SCIENCE AND TECHNOLOGY

From the beginning of people's existence they have used tools, various types of energy and materials, generally for the purposes of production of nearly everything in our world. Almost every human process for getting food and shelter depends on complex technological systems. At present, modern industry largely depends on power, materials, machinery and production processes.

In early human history, the only power available was muscle power augmented by primitive tools, such as the wedge or lever. The invention of the wheel (about 300 B.C.) was followed by the watermill and windmill (12th century A.D.). Not until the 18th century did an alternative source of power appear in the form of the first working steam engine developed and improved by James Watt. The steam engine and other technical advances made possible the replacement of traditional agrarian economy by one dominated by machinery and manufacturing. The sudden acceleration of technical and economic development that began in Britain in the second half of the 18th century is called the Industrial Revolution. This transferred the balance of political power from the landowner to the industrial capitalist and created an urban working class. The steam engine was originally developed for draining mines but was rapidly put to use in factories and on the railways. Hand-made products were replaced by machine-made products which increased in number, and together with faster transportation by means of a railway, this meant a significant change in industry.

Michael Faraday's demonstration of the dynamo in 1831 revealed the potential of the electrical motor and became the basis of electrical engineering.

Electricity generated on a commercial scale was available from the early 1880s and was used for electric motors which powered all kinds of machinery and for lighting, first by carbon arc lamp, invented by František Křižík in 1880, and by an electric bulb invented by Thomas A Edison in 1879.

Electricity is the most useful and most convenient form of energy, readily convertible into heat and light and used to power machines. Electricity can be generated in one place (power stations/plants) and distributed anywhere because it readily flows through wires.

The invention of the internal-combustion engine by German scientist Nicholas Otto in 1876 enabled two Germans, Gottlieb Daimler and Karl Benz to create the first petrol-driven motorcar (1885). This invention made transport faster and more comfortable and significantly shortened travel time.

The 1940s saw the explosion of the first atomic bomb and the subsequent development of the nuclear power industry. Nuclear energy as well as natural gas, water power, oil and coal are current sources of energy. Scientists try to increase the contribution of wind, tidal, solar and geothermic power.

The earliest materials used by humans were wood, bone, horn, shell and stone. Metals were rare and difficult to obtain, although forms of bronze and iron were used in 6 000 B.C. and 1 000 B.C. The introduction of the blast furnace in the15th century enabled cast iron to be extracted, but this process remained expensive until charcoal was substituted by coke in 1709. This change ensured a plentiful supply of cheap iron at the start of the Industrial Revolution.

Soon new materials were introduced, such as rubber, glass, leather, paper, bricks and porcelain and later, after the mid-1880s, entirely new synthetic materials appeared. First dyes, then plastic and celluloid and still later drugs were synthesized and synthetic fibres were made. This process still continues with the growth of genetic engineering which enabled the production of synthetic insulin and growth hormones.

Production process and equipment in the factories also changed as much as power and materials. The lathe (potter’s wheel), known in antiquity, was not fully developed until the 18th century when it was used to produce objects of great precision. The first attempts at automation were demonstrated in the 18th century when looms were controlled automatically by punched cards. The first moving assembly line appeared in 1870 in meat-packing factories in Chicago, USA, and then in the motor industry in 1913. At present, electronic computers control fully automated plants (robotics).

Plenty of inventions and discoveries have influenced and changed human life, such as aircraft, radio, television, telephone, X-ray machines, radar, air-cushion vehicles (hovercraft), electric welding, photographs, birth-control methods, test-tube babies, penicillin and vitamin C. Undoubtedly the transistor, integrated circuit (silicon chip) and laser were the three inventions that have had the greatest impact on modem-day life.

Electronic and microelectronic industries, space research and genetic engineering probably represent the branches where progress will continue most rapidly.

Space flights represent a special application of modem technology and science. The first satellites were launched into orbit around Earth in 1957 by the Russians and soon the first man-

operated spacecraft was put into orbit. In 1961 Soviet cosmonaut Yuri Gagarin became the first human in space aboard the spacecraft Vostok 1. In a few years manned missions to the Moon were achieved, the first being Apollo 11. The first people to step onto the Moon's surface on 20th July 1969 were Neil Armstrong and Edwin Aldrin. At present artificial satellites are used for scientic purposes, communications, weather forecasting and military purposes.

Since the 1960s we have spoken about the scientific-technical revolution because at present both science and technology are the most important phenomena which can contribute to solving the problems of people on the earth: to find other alternative energy sources, to reduce pollution of all kinds and protect the environment, to find ways how to feed the constantly increasing number of people and to discover medicine against such diseases as cancer, AIDS or the latest Ebola virus which threaten the contemporary world.

