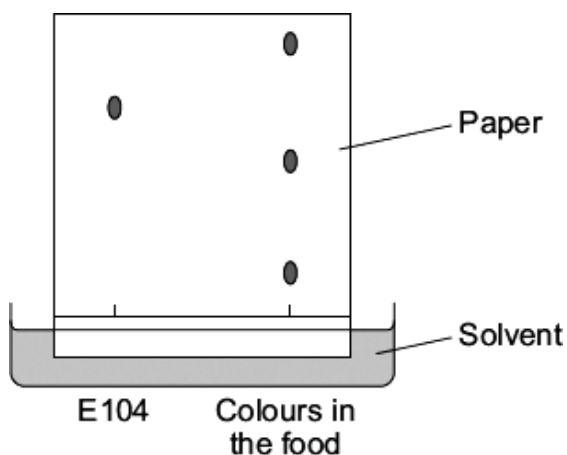


Q1. An article began:

Ban yellow additives

Quinoline yellow (E104) is suspected of causing hyperactivity, asthma and rashes in children.

- (a) A student tested a food to find out if it contained quinoline yellow (E104). The student's results are shown below.



- (i) Draw a ring around the correct answer to complete the sentence.

This method of detecting and identifying colours is called

chromatography.

distillation.

electrolysis.

(1)

- (ii) Using the student's results, how many different colours are in the food?

(1)

- (iii) Using the student's results, how can you tell that the food does **not** contain quinoline yellow (E104)?

.....
.....

(1)

(b) Quinoline yellow (E104) is used in foods such as sweets, drinks and ice cream.

(i) Give **one** reason why quinoline yellow (E104) is added to foods.

.....
.....

(1)

(ii) Suggest what should be done to decide if quinoline yellow (E104) should be banned.

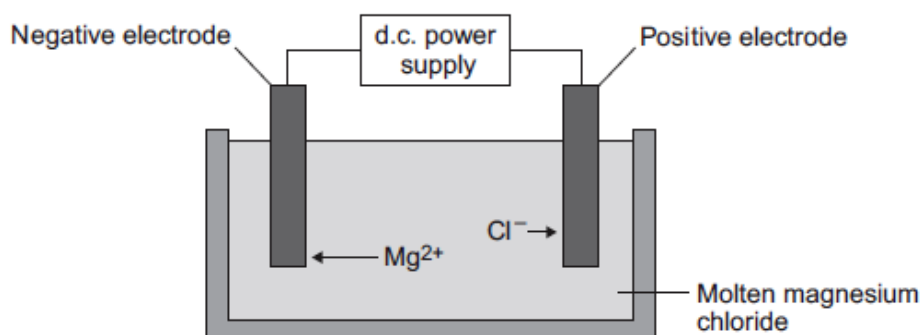
.....
.....

(1)

(Total 5 marks)

Q2. Some students investigated reactions to produce magnesium.

(a) The students used electrolysis to produce magnesium from magnesium chloride, as shown in the figure below.



(i) Magnesium chloride contains magnesium ions and chloride ions.

Why does solid magnesium chloride **not** conduct electricity?

.....
.....

(1)

(ii) One of the products of the electrolysis of molten magnesium chloride is magnesium.

Name the other product.

.....

(1)

(iii) Why do magnesium ions (Mg^{2+}) move to the negative electrode?

.....
.....

(1)

- (iv) At the negative electrode, the magnesium ions (Mg^{2+}) gain electrons to become magnesium atoms.

How many electrons does each magnesium ion gain?

.....

(1)

- (b) The students did the experiment four times and weighed the magnesium produced.

The table below shows their results.

Experiment	Mass of magnesium produced in grams
1	1.13
2	0.63
3	1.11
4	1.09

- (i) There is an anomalous result.

Suggest **one** possible reason for the anomalous result.

.....
.....

(1)

- (ii) Calculate the mean mass of magnesium produced, taking account of the anomalous result.

.....
.....
.....

Mean mass = g

(2)

(c) The formula of magnesium chloride is MgCl_2

The relative formula mass of magnesium chloride is 95.

The relative atomic mass of magnesium is 24.

(i) Use the equation to calculate the percentage mass of magnesium in magnesium chloride.

$$\text{Percentage mass of magnesium} = \frac{\text{mass of magnesium}}{\text{mass of magnesium chloride}} \times 100\%$$

.....
.....
.....

