

Write your name here

Surname

Other names

Centre Number

Candidate Number

**Pearson Edexcel  
International GCSE (9 - 1)**

# Chemistry

## Paper 2

Sample Assessment Materials for first teaching September 2017

**Time: 1 hour 15 minutes**

Paper Reference

**4CH1/2C**

**You must have:**

Calculator, ruler

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.*
- Calculators may be used.
- 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 70.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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# The Periodic Table of the Elements

	1	2	3	4	5	6	7	0										
	7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	11 <b>Na</b> sodium 11	12 <b>C</b> carbon 6	13 <b>Al</b> aluminium 13	14 <b>N</b> nitrogen 7	15 <b>P</b> phosphorus 15	16 <b>O</b> oxygen 8	17 <b>Cl</b> chlorine 17	18 <b>Ar</b> argon 18								
	19 <b>K</b> potassium 19	20 <b>Ca</b> calcium 20	21 <b>Sc</b> scandium 21	22 <b>Ti</b> titanium 22	23 <b>V</b> vanadium 23	24 <b>Cr</b> chromium 24	25 <b>Mn</b> manganese 25	26 <b>Fe</b> iron 26	27 <b>Co</b> cobalt 27	28 <b>Ni</b> nickel 28	29 <b>Cu</b> copper 29	30 <b>Zn</b> zinc 30	31 <b>Ga</b> gallium 31	32 <b>Ge</b> germanium 32	33 <b>As</b> arsenic 33	34 <b>Se</b> selenium 34	35 <b>Br</b> bromine 35	36 <b>Kr</b> krypton 36
	37 <b>Rb</b> rubidium 37	38 <b>Sr</b> strontium 38	39 <b>Y</b> yttrium 39	40 <b>Zr</b> zirconium 40	41 <b>Nb</b> niobium 41	42 <b>Mo</b> molybdenum 42	43 <b>Tc</b> technetium [98]	44 <b>Ru</b> ruthenium 44	45 <b>Rh</b> rhodium 45	46 <b>Pd</b> palladium 46	47 <b>Ag</b> silver 47	48 <b>Cd</b> cadmium 48	49 <b>In</b> indium 49	50 <b>Sn</b> tin 50	51 <b>Sb</b> antimony 51	52 <b>Te</b> tellurium 52	53 <b>I</b> iodine 53	54 <b>Xe</b> xenon 54
	55 <b>Cs</b> caesium 55	56 <b>Ba</b> barium 56	57 <b>La*</b> lanthanum 57	72 <b>Hf</b> hafnium 72	73 <b>Ta</b> tantalum 73	74 <b>W</b> tungsten 74	75 <b>Re</b> rhenium 75	76 <b>Os</b> osmium 76	77 <b>Ir</b> iridium 77	78 <b>Pt</b> platinum 78	79 <b>Au</b> gold 79	80 <b>Hg</b> mercury 80	81 <b>Tl</b> thallium 81	82 <b>Pb</b> lead 82	83 <b>Bi</b> bismuth 83	84 <b>Po</b> polonium 84	85 <b>At</b> astatine 85	86 <b>Rn</b> radon 86
	[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88	[227] <b>Ac*</b> actinium 89	[261] <b>Rf</b> rutherfordium 104	[262] <b>Db</b> dubnium 105	[266] <b>Sg</b> seaborgium 106	[264] <b>Bh</b> bohrium 107	[277] <b>Hs</b> hassium 108	[268] <b>Mt</b> meitnerium 109	[271] <b>Ds</b> darmstadtium 110	[272] <b>Rg</b> roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

1	<b>H</b>	1
	hydrogen	

### Key

relative atomic mass
atomic symbol
name
atomic (proton) number

\* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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Answer ALL questions. Write your answers in the spaces provided.

1 The table shows some properties of four substances, P, Q, R and S.

Substance	Melting point /°C	Boiling point /°C	Conducts electricity when	
			solid	liquid
P	3410	5930	yes	yes
Q	734	1435	no	yes
R	-95	69	no	no
S	2507	3900	no	no

Use the information in the table to answer the following questions.  
You may use each letter once, more than once or not at all.

