10 06 T

Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | Candidate Number

Chemistry

Paper: 2C

Sample Assessment Material
Time: 1 hour

Paper Reference
4CH0/2C

You must have:
Ruler
Candidates may use a 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 ▶

S41647A

S 4 1 6 4 7 A 0 1 1 5

PEARSON

The Periodic Table of the Elements

1	2										3	4	5	6	7	0
						1 H hydrogen 1										4 He helium 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
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
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
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] 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
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 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	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated					

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The Lanthanides (atomic numbers 58-71) and the Actinides(atomic numbers 90-103) have been omitted.***

Cu and Cl have not been rounded to the nearest whole number.

10 06 T

Answer ALL questions.

1 Lithium sulfate (Li_2SO_4) is used in some medicines. The presence of lithium sulfate in a medicine can be shown by two tests.

(a) A flame test can be used to show that the medicine contains lithium ions.

State the colour that lithium ions produce in a flame.

(1)

Red

(b) A sample of a medicine containing lithium sulfate is dissolved in water.

(i) Describe how you would test the solution for the presence of sulfate ions.

(3)

+ $BaCl_2$

+ HCl or HNO_3

white precipitate formed

(ii) Write a chemical equation for the reaction occurring in (b)(i).

(2)

$BaCl_2 + Li_2SO_4 \rightarrow BaSO_4 + 2LiCl$

(Total for Question 1 = 6 marks)

10 06 T

7

2 Ethanol can be manufactured by two different methods. The table gives some information about these two methods.

	Raw material	Quality of ethanol produced
Method **A**	crude oil	pure
Method **B**	sugar cane	impure

(a) In method **A**, ethanol is formed in the final step.

(i) Identify the **two** compounds that react together to form ethanol. **(2)**

C_2H_4 and H_2O

(ii) State **two** conditions used in this reaction. **(2)**

300°C / 60-70 atm / phosphoric acid

(b) The equation for the reaction that occurs in method **B** is

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

(i) Name the compound with the formula $C_6H_{12}O_6$. **(1)**

glucose

(ii) Identify the main impurity in the ethanol formed in this reaction. **(1)**

water ? CO_2

10 06 T

2 (c) Some of the ethanol produced by method **B** is converted into ethene by heating it with a catalyst.

(i) Name the catalyst used in this reaction.

(1)

aluminium oxide

(ii) Name the type of reaction.

(1)

dehydration

(iii) Write the chemical equation for this reaction.

(1)

$C_2H_5OH \rightarrow C_2H_4 + H_2O$

(d) Some of the ethanol produced by method **B** is used as a fuel. Balance the chemical equation for the complete combustion of ethanol.

(1)

$C_2H_5OH + \underline{3}\ O_2 \rightarrow \underline{2}\ CO_2 + \underline{3}\ H_2O$

(Total for Question 2 = 10 marks)

10 06T

3 Margaret goes on holiday to the seaside.

She notices some iron railings on the beach that are often in contact with the seawater. They are very rusty.

The iron railings in front of her hotel, some distance from the sea, are much less rusty.

Margaret predicts that seawater makes iron rust faster than rain water.

(a) Describe an experiment that Margaret could carry out to test her prediction.

(5)

- Set up tubes containing iron in rainwater + in seawater
- Set up control tube with iron + no water
- small mass nail + water
- leave tubes for same length of time
- measure mass change of nail
- repeat expt

(b) Why is rusting described as an oxidation reaction?

(1)

gains oxygen / loss of electrons.

(Total for Question 3 = 6 marks)

10 06 T

4 The gas hydrogen chloride, HCl, dissolves in water. The solution in water turns blue litmus paper red.

(a) (i) This solution of hydrogen chloride in water contains two ions.

Give the **formula** of each ion.

(2)

H^+ and Cl^-

(ii) What is the name given to a solution of hydrogen chloride in water?

(1)

hydrochloric acid

(b) Hydrogen chloride gas also dissolves in methylbenzene. This solution has no effect on blue litmus paper.

A student sets up two test tubes, one containing a solution of hydrogen chloride in water and the other containing a solution of hydrogen chloride in methylbenzene.

He adds a piece of magnesium ribbon to each test tube.

Compare the results that he would observe in both test tubes.