Percentage mass of magnesium in magnesium chloride = %

(2)

(ii) Draw a ring around the relative mass of chlorine in MgCl_2

71

95

119

(1)

(d) Magnesium is also produced from the reaction of magnesium oxide with silicon.

(i) The equation for the reaction is:



What is the meaning of this symbol \rightleftharpoons ?

Draw a ring around the correct answer.

neutralisation reaction

precipitation reaction

reversible reaction

(1)

(ii) The forward reaction is endothermic.

Draw a ring around the correct answer to complete the sentence.

In an endothermic reaction the temperature of the surroundings

decreases.
increases.
stays the same.

(1)

(Total 12 marks)

Q3. Ethene can be identified using instrumental methods.

(i) Name **one** instrumental method used to identify elements or compounds.

.....
.....

(1)

(ii) Give **one** advantage of using instrumental methods compared with chemical tests.

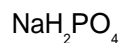
.....
.....

(1)

(Total 2 marks)

Q4. A student investigated some instant soup.

(a) Instant soup contains a food additive which has the formula:



Give the names of all the elements in this compound.

The periodic table on the Data Sheet may help you to answer this question.

.....
.....

(2)

(b) The student investigated the reaction which takes place when soup powder is added to cold water.

The student thought that the reaction might be *exothermic*.

(i) What is meant by the term *exothermic* reaction?

.....
.....

(2)

- (ii) Describe an experiment that the student could do to prove that this reaction is exothermic.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

.....

.....

.....

.....

.....

.....

.....

.....

(4)
(Total 8 marks)

Q5. The electrolysis of sodium chloride solution produces useful substances.

- (a) (i) Choose a word from the box to complete the sentence.

covalent	ionic	non-metallic
-----------------	--------------	---------------------

Electrolysis takes place when electricity passes through
compounds when they are molten or in solution.

(1)

- (ii) Choose a word from the box to complete the sentence.

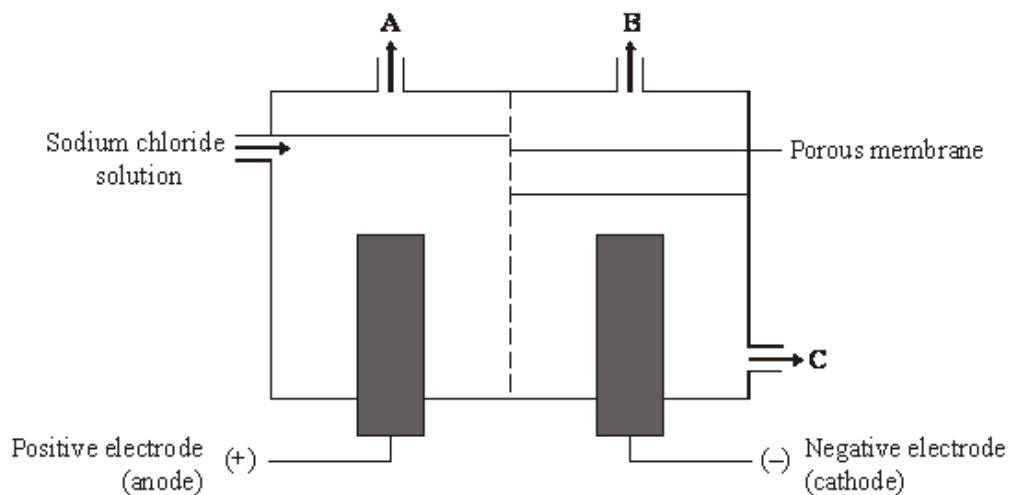
alkenes	elements	salts
----------------	-----------------	--------------

During electrolysis the compound is broken down to form.....

(1)

(b) The table of ions on the Data Sheet may help you to answer this question.

The diagram shows an apparatus used for the electrolysis of sodium chloride solution.



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Identify the products **A**, **B** and **C** on the diagram using substances from the box.

chlorine gas	hydrogen gas	oxygen gas
sodium hydroxide solution		sodium metal

- (i) **A** is (1)
- (ii) **B** is (1)
- (iii) **C** is (1)
- (Total 5 marks)**

Q6. Iron ore contains iron oxide.

