

Physics

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. 8

- ** A conductor's band structure has ^{the} valence band (outer electrons) overlapping with the conduction band ^(see fig A). Therefore, the energy required to make electrons in the valence band, 'jump' into the conduction band is negligible. Therefore, there is relatively ^{very} low electrical resistance.
- * A semiconductor has a small energy gap separating conduction & valence bands (see fig B). This means that according to de Broglie's wave model, energy is required to move valence electrons into a higher orbit, ~~and~~ into the conduction band. Therefore, more energy ~~is~~ is required to make a semiconductor conduct electricity than ~~is~~ is required for a conductor. Therefore resistance is higher than for a conductor.
- * An insulator has an electrical resistance higher than both conductors & semiconductors. This is because valence & conduction bands are separated by a large energy gap and thus, a lot of energy is required to make an insulator conduct. therefore resistance is very high.

Fig A

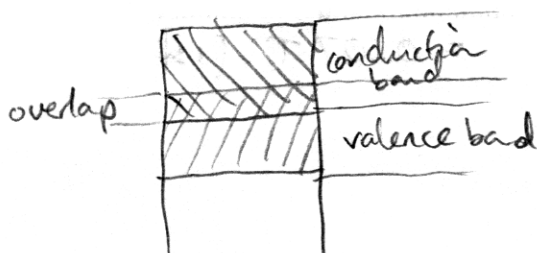


Fig B

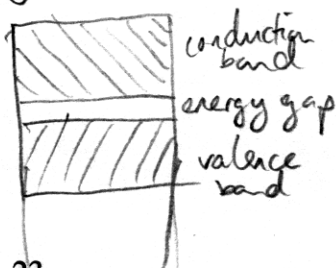


Fig C

