- Mark schemes 3.6 (cm<sup>3</sup>) (a) www.accesstuition.com 1. 1 hydrogen line only (b) 1 both lines (C) 1 (d) graphite has delocalised electrons 1 cathode (e) 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] (a) copper, zinc, sodium chloride solution 2. 1 (b) a reactant is used up allow the reaction stops allow electrolyte / electrode / ions / metal / metal hydroxide / alkali for reactant 1 the reaction is not reversible (C) 1 (d)  $2H_2 + O_2 \longrightarrow 2H_2O$ allow fractions / multiples allow 1 mark for O2
  - 2





3-4

1-2

0

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

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

No relevant content





from the table	from other knowledge	
<ul> <li>time for refuelling a fuel cell is faster than recharging or a fuel cell does not need to be recharged</li> <li>a fuel cell has a greater range</li> </ul>	<ul> <li>hydrogen can be renewable if made by electrolysis using renewable energy</li> <li>lithium-ion batteries can catch fire</li> <li>produces only water or no pollutants produced</li> <li>lithium-ion batteries may release toxic chemicals on disposal</li> <li>lithium-ion batteries (eventually cannot be recharged so) have a finite life</li> </ul>	

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

from the table	from other knowledge	
<ul> <li>lithium-ion uses energy more efficiently</li> <li>cost of lithium-ion car much less</li> <li>cost of recharging much less than refuelling with hydrogen</li> </ul>	<ul> <li>hydrogen is often made from fossil fuels so is not renewable</li> <li>charging points are more widely available than hydrogen filling stations</li> <li>hydrogen takes up a lot of space or is difficult to store</li> <li>hydrogen can be highly flammable / explosive</li> <li>no emissions produced</li> <li>(catalyst in the hydrogen fuel-cell eventually becomes poisoned so) have a finite life</li> </ul>	

3.	(a)	(diagram) complete circuit with power supply 1	Access Tuition
		test solution in beaker or other appropriate apparatus	1
		electrodes allow carbon, platinum or inert electrodes	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 allow an electric current	1
	(b)	(i) chlorine/Cl <sub>2</sub> do <b>not</b> accept chloride	1
		(ii) (zinc ions are) positive ignore to gain electrons	1
		and (opposite charges) attract	1
		(iii) reduction	1

(i) in alloy: (c)

(a)

(b)

5.

accept converse



different sized atoms/particles

or

UI		
no layers/rows		
accept layers distorted		
	1	
so cannot slide	1	
	1	
(ii) shape memory (alloys)		
accept smart	1	
		[8]
magnesium loses two electrons and chlorine gains one electron		
accept magnesium loses electrons <b>and</b> chlorine gains electrons for 1 mark		
ignore oxidation and reduction		
	2	
one magnesium and two chlorines		
accept MgCl <sub>2</sub>	1	
	•	
hoble 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 <b>not</b> accept covalent bonds		
reference to incorrect particles <b>or</b> incorrect bonding <b>or</b> incorrect structure = <b>max 3</b>	1	
(i) because ions can move		
ignore ions attracted		
do <b>not</b> accept molecules / atoms moving		
do <b>not</b> accept incorrect reference to electrons moving	1	
	1	

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		(and ions move) to the electrodes	Access
		or	www.accesstuition.com
		(and ions) carry charge	
		accept converse for solid	1
	(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 2 <sup>nd</sup> <b>and</b> 3 <sup>rd</sup> marking points	1
	(iii)	hydrogen	
		allow H <sub>2</sub>	1
	(iv)	magnesium is more reactive than hydrogen accept converse	
		, allow magnesium is high in the reactivity series <b>or</b> magnesium is very/too reactive.	
		do <b>not</b> accept magnesium ions are more reactive than hydrogen ions	
			1
	(v)	$2 \text{ Cl}^{-} \rightarrow \text{Cl}_{2} + \mathbf{2e}^{-}$	
		must be completely correct	1
(c)	laye	rs (of particles/atoms/ions)	
( )	(par	ticles/atoms/ions/lavers) can slide	1
			1
		any mention of intermolecular / weak bonds/forces = <b>max 1</b>	[14]
(a)	(i)	was well qualified	
(~)	(.)		1
	(ii)	check the results of the experiment	
4.5	<i>(</i> )		1
(b)	(I)	cannot move	1

6.

(ii) melt it / make it a liquid allow heat it

allow dissolve (in water) / make a solution

- (iii) they are positive *allow opposites attract* **or** *opposite charges*
- (iv) atoms

1

1

[6]