K EDUCATION CENTRE

GCSE COMBINED SCIENCE - HIGHER TIER

Ionic & Covalent Bonding

Edexcel-Style Chemistry Assignment

STUDENT DETAILS

Name: _____

Date: _____ Target grade / level: _____

ASSIGNMENT FOCUS

- Explain formation of ions and ionic bonds using electron transfer and electrostatic attraction
- Deduce ionic formulae and interpret dot-and-cross diagrams
- Explain covalent bonding and draw simple molecular structures
- Link structure and bonding to melting point, boiling point and electrical conductivity
- Apply bonding ideas to unfamiliar substances and extended-response questions

20 questions • Higher-tier practice • Original K Education Centre questions informed by Pearson Edexcel GCSE Combined Science assessment style.

Section A - Ionic Bonding

Use electron transfer, ion charges and electrostatic attraction accurately.

1. A sodium atom has electron arrangement 2,8,1. State the charge on the ion formed by sodium and explain how the ion forms. **[2 marks]**

2. A chlorine atom has electron arrangement 2,8,7. State the charge on the chloride ion and explain how it forms. **[2 marks]**

3. The table gives the charges on some ions. Deduce the formula of (a) magnesium chloride and (b) aluminium oxide. **[4 marks]**

Ion	Charge
magnesium	2+
chloride	1-
aluminium	3+
oxide	2-

4. Magnesium reacts with chlorine to form magnesium chloride. Draw a dot-and-cross diagram to show the ions in magnesium chloride. Show only outer-shell electrons and include ion charges. **[4 marks]**

5. Explain how an ionic bond forms between a magnesium ion and a chloride ion. Your answer must refer to charges and forces. **[3 marks]**

Section B - Covalent Bonding

Use shared pairs of electrons and correct molecular structures.

6. State what is meant by a covalent bond. **[2 marks]**

7. Hydrogen reacts with chlorine to form hydrogen chloride, HCl. Draw a dot-and-cross diagram for one HCl molecule. Show only outer-shell electrons. **[2 marks]**

8. Draw a dot-and-cross diagram for a molecule of water, H2O. Show the bonding pairs and the non-bonding outer-shell electrons on oxygen. **[3 marks]**

9. Oxygen gas contains O2 molecules. Draw a dot-and-cross diagram for O2 and use your diagram to show why the bond is a double covalent bond. **[3 marks]**

10. Carbon dioxide has the formula CO2. Draw a dot-and-cross diagram for a carbon dioxide molecule. Show all shared pairs of electrons. **[4 marks]**

11. Methane is a simple molecular substance with formula CH_4. Explain why methane does not conduct electricity. **[2 marks]**

Section C - Structure and Properties

Link the type of structure and bonding to observable physical properties.

12. The table shows properties of four substances. Identify which substance is most likely to be (i) an ionic compound and (ii) a simple molecular covalent substance. Give one reason for each choice. **[4 marks]**

Substance	Melting point / °C	Conducts as a solid?	Conducts when molten?
P	801	No	Yes
Q	-114	No	No
R	3550	Yes	-
S	3550	No	-

13. Sodium chloride has a much higher melting point than hydrogen chloride. Explain this difference in terms of structure, bonding and the energy needed to overcome attractions. **[4 marks]**

14. Solid sodium chloride does not conduct electricity, but molten sodium chloride does. Explain why. **[3 marks]**

15. A student says, “Simple covalent substances have low boiling points because the covalent bonds are weak.” Explain why this statement is incorrect. **[3 marks]**

Section D - Giant Covalent Structures and Higher-Tier Application

Apply bonding ideas to diamond, graphite and unfamiliar evidence.

16. Diamond and graphite are both forms of carbon. Describe one similarity in their bonding and one difference in their structures. **[4 marks]**

17. Explain why diamond is hard and is used in cutting tools. **[3 marks]**

18. Graphite conducts electricity and is soft enough to be used as a lubricant. Explain both properties in terms of its structure and bonding. **[5 marks]**

19. Model A is a ball-and-stick representation and Model B is a dot-and-cross representation. Give one useful feature and one limitation of either model when representing covalent substances. **[3 marks]**

Model A	Model B
Shows each atom as a coloured sphere joined by sticks. The sticks suggest fixed bonds and the atoms appear widely separated.	Shows only outer-shell electrons using dots and crosses. It does not show the real size of atoms or the three-dimensional shape.

20. Sodium chloride and carbon dioxide are both compounds, but they have very different physical properties. Compare their structures and bonding, and explain why sodium chloride has a high melting point and can conduct electricity when molten, whereas carbon dioxide has a low boiling point and does not conduct electricity. Use detailed scientific terminology. **[6 marks]**

End of assignment - Check that all diagrams show the correct electrons, charges and bonding. For explanation questions, link structure and bonding directly to the property being asked about.