GCSE Chemistry

Ionic Bonding

Mark Scheme

Time available: 65 minutes
Marks available: 58 marks

1. (a) lithium (atom) loses (one) electron(s)

1

chlorine (atom) gains (one) electron(s)

1

reference to transfer of one electron

1

to form positive and negative ions

allow to form noble gas electronic structures

or

allow to form stable electron arrangements

or

allow to form full outer shells

or

allow reference to ionic bonding

1

(b) $\frac{161}{81 + 98} \times 100$

1

= 89.944134

1

= 89.9 (%)

1

*an answer of 89.9 (%) scores **3** marks*

(c) more sustainable **or** less waste

allow any sensible economic or environmental reason but not 'cheaper' without qualification

1

(d) 50 / 1000 (dm^3) or 0.05 dm^3

or

80 / 1000 (g / cm^3) or 0.08 g / cm^3

1

= 4(.00) (g)

1

*an answer of 4(.00) (g) scores **2** marks*

[10]

2. (a) (i) 7 / seven

1

(ii) 1

*do **not** accept –1*

1

Electron 1

(iii) isotopes

1

(b) (i) (sodium +) fluorine → sodium fluoride

1

(ii) compounds

1

(iii) mole

1

(iv) sodium (atom) loses

1

fluorine (atom) gains

1

one electron

1

ions formed

1

allow sodium forms positive (ion) ***or*** *fluorine forms negative (ion)*
allow form ionic bond
allow to gain a full outer shell of electrons
allow forms noble gas structure
max 3 *if reference to incorrect particle / bonding*

(v) Dissolve in water

1

High melting point

1

[13]

3. (a) magnesium <u>loses electrons</u>

there are four ideas here that need to be linked in two pairs.

1

<u>two electrons</u>

1

<u>chlorine gains electrons</u>

*magnesium <u>loses</u> electrons and chlorine <u>gains</u> electrons scores **2** marks.*

1

<u>two atoms of chlorine</u>

magnesium <u>loses</u> <u>two</u> electrons and <u>two chlorines</u> each <u>gain</u> one electron will score full marks.

1

(b) 95

*correct answer with or without working gains **2** marks*

*if answer incorrect, allow 24 + 35.5 + 35.5 for **1** mark*

2

[6]

4. Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.

0 marks
No relevant content

Level 1 (1–2 marks)
*There is a statement about the bonding and / or structure **or** melting / boiling point of chlorine **or** sodium chloride.*

Level 2 (3–4 marks)
*There are statements about the bonding and / or structure of chlorine **or** sodium chloride.*

Level 3 (5–6 marks)
*There are statements about the bonding and / or structure of chlorine **and** sodium chloride.*

*There is an explanation of why chlorine is a gas **or** sodium chloride is a solid.*

Examples of chemistry points made in response:

Chlorine:

covalent bonds between atoms

forming (simple) molecules

no / weak attraction / bonds between molecules

low boiling point

Sodium chloride:

*ionic bonds **or** electrostatic attraction*

strong bonds

in all directions

between oppositely charged ions

forming giant lattice

large amounts of energy needed to break bonds

high melting point

[6]

5. (a) (i) nucleus

1

(ii) neutron

1

(iii) electron

1

(b) (i) 12

1

(ii) 24

1

(c) any **four** from:

*sharing / covalent / metallic = max **3***

- magnesium (atom) reacts with **two** iodine (atoms)
- magnesium (atom) loses electrons
- **2** electrons (from each atom)
- Iodine (atom) gains electron(s)
- **1** electron or an electron (to each atom)
- iodide ion formed

  allow iodine ion
- iodide has negative charge / is a negative ion / particle

  allow iodine

  ignore I^{2-}
- magnesium ion formed
- magnesium has positive charge
- oppositely charged ions attract
- a giant structure / lattice is formed

  *allow **1** mark for unqualified reference to ion formation or ionic bonding*

4

[9]

6. (a) electrons transferred from potassium to sulfur

1

two potassium atoms each lose one electron

1

forming K^+ / 1+ ions

1

sulfur atoms gain 2 electrons

1

forming S^{2-} / 2− ions **1**

(b) there are no gaps / sticks between the potassium ions and sulfide ions

1

(c) (two) shared pairs between H and S

1

rest correct - no additional hydrogen electrons and two non-bonding pairs on sulfur

second mark dependent on first

1

(d) 342

2

*allow **1** mark for evidence of (2 × 27) + 3[32 + (16 × 4)]*

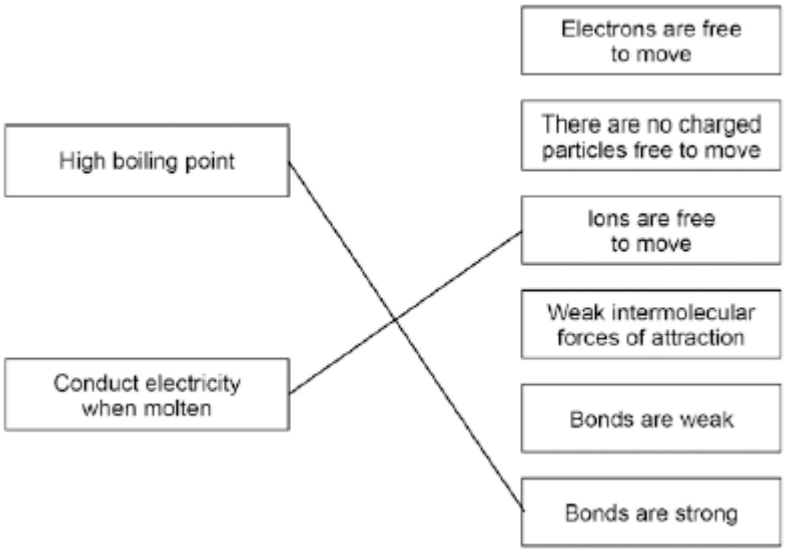
(e)

Property	**Explanation of property**
Low melting point	Weak intermolecular forces of attraction
Does not conduct electricity when molten	There are no charged particles free to move
	Electrons are free to move
	Ions are free to move
	Bonds are weak
	Bonds are strong

more than one line drawn from a variable negates the mark

2

(f) **Property** **Explanation of property**



more than one line drawn from a variable negates the mark

2

[14]