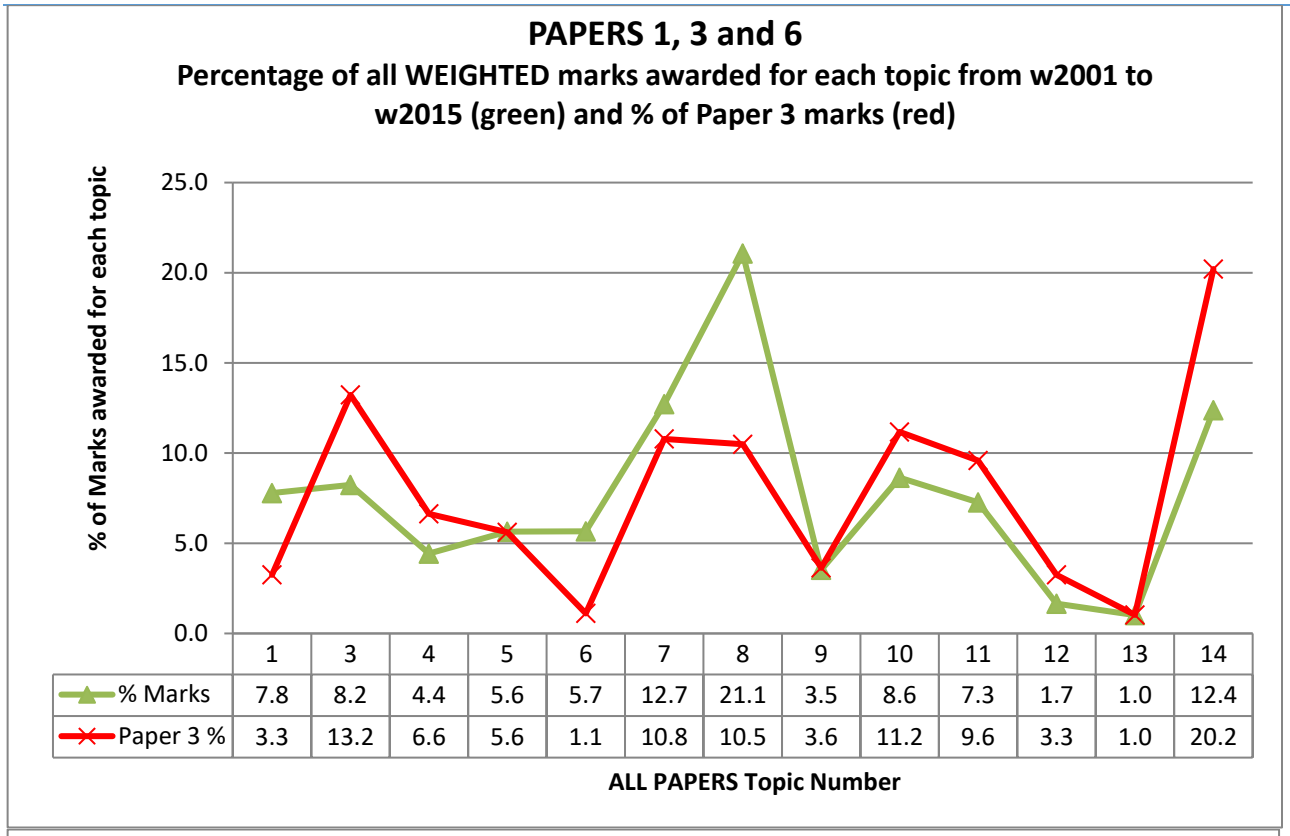
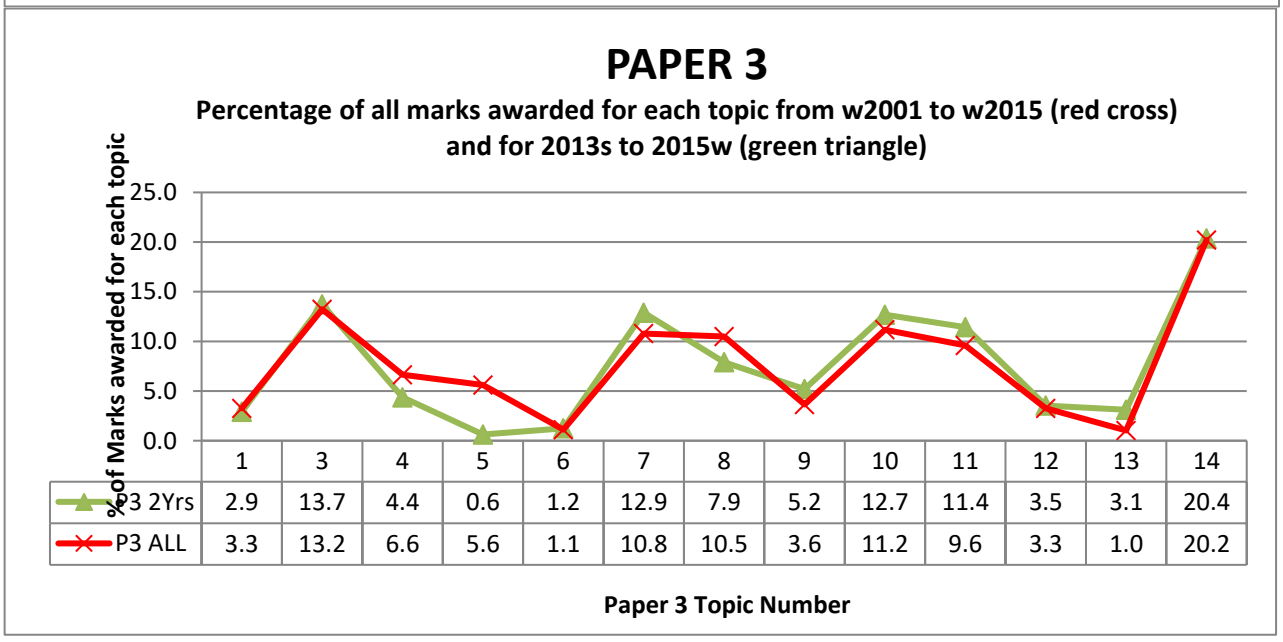
iG Chem 5 EQ P3 Electrochemistry NEW 125marks



	1	3	4	5	6	7	8	9	10	11	12	13	14
% Marks	7.8	8.2	4.4	5.6	5.7	12.7	21.1	3.5	8.6	7.3	1.7	1.0	12.4
Paper 3 %	3.3	13.2	6.6	5.6	1.1	10.8	10.5	3.6	11.2	9.6	3.3	1.0	20.2



