Write your name here

Surname	Other names

Edexcel Certificate
Edexcel International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry

Unit: KCH0/4CH0
Paper: 2C

Tuesday 29 May 2012 – Morning
Time: 1 hour

Paper Reference
KCH0/2C
4CH0/2C

You must have:
Ruler
Calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

P40135A

1/1/1/1/

P 4 0 1 3 5 A 0 1 1 6

PEARSON

THE PERIODIC TABLE

Period	1	2											3	4	5	6	7	0
	Group																	
1	1 H Hydrogen 1																	4 He Helium 2
2	7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
3	23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
4	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	63.5 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
5	86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
6	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
7	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key

Relative atomic mass
Symbol
Name
Atomic number

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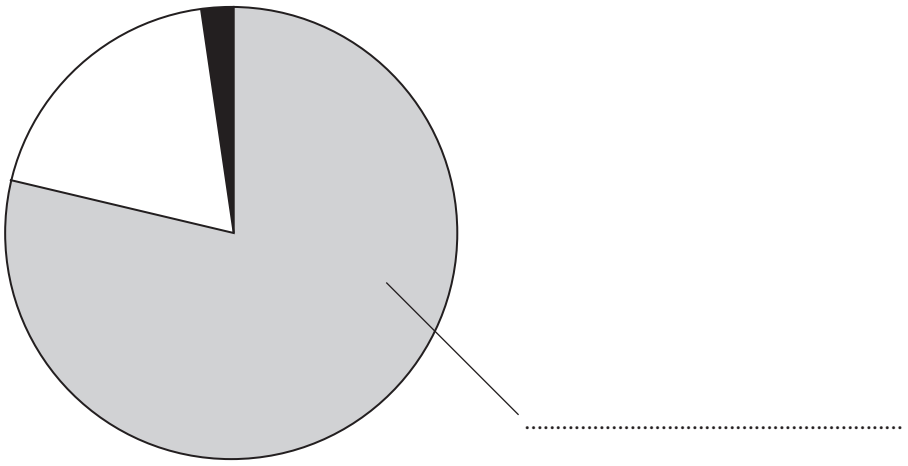
Answer ALL questions.

1 Many chemical reactions occur in the atmosphere.

(a) The pie chart shows the relative amounts of some gases in air.



(i) Label the pie chart with the name of the gas that makes up most of the air.

(1)

(ii) What is the approximate percentage of oxygen in air?

Place a cross (☒) in one box.

(1)

☒ 1

☒ 20

☒ 25

☒ 78

(iii) Use words from the box to complete the sentences about some of the other gases in air.

Each word may be used once, more than once or not at all.

(2)

diatomic	**dense**	**neon**	**nitrogen**	**unreactive**	**water**

One of the gases in air is argon. It is called a noble gas because it is

very ..... .

The percentage of ..... vapour in air varies with the weather.

(b) Rain water is naturally slightly acidic because carbon dioxide dissolves in it.
The word equation for the reaction that occurs is:

carbon dioxide + water → carbonic acid

Acid rain is more acidic because pollutant gases in the atmosphere also dissolve in water.

(i) Identify the acid formed when sulfur dioxide reacts with water.

(1)

.....

(ii) Identify another pollutant gas that forms acid rain.

(1)

.....

(iii) State **two** problems caused by acid rain.

(2)

1 .....

.....

2 .....

.....

(Total for Question 1 = 8 marks)

2 Iron and aluminium are two important metals extracted from their ores on a large scale.

(a) In the extraction of iron, three different raw materials are put into the top of a blast furnace.

Name the main compound present in the following raw materials.

(i) Haematite

(1)

.....

(ii) Limestone

(1)

.....

(b) The following equations represent reactions in the blast furnace.

A $C + O_2 \rightarrow CO_2$

B $CaCO_3 \rightarrow CaO + CO_2$

C $C + CO_2 \rightarrow 2CO$

D $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

E $CaO + SiO_2 \rightarrow CaSiO_3$

Choose from the letters **A**, **B**, **C**, **D** or **E** to answer parts (i) – (iv).

Each letter may be used once, more than once or not at all.

