

2002 HIGHER SCHOOL CERTIFICATE EXAMINATION
Physics

Section I – Part B (continued)

Marks

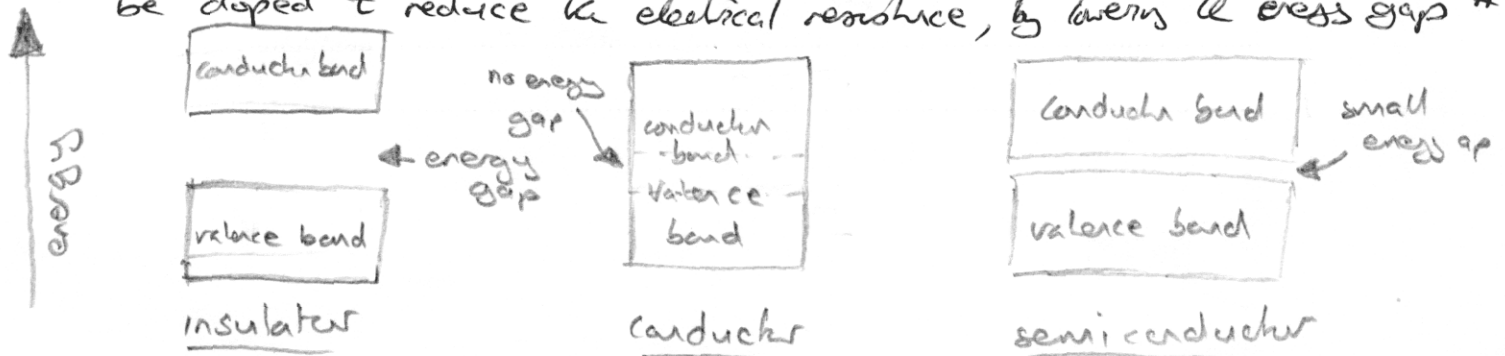
Question 24 (8 marks)

In terms of band structures and relative electrical resistance, describe the differences between a conductor, an insulator and a semiconductor. 8

insulators such as plastics have large energy gaps between the valence and conduction band. Consequently electrons do not have enough energy to jump into the conduction band. Insulators, also do not have electrons or free ions in their structure, thus they can not conduct electricity and have great electrical resistance.

In conductors on the other hand, the valence and conduction band overlap, thus there is no energy gap. Thus electrons freely move into the conduction band and can be conducted easily. Thus it has little electrical resistance, as there are free electrons. However electrical resistance occurs when the electrons collide with the vibrating ions in the lattice.

In semiconductors there is a small energy gap between the conduction band and the valence band. Thus a little bit of energy is required for the electrons to jump over the energy gap into the conduction band. Consequently there are electrons in the conduction band free to be conducted. Thus semiconductors like conductors have less electrical resistance than an insulator, and a semiconductor can be doped to reduce the electrical resistance, by lowering the energy gap.



* a semiconductor, however, because of the energy gap has a greater electrical resistance than a conductor.