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TURN OVER FOR QUESTION 1

1. The table shows the masses of ions present in 1 dm³ of a bottled mineral water.

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ion	mass (mg)	ion	mass (mg)
calcium	208.0	hydrogencarbonate	222.7
magnesium	53.5	sulphate	534.6
sodium	42.0	chloride	68.0
potassium	2.8	nitrate	0.77

(a) Suggest the name of a rock which had been in contact with the water before the water was bottled.

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(1)

(b) What would you see on shaking 10 cm³ of the mineral water with a few drops of soap solution?

Explain your answer.

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.....
(2)

(c) In some areas, scale forms on the inside of water pipes.

(i) Suggest why scale is an advantage in old houses with water pipes made of lead.

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(2)

(ii) Suggest why scale is a problem for all houses in these areas of the country.

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.....
(1)

(d) Read the following extract taken from a website.

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Facts about domestic water filters

The market for domestic water filters has increased enormously in recent years. This is partly due to the extravagant advertising about them, which casts doubt on the quality of tap water. Tap water is entirely safe to drink and you need not worry about it affecting your health.

In some cases filters can improve taste. They do, however, remove all chlorine and this means that the protection against contamination is also removed. If you do use a filter, remember to change the cartridge regularly and always keep the filtered water in a cool place. The fridge is best.

From www.portsmouthwater.co.uk

(i) Why does the water company make this information available on a website?

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(1)

(ii) Why do water companies add chlorine to their water supply?

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(1)

(iii) Suggest why filter cartridges should be replaced regularly.

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(1)

(iv) Suggest why filtered water should be kept in a fridge.

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(1)

(Total 10 marks)

Q1

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TURN OVER FOR QUESTION 2

2. Tests were carried out on colourless solutions of **X** and **Y**.

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(a) Tests on the solution of **X**

Some of the solution was mixed with an equal volume of dilute sodium hydroxide solution and boiled. A pungent smelling gas, which turned moist universal indicator paper purple, was given off.

The rest of the solution was mixed with an equal volume of dilute nitric acid followed by a few drops of silver nitrate solution. A white precipitate formed.

(i) Name the gas given off when the solution of **X** was heated with dilute sodium hydroxide solution.

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(1)

(ii) Name the cation present in **X**.

.....
(1)

(iii) Name the white precipitate formed when the acidified solution of **X** reacted with silver nitrate solution.

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(1)

(iv) Name the anion present in **X**.

.....
(1)

(b) Tests on the solution of Y

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Some of the solution was mixed with an equal volume of dilute hydrochloric acid followed by a few drops of barium chloride solution. A white precipitate formed.

The rest of the solution was evaporated to dryness. The solid gave a lilac flame test.

(i) Name the white precipitate.

..... (1)

(ii) Give the name of Y.

..... (2)

(iii) Describe how you would carry out a flame test on a solid.



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(3)

(Total 10 marks)

Q2

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TURN OVER FOR QUESTION 3

3. Sulphuric acid is one of the most important chemicals produced in the United Kingdom. About 92% of sulphuric acid is obtained from sulphur.

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The three main stages in the process are

stage 1 conversion of sulphur to sulphur dioxide

stage 2 conversion of sulphur dioxide to sulphur trioxide

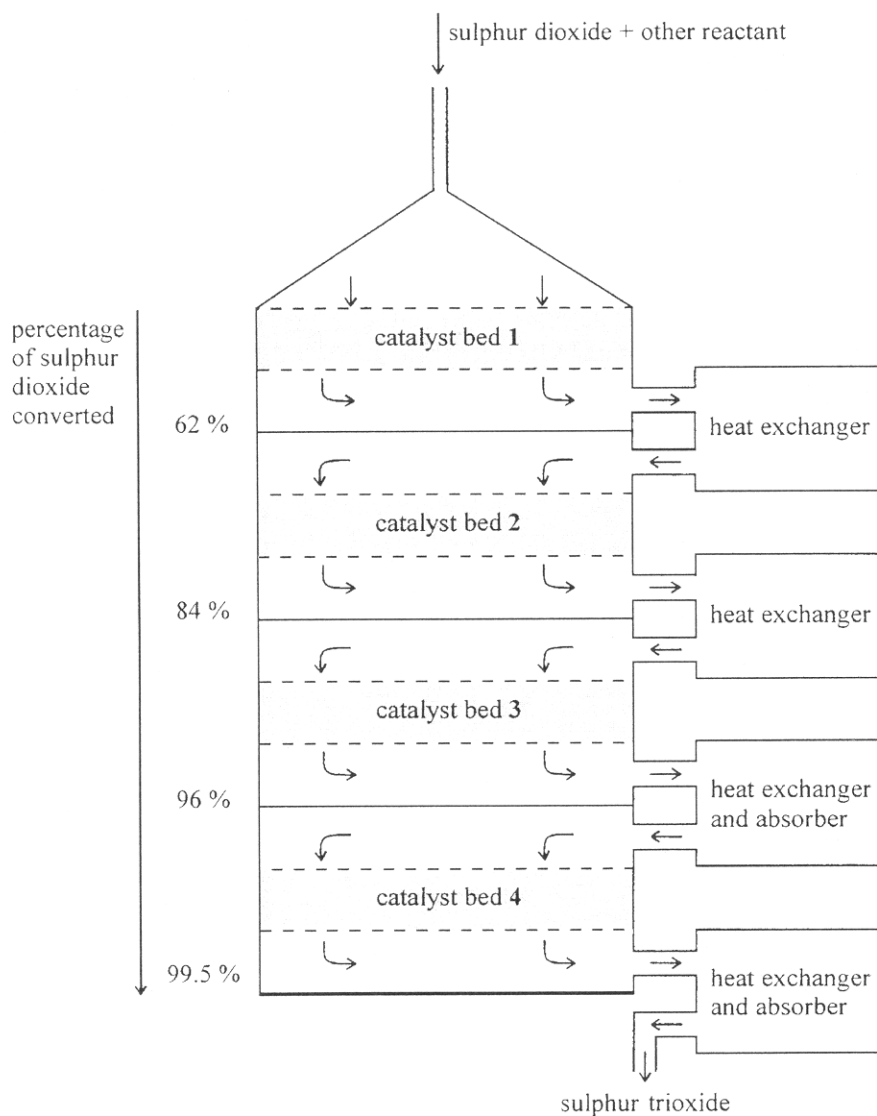
stage 3 absorption of sulphur trioxide into concentrated sulphuric acid

