

Question A4, 1996:

Define the terms interatomic bond stiffness and Young's modulus for a solid.

Show that a material containing atoms arranged on a primitive cubic lattice would be expected to have a Young's modulus E given by:

$$E = S/r_0$$

where S is the stiffness of the interatomic bond and r_0 is the equilibrium separation of the atoms.

The following materials all contain carbon-carbon bonds:

	E / GPa
diamond	1000
carbon graphite (parallel to fibre axis)	400
graphite (averaged over all directions)	30
polyethene	0.5

Explain the differences in the values of Young's modulus for these materials.

Estimate the Young's modulus for a composite material containing 20% fibres in a polyethene matrix, with all the fibres aligned parallel to the tensile axis. State your assumptions.