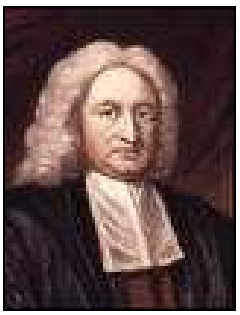
Not all inventions and discoveries, however, have brought people improvement and innovation. Ballistic missiles, extra powerful laser weapons, nuclear and H-bombs and pollution of the environment are only a few examples of how good ideas may be abused. Technology is dependent upon how people use it, under what circumstances new ideas and inventions are introduced into life.

WHO IS WHO IN SCIENCE

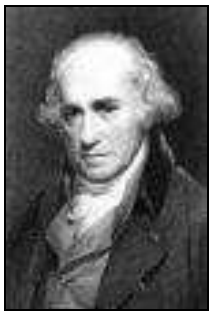
Sir William Harvey (1578-1657), physician to James I and Charles I, who discovered the circulation of blood. He showed that it was caused by the muscular action of the heart.

Sir Isaac Newton (1643-1727), English mathematician, physicist, astronomer and philosopher. He discovered the law of gravity, created calculus, discovered that white light is composed of many colours and developed the three standard laws of motion still in use today. His universal law of gravitation explained for the first time the phenomena of the universe, the tides and the motion of objects on the earth. From 1703 until his death he was President of the Royal Society, and was knighted in 1705. He was buried in Westminster Abbey.


Isaac Newton


Edmund Halley


Henry Cavendish


James Watt

Edmund Halley (1656-1742) astronomer, who was the first to predict the return of a comet since known as Halley's comet: he made contributions to the study of the moon and the motion of the stars.

Henry Cavendish (1731-1810), English physicist who discovered hydrogen and determined the compositions of water and nitric acid. He also discovered the mass and density of the Earth.

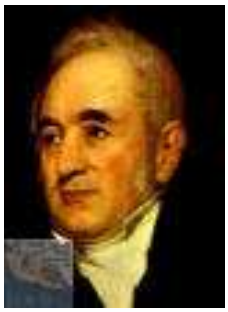
James Watt (1736-1819), Scottish engineer who developed a new type of steam engine of much greater efficiency than the previous types. He made Thomas Newcomen's steam engine more efficient by cooling the used steam in a condenser separate from the main cylinder.

Robert Fulton (1765-1815) American engineer and inventor. He pioneered steam navigation with his Clermont, the first commercially successful steamboat which appeared on the Hudson 1807. He experimented with submarines and torpedoes, and built the Fulton, the first steam warship.

Humphry Davy (1778-1829) English chemist who discovered the elements sodium, potassium, calcium, boron, magnesium, strontium and barium and proposed that hydrogen is present in all acids.

George Stephenson (1781-1848) English engineer who constructed the first successful steam locomotive (1814) and built the world's first public passenger railway (1821) between Stockton and Darlington.






Robert Fulton Humphry Davy George Stephenson Michael Faraday

Michael Faraday (1791-1867) English chemist and physicist who is known especially for the discovery of the transformation of energy from mechanical to electrical which led to the later discovery of the electric generator. He also investigated electrolysis. He experimented with electromagnetism and discovered the induction of electric currents and made the first dynamo.

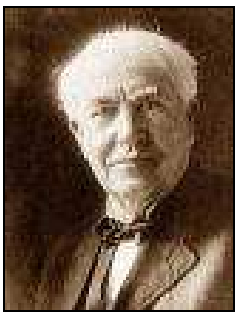
Charles Darwin (1809-1882) English scientist who developed the modem theory of evolution and proposed the principle of natural selection). After research in South America and the Galápagos Islands as a naturalist Darwin published On the Origin of Species by Means of Natural Selection and later Descent of Man. He explained that the many species of living creatures are not the result of acts of creation, but have developed from slight differences in individuals due to their special surroundings and their struggle for existence. His theory aroused bitter controversy because it was interpreted as saying that we were descended from monkeys and the church took it as an attack on the validity of the Scriptures. But Darwin lived to see his theories widely accepted. ¨

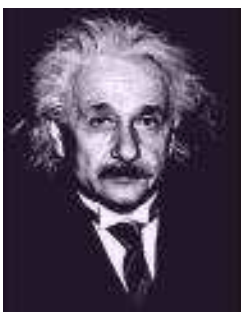
Thomas Alva Edison (1847-1931), American inventor with over 1000 patents. In Menlo Park, New Jersey, he produced his most important inventions, including the electric bulb in 1879. He constructed a system of electric power distribution for consumers, the telephone transmitter, and the phonograph.

Alexander Graham Bell (1847-1922), Scottish inventor, who patented his invention of the telephone in 1876.