- (a) In **stage 1**, molten sulphur is sprayed into a furnace and burns in air at high temperatures.

Write the balanced chemical equation for this reaction.

..... (2)

- (b) **Stage 2**



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(i) What does sulphur dioxide react with in **stage 2**?

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(1)

(ii) Name the catalyst used in **stage 2**.

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(1)

(iii) Why is the mixture passed through the catalyst four times rather than once?

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(1)

(c) State **one** industrial use of sulphuric acid.

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(1)

Q3

(Total 6 marks)

TURN OVER FOR QUESTION 4

4. Several reactions take place during the production of iron from iron ore in the blast furnace. Some reactions are exothermic, while others are endothermic.

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(a) The oxidation of coke to carbon dioxide is an exothermic reaction



(i) Where in the blast furnace does this reaction take place?

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(1)

(ii) In terms of energy, explain the significance of this reaction in the blast furnace.

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(1)

(b) One endothermic reaction taking place in the blast furnace is the formation of carbon monoxide from coke and carbon dioxide.

Write the balanced equation, including state symbols, for the reaction.

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(3)

(c) Cast iron from the furnace contains up to 4% carbon, which causes the iron to be brittle. Most of the iron from the blast furnace is converted to steel. Mild steel, which is used in the construction industry, contains only 0.15–0.25% carbon.

Explain how the carbon content of the iron from the blast furnace is lowered to produce mild steel.

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(2)

(Total 7 marks)

Q4

5. (a) (i) Give the name of the homologous series of compounds to which ethyl propanoate belongs.

Leave blank

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(1)

(ii) Draw the structural formula of ethyl propanoate showing **all** the bonds.

(2)

(b) Ethyl propanoate is formed by the reaction of ethanol with propanoic acid.

What is the formula of propanoic acid?

.....
(1)

(c) Each year, in the United Kingdom, about 330 000 tonnes of ethanol are produced by the hydration of ethene. Ethanol is also manufactured by the fermentation of sugars.

(i) Write the balanced equation for the hydration of ethene to form ethanol.

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(2)

(ii) Suggest why both methods of producing ethanol are widely used.



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(3)

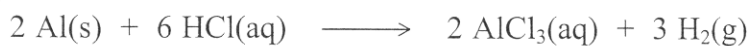
Q5

(Total 9 marks)

TURN OVER FOR QUESTION 6

6. Aluminium is a very reactive metal but its true reactivity is hidden due to a thin layer of aluminium oxide on the surface of the metal. The oxide layer can be removed by treating the metal with mercury(II) chloride solution. The pure metal reacts vigorously with dilute hydrochloric acid.

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- (a) The oxide layer can be made thicker by anodising the aluminium.

Explain how anodising thickens the aluminium oxide layer.

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..... (2)

- (b) (i) Describe the **two** changes you would **see** when sodium hydroxide solution is added, drop by drop until in excess, to an aqueous solution containing aluminium ions.

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..... (2)

- (ii) Write the ionic equation for the first change which occurs.

..... (3)

(c) Calculate the volume, measured at room temperature and pressure, of hydrogen produced when 2.70 g of pure aluminium reacts completely with excess dilute hydrochloric acid.

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(Relative atomic mass: Al = 27.0

1 mol of a gas occupies 24.0 dm³ at room temperature and pressure)

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(3)

(Total 10 marks)

Q6

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TURN OVER FOR QUESTION 7

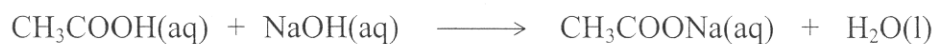
7. Vinegar is a solution of ethanoic acid. The concentration of ethanoic acid was determined by titrating some of the vinegar with $0.500 \text{ mol dm}^{-3}$ sodium hydroxide solution (NaOH).

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Here are the results of the titration.

volume of vinegar used for each titration		= 10.0 cm^3
volumes of sodium hydroxide solution	trial titration	= 18.1 cm^3
	1st titration	= 17.8 cm^3
	2nd titration	= 17.7 cm^3

The equation for the reaction is



- (a) After the trial titration, why was it necessary to carry out two further titrations?

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(1)

- (b) Describe how to carry out one of the accurate titrations in this experiment.

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(3)

(c) Calculate the concentration, in mol dm⁻³, of ethanoic acid (CH₃COOH) present in the vinegar.

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(4)

Q7

(Total 8 marks)

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TOTAL FOR PAPER: 60 MARKS

END