(4)

(i) A reaction that is used to produce heat .....

(ii) A neutralisation reaction .....

(iii) A decomposition reaction .....

(iv) A reaction that forms a reducing agent .....

(c) Molten iron and another molten substance collect at the bottom of the blast furnace.

What is the common name of this other molten substance?

(1)

.....

(d) Aluminium is extracted from its ore by electrolysis. This is a more expensive process than using a blast furnace.

(i) Why is a different method used for aluminium?

(1)

.....

.....

(ii) State the major reason for the high cost of extracting aluminium.

(1)

.....

.....

(e) Coke used in the blast furnace contains carbon. Carbon is also used in the extraction of aluminium, but for a different purpose.

What is this purpose?

(1)

.....

.....

(f) The extraction of aluminium can be represented by the chemical equation:

$$2Al_2O_3 \rightarrow 4Al + 3O_2$$

Write the two ionic half-equations that can also be used to represent this extraction.

(3)

Half-equation 1 .....

Half-equation 2 .....

(Total for Question 2 = 13 marks)

3 A group of students planned an experiment to find the temperature rise in a neutralisation reaction. This is their method.

- Use a measuring cylinder to add 25 cm^3 of an alkali to a 100 cm^3 beaker
- Record the temperature of the alkali
- Use a burette to add an acid to the alkali in 5.0 cm^3 portions
- Record the temperature of the mixture after adding each portion of acid
- Stop the experiment when the neutralisation is complete

(a) The teacher asked the students about their method.

Suggest an answer to each of her questions.

(i) Why would it be better to use a pipette instead of a measuring cylinder?

(1)

.....

.....

(ii) It would be better if a polystyrene cup were used instead of a beaker.

What property of polystyrene makes this an improvement?

(1)

.....

.....

(iii) What extra step should there be between adding each portion of acid and measuring the temperature?

(1)

.....

.....

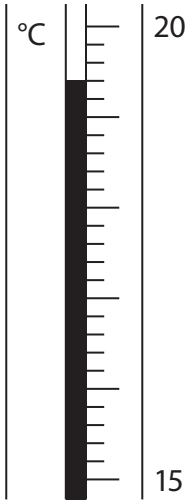
(iv) How would you know when the neutralisation was complete?

(1)

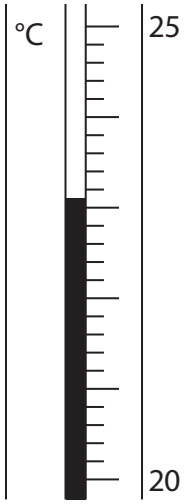
.....

.....

(b) The diagrams show the readings on the thermometer before and after one of the students added a portion of acid.



before adding acid



after adding acid

Write down the thermometer readings and calculate the temperature change.

(3)

