

## TEXT 4 Silicon Chips

### Reading

1. Do radios look different now compared with 65 year ago? If so, can you think of any reasons for this?
2. Why were there no pocket calculators or digital watches 65 years ago?
3. Why are wires for conducting electricity covered in plastic?
4. If you dropped a piece of clothing onto an electric fire and it started to burn, how would you put it out?
5. How do you control electricity in the home?
6. Why is it often important to notice the colour of wires when you attach plug to a piece of electrical equipment?

### Text

Para 1 1 Until the 1950s items of electrical equipment like radios had to be fairly large, mainly because they contained a number of valves – glass tubes built into the electrical circuit, looking a little like electric light bulbs. Inside the tube was a vacuum – or sometimes a gas – through which electrons could pass. These components were really like switches – they controlled the direction and strength of the current passing through them. They had to warm up before they worked properly; they took up a lot of space; they eventually burned out and had to be replaced; also they were fragile, so dropping or knocking a radio often meant expensive repairs. Early computers had valves 10 but they were in consequence slow in operation and very limited in complexity because of the problems of size and maintenance.

P2 1 In 1947 the first transistors were produced at the Bell Telephone Laboratories in the USA. The transistor does not incorporate a vacuum or gas-filled tube, but the electricity passes through solid material. It is for this reason that transistors mark the beginning of what is known as solid-state technology.

P3 1 In the late fifties technologists developed a way of printing circuits onto sheets of material. In this way, the size of electrical equipment began to decrease even further: instead of separate valves mounted on a large framework and connected by wires, both the transistors and their connections were combined in single, small, tough units.

- P4 1 The use of silicon is basic to the developments which have taken place since the fifties. This element has special electrical properties. It is a semi-conductor, half way between a full conductor such as copper and an insulator like plastic. By adding small amounts of other chemicals to pieces of silicon and then joining the resulting different types together in various ways, very fast, efficient 'switches' can be produced.
- P5 1 As manufacturing processes grew more and more sophisticated it became possible to pack more and more individual transistors onto a single piece of silicon (called a chip). These chips are at most 1 cm square and about ½ mm thick. In 1960 a chip could hold 1 transistor. Today it can contain as many as 5 a million.
- P6 1 Silicon chips are changing our world at an enormous pace: they affect or will affect all aspects of our lives – industry, transportation, finance, education, medicine, communication, domestic and recreational spheres. By using micro-technology, computers can now be made with an almost infinite operational capacity. The cost is actually decreasing, their speed of operation is increasing; and their microcomponents will last indefinitely under normal conditions.
- P7 1 In the talk that follows you will hear how silicon chips are manufactured. Remember that the simplest transistor consists of two kinds of silicon in close contact, the difference depending on which impurity is added to each part. The first stage of the process consists in the production of a single crystal of very pure silicon. The crystal is in the shape of a long bar of about 10 cm in diameter and any chemical impurity which is needed to make one component of the transistors is added to the silicon while it is still liquid. The solidified bar is then cut into circular pieces about ½ mm thick. These are known as wafers and each one when cut up will yield perhaps a hundred chips.

## TEXT Study 4

### A. Content skim :

1. Read the first sentence of each paragraph and decide what, in general, is the passage about?

.....Development of electrical equipment into electronics and microelectronics.....

2. What particular development does the passage lead up to?

.....Development of microelectronics.....

3. What is the topic of each?

Para. 1	. Description of early electrical equipment .....
Para. 2	. Development of semi-conductors in terms of transistors .....
Para. 3	. Development of printing circuit technology .....
Para. 4	. Use of silicon to manufacture transistors .....
Para. 5	. Development of silicon chips .....
Para. 6	. Impact of the use of silicon chips .....
Para. 7	. Manufacturing process of silicon chips .....

### B. Comprehension Scan

Para 1 Line 5	Which “components” are referred to	valves
Para 1 Line 7	What does “they” refer to	valves

Para 2 Line 2	What does incorporate such a tube	solid material
Para 2 Line 3	“Solid material” rather than what	vacuum or gas
Para 2 Line 3	What is the reason referred to	electricity pass through a solid

Para 3 Line 4	Which developments made this possible	printing circuits onto sheets of material
Para 3 Line 4	What does “their” refer to	transistors

Para 4 Line 2	Which element is referred to as “ <b>this element</b> ”	silicon
Para 4 Line 5	Different types of what?	silicon

Para 6 Line 5	What does “ <b>their</b> ” refer to	computers
Para 6 Line 6	What does “ <b>their</b> ” refer to	computers

Para 7 Line 6	“ <b>Remember</b> ” tells that the information has already been given. Site it (where) in the passage	Para 4 Lines 4,5
Para 7 Line 6	What does “ <b>which</b> ” refer to	chemical impurities
Para 7 Line 8	What does “ <b>these</b> ” refer to	circular pieces

### C. Note-making

List five limitations of valve systems. Beside each write any contrasting advantages of solid-state systems mentioned in the text:

1. ... had to warm up before working / work without warming up .....
2. ... took up a lot of space / smaller size .....
3. ... burn out / burn in .....
4. ... fragile and expensive to repair / tough easy and cheap to repair .....
5. ... work slowly and limited for complex calculations . / work very fast and unlimited for complex calculations

### D. Identifying

Using information in the final paragraph, label diagrams 1-4. These show the first stages in the production of a silicon chip.