	1	3	4	5	6	7	8	9	10	11	12	13	14
P3 2Yrs	2.9	13.7	4.4	0.6	1.2	12.9	7.9	5.2	12.7	11.4	3.5	3.1	20.4
P3 ALL	3.3	13.2	6.6	5.6	1.1	10.8	10.5	3.6	11.2	9.6	3.3	1.0	20.2

	Total	1	3	4	5	6	7	8	9	10	11	12	13	14
Total Marks	2320	76	309	155	131	26	252	245	85	261	224	76	24	472
% of Marks	2336	3.3	13.2	6.6	5.6	1.1	10.8	10.5	3.6	11.2	9.6	3.3	1.0	20.2
# of Questions		20	58	39	25	6	46	53	19	54	46	14	5	79
Average marks per Q		**3.8**	**5.3**	**4.0**	**5.2**	**4.3**	**5.5**	**4.6**	**4.5**	**4.8**	**4.9**	**5.4**	**4.8**	**6.0**

Topic	14	3	10	7	8	11	4	5	9	1	12	6	13
Rank ALL Papers	2	4	5	3	1	6	9	8	11	7	12	10	13
Rank P3: A* Focus	1	2	3	4	5	6	7	8	9	10	10	12	13
All Syllabus Word Count RANK	1	2	5	3	6	4	9	7	10	8	12	11	13

5. Electricity and chemistry

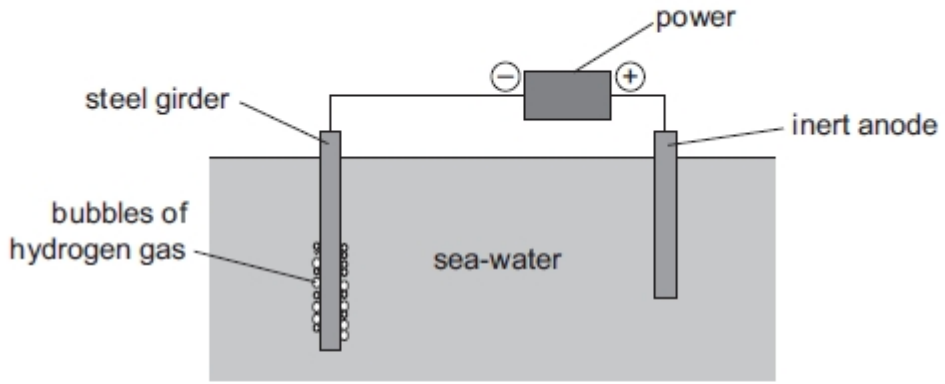
Core	Supplement
• Define electrolysis as the breakdown of an ionic compound, molten or in aqueous solution, by the passage of electricity	• Relate the products of electrolysis to the electrolyte and electrodes used, exemplified by the specific examples in the Core together with aqueous copper(II) sulfate using carbon electrodes and using copper electrodes (as used in the refining of copper)
• Describe the electrode products and the observations made during the electrolysis of: – molten lead(II) bromide – concentrated hydrochloric acid – concentrated aqueous sodium chloride – dilute sulfuric acid between inert electrodes (platinum or carbon)	• Describe electrolysis in terms of the ions present and reactions at the electrodes in the examples given
• State the general principle that metals or hydrogen are formed at the negative electrode (cathode), and that non-metals (other than hydrogen) are formed at the positive electrode (anode)	
• Predict the products of the electrolysis of a specified binary compound in the molten state	• Predict the products of electrolysis of a specified halide in dilute or concentrated aqueous solution
• Describe the electroplating of metals	• Construct ionic half-equations for reactions at the cathode
• Outline the uses of electroplating	• Describe the transfer of charge during electrolysis to include: – the movement of electrons in the metallic conductor – the removal or addition of electrons from the external circuit at the electrodes – the movement of ions in the electrolyte
• Describe the reasons for the use of copper and (steel-cored) aluminium in cables, and why plastics and ceramics are used as insulators	• Describe the production of electrical energy from simple cells, i.e. two electrodes in an electrolyte. (This should be linked with the reactivity series in section 10.2 and redox in section 7.4.)
	• Describe, in outline, the manufacture of: – aluminium from pure aluminium oxide in molten cryolite (refer to section 10.3) – chlorine, hydrogen and sodium hydroxide from concentrated aqueous sodium chloride (Starting materials and essential conditions should be given but not technical details or diagrams.)

Q# 1/ iGCSE Chemistry/2014/w/Paper 31/ Q4

(d) There are two electrochemical methods of rust prevention.

(i) The first method is sacrificial protection.

The second method is to make the steel article the cathode in a circuit for electrolysis.



(ii) Mark on the diagram the direction of the electron flow. [1]

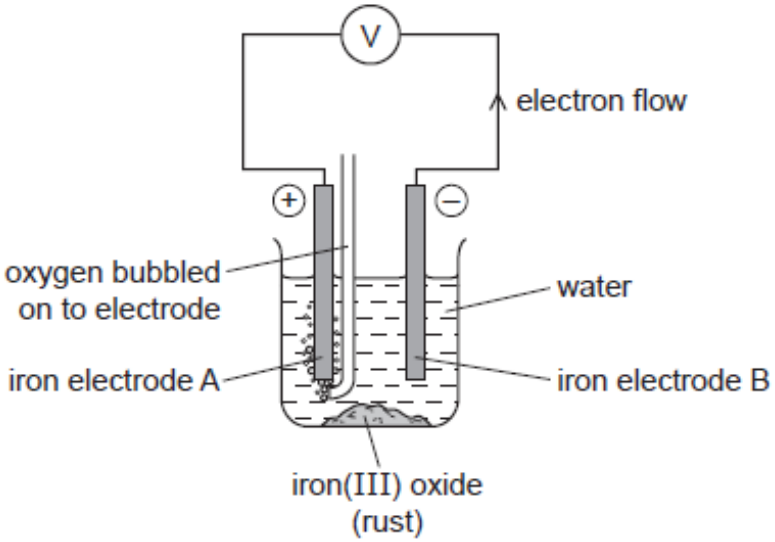
(iii) The steel girder does not rust because it is the cathode. Reduction takes place at the cathode. Give the equation for the reduction of hydrogen ions.

..... [2]

Q# 2/ iGCSE Chemistry/2012/s/Paper 31/

8 Iron and steel rust when exposed to water and oxygen. Rust is hydrated iron(III) oxide.

(a) The following cell can be used to investigate rusting.



(i) What is a cell?

.....

..... [2]

(ii) Which electrode will be oxidised and become smaller? Explain your choice.

.....

.....

..... [3]

(iii) What measurements would you need make to find the rate of rusting of the electrode you have chosen in **(ii)**?