Temperature before adding acid ..... °C

Temperature after adding acid ..... °C

Temperature change ..... °C

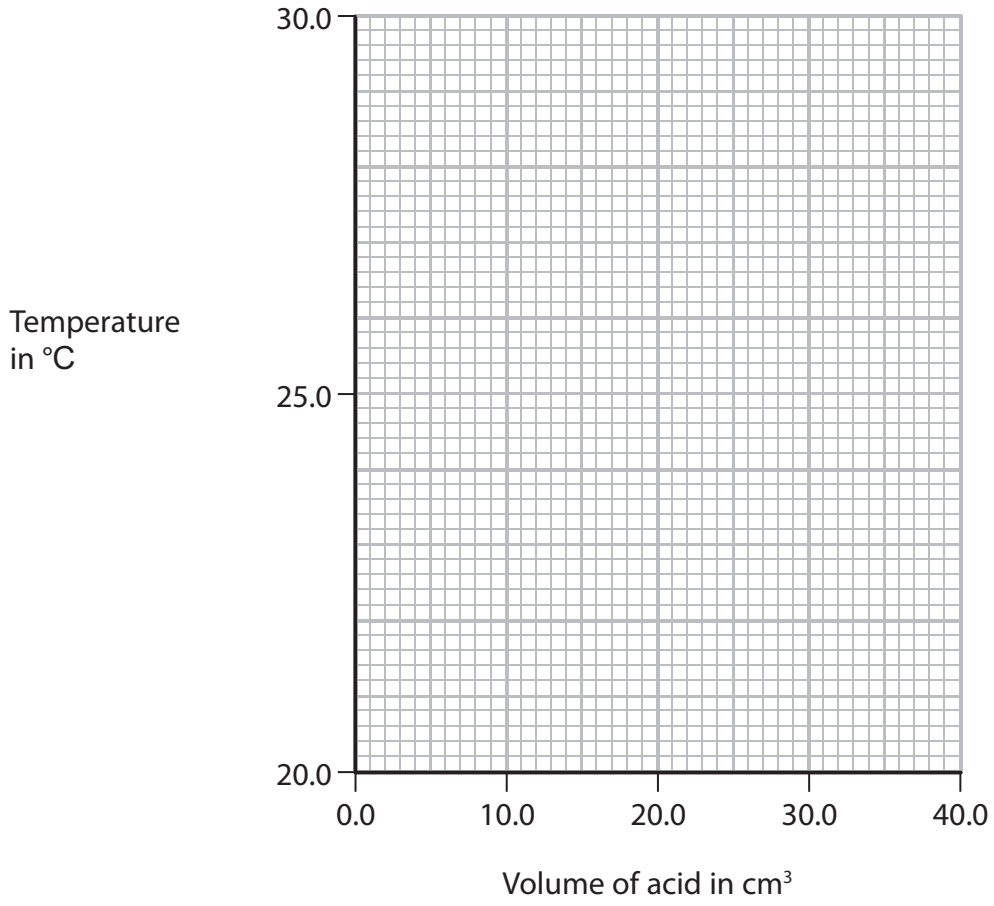
(c) One student obtained these results from an experiment in which she added a total of 40.0 cm^3 of hydrochloric acid to 25 cm^3 of sodium hydroxide solution.

Volume of acid in cm^3	0.0	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0
Temperature in °C	21.0	22.3	24.4	26.2	27.8	27.8	27.5	26.7	26.2

(i) Plot a graph of these results on the grid below.

Draw a straight line of best fit through the first five points and another straight line of best fit through the last four points. Make sure that the two lines cross.

(4)



(ii) The point where the lines cross indicates the volume of acid needed to exactly neutralise the alkali, and also the maximum temperature reached.

Use your graph to record these values.

(2)

Volume of acid ..... cm^3

Maximum temperature .....°C

(d) A second student used the same method and found that 30.0 cm^3 of acid were needed to neutralise 25 cm^3 of alkali.

He obtained a temperature rise of 5.5 °C in his experiment.

Calculate the heat energy change in this experiment using the expression:

heat energy change = total volume of mixture × 4.2 × temperature change

(2)

Heat energy change = ... J

(e) A third student calculated that the heat energy change in her experiment was 1800 J. This heat energy was released by the neutralisation of 25 cm^3 of 1.50 mol/dm^3 sodium hydroxide solution.

(i) Calculate the amount, in moles, of sodium hydroxide neutralised.

(2)

Amount = ... mol

(ii) Calculate the molar enthalpy change, in kJ/mol, for the neutralisation of sodium hydroxide.

(2)

Molar enthalpy change = ... kJ/mol

(Total for Question 3 = 19 marks)

4 There are two important ways to manufacture ethanol.

Reaction 1 $C_2H_4 + H_2O \rightarrow C_2H_5OH$

Reaction 2 $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

(a) (i) Identify one raw material that could be used as the source of $C_6H_{12}O_6$

(1)

.....

(ii) Reaction 2 uses a catalyst called zymase, which is present in yeast.

Identify the catalyst used in reaction 1.

(1)

.....

(iii) In both reactions it is important to control the temperature.

State why the temperature in reaction 2 is kept below 35 °C.

(1)

.....

.....

(b) A manufacturing company plans to build a factory to produce ethanol on a large scale. The factory will be near an oilfield. The ethanol will be used as a solvent for perfume.

