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Write your name here

Surname	Other names

Pearson Edexcel Certificate
Pearson Edexcel
International GCSE

Centre Number	Candidate Number

Chemistry

Unit: KCH0/4CH0
Paper: 2C

Thursday 16 January 2014 – Afternoon **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.
- Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (~~☒~~) and then mark your new answer with a cross (☒).

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 ▶

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THE PERIODIC TABLE

Period	Group 1	2											3	4	5	6	7	0
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 The table shows the numbers of particles in two atoms, L and M.

	Atom L	Atom M
number of electrons	6	6
number of neutrons	8	6
number of protons	6	6

(a) Which particles are present in the nuclei of both atoms?

(1)

- ☐ **A** electrons and neutrons
- ☐ **B** electrons and protons
- ☑ **C** neutrons and protons
- ☐ **D** neutrons, protons and electrons

(b) (i) The atomic number of atom L is ~~14~~ 6.

(1)

(ii) The mass number of atom L is 14.

(1)

(c) Atoms L and M are neutral because

(1)

- ☐ **A** the numbers of electrons and neutrons are equal
- ☑ **B** the numbers of electrons and protons are equal
- ☐ **C** the numbers of neutrons and protons are equal
- ☐ **D** the numbers of electrons, neutrons and protons are equal

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(d) Use information from the table to explain why atoms L and M are isotopes of the same element.

(2)

atoms of the same element but with different numbers of neutrons

(e) The electronic configuration of atom M is

(1)

- ☐ **A** 2.2.2
- ☑ **B** 2.4
- ☐ **C** 2.4.6
- ☐ **D** 4.2

(Total for Question 1 = 7 marks)

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2 Bromine, chlorine, fluorine and iodine are elements in Group 7 of the Periodic Table.

(a) Which two of these elements have the darkest colours?

(1)

Iodine and Bromine

(b) The equation for the reaction between hydrogen and chlorine is

$$H_2 + Cl_2 \rightarrow 2HCl$$

Different names are used for the product, depending on its state symbol.

(i) What are the names used for HCl(g) and HCl(aq)?

(2)

HCl(g) hydrogen chloride

HCl(aq) hydrochloric acid

(ii) The presence of HCl(g) can be confirmed by adding ammonia (NH_3) gas.

State the observation in the reaction between HCl(g) and ammonia gas and write a chemical equation for the reaction.

(2)

observation white solid formed

chemical equation $HCl + NH_3 \rightarrow NH_4Cl$

(iii) The presence of chloride ions in HCl(aq) can be shown by mixing it with silver nitrate solution and dilute nitric acid.

State the result of this test and complete the chemical equation for the reaction by adding the state symbols.

(3)

result white precipate

$AgNO_3$(aq) + HCl(aq) → AgCl(s) + HNO_3(aq)

2 (c) Solution X is made by dissolving HCl(g) in water.

Solution Y is made by dissolving HCl(g) in methylbenzene.

A student added magnesium ribbon and blue litmus paper to separate samples of each solution.

The table shows her results.

Test	Solution X	Solution Y
magnesium ribbon added	bubbles	no change
blue litmus paper added	goes red	stays blue

(i) What substance is responsible for the bubbles?

(1)

$H_2(g)$

(ii) State one change to the magnesium ribbon that could be seen after adding it to solution X.

(1)

disappears

(iii) What does the colour change of the litmus paper show about solution X?

(1)

acid

(iv) Why does the litmus paper stay blue in solution Y?

(1)

neutral

(Total for Question 2 = 12 marks)

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3 Tungsten is a useful metal. It has the chemical symbol W.

(a) One method of extracting tungsten involves heating a tungsten compound (WO_3) with hydrogen.

(i) Suggest the chemical name of WO_3

(1)

tungsten oxide

(ii) Balance the equation for the reaction between WO_3 and hydrogen.

(1)

WO_3 + 3 H_2 → W + 3 H_2O

(iii) Why is this reaction described as reduction?

(1)

tungsten looses oxygen

(b) Scheelite is an ore of tungsten.

The main compound in scheelite has the percentage composition by mass Ca = 13.9%, W = 63.9%, O = 22.2%.

Calculate the empirical formula of this compound.