Choose a substance that:

(a) is a solid at 3000 °C.

(1)

- A substance P
- B substance Q
- C substance R
- D substance S

(b) is a liquid at 25 °C.

(1)

- A substance P
- B substance Q
- C substance R
- D substance S

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(c) is an ionic compound.

(1)

- A** substance **P**
- B** substance **Q**
- C** substance **R**
- D** substance **S**

(d) is a metal.

(1)

- A** substance **P**
- B** substance **Q**
- C** substance **R**
- D** substance **S**

**(Total for Question 1 = 4 marks)**

2 This is a method used to measure the solubility of a solid in water:

- add an excess of solid to some water in a boiling tube and stir
- measure the temperature of the saturated solution formed
- weigh an empty evaporating basin
- pour some of the saturated solution into the evaporating basin
- weigh the basin and contents
- heat the evaporating basin to remove all of the water
- weigh the evaporating basin and remaining solid.

(a) The table shows the results of an experiment using this method.

mass of evaporating basin / g	89.6
mass of evaporating basin + saturated solution / g	115.8
mass of evaporating basin + solid / g	94.9

Calculate the mass of solid obtained and the mass of water removed.

(2)

mass of solid = ..... g

mass of water = ..... g

(b) In another experiment, at a different temperature, the mass of solid obtained is 10.5 g and the mass of water removed is 16.8 g.

Calculate the solubility of the solid, in g per 100 g of water, at this temperature.

(2)

solubility = ..... g per 100 g of water

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(c) If the evaporating basin is heated too strongly some of the solid decomposes to form a gas.

Explain how this strong heating would affect the value of the calculated solubility of the solid.

(3)

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**(Total for Question 2 = 7 marks)**

3 Astatine, bromine, chlorine, fluorine and iodine are all halogens.  
They are found in Group 7 of the Periodic Table.

(a) Predict which halogen has the lightest colour.

(1)

(b) Name a halogen that is a solid at room temperature.

(1)

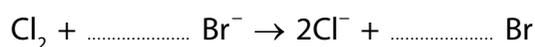
(c) Bromine can be obtained from the bromide ions in sea water.

Chlorine is bubbled into sea water.

The chlorine oxidises the bromide ions to bromine atoms.

The bromine atoms then form bromine molecules.

(i) Complete the equation to show how bromine **atoms** are formed from bromide ions.



(1)

(ii) State why this reaction is described as the oxidation of bromide ions.

(1)

(iii) Write an equation to show how bromine atoms form bromine molecules.

(1)

(d) Boron and fluorine form a covalent compound that has the molecular formula  $\text{BF}_3$

Draw a dot-and-cross diagram to show the arrangement of the outer electrons in a molecule of  $\text{BF}_3$

Use crosses (X) to represent the outer electrons of boron. Use dots (•) to represent the outer electrons of fluorine.

(2)

**(Total for Question 3 = 7 marks)**



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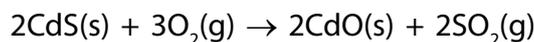
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**5** Zinc metal is obtained from sulfide ores.

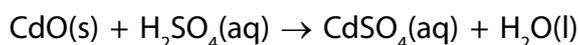
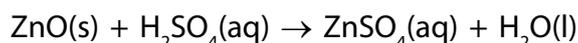
The most common ore of zinc is sphalerite, which contains zinc sulfide (ZnS) and a small amount of cadmium sulfide (CdS).

The stages involved in the extraction of zinc from sphalerite are:

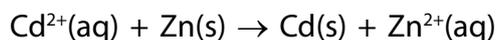
Stage 1 Sphalerite is strongly heated in air.



Stage 2 The mixture of oxides is reacted with sulfuric acid.



Stage 3 Zinc dust is added to the solution containing zinc sulfate and cadmium sulfate to remove the cadmium ions.



Stage 4 The solid cadmium is filtered off and the pure zinc sulfate solution is electrolysed.

(a) State how the reaction in stage 3 shows that zinc is more reactive than cadmium.