Suggest why the company should use reaction 1 rather than reaction 2.

(3)

(c) In the future, it may be necessary to convert the ethanol (produced by reaction 2) into ethene.

Write the equation for this reaction and state the type of reaction that occurs.

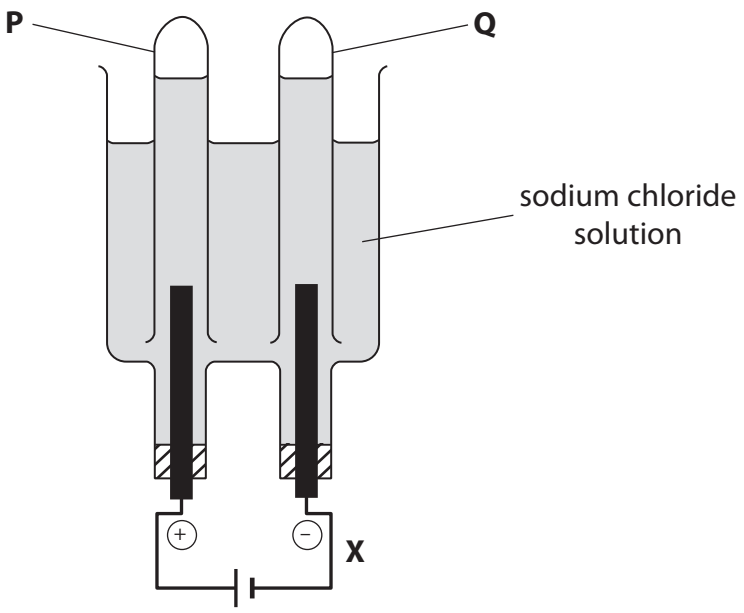
(2)

Equation .....

Type of reaction .....

(Total for Question 4 = 8 marks)

5 The diagram shows how sodium chloride solution can be electrolysed and the products of electrolysis collected.



(a) (i) Draw an arrow on the diagram to show the direction of electron flow at point **X**.

(1)

(ii) The diagram shows one of the gases being collected in test tube **Q**.

Identify this gas.

(1)

.....

(iii) When the concentration of the sodium chloride solution is low, the gas collected in test tube **P** is mostly oxygen. The formation of this gas can be represented by an ionic half-equation.

Balance the equation.

(1)

$$\text{.....}OH^- \rightarrow \text{.....}H_2O + \text{.....}O_2 + \text{.....}e^-$$

(b) When the concentration of sodium chloride solution is high, the gas that collects in test tube **P** is mostly chlorine. The equation for its formation is:

$$2Cl^- \rightarrow Cl_2 + 2e^-$$

In one experiment, the volume of chlorine gas collected was 18 cm^3.

(i) Calculate the amount, in moles, of chlorine gas in 18 cm^3.

(The volume of 1 mol of a gas at room temperature and pressure is 24 000 cm^3)

(2)

Amount = ... mol

(ii) Calculate the quantity of electricity, in coulombs, needed to produce this volume of chlorine gas.

(1 faraday = 96 500 coulombs)

(2)

Quantity = ... C

(c) Chlorine reacts with potassium bromide solution. The equation for this reaction is:

$$Cl_2(g) + 2Br^-(aq) \rightarrow 2Cl^-(aq) + Br_2(aq)$$

This reaction can be described as both a displacement reaction and a redox reaction.

(i) Identify the element that is displaced in this reaction.

(1)

.....

(ii) State the meaning of the term **redox**.

(1)

.....

.....

QUESTION 5 CONTINUES ON THE NEXT PAGE

(d) Chlorine is used in the manufacture of phosphorus pentachloride, PCl_5

The equation for the reaction is:

$$PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g) \qquad \Delta H = -124 \text{ kJ/mol}$$

(i) What does the $\rightleftharpoons$ symbol indicate about this reaction?

(1)

.....

(ii) Predict and explain the effect of increasing the pressure on the equilibrium position of this reaction.

(2)

Prediction .....

Explanation .....

.....

.....

(Total for Question 5 = 12 marks)

(TOTAL FOR PAPER = 60 MARKS)