.....

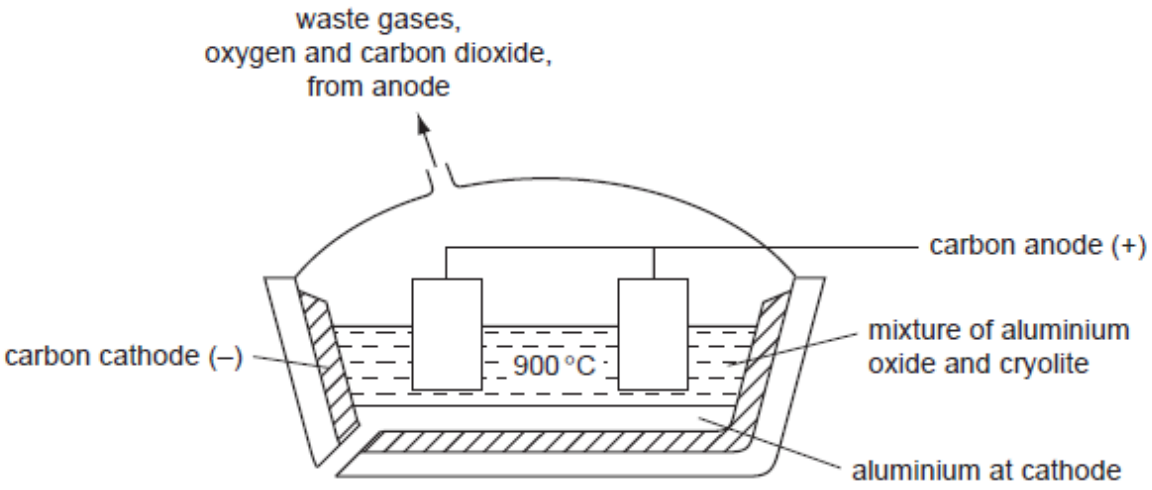
..... [2]

(iv) Suggest an explanation why the addition of salt to the water increases the rate of rusting.

..... [1]

Q# 3/ iGCSE Chemistry/2011/w/Paper 31/

3 Aluminium is extracted by the electrolysis of a molten mixture of alumina, which is aluminium oxide, and cryolite.



(a) **(i)** Alumina is obtained from the main ore of aluminium.
Name this ore.

..... [1]

(ii) Explain why it is necessary to use a mixture, alumina and cryolite, rather than just alumina.

.....

..... [2]

(iii) Copper can be extracted by the electrolysis of an aqueous solution.
Suggest why the electrolysis of an aqueous solution cannot be used to extract aluminium.

.....

.....

..... [2]

(b) The ions which are involved in the electrolysis are Al^{3+} and O^{2-}. The products of this electrolysis are given on the diagram.
Explain how they are formed. Use equations where appropriate.

.....

.....

.....

..... [4]

Q# 4/ iGCSE Chemistry/2011/s/Paper 31/ Q2 (a)

(ii) Name a device which can change chemical energy into electrical energy.

..... [2]

Q# 5/ iGCSE Chemistry/2010/w/Paper 31/ Q5 (b)

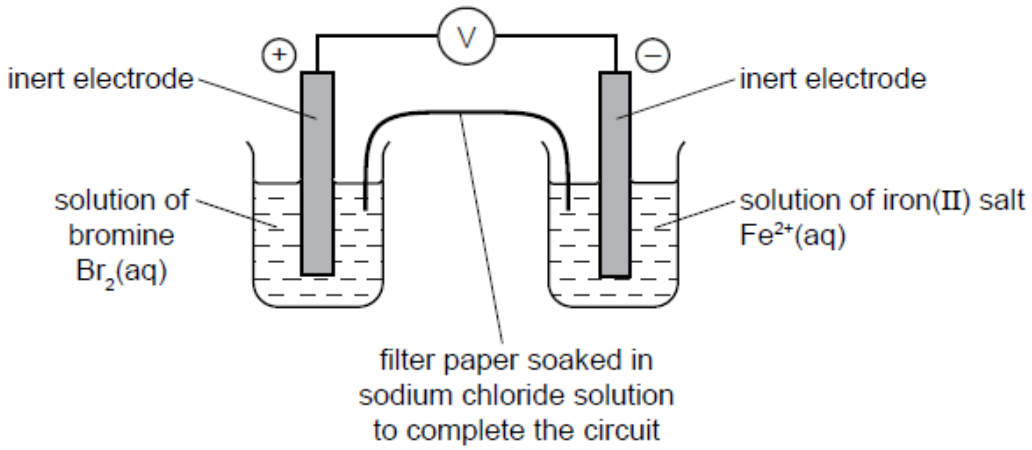
(iii) Describe an industrial method of making chlorine.

.....

..... [2]

Q# 6/ iGCSE Chemistry/2010/w/Paper 31/

3 The diagram shows a cell. This is a device which produces electrical energy. The reaction in a cell is a redox reaction and involves electron transfer.



(i) Complete the sentence.

A cell will change ..... energy into electrical energy. [1]

(ii) Draw an arrow on the diagram to show the direction of the electron flow. [1]

(iii) In the left hand beaker, the colour changes from brown to colourless.
Complete the equation for the reaction.

$$Br_2 + \text{.....} \rightarrow \text{.....}$$

[2]

(iv) Is the change in **(iii)** oxidation or reduction? Give a reason for your choice.

.....

..... [1]

(v) Complete the following description of the reaction in the right hand beaker.

Fe^{2+} changes into ..... . [1]

(vi) When a solution of bromine is replaced by a solution of chlorine, the voltage increases. When a solution of bromine is replaced by a solution of iodine, the voltage decreases.
Suggest an explanation for this difference.

.....

..... [1]

Q# 7/ iGCSE Chemistry/2009/w/Paper 3/ Q4

(b) Ozone is an oxidant. It can oxidise an iodide to iodine.

$$2I^- + O_3 + 2H^+ \rightarrow I_2 + O_2 + H_2O$$

(i) What would you see when ozone is bubbled through aqueous acidified potassium iodide?

.....

.....

.....

..... [2]

(ii) Explain in terms of electron transfer why the change from iodide ions to iodine molecules is oxidation.

.....