(3)

Ca	W	O
13.9	63.9	22.2
40	184	16
0.3475	0.3473	1.386
	0.1386	
2.5	2.5	1 (×2)
5	5	2

empirical formula = $Ca_5W_5O_2$

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3 (c) Tungsten can also be obtained by reacting tungsten fluoride with hydrogen.

The equation for this reaction is

$$WF_6 + 3H_2 \rightarrow W + 6HF$$

(i) In an experiment, a chemist used 59.6 g of tungsten fluoride.

What is the maximum mass of tungsten he could obtain from 59.6 g of tungsten fluoride?

Relative formula mass of tungsten fluoride = 298

(2)

WF_6 W

59.6 ?

298 184

= 0.2 = 0.2 x

maximum mass = 36.8 g

(ii) Starting with a different mass of tungsten fluoride, he calculates that the mass of tungsten formed should be 52.0 g. In his experiment he actually obtains 47.5 g of tungsten.

What is the percentage yield of tungsten in this experiment?

(2)

$\frac{47.5}{52.0}$ x100

percentage yield = 91.3 %

(Total for Question 3 = 10 marks)

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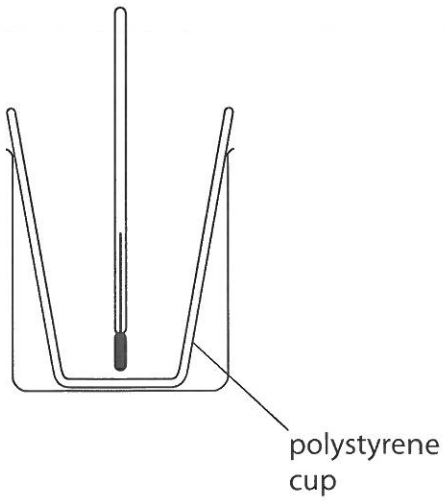
4 A student investigated the neutralisation of acids by measuring the temperature changes when alkalis were added to acids of known concentrations.

He used this apparatus to add different volumes of sodium hydroxide solution to a fixed volume of dilute nitric acid.



He used this method.

- measure the temperature of 25.0 cm^3 of the acid in the polystyrene cup
- add the sodium hydroxide solution in 5.0 cm^3 portions until a total of 30.0 cm^3 has been added

(a) State two properties of the sodium hydroxide solution that should be kept constant for each 5.0 cm^3 portion.

(2)

1 conc

2 temp

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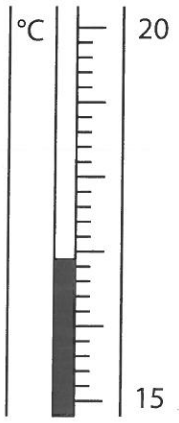
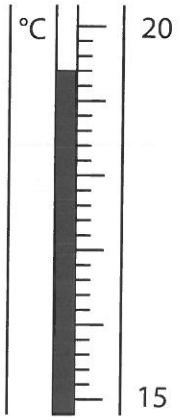
4 (b) The diagram shows the thermometer readings in one experiment.



before adding alkali



after adding alkali

Write down the thermometer readings and calculate the temperature change.

(3)

temperature after adding alkali 19.4 °C

temperature before adding alkali 16.9 °C

temperature change 2.5 °C

4 (c) The student carried out the experiment three times.

The table shows his results.

Volume of alkali added in cm^3	Temperature in °C		
	experiment 1	experiment 2	experiment 3
0.0	17.4	16.6	15.9
5.0	18.5	21.0	18.0
10.0	19.6	24.5	20.0
15.0	20.5	23.6	22.2
20.0	21.4	22.7	23.6
25.0	22.5	21.4	22.8
30.0	23.4	20.5	22.0

The teacher said that only the results for experiment 3 showed the expected increase and decrease in temperature.

(i) Why was there no temperature decrease in experiment 1?

(1)

☐ **A** The alkali was added too quickly

☐ **B** The starting temperature of the acid was too high

☐ **C** The acid concentration was half what it should have been

☑ **D** The volume of acid used was 50.0 cm^3 instead of 25.0 cm^3

(ii) Why were the temperature increases in experiment 2 much greater than expected?

