

1 Lattices

1. How might the structure of a normal metal differ from a regular lattice?

Solution: Metals are likely to have lattice defects such as dislocations.

2 Properties

1. Why do you think dislocations make metals weaker than perfect crystals?

Solution: Dislocations allow layers of atoms to slip easily, requiring only some bonds to change, which means metals are often more easy to deform (more malleable).

2. As you work a metal, it becomes more brittle and less ductile, why?

Solution: As slipping happens, dislocations in the lattice are eliminated, meaning there is less scope for slipping and the metal becomes less ductile.

3 Alloys

1. Why might dislocations be disrupted in alloys? Use the diagram and your knowledge of dislocations to explain this.

Solution: Alloy atoms “pin” dislocations, by sitting in the gap. This prevents the alloy from slipping, so it becomes stronger.

4 Example exam questions

1. Explain why the stress at the tip of a crack varies for tough and brittle materials

Solution: Tough materials are often more malleable so rather than transmitting the stress, the crack just blunts

2. Carbon-steel contains interstitial carbon atoms. How does this affect the ductility? Why?

Solution: Less ductile, as dislocations are pinned, preventing easy slipping.