..... [1]

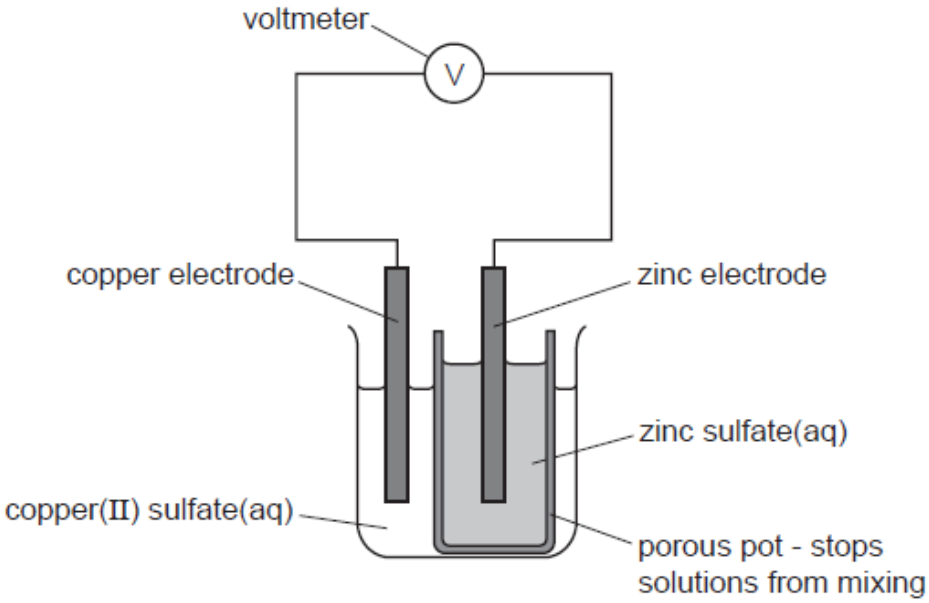
(iii) Explain, using your answer to **b(ii)**, why ozone is the oxidant in this reaction.

.....

..... [1]

Q# 8/ iGCSE Chemistry/2009/w/Paper 3/ Q3

(c) Zinc electrodes have been used in cells for many years, one of the first was the Daniel cell in 1831.



(i) Give an explanation for the following in terms of atoms and ions.

observation at zinc electrode – *the electrode becomes smaller*

explanation .....

..... [1]

observation at copper electrode – *the electrode becomes bigger*

explanation .....

..... [1]

(ii) When a current flows, charged particles move around the circuit.

What type of particle moves through the electrolytes?

..... [1]

Which particle moves through the wires and the voltmeter?

..... [1]

Q# 9/ iGCSE Chemistry/2009/s/Paper 31/

2 The results of experiments on electrolysis using inert electrodes are given in the table.

Complete the table; the first line has been completed as an example.

electrolyte	change at negative electrode	change at positive electrode	change to electrolyte
molten lead(II) bromide	lead formed	bromine formed	used up
....	potassium formed	iodine formed	used up
dilute aqueous sodium chloride	.....	.....	....
aqueous copper(II) sulfate	.....	.....	....
....	hydrogen formed	bromine formed	potassium hydroxide formed

[Total: 8]

Q# 10/ iGCSE Chemistry/2008/w/Paper 31/

5 The electrolysis of concentrated aqueous sodium chloride produces three commercially important chemicals hydrogen, chlorine and sodium hydroxide.

(a) The ions present are $Na^+(aq)$, $H^+(aq)$, $Cl^-(aq)$ and $OH^-(aq)$.

(i) Complete the ionic equation for the reaction at the negative electrode (cathode).

..... + ... → H_2 [1]

(ii) Complete the ionic equation for the reaction at the positive electrode (anode).

..... – ..... → Cl_2 [1]

(iii) Explain why the solution changes from sodium chloride to sodium hydroxide.

..... [1]

Q# 11/ iGCSE Chemistry/2008/s/Paper 31/

3 Copper is purified by electrolysis.

(a) Complete the following.

The positive electrode (anode) is made from .....

The negative electrode (cathode) is made from .....

The electrolyte is aqueous ..... [3]

(b) Write an ionic equation for the reaction at the positive electrode (anode).

..... [2]

Q# 12/ iGCSE Chemistry/2007/s/Paper 3/

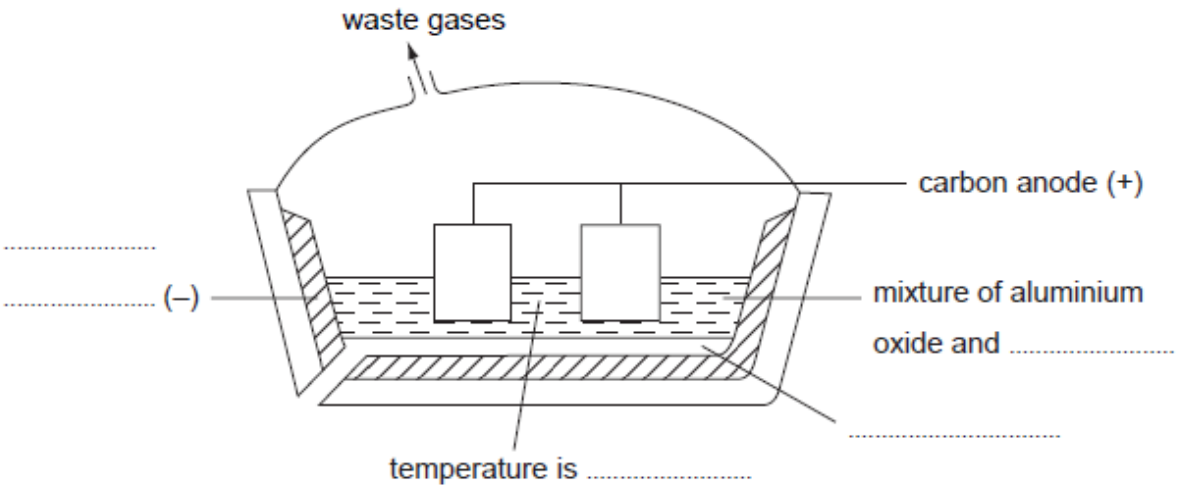
6 Aluminium is extracted by the electrolysis of a molten mixture that contains alumina, which is aluminium oxide, Al_2O_3.

(a) The ore of aluminium is bauxite. This contains alumina, which is amphoteric, and iron(III) oxide, which is basic. The ore is heated with aqueous sodium hydroxide. Complete the following sentences.

The ..... dissolves to give a solution of .....

The ..... does not dissolve and can be removed by ..... [4]

(b) Complete the labelling of the diagram.



[4]

(c) The ions that are involved in the electrolysis are Al^{3+} and O^{2-}.

(i) Write an equation for the reaction at the cathode.

..... [2]

(ii) Explain how carbon dioxide is formed at the anode.

.....

..... [2]

(d) Give an explanation for each of the following.

(i) Aluminium is used extensively in the manufacture of aircraft.

..... [1]

(ii) Aluminium is used to make food containers.