(1)

☐ **A** The starting temperature of the acid was too high

☐ **B** The acid concentration was double what it should have been

☐ **C** The volume of acid used was 50.0 cm^3 instead of 25.0 cm^3

☑ **D** The alkali was added in 10.0 cm^3 portions but were recorded as 5.0 cm^3 portions

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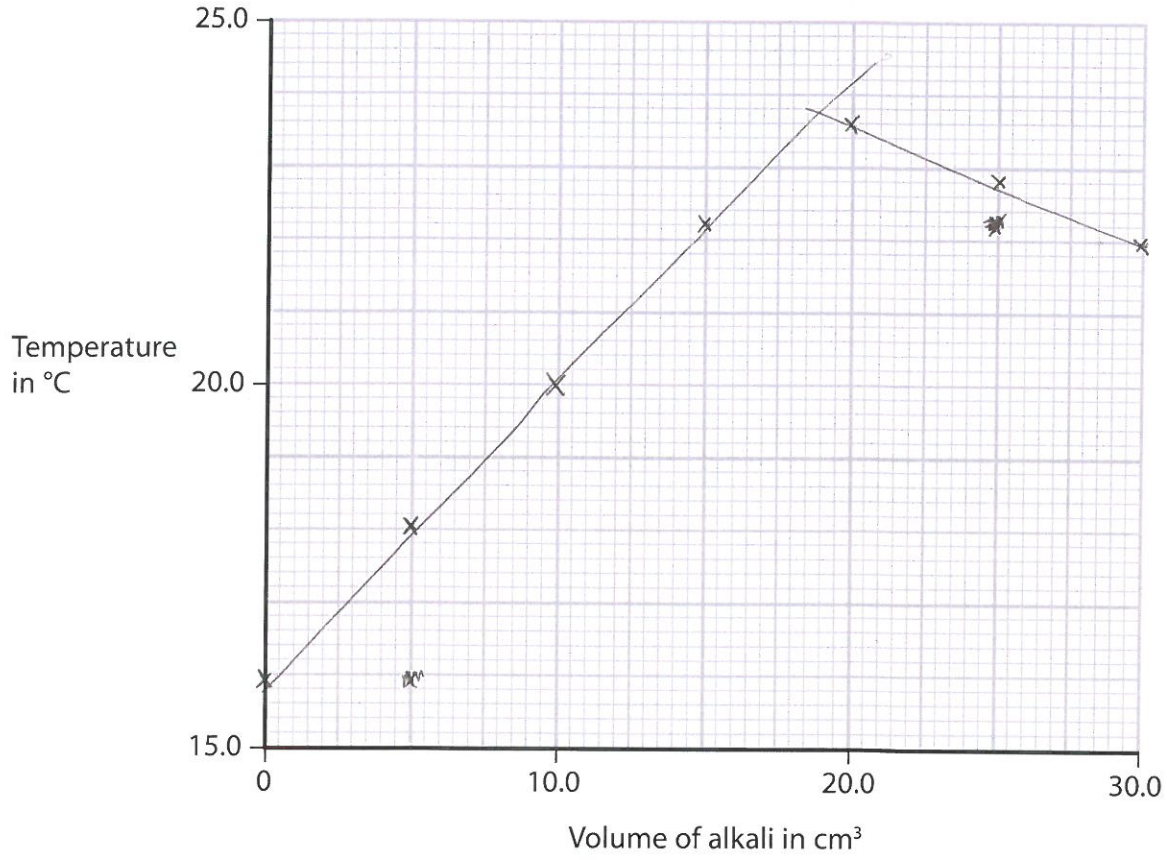
(d) Plot the results of experiment 3 on the grid.

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

(4)



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

Record these values.

(2)

volume of alkali 18.5 cm^3

maximum temperature 23.7 °C

(f) Another student used sulfuric acid instead of nitric acid in her experiments.
She started with 25.0 cm^3 of sulfuric acid of concentration 0.650 mol/dm^3.

She added 0.500 mol/dm^3 sodium hydroxide solution until the acid was completely neutralised.

The equation for this reaction is

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

(i) Calculate the amount, in moles, of sulfuric acid used.

(2)

$\frac{25 \times 0.65}{1000}$

amount = 0.01625 mol

(ii) Calculate the amount, in moles, of sodium hydroxide needed to neutralise this amount of sulfuric acid.

(1)

0.01625×2

amount = 0.0325 mol

(iii) Calculate the volume, in cm^3, of sodium hydroxide solution needed to neutralise this amount of sulfuric acid.

