

Section I - Part B (continued)

Marks

Question 24 (8 marks)

In terms of band structures and relative electrical resistance, describe the differences between a conductor, an insulator and a semiconductor.

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- bands are areas where electrons reside. The lowest band ~~is~~ is called the ground state. The highest band containing electrons is called the valence band, above the valence band is a section called a conduction band. If electrons can jump into the conduction band they can conduct electricity.

Conductors: There is a gap between the valence band and conduction band called the forbidden energy gap. If electrons jump this they fall into conduction band and conduct electricity. In conductors the forbidden energy gap is very small so electrons are easily excited into this band. Therefore conductors have the least electrical resistance.

Insulators: The forbidden energy gap is the largest in insulators. Therefore no electrons can jump the gap into the conduction band. Insulators have the most electrical resistance.

Semiconductors: The forbidden energy gap ~~is~~ between the ~~valence~~ valence and conduction band for semiconductors is much smaller than insulators but not as small as conductors. Sufficient thermal energy can excite electrons into the conduction band. So electrical resistance is in between conductors and insulators.