..... [2]

(iii) Aluminium electricity cables have a steel core.

..... [1]

Q# 13/ iGCSE Chemistry/2006/w/Paper 3/ Q6

(b) Impure copper is extracted from the ore. This copper is refined by electrolysis.

(i) Name;
the material used for the positive electrode (anode),

.....

the material used for the negative electrode (cathode),

.....

a suitable electrolyte.

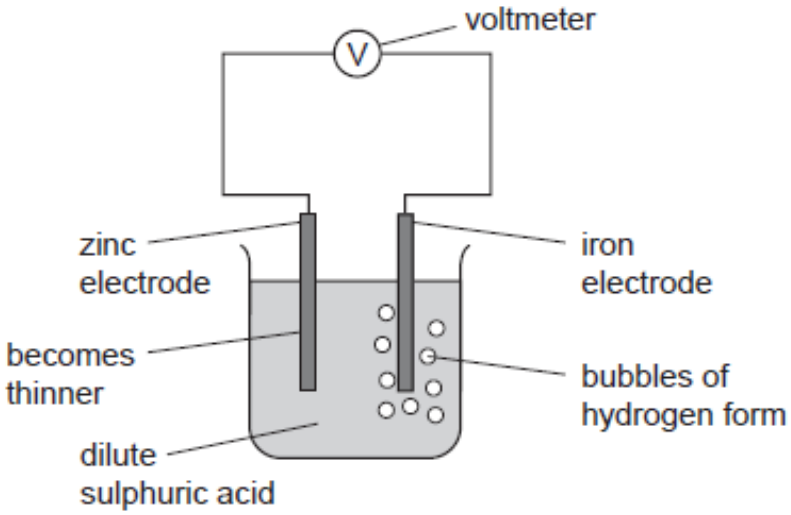
..... [3]

(ii) Write an ionic equation for the reaction at the negative electrode.

..... [1]

(c) Cell reactions are both exothermic and redox. They produce electrical energy as well as heat energy.

(i) The diagram shows a simple cell.



Which substance in this cell is the reductant and which ion is the oxidant?

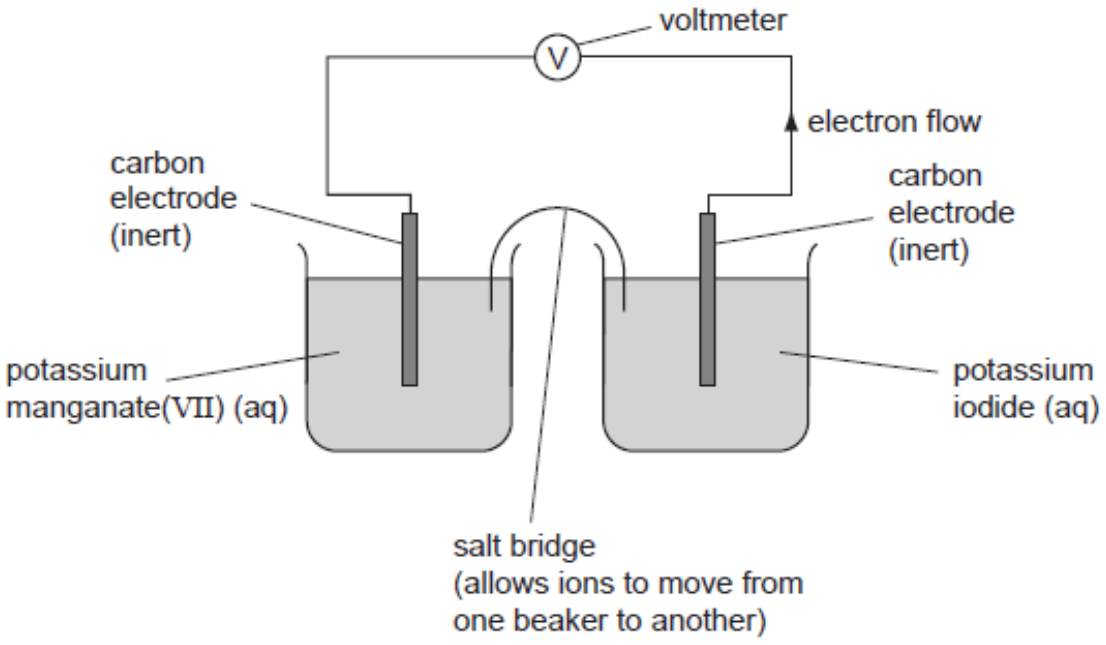
reductant .....

oxidant ..... [2]

(ii) How could the voltage of this cell be increased?

..... [1]

(d) Cells can be set up with inert electrodes and the electrolytes as oxidant and reductant.



The potassium manganate(VII) is the oxidant and the potassium iodide is the reductant.

(i) Describe the colour change that would be observed in the left hand beaker.

..... [2]

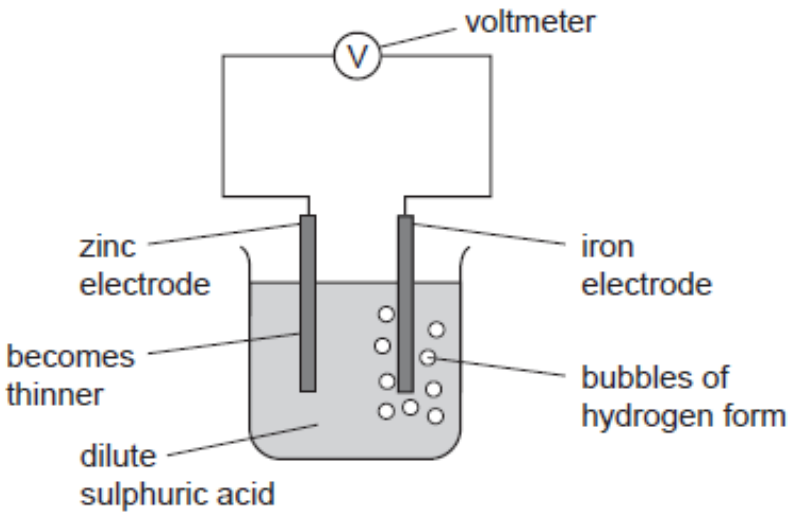
(ii) Write an ionic equation for the reaction in the right hand beaker.

..... [2]

Q# 15/ iGCSE Chemistry/2006/s/Paper 3/ Q6

(c) Cell reactions are both exothermic and redox. They produce electrical energy as well as heat energy.

(i) The diagram shows a simple cell.



(iii) What is the important large scale use, relating to iron and steel, of this type of cell reaction?

