2.6 Metallic Bonding, Alloys and Properties of Metals: Test Pack

EDEXCEL 4CH1 · Calculator allowed · about 15 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 State the charge on the metal ions in the metallic lattice model used to explain metallic bonding in a piece of copper.

(Total for Question 1 is 1 mark)

2 An electrically neutral model of a metal contains 60 metal ions, each with charge +2. The only other particles shown are delocalised electrons, each with charge -1. Determine how many delocalised electrons the model must contain.

(Total for Question 2 is 1 mark)

3 State why molten metals conduct electricity, referencing which particles move.

(Total for Question 3 is 1 mark)

4 A model of an alloy contains 80 atoms of the main metal at lattice positions and 20 atoms of an added element in the gaps between them. Calculate the percentage of all atoms in the model that belong to the added element, then name the type of alloying represented.

(Total for Question 4 is 2 marks)

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5 Describe why many metals have high melting points, using the metallic bonding model and referring to forces between particles.

(Total for Question 5 is 2 marks)

6 A bar of pure aluminium is more easily bent than an aluminium alloy used for aircraft. Describe a structural reason for this difference, referring to atom sizes and lattice defects.

(Total for Question 6 is 2 marks)

7 A pupil models a solid alloy using uncharged wooden beads of two sizes arranged in rows. The beads are the only objects in the model. Explain why this model cannot account for electrical conduction or for the force holding the real alloy together.

(Total for Question 7 is 2 marks)

8 Explain why pure metals can be hammered into thin sheets but alloys are generally harder and less malleable, using the idea of layers and atomic arrangement.

(Total for Question 8 is 2 marks)

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Mark scheme · 2.6 Metallic Bonding, Alloys and Properties of Metals: Test Pack

Question 1

positive (cations) **B1**

Answer: Positive (metal ions, cations)

Question 2

120 delocalised electrons **B1**

Answer: 120 delocalised electrons

Question 3

delocalised electrons still move and conduct in the molten state; conduction is by electrons not ions in metals **B1**

Answer: Because conduction in metals is by delocalised electrons which remain mobile when molten, so the molten metal conducts electricity

Question 4

20% of all atoms belong to the added element **B1**

interstitial alloying **B1**

Answer: Percentage = 20 / (80 + 20) x 100 = 20%. The model represents interstitial alloying.

Question 5

states there are strong electrostatic attractions between positive ions and delocalised electrons **B1**

explains that a lot of energy is needed to overcome these strong attractions to separate the ions **B1**

Answer: Strong electrostatic attraction between positive ions and the sea of delocalised electrons requires a large input of energy to break, so many metals have high melting points

Question 6

alloy contains atoms of different sizes or extra elements that create lattice distortions **B1**

these distortions impede the movement of dislocations and layers, making the alloy stronger and less easily bent **B1**

Answer: Alloying adds atoms of different sizes that distort the lattice and create defects which impede dislocation motion, so the alloy is stronger and less easily bent than pure aluminium

Question 7

the model lacks mobile delocalised electrons to carry charge, so it cannot account for conduction **B1**

uncharged beads cannot represent the electrostatic attraction between positive metal ions and delocalised electrons that holds the alloy together **B1**

Answer: The model has no mobile delocalised electrons to carry electrical charge. Its uncharged beads also cannot represent the electrostatic attraction between positive metal ions and delocalised electrons that holds the alloy together.

Question 8

pure metal has regular layers of identical atoms that can slide over each other **B1**

in an alloy different sized atoms distort the lattice and stop layers sliding, making it harder and less malleable **B1**

Answer: Pure metals have regular layers of identical atoms that can slide, allowing malleability, but alloys contain atoms of different sizes which distort the lattice and hinder sliding so they are harder and less malleable

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