Bonding and Structure

GCSE Science • **Combined and Triple** • Grades 3–6

WORKED SOLUTIONS

Name: worked example Class: _____ Total: 58 / 58

Show all your working. Marks are given for correct method as well as the final answer.

1. Name the type of bonding between a metal and a non-metal. **[1 mark]**

electrons are transferred

Answer: ionic

2. Name the type of bonding between two non-metals. **[1 mark]**

electrons are shared

Answer: covalent

3. Describe what happens to the electrons when sodium reacts with chlorine. **[3 marks]**

sodium has 1 outer electron and loses it
chlorine has 7 and gains one
both end up with a full outer shell

Answer: sodium loses one electron to chlorine

4. Write down the charges on the sodium and chloride ions. **[2 marks]**

sodium lost an electron, so 1+
chlorine gained one, so 1–

Answer: Na^+ and Cl^-

5. Write down the charge on a magnesium ion. **[1 mark]**

group 2, so it loses 2 electrons

Answer: 2+

6. Write down the charge on an oxide ion. **[1 mark]**

group 6, so it gains 2 electrons

Answer: 2–

7. Explain why ionic compounds have high melting points. **[3 marks]**

a giant lattice of oppositely charged ions
the attraction between them is strong
say electrostatic -- it is a terminology mark

Answer: strong electrostatic forces need lots of energy to break

8. Explain why ionic compounds conduct electricity when molten but not when solid. **[3 marks]**

conduction needs charged particles that can MOVE
in a solid the ions are locked in the lattice
melting frees them

Answer: the ions can only move when molten

9. Explain why simple molecular substances have low melting points. **[3 marks]**

the covalent bonds INSIDE are strong
but the intermolecular forces between them are weak
it is the weak forces that break, not the bonds

Answer: ____ the forces between molecules are weak____

10. Explain why simple molecular substances do not conduct electricity. **[2 marks]**

no free electrons and no ions

Answer: ____ the molecules have no overall charge____

11. Name the structure of diamond and graphite. **[1 mark]**

both are forms of carbon

Answer: _____ giant covalent_____

12. Explain why diamond is very hard. **[3 marks]**

a rigid three-dimensional lattice
all the bonds are strong covalent bonds
so there are no weak points to break

Answer: ____ every carbon is bonded to four others____

13. Explain why graphite is soft and slippery. **[3 marks]**

each carbon bonds to only three others
this makes flat layers
the forces BETWEEN layers are weak, so they slide

Answer: ____ the layers slide over each other____

14. Explain why graphite conducts electricity but diamond does not. **[3 marks]**

graphite: 3 bonds used, so 1 electron is free to move
diamond: all 4 electrons are used in bonds

Answer: ____ graphite has one delocalised electron per carbon____

15. Describe the structure of a metal. **[3 marks]**

a regular lattice of metal ions
the outer electrons are free to move through it

Answer: ____ positive ions in a sea of delocalised electrons____

16. Explain why metals conduct electricity. **[2 marks]**

free electrons flow through the structure

Answer: ____ the delocalised electrons can move and carry charge____

17. Explain why metals can be bent and hammered into shape. **[3 marks]**

the ions are all the same size, in regular layers
they slide without breaking the metallic bonding

Answer: ____ the layers of ions can slide over each other____

18. Explain why an alloy is harder than a pure metal. **[3 marks]**

an alloy mixes in atoms of a different size
this distorts the regular layers
the layers can no longer slide past each other

Answer: ____ different sized atoms stop the layers sliding____

19. Sodium chloride and water have very different properties.

(a) Name the structure and bonding in each. **[2 marks]**

sodium chloride: giant ionic lattice
water: simple molecular, covalent bonds

(b) Explain why sodium chloride melts at 801°C but water at 0°C. **[4 marks]**

melting sodium chloride breaks strong electrostatic
attractions throughout a giant lattice
melting ice only overcomes weak forces BETWEEN molecules
the covalent bonds in water are not broken at all

Answer: ____ giant ionic vs simple molecular ; strong lattice vs weak intermolecular forces____

20. A student tests an unknown white solid. It does not conduct as a solid, does conduct when dissolved, and melts above 700°C.

(a) Name the type of bonding, with reasons. **[3 marks]**

ionic
the high melting point means a giant lattice
conducting only when dissolved means mobile IONS

(b) Predict whether it would dissolve in water. **[2 marks]**

yes -- most ionic compounds dissolve in water
which is why it conducted in solution

Answer: ____ ionic ; yes, it dissolves____

21. Compare diamond and graphite.

(a) State one similarity in their bonding. **[2 marks]**

both are giant covalent structures of carbon
both have strong covalent bonds

(b) Explain two differences in their properties. **[4 marks]**

hardness: diamond has 4 bonds per atom so it is rigid;
graphite has layers that slide, so it is soft
conduction: graphite has a delocalised electron per atom;
diamond has none, so it is an insulator

Answer: ____ *both giant covalent ; hardness and conductivity differ* ____

Free to print and use at home or in class. Please do not re-host or sell. Written by Hampstead Tuition Centre from the published exam specifications.