IB · HL · Chemistry

1 hour 9 questions

Structured Questions

The Metallic Model

Properties of Metals & Their Uses / s & p Block Elements / Physical Properties of Transition Elements (HL)

Easy (3 questions)	/21
Medium (3 questions)	/30
Hard (3 questions)	/27
Total Marks	**/78**

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Easy Questions

1 (a) Describe the bonding in solid sodium.

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(2 marks)

(b) Potassium has a lower melting point than sodium does.

Explain why.

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(2 marks)

(c) Magnesium is in the same period as sodium, but has a much higher melting point.

Explain why.

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(2 marks)

(d) Predict whether magnesium is harder or softer than sodium and explain why.

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(2 marks)

2 (a) Copper is a common metal used in wiring.

Explain the electrical conductivity of copper.

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(2 marks)

Explain why copper is also very malleable.

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(2 marks)

(b)

(c) Copper is used in alloys such as brass and bronze.

Outline why copper alloys are usually less malleable than pure copper.

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(1 mark)

(d) Copper is used for water pipes.

Suggest two properties of copper that make it suitable for this use, excluding malleability.

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(2 marks)

3 (a) Potassium ions are vital for the functioning of all living cells and is a Group 1 metal

Describe the bonding in a Group 1 metal.

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(2 marks)

(b) Potassium reacts readily with oxygen to form potassium oxide. Write a balanced symbol equation for this reaction including state symbols.

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(2 marks)

(c) Explain why potassium has a higher melting point than rubidium.

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(2 marks)

Medium Questions

1 (a) Magnesium is a lightweight metal used for the manufacturing of car seats. Describe the structure and bonding present in solid magnesium.

(3 marks)

(b) Magnesium has a considerably higher boiling point than sodium. Explain this difference, despite the fact both elements are in period 3.

(3 marks)

(c) Explain, with reference to bonding, the principal property of a metal that makes it suited to manufacturing shaped objects such as railings.

(3 marks)

(d) Many alloys are harder than their constituent metal elements alone.

Outline the reason for this with reference to the structure of metal alloys.

(2 marks)

2 (a) The elements sodium, aluminium, silicon, phosphorus and sulfur are in period 3 of the periodic table.

Describe and explain the general trend in melting points of the metals in period 3.

(4 marks)

(b) Identify, with reasoning, which of the period 3 metals has the highest melting point.

(3 marks)

(c) Explain, by reference to the intermolecular forces, why sulfur has a higher melting point than phosphorus.

(2 marks)

(d) Although the molar masses of IC*l* and Br_2 are very similar, the boiling point of IC*l* is 97.4 °C and that of Br_2 is 58.8 °C.

Explain the difference in these boiling points in terms of the intermolecular forces present in each liquid.

(2 marks)

3 (a) Copper is a transition metal. Describe the bonding in metals.

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(2 marks)

(b) Aluminium and copper can be used to make the alloy duralumin.

Explain why an aluminium-copper alloy is harder than pure aluminium.

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(2 marks)

(c) This question is about the chlorides of copper and aluminium.

i) State the type of bonding present in copper(II) chloride which melts at 771 K.

[1]

ii) The chloride of aluminium, $AlCl_3$, melts 465 K. Suggest why the melting point is so much lower than that of $CuCl_2$.

[1]

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(2 marks)

(d) Both copper and benzene have delocalised electrons. Explain why both structures have delocalised electrons, copper conducts electricity, but benzene does not.

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(2 marks)

Hard Questions

1 (a) Explain why transition metals, such as iron, alloy best with other transition metals, such as nickel.

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(2 marks)

(b) State the name of the most common type of iron alloy and the element it is alloyed with.

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(2 marks)

(c) Describe and explain the trend in the melting points of all the Group 1 metals as you descend the group.

Use section 8 of the Data book.

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(3 marks)

(d) Describe and explain the trend in melting points across the Period 3 metals of sodium, magnesium and aluminium.

Use section 8 of the Data book.

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(3 marks)

Explain why pure gold is not often used to make jewellery.

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2 (a) **(2 marks)**

(b) Gold is often alloyed with other metals.

i) Suggest why alloying gold is useful.

[2]

ii) Give some examples of metals that are commonly alloyed with gold.

[2]

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(4 marks)

(c) Silver is the best metal electrical conductor.

i) Explain how silver conducts electricity so well.

[2]

ii) Explain why copper is often used instead of silver in wiring.

[1]

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(3 marks)

3 (a) Lead is an excellent roofing material. It is malleable and resistant to corrosion. Lead rapidly becomes coated with basic lead carbonate which protects it from further corrosion.

Lead has a typical metallic structure.

i) Explain why there are attractive forces in a metallic structure.

[2]

ii) Explain why a metal, such as lead, is malleable.

[2]

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(4 marks)

(b) The alloy solder can be made by heating together the metals lead and tin. The melting points of tin and lead are 232 °C and 328 °C respectively, whilst the solder melts at a lower temperature than either of these.

Use your knowledge of alloy to suggest why the melting point of solder is lower than its constituent metals.

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(2 marks)

(c) Whilst solder has a lower melting point than lead and tin, it is stronger.

Explain, on an atomic level, why the addition of other elements and forming an alloy has this effect.

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(2 marks)