Ernest Rutherford (1871-1937) New Zealand physicist, a pioneer of modem atomic science. His main research was in the field of radioactivity, and he discovered alpha, beta and gamma rays. He named the nucleus, and was the first to recognize the ionizing nature of the atom. He was awarded the Nobel Prize in 1908.

Albert Einstein (1879-1955) German born US physicist. He profoundly influenced science in many fields, such as radiation physics and thermodynamics, but is best known for formulating the theories of relativity (1905 and 1915). He is also distinguished for his work for peace and justice. He received the Nobel Prize in 1921. In 1911 he became a lecturer in theoretical physics in Prague; in 1933 he emigrated to the USA and became professor of mathematics in Princeton, New Jersey.



Charles Darwin Thomas A. Edison Alexander G. Bell Albert Einstein

Sir Alexander Fleming (1881-1955), Scottish bacteriologist, who discovered the first antibiotic drug, penicillin in 1928, although it did not come into use until 1941. In 1945 he won the Nobel Prize with Howard W. Florey and Ernst B. Chain.

Linus Carl Pauling (1901-) American chemist who investigated the properties and uses of vitamin C as related to human health. He was awarded the Nobel Prize for Chemistry in 1954. As he was an outspoken opponent of nuclear testing, he also received the Nobel Peace Prize in 1962.

James Dewey Watson (1928-) American biologist whose research on the molecular structure of DNA and the genetic code, in collaboration with Francis Crick, earned him a shared Nobel prize in 1962. He was born in Chicago. After attending public schools in his native town, he entered the university there in 1943, when only 16. When he had graduated, he did work in genetics at Indiana University and received his PhD in 1950. Then he went to Europe and worked at the Cavendish Laboratory in Cambridge, Great Britain, from 1951 to 1953. There he met Francis Crick and Maurice Wilkins, and the collaboration resulted in the discovery of a structure for DNA in 1953. DNA (deoxyribonucleic acid) is the molecule of heredity, and to know its structure enables science to know how the forms of life are transmitted from one generation to the next one. The forms of life are passed on in the cells of the double helix from the parents to the next generation. This major scientific advance in genetics led to the awarding of the 1962 Nobel Prize to the whole team. J. Watson became the youngest ever holder of the Nobel Prize. After his return to the USA he became professor of biology at Harvard University, Cambridge. His discovery stimulated a rapid development of genetic engineering in America.

QUESTIONS ON THE TEXT:

1. What does modem industry depend on?
2. What inventions augmented muscle power?
3. What phenomena stimulated the Industrial Revolution?
4. When did electricity begin to be used and why is it convenient?
5. Which inventors and scientists affected the use of electricity?
6. Why was the invention of the internal-combustion engine so important?
7. What are the current and future energy sources?
8. How did materials change throughout human development?
9. What synthetic materials were developed and when?
10. What kind of machinery helped in the production process?
11. When and where was automation used for the first time?
12. What inventions and discoveries changed human life and how?
13. What do you know about space flights?
14. What problems of mankind should science and technology solve?
15. Do you know of any abuses of scientific achievements?

ASSOCIATE EACH INVENTION OR IDEA WITH A NAME:

1. Pasteurization (process of making
2. dairy products free of micro organisms
3. Ships' screw propeller
4. Dynamite
5. Radioactivity
6. Arc lamp
7. Space travel
8. Lightning conductor
9. Soft contact lens
10. Petrol-driven car
11. The sun is the centre of the solar
12. First circumnavigation of the world
13. Polarography
14. Free association method and
15. interpretation of dreams
16. Internal-combustion engine
17. Development of the atomic bomb
18. The first successful powered flight (1903)
19. Founder of genetics
20. Four blood groups

a) Galileo Galilei (1564-1642)
b) František Křižík (1847-1941)
c) Georg Johann Mendel (1822-1884)
d) Louis Pasteur (1822 – 1895)
e) Alfred Nobel (1833-1896)
f) Orville Wright (1871-1948), Wilbur Wright (1867-1912)
g) Gottlieb Daimler (1834-1900), Karl Benz (1844-1929)
h) Otto Wichterle (1913-)
i) Julius Robert Oppenhaimer system (1904-1967)
j) Ferdinand Magellan (1480-1521)
k) Sigismund Freud (1865-1939)
l) Jan Janský (1873-1921)
m) Nicolaus August Otto (1832-1891)
n) Josef Ressel (1793-1857)
o) Jaroslav Heyrovský (1890-1967)
p) Yuri Gagarin (1934-1968)
q) Prokop Diviš (1696-1765), Benjamin Franklin (1706-1790)
r) Marie Curie (1867-1934), Pierre Curie (1959-1906)