(i) Calculate the relative formula mass of iron oxide, Fe_2O_3 .

Relative atomic masses: O = 16; Fe = 56.

.....

.....

Answer =

(2)

(ii) Calculate the percentage by mass of iron in iron oxide.

.....

Percentage of iron = %

(2)

(iii) Calculate the mass of iron that could be extracted from 1000 kg of iron oxide.

Use your answer to part (c) (ii) to help you with this calculation.

.....

Mass of iron = kg

(1)

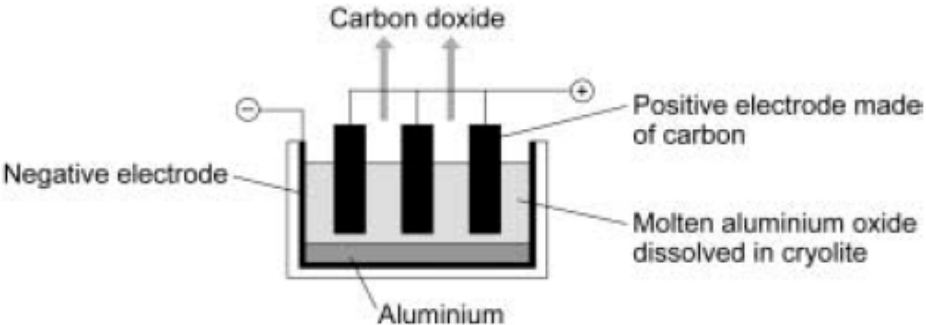
(Total 5 marks)

Q7. Read the information in the box and then answer the question.

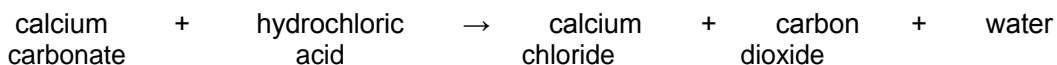
Aluminium is made by the electrolysis of aluminium oxide.

Aluminium oxide is an ionic compound containing aluminium ions (Al^{3+}) and oxide ions (O^{2-}).

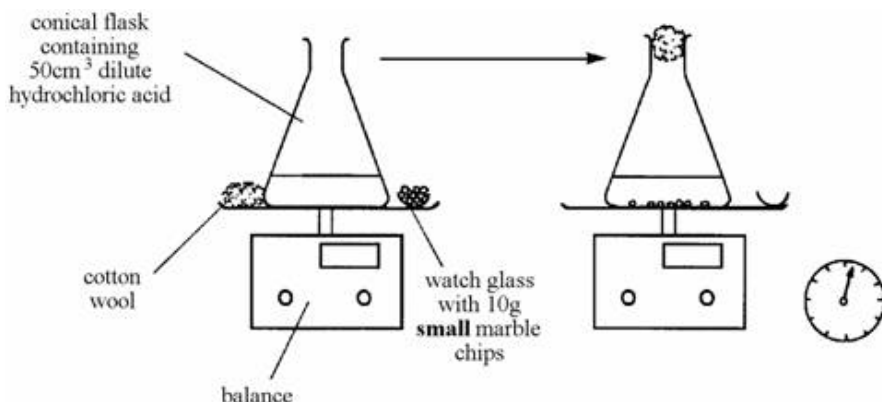
The diagram below shows the apparatus used to electrolyse aluminium oxide.



Q8. Marble chips (calcium carbonate) react with dilute hydrochloric acid.



A student wanted to find out if the size of the marble chips made a difference to how fast the reaction took place.



(a) What readings should she take?

.....

.....

.....

(2)

(b) She repeated the experiment but this time used the same mass (10g) of **large** marble chips.

In both experiments there was some marble left in the flask when the reaction stopped.

These are the results of the two experiments.

TIME (minutes)	0	2	4	6	8	10	12
Loss in mass (g), using small chips	0.00	0.40	0.72	0.91	1.04	1.04	1.04
Loss in mass (g), using large chips	0.00	0.28	0.52	0.70	0.84	0.94	1.04

(i) Explain the loss in mass in the two experiments.

.....

.....

.....

.....

(1)

(ii) What difference does the size of the chips make?

.....
.....

