

## State Examination Commission – Physics Higher Level, 2007

### Question 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.

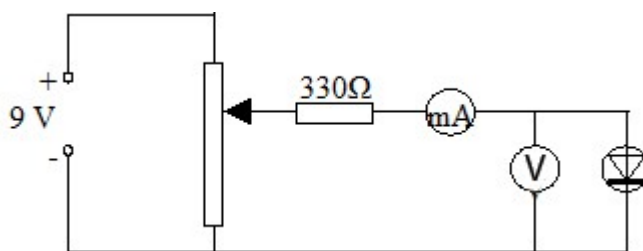
Estimate from your graph the junction voltage of the diode. (12)

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)

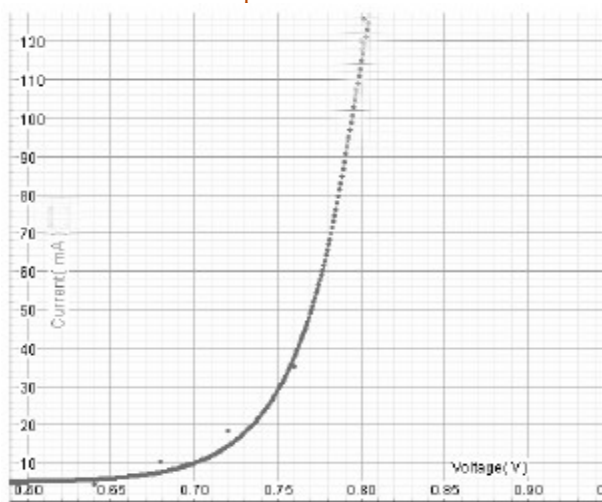
Draw a circuit diagram used by the student.



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

The p.d. was varied by sliding the contact on the potential divider.

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



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

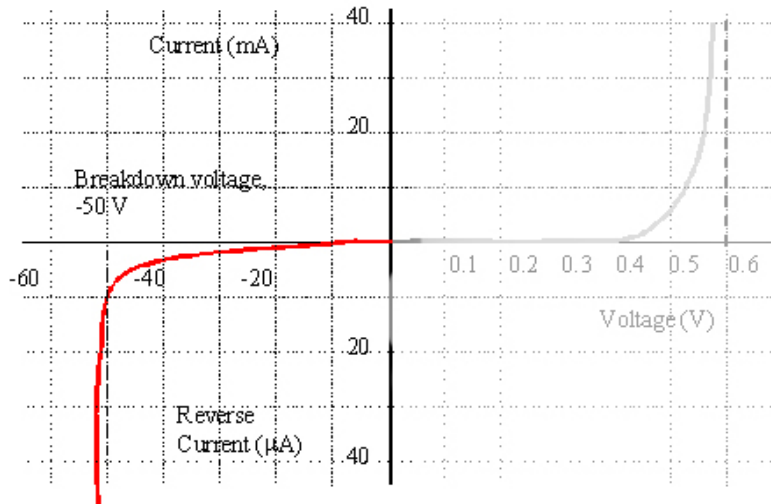
The junction voltage is approximately 0.70 V

The student then put the diode in reverse bias and repeated the experiment.  
What changes did the student make to the initial circuit?

The diode was reversed and the milliammeter was replaced with a microammeter. Also the voltmeter was then connected across the series combination of both the microammeter and diode ( the diode now has a very high resistance, comparable to that of the voltmeter – we need to measure current through diode only).

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

(13)



The reverse bias graph is shown in red