..... [1]

Q# 16/ iGCSE Chemistry/2005/w/Paper 3/ Q5

(c) The major ore of strontium is its carbonate, $SrCO_3$. Strontium is extracted by the electrolysis of its molten chloride.

(i) Name the reagent that will react with the carbonate to form the chloride.

..... [1]

(ii) The electrolysis of molten strontium chloride produces strontium metal and chlorine. Write ionic equations for the reactions at the electrodes.

negative electrode (cathode) .....

positive electrode (anode) ..... [2]

(iii) One of the products of the electrolysis of concentrated aqueous strontium chloride is chlorine. Name the other two.

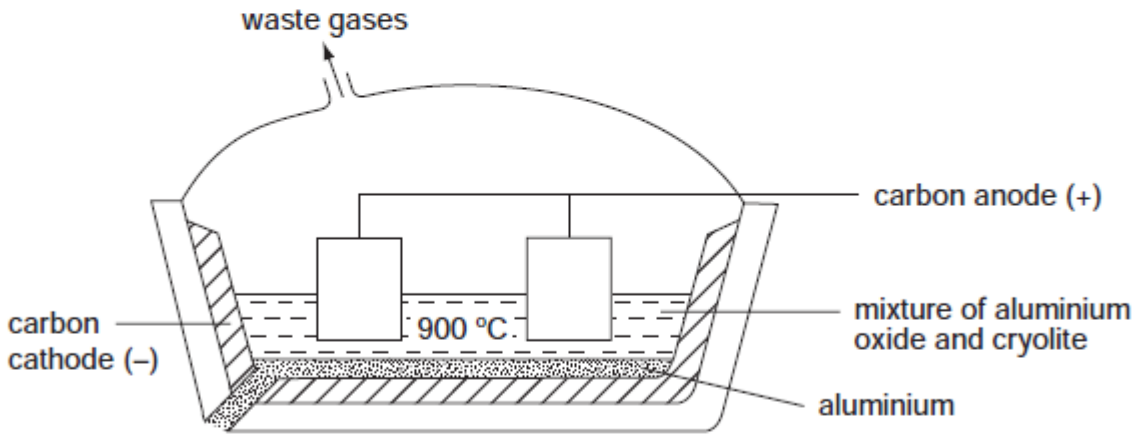
..... [2]

Q# 17/ iGCSE Chemistry/2005/s/Paper 3/

6 The position of aluminium in the reactivity series of metals is shown below.

magnesium
aluminium
zinc
copper

(a) Aluminium is extracted by the electrolysis of its molten oxide.



(i) Name the main ore of aluminium.

..... [1]

(ii) Why does the molten electrolyte contain cryolite?

..... [1]

(iii) Oxygen is produced at the positive electrode (anode). Name another gas which is given off at this electrode.

..... [1]

Q# 18/ iGCSE Chemistry/2004/s/Paper 3/ Q5

(b) Aqueous copper(II) sulphate solution can be electrolysed using carbon electrodes. The ions present in the solution are as follows.

$Cu^{2+}(aq)$, $SO_4^{2-}(aq)$, $H^+(aq)$, $OH^-(aq)$

(i) Write an ionic equation for the reaction at the negative electrode (cathode).

..... [1]

(ii) A colourless gas was given off at the positive electrode (anode) and the solution changes from blue to colourless.

Explain these observations.

.....

..... [2]

(c) Aqueous copper(II) sulphate can be electrolysed using copper electrodes. The reaction at the negative electrode is the same but the positive electrode becomes smaller and the solution remains blue.

(i) Write a word equation for the reaction at the positive electrode.

..... [1]

(ii) Explain why the colour of the solution does not change.

.....

..... [2]

(iii) What is the large scale use of this electrolysis?

..... [1]

Q# 19/ iGCSE Chemistry/2003/s/Paper 3/

5 The first three elements in Period 6 of the Periodic Table of the Elements are caesium, barium and lanthanum.

(b) All three metals can be obtained by the electrolysis of a molten halide. The electrolysis of the aqueous halides does not produce the metal.

(i) Complete the equation for the reduction of lanthanum ions at the negative electrode (cathode).

La^{3+} + ... → .....

(ii) Name the **three** products formed by the electrolysis of aqueous caesium bromide.

.....

.....[4]

Q# 20/ iGCSE Chemistry/2003/s/Paper 3/

1 No one knows where iron was first isolated. It appeared in China, the Middle East and in Africa. It was obtained by reducing iron ore with charcoal.

(e) One of the methods used to prevent iron or steel from rusting is to electroplate it with another metal, such as tin. Complete the following.

The anode is made of ..... .

The cathode is made of ..... .

The electrolyte is a solution of ..... .

[3]

Q# 21/ iGCSE Chemistry/2002/w/Paper 3/ Q4

(b) Copper is refined by the electrolysis of aqueous copper(II) sulphate using copper electrodes. Describe the change that occurs at the electrodes.

(i) cathode (pure copper) .....

.....[1]

(ii) anode (impure copper) .....

.....[1]

(iii) Write an ionic equation for the reaction at the cathode.

.....[1]

(iv) If carbon electrodes are used, a colourless gas is given off at the anode and the electrolyte changes from a blue to a colourless solution.

The colourless gas is ..... .

The solution changes into ..... . [2]

(c) Electrolysis and cells both involve chemical reactions and electricity.

What is the essential difference between them?

.....

.....[2]

Q# 22/ iGCSE Chemistry/2002/s/Paper 3/ QiGCSE Chemistry/201

(b) Aluminium is produced by the electrolysis of an electrolyte that contains aluminium oxide.

(i) Write an ionic equation for the reduction of the aluminium ion at the cathode.

.....[2]

(ii) Name the main ore of aluminium.

.....[1]

(iii) Complete the following description of the electrolyte by filling the spaces.

The electrolyte is a ..... mixture of aluminium oxide and ..... which is maintained at 900 °C. [2]

(iv) Explain why the gas given off at the anode is a mixture of oxygen and carbon dioxide.

.....