(2)

$V = \frac{0.0325 \times 1000}{0.500}$

0.0005

volume = 71 cm^3

(Total for Question 4 = 18 marks)

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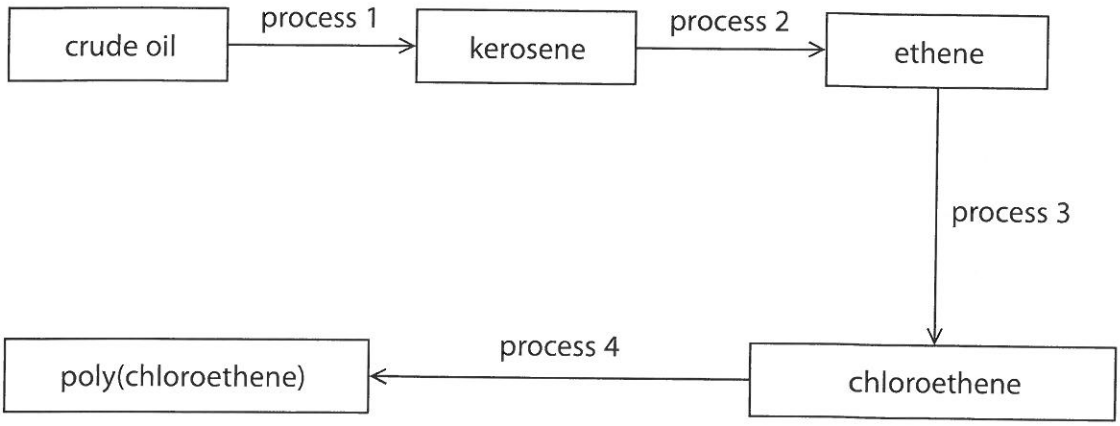
5 The diagram shows some important conversion processes used in the oil industry.



(a) Process 1 is called

(1)

- ☐ **A** catalytic cracking
- ☐ **B** condensation polymerisation
- ☑ **C** fractional distillation
- ☐ **D** thermal decomposition

(b) Describe the differences between crude oil and kerosene. In your answer you should refer to

- the average size of the molecules in the two liquids
- the covalent bonding in the molecules
- the viscosities of the two liquids

(3)

- Crude oil is a mixture of $C_{1}H_{4}$ to C_{30}
- kerosene is a medium sized molecule C_{8-10}
- Both have only covalent bonding
- Crude oil is more viscous.

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5 (c) The equation for one reaction that could occur in process 2 is

$$C_xH_y \rightarrow C_5H_{12} + 2C_2H_4$$

(i) Deduce the formula of C_xH_y

(1)

C_9H_{20}

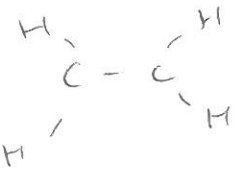
(ii) Give the name of the compound C_5H_{12}

(1)

pentane

(iii) Draw the displayed formula of C_2H_4

(1)

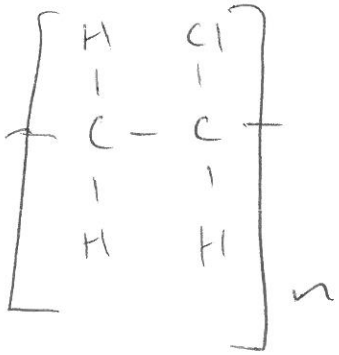


(d) The structural formula of chloroethene formed in process 3 is $CH_2{=}CHCl$

The polymer formed in process 4 is poly(chloroethene).

Draw the **displayed** formula for the repeat unit of poly(chloroethene).

(2)



5 (e) Poly(chloroethene) is formed by addition polymerisation.

Nylon is formed by condensation polymerisation.

(i) How does condensation polymerisation differ from addition polymerisation?

(1)

* water is formed

(ii) Poly(chloroethene) and nylon do not biodegrade easily.

What is meant by the term **biodegrade**?

(2)

living organisms break a substance down into smaller molecules.

(iii) What feature of addition polymers makes it difficult for them to biodegrade?

(1)

~~is~~ inert.

(Total for Question 5 = 13 marks)

(TOTAL FOR PAPER = 60 MARKS)

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