InkChemistry

QUESTION WORKBOOK

Covalent, dative covalent and metallic bonding

Bonding and structure · Unit C03

AQA 3.1.3.2, 3.1.3.3 · OCR A 2.2.2, 3.1.1

21 questions · 64 marks

NAVY SCREEN EDITION

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SECTION A · Short, 1 to 2 marks

A1 CDC-Q1
State what is meant by a covalent bond. [2]

A2 CDC-Q2
State what is meant by a dative covalent bond, and state how one is shown in a displayed formula. [2]

A3 CDC-Q5
Give the number of bonding pairs and the number of lone pairs round the central atom in H_2O and in CO_2. [2]

A4 CDC-Q8
Explain why nitrogen gas, N_2, is very unreactive. [2]

A5 CDC-Q20
Give the number of σ bonds and the number of π bonds in a molecule of hydrogen cyanide, HCN. [2]

SECTION B · Standard, 3 to 5 marks

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B1 CDC-Q9 Explain why magnesium has a higher melting point than sodium. [4]

B2 CDC-Q10 Explain why metals conduct electricity and why they are malleable. [4]

B3 CDC-Q18 Explain, using hybridisation, why the bond angles round each carbon atom in ethene, C_2H_4, are about 120° and why the molecule is planar. [4]

B4 CDC-Q3 Describe the dot-and-cross diagram for ammonia, NH_3, showing outer electrons only. [3]

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B5 CDC-Q4 Describe the dot-and-cross diagram for a nitrogen molecule, N_2. [3]

B6 CDC-Q6 Explain how an ammonium ion forms from an ammonia molecule and a hydrogen ion, and why its four N–H bonds are identical. [3]

B7 CDC-Q7 Explain how two $AlCl_3$ molecules join to form an Al_2Cl_6 molecule. [3]

B8 CDC-Q11 Suggest how the bonding in a carbon monoxide molecule, CO, allows both atoms to have eight outer electrons, given that the molecule contains a triple bond. [3]

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B9 CDC-Q12 Suggest why bronze, an alloy of copper with tin, is harder than pure copper. [3]

B10 CDC-Q13 Suggest why phosphorus forms both PCl_3 and PCl_5, but nitrogen forms NCl_3 and no NCl_5. [3]

B11 CDC-Q14 Calculate the number of delocalised electrons in 1.00 g of magnesium. Ar of Mg = 24.3; L = 6.022×10^{23} mol^{-1}. [3]

B12 CDC-Q15 Calculate the energy needed to break every N≡N bond in 2.40 dm^3 of nitrogen gas at room temperature and pressure. N≡N bond enthalpy = 945 kJ mol^{-1}; molar gas volume = 24.0 dm^3 mol^{-1}. [3]

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B13 CDC-Q17 Evaluate the claim that the dative bond in an ammonium ion is weaker than its other three N–H bonds and can be identified in the ion. [3]

B14 CDC-Q19 Calculate an estimate of the energy needed to break only the π bonds in 5.60 g of nitrogen gas, N_2, taking the σ part of the triple bond as equal to an N–N single bond. Bond enthalpies: N–N 163 kJ mol^{-1}, N≡N 945 kJ mol^{-1}; Mr of N_2 = 28.0. [3]

B15 CDC-Q21 Suggest why a hot wire placed in hydrogen iodide produces violet fumes of iodine, but the same wire has no effect on hydrogen chloride. Bond enthalpies: H–Cl 432 kJ mol^{-1}, H–I 298 kJ mol^{-1}. [3]

SECTION C · Long, 6 marks or more

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C1 CDC-Q16 Compare the bonding in solid sodium with the bonding in solid sodium chloride, and use the comparison to explain the differences in their electrical conductivity and in how they respond to a hammer blow. [6]

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