(3)

in methylbenzene = no reaction

in water = • fizzing.
• Mg disappears
• gets warm.

(Total for Question 4 = 6 marks)

10 06 T

7

5 Polymers can be classified as addition polymers or condensation polymers.

(a) An addition polymer can be formed from the monomer C_3H_6

(i) Name this monomer and the addition polymer it forms.

(1)

Monomer propene

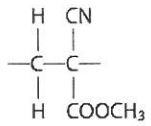
Polymer polypropene

(ii) Explain why there are problems with the disposal of addition polymers.

(2)

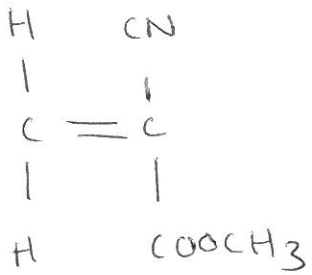
- not biodegradable
- inert
- strong C-C bonds

(b) Superglues are liquid adhesives that easily form addition polymers, giving a solid that sticks objects together firmly. The repeat unit of a superglue polymer is shown below.



Draw the structure of the monomer used to make this polymer.

(1)



(c) 06 T

5 (c) Nylon is an example of a condensation polymer.

Describe one difference between a condensation polymer and an addition polymer.

(2)

• addition = 1 type of monomer reacts with itself.

condensation = two different monomers.

or addition = only one product formed.

(Total for Question 5 = 6 marks)

cond = another product formed, e.g H_2O or HCl

16 06 T

7

6 Potassium chloride is a soluble salt. It can be prepared by reacting together solutions of potassium hydroxide and hydrochloric acid.

(a) A student did a titration to find the volume of hydrochloric acid needed to react with 25.0 cm^3 of potassium hydroxide solution, KOH.

Exactly 25.0 cm^3 of potassium hydroxide solution and a few drops of methyl orange indicator were added to a conical flask.

Hydrochloric acid was then added until a colour change was seen.

(i) State the type of reaction occurring between potassium hydroxide and hydrochloric acid.

(1)

Neutralisation

(ii) Write a chemical equation for this reaction.

(1)

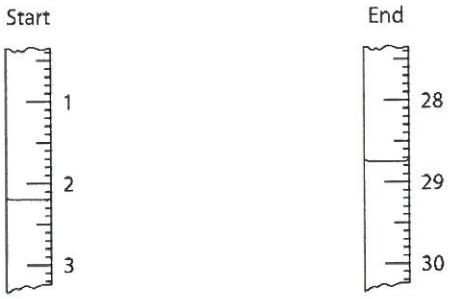
$KOH + HCl \longrightarrow KCl + H_2O$

(iii) State the final colour of methyl orange in the titration.

(1)

~~org~~ orange

(iv) The diagrams show the readings on the burette at the start and at the end of a titration.



Use these diagrams to complete the table, entering all values to the nearest 0.05 cm^3.

(3)

Burette reading at end in cm^3	28.75
Burette reading at start in cm^3	2.20
Volume of acid added in cm^3	26.55

10 06 T

6 (b) Another student did the titration and recorded these results.

Burette reading at end in cm^3	27.35	28.50	27.30	29.15
Burette reading at start in cm^3	0.20	1.80	1.20	2.65
Volume of acid added in cm^3	27.15	26.70	26.10	26.50
Titration results to be used (✓)		✓		✓

(i) Concordant results are those that differ from each other by 0.20 cm^3 or less.

Identify the concordant results by placing ticks (✓) in the table as shown.

(1)

(ii) Use your ticked results to calculate the average volume of acid added.

(2)

$$\frac{26.70 + 26.50}{2}$$

Average volume = 26.60 cm^3

10 06 T

6 (c) A student was asked to suggest a method of obtaining pure, dry crystals of potassium chloride from the dilute solution of potassium chloride formed in the titration.

This is her suggested method.

- Pour the neutral potassium chloride solution from the conical flask into an evaporating basin.
- Heat the solution until it has been bubbling for a few minutes.
- Stop heating and leave it until crystals start to form.
- Pour the liquid away so the crystals are left behind.
- Scrape the crystals onto some blotting paper and to dry them.

