BBMerlion

Physics

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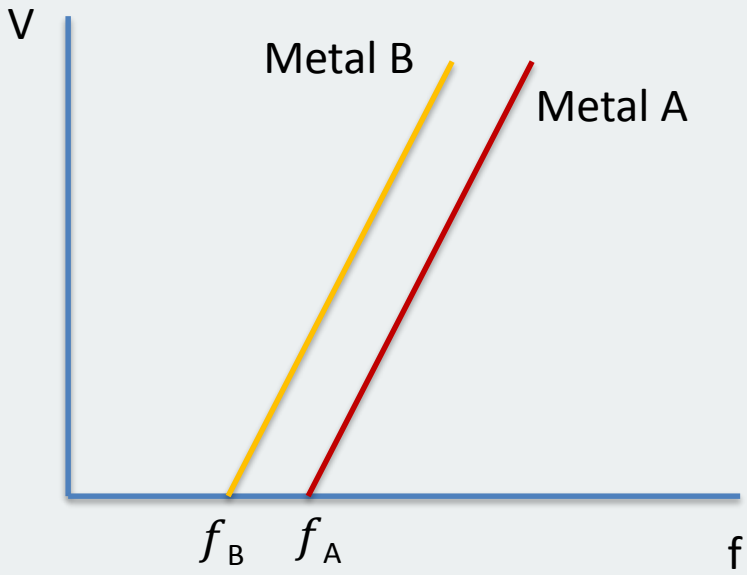
QUIZ 4 SOLUTION

Quantum Physics

Lasers and Semiconductors

Nuclear Physics

Question 1



Both gradient are (h/e)

Question 1

From Einstein's photon theory

$$eV = hf - \Phi$$

e = charge of one electron (1.6 x 10^{-19} C);

V = Stopping Potential (Volt);

Φ = Work Function (Joule);

Question 1

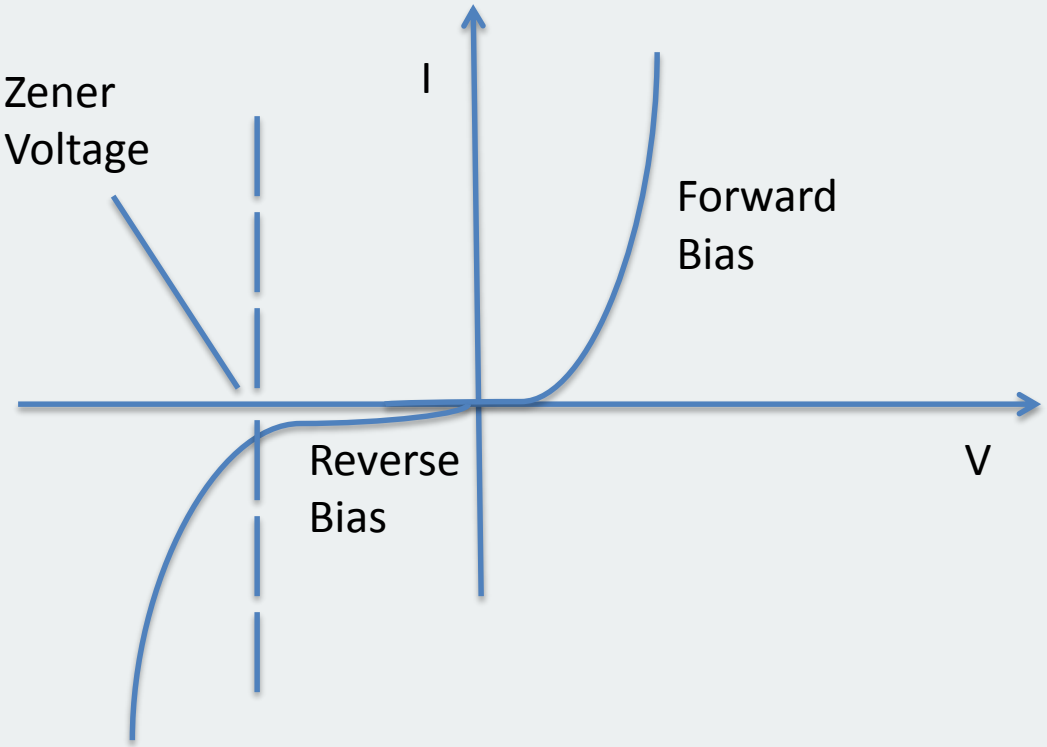
The equation can be arranged into the form

y = mx + c;

$$V(f) = (hf - \Phi)/e;$$

where gradient of the graph is (h/e), and constanta of the graph is (Φ/e), since Φ_A is greater then Φ_B, the threshold frequency (f_A) of A is greater than (f_B)

Question 2



Question 2

- Forward Bias: According to p-n junction theory the forward bias resulting in the big positive current compared to the reverse bias current (you can refer to our lecture note).

Question 2

- Forward Bias: this is due to many holes from P-type semiconductor flow to depletion region and many electrons from the N-type is flowing to depletion region inducing big positive current.

Question 2

- Forward Bias: Notice that only small current flow until it reached certain voltage it represents the work required to enable charge carriers to cross the depletion region.

Question 2

- Reverse Bias: the current is much smaller then the forward bias (almost negligible) due to only small amount of minority carrier of both P-type and N-type that can flow to depletion region.

Question 2

- Breakdown Region: when high reverse voltage is applied until a certain amount of voltage (Zener volatage) to the devise, the reverse breakdown occur, this is when the diode is damaged followed by large increase of reverse current (Avalanche breakdown)

Question 3

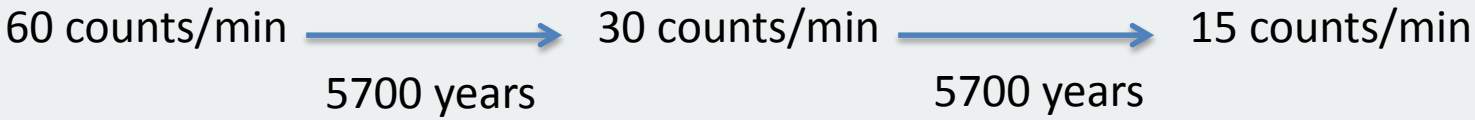
By eliminating the background radioactivity, we can find the actual count rate

Actual count rate of living wood = 80 (initial count rate of living wood) – 20 (count rate of ‘no sample’) = 60 counts/min

Actual count rate of wooden archeological specimen = 35 -20 = 15 counts/min

Question 3

Since the half-life is 5700 years



The total time taken to reach 15 counts/min from 60 counts/min is 5700 years + 5700 years = 11400 years. hence the age of the wooden archeological specimen is 11400 years

References

A level complete guide, Themis Publisher,

www.xtremepapers.com,

Physics MCQ with helps (topical).