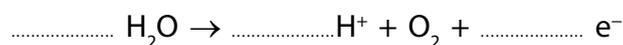
(1)

(b) (i) During the electrolysis in stage 4, zinc is deposited on the cathode.

Write an ionic half-equation for the reaction that occurs.

(1)

(ii) Complete the ionic half-equation for the reaction occurring at the anode.



(1)

(iii) Explain how the pH of the solution surrounding the anode changes during the electrolysis.

(2)

(c) Zinc is mixed with copper to make the alloy brass.

Explain why brass is harder than pure copper.

(3)

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**(Total for Question 5 = 8 marks)**

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6 The mineral nesquehonite is a form of hydrated magnesium carbonate.

The formula,  $\text{MgCO}_3 \cdot x\text{H}_2\text{O}$ , shows that nesquehonite contains water of crystallisation.

When a sample of nesquehonite is heated gently, the water of crystallisation is given off and anhydrous magnesium carbonate is left.

Six students are each given a sample of nesquehonite of mass 6.1 g. The students heat their samples for different times. The samples are then allowed to cool before being reweighed.

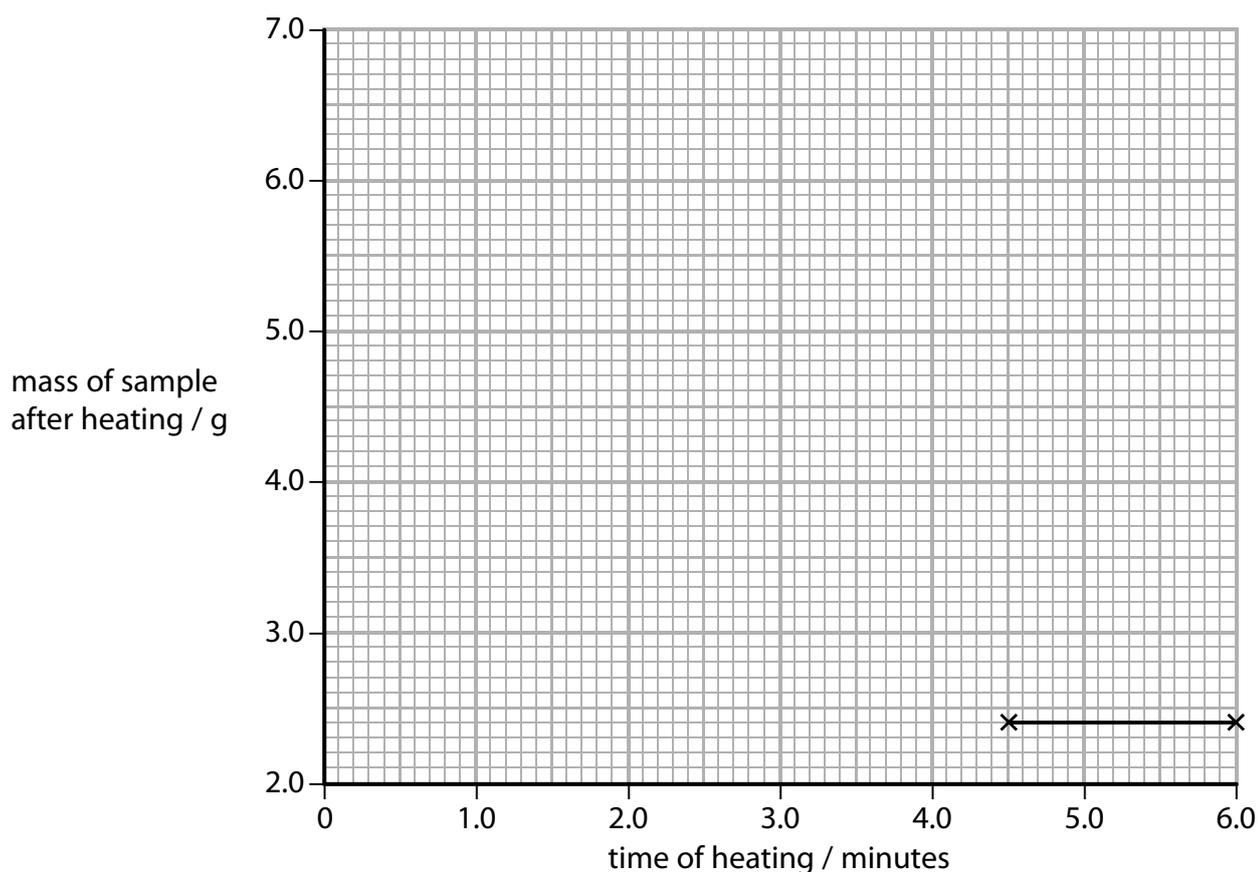
The table shows their results.