.....[2]

Q# 23/ iGCSE Chemistry/2002/s/Paper 3/

3 A major food retailer in the UK is going to distribute sandwiches using hydrogen-powered vehicles.

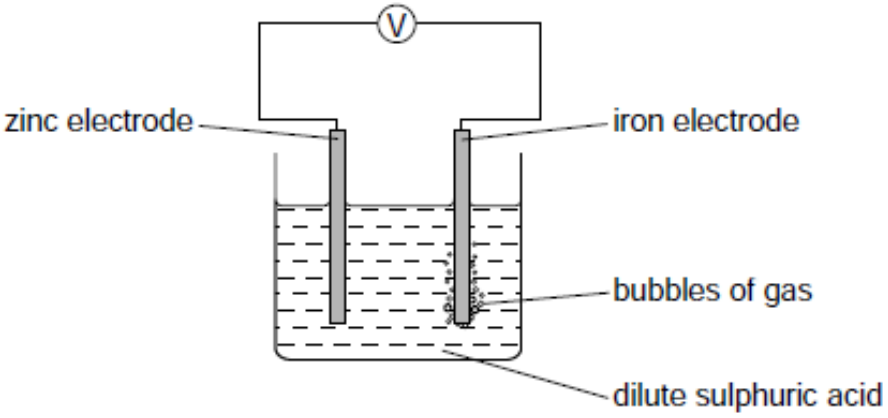
(c) Outline how hydrogen is manufactured from water.

.....

.....[2]

Q# 24/ iGCSE Chemistry/2001/w/Paper 3/ Q4

(e) The diagram below represents a simple cell.



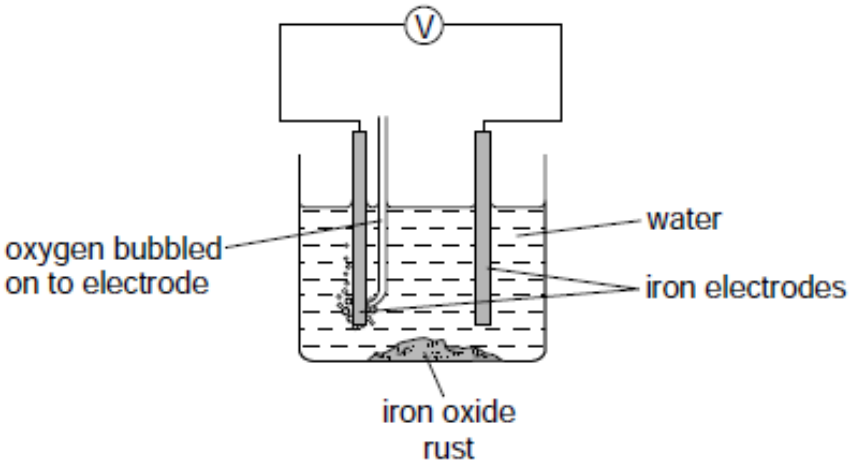
(i) Write an ionic equation for the reaction that occurs at the zinc electrode.

.....[1]

(ii) How could the voltage of the cell be increased?

.....[1]

(f) A different type of cell is drawn below.



(i) The pH of the solution increases. Give the name of the ion formed.

.....[1]

(ii) Complete the equation that represents the formation of this ion.

O_2 + ... H_2O + ... → ..... [2]

Mark Scheme

Q# 1/ iGCSE Chemistry/2014/w/Paper 31/ Q4 (d)

(ii) R to L in wire [1]

(iii) $2H^+ + 2e^- \rightarrow H_2$
species (1) balancing (1) [2]

Q# 2/ iGCSE Chemistry/2012/s/Paper 31/

8 **(a) (i)** device which changes chemical energy; [1]
into electrical energy; [1]
OR
produces a voltage / potential difference / electricity; [1]
due to difference in reactivity of two metals; [1]
OR
produces a voltage / potential difference / electricity; [1]
by redox reactions; [1]

(ii) negative / electrode B / right electrode; [1]
accept: anode because it is the electrode which supplies electrons to external circuit
loses ions / iron ions / Fe^{2+} or Fe^{3+}; [1]
electrons move from this electrode; [1]

(iii) change of mass of electrode / mass of rust formed; [1]
time / mention of stop watch / regular intervals; [1]

(iv) to make it a better conductor; [1]

Q# 3/ iGCSE Chemistry/2011/w/Paper 31/

3 (a) (i) bauxite [1]

(ii) lowers melting point [1]
better conductor / reduces amount of energy needed / reduces cost / more economic / makes process viable / conserves energy [1]

(iii) aluminium more reactive than copper / aluminium higher in reactivity series [1]
hydrogen not aluminium formed at cathode [1]

(b) $Al^{3+} + 3e \rightarrow Al$ [1]
$2O^{2-} \rightarrow O_2 + 4e$ [2]
note: not balanced = 1
oxygen reacts with carbon (anode) to form carbon dioxide / $C + O_2 \rightarrow CO_2$ [1]
note: if mark(s) for an electrode reaction are not awarded then allow aluminium ions accept electrons / are reduced [1]
oxide ion loses electrons / is oxidised [1]
max 4

Q# 4/ iGCSE Chemistry/2011/s/Paper 31/ Q2 (a)

(ii) cell [1]
accept battery
not generator

Q# 5/ iGCSE Chemistry/2010/w/Paper 31/ Q5 (b)

(iii) electrolysis [1]
aqueous sodium chloride [1]

Q# 6/ iGCSE Chemistry/2010/w/Paper 31/

3 (i) chemical [1]

(ii) from right to left [1]
not through salt bridge

(iii) $Br_2 + 2e \rightarrow 2Br^-$ [2]
for Br^- as product [1]

(iv) reduction because electron gain [1]
/ because oxidation number decreases
need both points

(v) Fe^{3+} [1]

(vi) any correct discussion of the reactivity of the halogens [1]
e.g. the more reactive the halogen the higher the voltage
not better conductor

Q# 7/ iGCSE Chemistry/2009/w/Paper 3/ Q4

(b) (i) from colourless (solution) [1]
to brown (solution) [1]

(ii) I^- loses electrons (to form iodine molecules) [1]
must be in terms of electron transfer **NOT** oxidation number

(iii) they (electrons) are accepted by ozone
or it is an electron acceptor [1]

Q# 8/ iGCSE Chemistry/2009/w/Paper 3/ Q3

(c) (i) zinc atoms change into ions, (the zinc dissolves) [1]
copper(II) ions change into atoms, (becomes plated with copper) [1]

(ii) ions [1]
electrons [1]

Q# 9/ iGCSE Chemistry/2009/s/Paper 31/

2 molten potassium iodide **NOT** aqueous [1]

hydrogen [1]
oxygen [1]
water used up **or** solution becomes more concentrated **or** sodium chloride remains
NOT no change [1]
If products are given as hydrogen, chlorine and sodium hydroxide then 2/3

copper [1]
oxygen (and water) [1]
sulfuric acid accept hydrogen sulfate [1]

aqueous **or** dilute **or** concentrated potassium bromide [1]
accept correct formulae

[Total: 8]

Q# 10/ iGCSE Chemistry/2008/w/Paper 31/

5 (a) (i) $2H^+ + 2e \rightarrow H_2$ [1]