(1)

(c) A chemical reaction occurs when reacting particles collide with sufficient energy. The reaction between marble and hydrochloric acid is faster if the acid is at a higher temperature. Explain why.

.....
.....
.....
.....

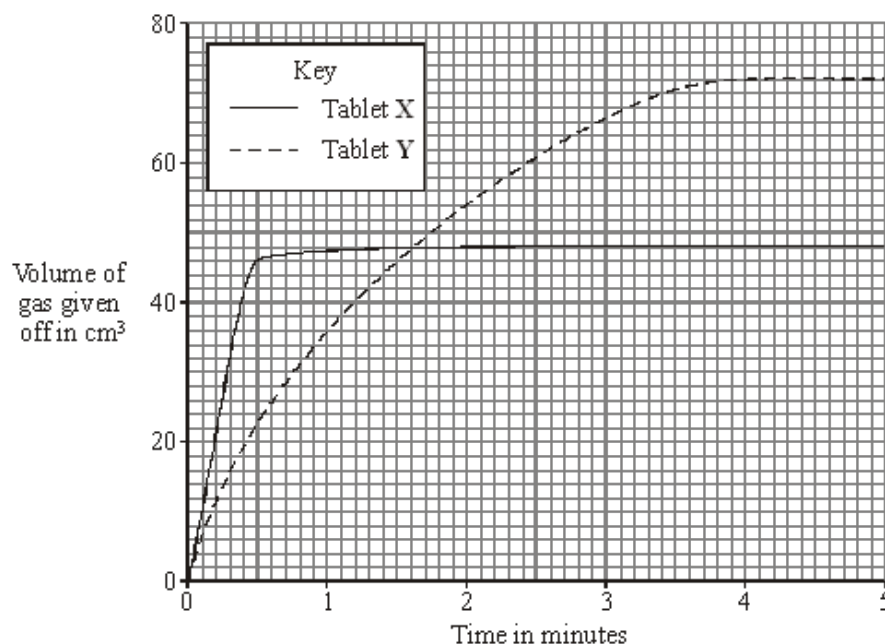
(3)

(Total 7 marks)

Q9. Many indigestion tablets contain calcium carbonate as their only active ingredient. Calcium carbonate neutralises some of the hydrochloric acid in the stomach.

Two different indigestion tablets, **X** and **Y**, were separately reacted with excess hydrochloric acid. The volume of gas given off in each reaction was measured every minute.

The results are shown in the graph.



(i) Which tablet, **X** or **Y**, contained most calcium carbonate?

Explain the reason for your answer.

.....
.....

(1)

(ii) Which tablet, **X** or **Y**, reacted faster with hydrochloric acid?.....

Explain the reason for your answer.

.....
.....

(1)

(iii) Explain the shape of the graph for tablet **X** between 3 and 5 minutes.

.....
.....
.....
.....

(1)

(Total 3 marks)

- M1.** (a) (i) chromatography 1
- (ii) 3 / three 1
- (iii) the colour / E104 is not on the same level as any of the colours in the food
accept E104 does not match 1
- (b) (i) to improve the appearance of the food
ignore adds yellow / colour
ignore taste / flavour 1
- (ii) further / or different tests (for harmful effects) **or** obtain more evidence
(that it is harmful)
allow do a survey / study 1

[5]

M2.	(a) (i) ions cannot move <i>allow only conducts as a liquid</i>	1
	(ii) chlorine	1
	(iii) they are positively / oppositely charged or they are attracted	1
	(iv) 2	1
(b)	(i) any one from: <ul style="list-style-type: none"> • not all the magnesium was collected <i>allow some magnesium was lost</i> • <i>used less time or lower current or different battery / power pack or different balance or lower voltage</i> • error in reading balance • error in recording result 	1
	(ii) 1.11 <i>correct answer with or without working gains 2 marks. if answer incorrect, allow 1 mark for 0.99 or for 1.13 + 1.11 + 1.09</i>	2
(c)	(i) 25 – 25.3 <i>correct answer with or without working gains 2 marks. If answer incorrect, allow 1 mark for 24 / 95</i>	2
	(ii) 71	1
(d)	(i) reversible reaction	1
	(ii) decreases	1
		[12]

