InkChemistry

QUESTION WORKBOOK

The four crystal structures and their properties

Bonding and structure · Unit C03

AQA 3.1.3.4 · OCR A 2.2.2, 3.1.1

20 questions · 59 marks

NAVY SCREEN EDITION

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SECTION A · Short, 1 to 2 marks

A1 FCS-Q1
Name the type of crystal structure in magnesium, sodium chloride, ice and silicon dioxide. [2]

A2 FCS-Q2
Give the number of atoms each carbon atom is covalently bonded to in diamond and in graphite, and the bond angle in each. [2]

A3 FCS-Q4
State two physical properties typical of a molecular crystal such as iodine, with a reason for each. [2]

A4 FCS-Q14
Suggest why iodine dissolves readily in hexane but only slightly in water. [2]

A5 FCS-Q19
Suggest why solid C_{60} is a very poor conductor of electricity, although it has delocalised electrons. [2]

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SECTION B · Standard, 3 to 5 marks

B1 FCS-Q5

Explain why graphite conducts electricity but diamond does not. [4]

B2 FCS-Q8

Explain why ice is less dense than liquid water. [4]

B3 FCS-Q12

Suggest the type of crystal structure of each solid. P melts at 1538 °C and conducts as a solid. Q melts at 44 °C and does not conduct when molten. R melts at 2072 °C, does not conduct as a solid, but conducts when molten. S does not melt below 3000 °C and does not conduct in any state. [4]

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B4 FCS-Q15 Compare the structures of diamond and graphite. [4]

B5 FCS-Q3 Describe the structure of silicon dioxide. [3]

B6 FCS-Q6 Explain why graphite is soft enough to be used as a lubricant but has a very high melting point. [3]

B7 FCS-Q7 Explain why iodine has a low melting point, and state what happens to the I–I bonds when iodine melts. [3]

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B8 FCS-Q9 Explain why diamond has a very high melting point and is very hard. [3]

B9 FCS-Q10 Calculate the number of C–C bonds in the layers of 0.600 g of graphite. Ar of C = 12.0; L = 6.022×10^{23} mol^{-1}. [3]

B10 FCS-Q11 Calculate the increase in volume when 1.00 kg of liquid water at 0 °C freezes. Density of water = 1.00 g cm^{-3}; density of ice = 0.917 g cm^{-3}. [3]

B11 FCS-Q13 Suggest why hexagonal boron nitride, BN, which has flat layers of hexagons like graphite, is an electrical insulator. [3]

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B12 FCS-Q16 Evaluate the claim that metallic bonding is always stronger than ionic bonding, using these melting points: magnesium 650 °C, sodium chloride 801 °C, tungsten 3422 °C. [3]

B13 FCS-Q18 Explain why buckminsterfullerene, C_{60}, turns to vapour at a far lower temperature than diamond, although both are pure carbon. [3]

B14 FCS-Q20 Calculate the energy needed to boil 45.0 g of water at 100 °C. Enthalpy of vaporisation of water = 40.7 kJ mol^{-1}; Mr of H_2O = 18.0. [3]

B15 FCS-Q21 Explain why the enthalpy of vaporisation of water, 40.7 kJ mol^{-1}, is much larger than its enthalpy of fusion, 6.01 kJ mol^{-1}. [3]

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