cell phones, TVs, all this stuff, is just waiting to release all their toxics when we throw them away. Some of them are slowly releasing this stuff even while we're using them. Another study was able to associate the high levels of one type of BFR (deca-BDE) in dust collected in certain homes with the same BFR found in televisions in those homes. And in the lab, electronics have been determined to emit flame retardants, with emissions increasing as much as 500 times as the temperature increased.

You know those fat, old TVs that people are chucking for high-def flat screens? They each have about 5 pounds of lead in them. Old style TVs and computers contain a large glass Cathode Ray Tube (CRT). The glass contains lead, both to shield against radiation and to improve the optical quality of the picture, and it does a lot of other nasty things too. Also, it's not just old TVs and computers, lead is present in solder used in many electronic products. Lead! As in lead **poisoning**! Lead exposure can cause many health effects, particularly damage to the nervous system. Kids are especially vulnerable to lead exposures, which can cause brain damage and death at high levels. Studies link lead exposure in children to lower IQs, higher incidents of ADHD, **hearing** and balance problems.

So almost all this e-waste either goes from my garage to a landfill or it gets shipped overseas to the garage workshop of some guy in Guiyu, China whose job it is to recycle it.

I've visited a bunch of these so-called **recycling** operations. Workers, without protective gear, sit on the ground, smashing open electronics to recover the valuable metals inside and **chucking** or **burning** the parts no one will pay them for. So while I'm on to my next gadget, my last gadget is off **poisoning** families in Guiyu or India or Nigeria. Each year we make 25 million tonnes of e-waste which gets dumped, burned or recycled. And that **recycling** is anything but green. So are the geniuses who design these electronics actually… evil geniuses? I don't think so, because the problems they're creating are well hidden even from them. You see, the companies they work for keep these human and environmental costs out of sight and off their accounting books. It's all about **externalizing** the true costs of production. Externalized costs, also known as "hidden costs," are any kind of loss or damage such as illness, environmental degradation, or economic disruption caused by industries engaged in natural resource extraction, production, distribution, and disposal, but not paid for by those industries. Externalized costs are most often borne by workers, community members and the environment, rather than by industries and corporations.

Instead of companies paying to make their facilities safe the workers pay with their health. Instead of them **paying** to redesign using less toxics villagers pay by **losing** their clean **drinking** water. Externalizing costs allows companies to keep designing for the dump – they get the profits and everyone else pays. When we go along with it, it's like we're looking at this toxic mess and saying to companies "you made it, but we'll deal with it." I've got a better idea. How about "you made it, you deal with it"? Doesn't that make more sense? Imagine that instead of all this toxic e-waste **piling up** in our garages and the streets of Guiyu, we sent it to the garages of the CEOs who made it. You can bet that they'd be on the phone to their designers **demanding** they stop **designing** for the dump.

Making companies deal with their e-waste is called Extended Producer Responsibility or Product Takeback. If all these old gadgets were their problem, it would be cheaper for them to just design longer lasting, less toxic, and more recyclable products in the first place. They could even make them modular, so that when one part broke, they could just send us a new piece, instead of **taking** back the whole broken mess. Already takeback laws are popping up all over Europe and Asia. In the U.S. many cities and states are passing similar laws – these need to be protected and strengthened. Twenty-three states have already passed e-waste legislation and New York City passed an e-waste law but it was recently pre-empted by a statewide law in New York. It's time to get these brainiacs working on our side. With takeback laws and citizen action to demand greener products, we are starting a race to the top, where designers compete to make **long-lasting**, toxic-free products. So, let's have a green Moore's law. How about: the use of toxic chemicals will be cut in half every 18 months? The number of workers poisoned will decline at an even faster rate? We need to give these designers a challenge they can rise to and do what they do best – innovate. Already, some of them are realizing they're too smart to be dump designers and are figuring out how to make computers without PVC or toxic flame retardants. But we can do even more. When we take our e-waste to recyclers, we can make sure they don't export it to **developing** countries. To ensure that your e-waste is recycled responsibly and not exported overseas, make sure that your recycler is a certified E-Steward. E-Stewards are recyclers who voluntarily adhere to the highest standards in the recycling industry: not to export e-waste to developing nations, not to send it to prison recycling, not to landfill/ incinerate it. This program was developed by the non-profit Basel Action Network (BAN) as a voluntary pledge program – but it has recently been expanded into a rigorous certification program, with independent, accredited auditors.

And when we do need to buy new gadgets, we can choose greener products. Two good sources to use are the Greenpeace Guide to Greener Electronics, and the ETBC Recycling report card, which grades companies on their efforts to take back and recycle their old products.

But the truth is: we are never going to just shop our way out of this problem because the choices available to us at the store are limited by choices of designers and policymakers outside of the store. That's why we need to join with others to demand stronger laws on toxic chemicals and on **banning** e-waste exports. On the road to cleaner, greener electronics legislation Europe has taken an important step with the passage of the REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) law. REACH puts the burden on the chemical producers and users to provide and share data about chemical hazards.

There was additional progress made with the passage of the Restriction on Hazardous Substances (ROHS) in Europe, which limits the use of six substances in electronic products sold into the EU. But the follow up legislation to expand the list of restricted substances was less successful due to industry opposition.

But the US is lagging behind, as there is very inadequate oversight, required testing, or disclosure of toxic chemicals in electronics or most other products in the US. Under our current laws, chemical companies can introduce and sell chemicals in the marketplace, and it’s up to the EPA to “prove” when the chemicals are unsafe and shouldn’t be sold. This puts all the burden of testing and research on the government, instead of the companies selling the chemicals. It also means that it’s hard for manufacturers to find out the hazardous traits of chemicals they use in products. We need to adopt a more sensible approach to toxic chemical policy, where companies have to prove their chemicals are safe before they put them into products that go into our homes and schools. Other signs of hope include a new bill to outlaw the export of hazardous e-waste that has been introduced in the US Congress, H.R.

There are billions of people out there who want access to the incredible web of information and entertainment electronics offer. But it’s the access they want, not all that toxic garbage. So let’s get our brains working on **sending** that old design for the dump mentality to the dump where it belongs and instead **building** an electronics industry and a global society that’s designed to last.

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

1. *Гальскова Н.Д., Гез Н.И.* Современная методика обучения иностранным языкам. Москва, Academia, 2009. 336 с.

2. *Колесникова И.Л., Долгина О.А.* Англо-русский терминологический справочник по методике преподавания иностранных языков, Справочное пособие. Москва, Дрофа, 2008. 432 с.

3. *Chazal de E., Moore J.* Oxford EAP: a course in English for Academic Purposes. Advanced. Oxford: Oxford University Press, 2013. – 239 p.

4. *Clough P., Nutbrown C.* Student's Guide to Methodology. SAGE Publications Ltd, 2012. 288 p.

5. Story of Electronics. https://www.storyofstuff.org/wp-content/uploads/2020/01/SoElectronics_Annotated_Script.pdf

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