

Mark schemes

- 1.** (a) 3.6 (cm³) 1
- (b) hydrogen line only 1
- (c) both lines 1
- (d) graphite has delocalised electrons 1
- (e) **cathode** **anode**
- zinc (1) chlorine (1)
- do not accept chloride*
- allow 1 mark if chlorine and zinc the wrong way around* 1+1
- hydrogen (1) bromine (1)
- do not accept bromide*
- allow 1 mark if bromine and hydrogen the wrong way around* 1+1
- [8]**
- 2.** (a) copper, zinc, sodium chloride solution 1
- (b) a reactant is used up
- allow the reaction stops*
- allow electrolyte / electrode / ions / metal / metal hydroxide / alkali for reactant* 1
- (c) the reaction is not reversible 1
- (d) $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
- allow fractions / multiples*
- allow 1 mark for O₂* 2

(e) **Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

5-6

Level 2: Some logically linked reasons are given. There may also be a simple judgement.

3-4

Level 1: Relevant points are made. This is not logically linked.

1-2

No relevant content

0

Indicative content

reasons why fuel cells could be judged as better

from the table	from other knowledge
<ul style="list-style-type: none">time for refuelling a fuel cell is faster than recharging <p>or</p> <ul style="list-style-type: none">a fuel cell does not need to be recharged <ul style="list-style-type: none">a fuel cell has a greater range	<ul style="list-style-type: none">hydrogen can be renewable if made by electrolysis using renewable energylithium-ion batteries can catch fireproduces only water <p>or</p> <ul style="list-style-type: none">no pollutants producedlithium-ion batteries may release toxic chemicals on disposallithium-ion batteries (eventually cannot be recharged so) have a finite life

reasons why the lithium-ion battery could be judged as better

from the table	from other knowledge
<ul style="list-style-type: none">lithium-ion uses energy more efficientlycost of lithium-ion car much lesscost of recharging much less than refuelling with hydrogen	<ul style="list-style-type: none">hydrogen is often made from fossil fuels so is not renewablecharging points are more widely available than hydrogen filling stationshydrogen takes up a lot of space <p>or</p> <ul style="list-style-type: none">is difficult to storehydrogen can be highly flammable / explosiveno emissions produced(catalyst in the hydrogen fuel-cell eventually becomes poisoned so) have a finite life

[11]

3.	(a) (diagram) complete circuit with power supply	1
	test solution in beaker or other appropriate apparatus	1
	electrodes <i>allow carbon, platinum or inert electrodes</i>	1
	(independent variable) salt solutions (with different metal ions)	1
	(observation) solid / metal deposit on the negative electrode	1
	(b) (sometimes) hydrogen is produced	1
	(because) the metal is more reactive than hydrogen	1
	(c) chlorine	1
	oxygen	1
		[9]
4.	(a) electricity <i>allow an electric current</i>	1
	(b) (i) chlorine/Cl ₂ <i>do not accept chloride</i>	1
	(ii) (zinc ions are) positive <i>ignore to gain electrons</i>	1
	and (opposite charges) attract	1
	(iii) reduction	1

(c) (i) in alloy:

accept converse

different sized atoms/particles

or

no layers/rows

accept layers distorted

1

so cannot slide

1

(ii) shape memory (alloys)

accept smart

1

[8]

5.

(a) magnesium loses two electrons **and** chlorine gains one electron

*accept magnesium loses electrons **and** chlorine gains electrons for
1 mark*

ignore oxidation and reduction

2

one magnesium and two chlorines

accept $MgCl_2$

1

noble gas structure

or

eight electrons in the outer shell

accept full outer shell (of electrons)

or

(electrostatic) attraction between ions

or

forms ionic bonds

*do **not** accept covalent bonds*

1

*reference to incorrect particles **or** incorrect bonding **or** incorrect
structure = **max 3***

(b) (i) because ions can move

ignore ions attracted

*do **not** accept molecules / atoms moving*

*do **not** accept incorrect reference to electrons moving*

1

(and ions move) to the electrodes

or

(and ions) carry charge

1

accept converse for solid

(ii) magnesium (ions) attracted (to the electrode)

1

so magnesium ions gain electrons

accept magnesium ions are reduced

ignore oxidised

1

2 electrons

*accept a correct half equation for 2nd **and** 3^d marking points*

1

(iii) hydrogen

allow H₂

1

(iv) magnesium is more reactive than hydrogen

accept converse

*allow magnesium is high in the reactivity series **or** magnesium is very/too reactive.*

*do **not** accept magnesium ions are more reactive than hydrogen ions*

1

(v) $2 \text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$

must be completely correct

1

(c) layers (of particles/atoms/ions)

1

(particles/atoms/ions/layers) can slide

1

*any mention of intermolecular / weak bonds/forces = **max 1***

[14]

6.

(a) (i) was well qualified

1

(ii) check the results of the experiment

1

(b) (i) cannot move

1

(ii) melt it / make it a liquid

allow heat it

allow dissolve (in water) / make a solution

1

(iii) they are positive

*allow opposites attract **or** opposite charges*

1

(iv) atoms

1

[6]