Identify **two** problems with the student's method. For each problem, suggest an improvement to the method to overcome the problem.

You may assume that the student is working safely.

(4)

Problem 1 Sol. contaminated with indicator
• sol. heated for too long

Improvement repeat titration with no indicator
• evaporate until crystalisation point

Problem 2 crystals lost when sol. powed off
• blotting may not dry crystals

Improvement filter
• place in warm place.

6 (d) In another titration, some potassium hydroxide solution was neutralised by sulfuric acid. The equation for the reaction is

$$2KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$$

A 25.0 cm^3 sample of 0.200 mol/dm^3 potassium hydroxide was neutralised by 28.40 cm^3 of sulfuric acid.

(i) Calculate the amount, in moles, of potassium hydroxide used.

(2)

$\frac{25 \times 0.2}{1000} = 0.005$ mol

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

(1)

$\frac{0.005}{2} = 0.0025$

(iii) Calculate the concentration, in mol/dm^3, of the sulfuric acid.

(2)

$\frac{0.0025 \times 1000}{28.4} = 0.088$ mol/dm^3

(Total for Question 6 = 18 marks)

10 06 T

7

7 Lansfordite is the common name for a form of hydrated magnesium carbonate, $MgCO_3.xH_2O$.

This formula shows that lansfordite contains water of crystallisation. When a sample of lansfordite is heated gently, the water of crystallisation is given off and eventually anhydrous magnesium carbonate is left.

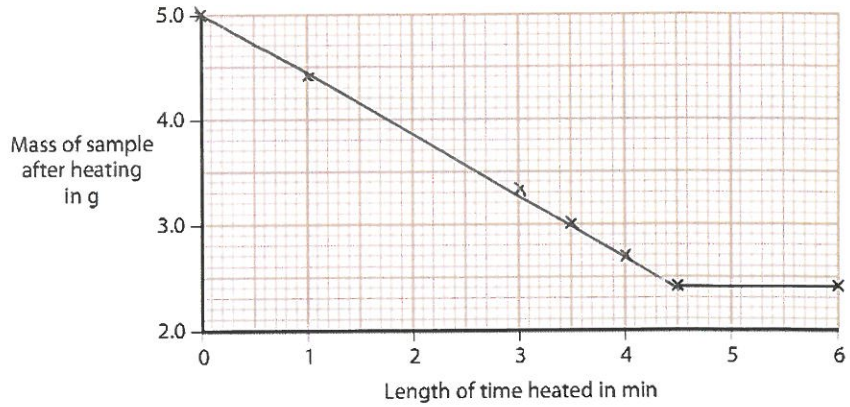
A teacher gave 5.0 g samples of powdered lansfordite to some students and told each student to heat the sample, then to let it cool and reweigh it.

The students heated the samples for different times. The teacher recorded their results in a table.

Length of time heated in min	0.0	1.0	3.0	3.5	4.0	4.5	6.0
Mass of sample after heating in g	5.0	4.4	3.3	3.0	2.7	2.4	2.4

(a) Plot a graph of these results on the grid. The last two results have been plotted for you.

Draw a straight line of best fit through the points you have plotted.



(3)

(b) Use your graph to predict the mass of a sample after heating for 2.0 minutes.

(1)

3.8 g

10 06 T

7 (c) Suggest why the masses of the samples after heating for 4.5 minutes and after heating for 6.0 minutes were the same.

(1)

reaction complete

(d) The teacher told one of the students that the amount of hydrated salt in a sample of lansfordite was 0.030 mol, and that the amount of water lost on heating was 0.15 mol.

Calculate the value of x in the formula $MgCO_3.xH_2O$

(1)

$\frac{0.03}{0.15} = 5$

(e) When anhydrous magnesium carbonate is heated strongly it decomposes. The equation for the reaction is:

$$MgCO_3(s) \rightarrow MgO(s) + CO_2(g)$$

Calculate the volume, in dm^3, of carbon dioxide formed when 0.030 mol of anhydrous magnesium carbonate is completely decomposed.

(You may assume that the molar volume of a gas is 24 dm^3)

(2)

$0.03 \times 24 = 0.72\ dm^3$

(Total for Question 7 = 8 marks)

TOTAL FOR PAPER = 60 MARKS