

Question 1

- (f) What are the charge carriers in (i) semiconductors and (ii) metals?

Question 2

- (b) A semiconductor diode is formed when small quantities of phosphorus and boron are added to adjacent layers of a crystal of silicon to increase its conduction.

Explain how the presence of phosphorus and boron makes the silicon a better conductor. (6)

What happens at the boundary of the two adjacent layers? (9)

Describe what happens at the boundary when the semiconductor diode is (i) forward biased, (ii) reverse biased. (9)

Give a use of a semiconductor diode. (4)

Question 3

- (g) What are the charge carriers when an electric current (i) passes through a semiconductor; (ii) passes through an electrolyte? (7)

Question 4

4. The following is part of a student's report of an experiment to investigate of the variation of current I with potential difference V for a semiconductor diode.

I put the diode in forward bias as shown in the circuit diagram. I increased the potential difference across the diode until a current flowed. I measured the current flowing for different values of the potential difference.

I recorded the following data.

V/V	0.60	0.64	0.68	0.72	0.76	0.80
I/mA	2	4	10	18	35	120

Draw a circuit diagram used by the student.

How did the student vary and measure the potential difference? (15)

Draw a graph to show how the current varies with the potential difference.

Estimate from your graph the junction voltage of the diode. (12)

The student then put the diode in reverse bias and repeated the experiment.

What changes did the student make to the initial circuit?

Draw a sketch of the graph obtained for the diode in reverse bias. (13)

Question 5

- (h) Sketch a graph to show the variation of current with potential difference for a semiconductor diode in forward bias.

(7)