M3. (i) correct named instrumental method

eg

atomic absorption spectroscopy / spectrometry
accept atomic / absorption spectroscopy
accept aas

or

mass spectrometry / spectroscopy
accept mass spec

or

infrared (spectrometry) / IR

or

ultraviolet / spectroscopy / UV

or

nuclear magnetic spectroscopy / nmr

or

gas-liquid chromatography / GLC

1

(ii) any **one** from:

- fast / quick **or** comment about speed
ignore lost
ignore human error
- small amount
accept operators do not need chemical skills
- sensitive / accurate / precise
ignore safe / easier to use
- ease of automation
- reliable / efficient
- can be left to run / continuous analysis

1

[2]

M4. (a) sodium
hydrogen
phosphorus
oxygen

*2 marks for all 4
1 mark for 2 or 3
0 marks for 0 or 1
not symbols / formulae*

2

(b) (i) gives out
gets hot(ter) / temperature rises (1)

1

heat / energy
independent mark

1

(ii) **Quality of written communication**
for clearly expressed ideas

1

take temperature of water at start
owtte

1

take temperature after adding soup powder

1

plus any **one** from:

- using a thermometer
 - mix / stir / shake etc
 - in beaker / conical flask / test tube / plastic cup
 - temperature will rise (indicates an exothermic reaction)
- 1

[8]

M5. (a) (i) ionic

1

(ii) elements

1

- (b) (i) chlorine (gas)
allow Cl₂ / Cl / Cl[∘]
allow chloride 1
- (ii) hydrogen (gas)
allow H / H₂ / H[∘] 1
- (iii) sodium hydroxide (solution)
allow NaOH
allow sodium solution 1
- [5]**

M6. (i) 160 ignore units
 (2 × 56) + (3 × 16) for 1 mark 2

(ii) 70

$$\frac{2 \times 56}{160} (\times 100) \text{ for 1 mark}$$
allow ecf from part (i) 2

(iii) 700
allow ecf from part (ii) 1

[5]

M7. (a) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.

No relevant content. **0 marks**

There is a brief description of the electrolysis of aluminium oxide. **Level 1 (1–2 marks)**

There is some description of the electrolysis of aluminium oxide. **Level 2 (3–4 marks)**

There is a clear, balanced and detailed description of the electrolysis of aluminium oxide. **Level 3 (5–6 marks)**

examples of the chemistry points made in the response

- aluminium oxide is melted / made liquid
 - aluminium ions are attracted to the negative electrode
 - at the negative electrode aluminium is formed **or** aluminium ions gain electrons
 - oxide ions are attracted to the positive electrode
 - oxygen is formed at the positive electrode **or** oxide ions lose electrons
 - the oxygen reacts with carbon to make carbon dioxide **or** carbon dioxide formed at positive electrode.
- (b) there are delocalised electrons / free electrons / electrons which move within the aluminium / metallic structure 1
- therefore these electrons are able to carry the current / charge 1
- if the candidates use the terms covalent / ionic / molecules / intermolecular incorrectly in the answer this will limit the mark to a maximum of 1.*

[8]

- M8.** (a) *ideas that*
- ref to read the balance / read the mass / weight
 - ref to read the stop clock / read the time
 - 'readings' taken at the beginning and end / at regular intervals
for 1 mark each 2
- (b) (i) • loss of carbon dioxide (from the flask) }
- (ii) • smaller chips give faster reaction / reaction } **mark as a whole**
finishes quicker / dissolved faster [*or reverse*] }
- smaller chips have a larger surface area }
any 2 for 1 mark each
[Allow converse answers] 2

(c) *ideas that*

- heating increases the speed / energy / vibration of the (acid) particles / marble particles
- (acid) particles collide (with marble chips / (particles)) more frequently / more likely to collide
- reacting particles collide with greater energy / collide faster
- so particles more likely to react [*do not accept 'react faster'*]

[Accept 'atoms', 'molecules' or 'ions' instead of 'particles' *in this question*]
any three for 1 mark each

3

[7]

M9.

(i) (Y)

more gas / carbon dioxide given off

1

(ii) (X)

curve / slope steeper

accept rises more rapidly / only took 30 seconds

1

(iii) (flat)

since calcium carbonate /
substrate all used up

*accept the reaction has stopped /
no more gas is being produced* 1

1

[3]

