2.2 Bonding, Structure and Properties of Matter: 30-minute Pack

AQA 8462 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Ionic bonding forms between metals and non-metals.

(a) Give the charge on a sodium ion, Na^{+}. **(1)**

(b) Give the charge on a chloride ion, Cl^{-}. **(1)**

(Total for Question 1 is 2 marks)

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2 A student draws dot and cross diagrams to show bonding in compounds.

(a) State the ending of the name of ions formed from non-metals (for example chloride from chlorine). **(1)**

(b) Draw a simple dot and cross diagram showing the bonding in hydrogen chloride, HCl. Show only the outer-shell electrons and label one of the lone pairs on the chlorine atom. **(2)**

(Total for Question 2 is 3 marks)

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3 A simple calculation with relative formula mass (Mr). Relative atomic masses: C = 12, H = 1, O = 16.

(a) Calculate the relative formula mass, Mr, of CH_4O (one carbon, four hydrogen, one oxygen). **(3)**

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(Total for Question 3 is 3 marks)

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4 A student compares electrical conductivity of three substances at room temperature: solid copper, solid sodium chloride and aqueous sodium chloride solution.

(a) Rank the three substances from best conductor to worst conductor. **(2)**

(Total for Question 4 is 2 marks)

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5 Simple molecular substances have low melting points because of weak forces between molecules.

(a) Explain why iodine (a simple molecular substance) has a low melting point compared with sodium chloride. **(2)**

(Total for Question 5 is 2 marks)

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6 Describe the type of bonding and the particle arrangement in sodium chloride (table salt).

(a) Name the type of bonding in sodium chloride. **(1)**

(b) State the arrangement of the ions in the solid (type of structure). **(1)**

(Total for Question 6 is 2 marks)

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7 Draw a simple dot-and-cross style diagram showing the bonding in a hydrogen chloride molecule, HCl, and state the type of bond.

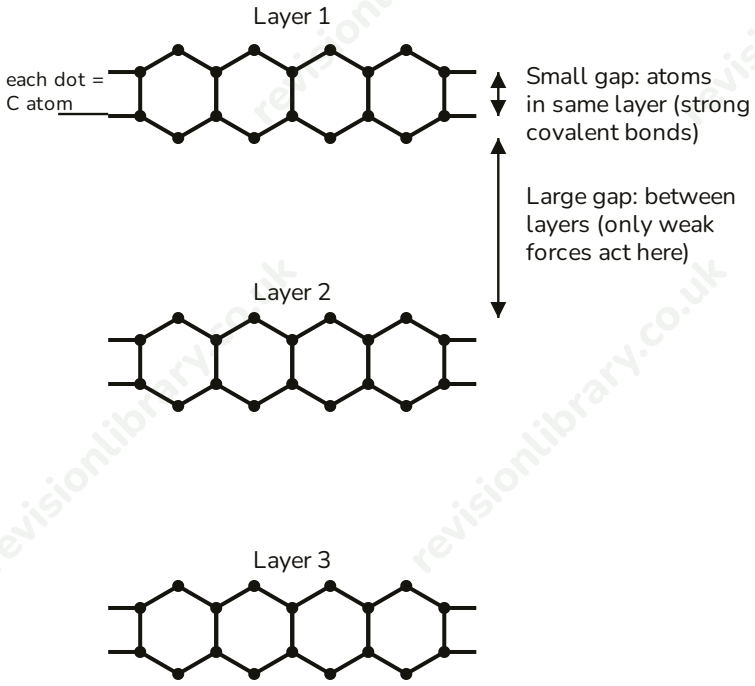
(a) Show the electrons for H and Cl and indicate the shared pair. **(2)**

(b) State the type of bond in HCl. **(1)**

(Total for Question 7 is 3 marks)

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8 Graphite is another giant covalent structure made of carbon atoms, but its properties are very different from diamond.



Cross-section of graphite: hexagonal layers of carbon atoms
Gap between layers is much larger than the gap between atoms within a layer

(a) Describe the structure of graphite. **(2)**

(b) Explain why graphite is able to conduct electricity, even though it is a form of carbon like diamond, which does not conduct. **(2)**

(c) Explain why graphite is soft and slippery. **(2)**

(Total for Question 8 is 6 marks)

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Mark scheme · 2.2 Bonding, Structure and Properties of Matter: 30-minute Pack

Question 1

(a) +1 or 1+ cao **B1**

(a) Answer: +1

(b) -1 or 1- cao **B1**

(b) Answer: -1

Question 2

(a) -ide cao **B1**

(a) Answer: -ide

(b) shows H with one electron and Cl with seven electrons and a shared pair between them (dot and cross or similar), oe **M1**

(b) shows Cl has three lone pairs remaining (labelled or clearly drawn) cao **A1**

(b) Answer: H-Cl with a shared pair between H and Cl; Cl also shown with three lone pairs (one pair labelled).

Question 3

(a) substitutes atomic masses: Mr = 1x12 + 4x1 + 1x16 **M1**

(a) adds to get 32 **M1**

(a) 32 cao **A1**

(a) Answer: 32

Question 4

(a) order given with reasoning or correct order: copper > aqueous sodium chloride > solid sodium chloride **M1**

(a) explicit mention that copper has free electrons, aqueous solution has mobile ions, solid ionic lattice has fixed ions cao **A1**

(a) Answer: Copper > aqueous sodium chloride > solid sodium chloride. Copper conducts via free electrons; aqueous solution conducts via mobile ions; solid ionic lattice does not conduct as ions are fixed.

Question 5

(a) states that iodine has weak intermolecular forces between molecules (Van der Waals) compared with ionic bonds in sodium chloride **M1**

(a) so less energy is needed to separate particles and iodine melts at a much lower temperature cao **A1**

(a) Answer: Iodine has weak intermolecular forces between molecules, whereas sodium chloride has strong ionic bonds; therefore less energy is needed to separate iodine molecules so its melting point is much lower.

Question 6

(a) ionic bonding cao **B1**

(a) Answer: Ionic bonding

(b) giant ionic lattice (regular arrangement of alternating Na^+ and Cl^- ions) cao **B1**

(b) Answer: Giant ionic lattice (regular arrangement of Na^+ and Cl^- ions)

Question 7

(a) diagram shows H with 1 electron and Cl with 7 electrons and a shared pair between them (dot and cross or equivalent) **M1**

(a) shared pair shown so Cl has 8 electrons and H has 2, cao **A1**

(a) Answer: H has 1 electron, Cl has 7; they share one pair so H has 2 and Cl has 8 electrons (dot and cross).

(b) polar covalent bond or covalent bond with polarity cao **B1**

(b) Answer: Polar covalent bond

Question 8

(a) carbon atoms are arranged in layers of hexagonal rings oe **B1**

(a) each carbon atom forms three covalent bonds to three other carbon atoms (within its layer) oe **B1**

(a) Answer: Carbon atoms form layers of hexagonal rings, with each carbon bonded to three others within its layer.

(b) each carbon atom in graphite forms only three covalent bonds (not four), leaving one outer-shell electron per atom that is delocalised oe **B1**

(b) these delocalised electrons are free to move along the layers and can carry electrical charge/current oe **B1**

(b) Answer: Each carbon has one spare (delocalised) electron not used in bonding; these electrons move freely along the layers and carry charge.

(c) the layers of carbon atoms are held together only by weak forces of attraction (weak intermolecular forces between layers) oe **B1**

(c) so the layers can slide over each other easily oe **B1**

(c) Answer: The layers are held together by weak forces, so they can easily slide over one another, making graphite soft and slippery.

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