(ii) $2Cl^- - 2e \rightarrow Cl_2$ **or** $2Cl^- \rightarrow Cl_2 + 2e$ [1]

(iii) Na^+ and OH^- are left [1]
OR Cl^- removed OH^- left
NB ions by name **or** formula essential
NOT any reaction of Na **or** Na^+
NOT Na^+ and OH^- combine

Q# 11/ iGCSE Chemistry/2008/s/Paper 31/

3 (a) impure copper [1]
(pure) copper [1]
ACCEPT any (soluble) copper salt **or** Cu^{2+} [1]
if both name and formulae given, both have to be correct

(b) $Cu - 2e \rightarrow Cu^{2+}$ **or** $Cu \rightarrow Cu^{2+} + 2e$ [2]
for having $Cu \rightarrow Cu^{2+}$ [1] **ONLY**

Q# 12/ iGCSE Chemistry/2008/s/Paper 31/

6 (a) alumina **or** aluminium oxide [1]
sodium aluminate [1]
iron(III) oxide [1]
filtration **or** centrifuge NOT conditional [1]

(b) from left to right:
carbon cathode **or** carbon negative electrode [1]
900 to 1000°C [1]
aluminium [1]
cryolite [1]

(c) (i) Al^{3+} + 3e = Al [2]
not balanced [1]
$Al^{3+}(aq)$ = 0

(ii) oxygen is formed **NOT** oxide [1]
reacts with carbon anode [1]

(d) (i) low density **or** light or resistant to corrosion
accept strength/weight ratio **or** alloys are strong [1]
strong on its own is neutral

(ii) not attacked **or** corroded **or** unreactive
oxide layer
easily shaped **or** malleable **or** ductile
any **TWO** [2]

Q# 13/ iGCSE Chemistry/2006/w/Paper 3/ Q6

(b) (i) impure copper/blister copper/boulder copper etc [1]
(pure) copper [1]
copper sulphate **or** nitrate **or** chloride **or** contains $Cu^{2+}aq$ [1]

(ii) $Cu^{2+} + 2e^- = Cu$ [1]

(iii) Zinc [1]

Q# 14/ iGCSE Chemistry/2006/s/Paper 3/ Q6

(c) (i) reductant zinc [1]
oxidant hydrogen (ions) [1]

(ii) magnesium instead of zinc **or** increase concentration of acid
or copper instead of iron [1]

(iii) sacrificial protection **or** stop iron/steel rusting [1]
or galvanising

(d) (i) pink **or** purple [1]
to colourless **or** decolourised [1]
NOT red **NOT** clear

(ii) $2I^- - 2e = I_2$ [2]
unbalanced **ONLY** [1]

Q# 15/ iGCSE Chemistry/2006/s/Paper 3/ Q6 (c)

(iii) sacrificial protection **or** stop iron/steel rusting [1]
or galvanising

Q# 16/ iGCSE Chemistry/2005/w/Paper 3/ Q5

(c)(i) hydrochloric acid [1]

(ii) Sr^{2+} + 2e = Sr [1]
$2Cl^- - 2e = Cl_2$ [1]
or $2Cl^- = Cl_2 + 2e$

(iii) hydrogen **[1]** and strontium hydroxide **[1]** [2]

Q# 17/ iGCSE Chemistry/2005/s/Paper 3/

6 (a) (i) bauxite [1]

(ii) to reduce melting point **or** improve conductivity
or as a solvent **or** reduce the working temperature [1]

(iii) carbon dioxide **or** monoxide **or** fluorine [1]

Q# 18/ iGCSE Chemistry/2004/s/Paper 3/ Q5

(b) (i) $Cu^{2+} + 2e = Cu$ [1]

(ii) gas is oxygen [1]

(copper(II) sulphate) changes to sulphuric acid
or copper ions removed from solution [1]

(c) (i) copper atoms - electrons = copper ions
accept correct symbol equation [1]

(ii) concentration of copper ions does not change **or**
amount **or** number of copper ions does not change [1]

copper ions are removed and then replaced
or copper is transferred from anode to cathode [1]

(iii) refining copper **or** plating (core)
or extraction of boulder copper [1]

Q# 19/ iGCSE Chemistry/2003/s/Paper 3/ Q5

(b) (i) $La^{3+} + 3e- = La$ [1]
(ii) hydrogen [1]
bromine NOT Bromide [1]
caesium hydroxide [1]
ignore any comments about electrodes

Q# 20/ iGCSE Chemistry/2003/s/Paper 3/ QiGCSE Chemistry/201

(e) anode tin NOT impure time [1]
cathode iron or steel [1]
tin salt **or** tin ions as electrolyte [1]
NOT oxide or hydroxide or carbonate

Q# 21/ iGCSE Chemistry/2002/w/Paper 3/ Q4

(b) (i) copper deposited **or** mass increases [1]

(ii) copper goes into solution **or** mass decreases [1]

(iii) $Cu^{2+} + 2e \Longrightarrow Cu$ [1]

(iv) oxygen [1]
sulphuric acid accept hydrogen sulphate [1]

(c) (ii) cells produce electricity **or** exothermic **or** change
chemical energy into electrical energy [1]

electrolysis uses it **or** endothermic **or** change
electrical energy into chemical energy [1]

Q# 22/ iGCSE Chemistry/2002/s/Paper 3/ QiGCSE Chemistry/201

(b) (i) $Al^{3+} + 3e \Longrightarrow Al$ [2]
For Al^{3+} **ONLY [1]** anywhere in equation

(ii) bauxite [1]

(iii) molten or liquid or fused or homogeneous [1]
cryolite [1]

(iv) oxygen from oxide or formed at anode or implied it is formed [1]
carbon (anode) to form carbon dioxide [1]

Q# 23/ iGCSE Chemistry/2002/s/Paper 3/ Q3

(c) (steam) and alkane [1]
heat or catalyst or details of chemistry – forms carbon monoxide/dioxide and (hydrogen) [1]

OR electrolysis [1]
brine or acidified water
or hydrogen forms at cathode [1]

OR carbon/coke [1]
heat or details of chemistry – forms carbon monoxide/dioxide and (hydrogen) [1]

Q# 24/ iGCSE Chemistry/2001/w/Paper 3/ Q4

(e) (i) $Zn - 2e \Rightarrow Zn^{2+}$ [1]

(ii) Higher reactivity metal instead of Zn
or lower instead of iron or bigger difference in reactivity or increase concentration of acid [1]

(f) (i) hydroxide [1]

(ii) $O_2 + 2H_2O + 4e \Rightarrow 4OH^-$ [2]
unbalanced only [1]
$O_2 + 2H_2O + 2Fe \rightarrow 2Fe(OH)_2$ [2]