time of heating / minutes	0	1.0	2.0	3.0	4.0	4.5	6.0
mass of sample after heating / g	6.1	5.3	4.5	3.7	2.8	2.4	2.4

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

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

(2)



- (b) Predict the mass of sample remaining after heating for 2.5 minutes.  
Show on the graph how you obtain your answer. (2)

mass after 2.5 minutes = ..... g

- (c) State why the last two masses in the table are exactly the same. (1)

- (d) A sample of nesquehonite contains 1.68 g of  $\text{MgCO}_3$  and 1.08 g of  $\text{H}_2\text{O}$ .  
Calculate the value of x in the formula  $\text{MgCO}_3 \cdot x\text{H}_2\text{O}$   
[ $M_r$  of  $\text{MgCO}_3 = 84$ ;  $M_r$  of  $\text{H}_2\text{O} = 18$ ] (3)

x = .....

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



Calculate the volume of carbon dioxide formed in  $\text{cm}^3$ , at rtp, when 4.2 g of anhydrous magnesium carbonate are completely decomposed.

[ $M_r$  of  $\text{MgCO}_3 = 84$ ]

[Assume that the molar volume at rtp of carbon dioxide is  $24 \text{ dm}^3$ ]

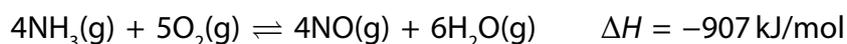
(3)

volume = .....  $\text{cm}^3$

**(Total for Question 6 = 11 marks)**

7 Ammonia is manufactured on a large scale and is used to make fertilisers such as ammonium nitrate ( $\text{NH}_4\text{NO}_3$ ).

- (a) The first stage in the manufacture of ammonium nitrate is to react ammonia gas with oxygen gas.

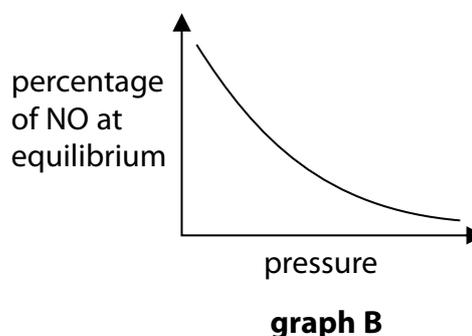
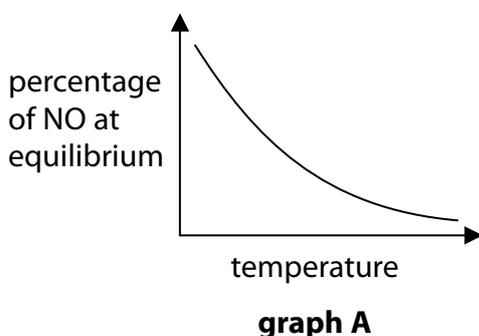


The reaction is carried out at a pressure of about 10 atm and at a temperature of 800 °C, in the presence of a catalyst.

If the mixture is left for long enough in a sealed container, the reaction reaches a position of dynamic equilibrium.

Graph A shows how the percentage of nitrogen monoxide (NO) in the equilibrium mixture varies with temperature at constant pressure.

Graph B shows how the percentage of nitrogen monoxide (NO) in the equilibrium mixture varies with pressure at constant temperature.



- (i) Explain why the percentage of NO at equilibrium decreases in each case.

(4)

Graph A .....

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Graph B .....

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

(a) An addition polymer can be formed from the monomer  $\text{CH}_2=\text{CHCl}$

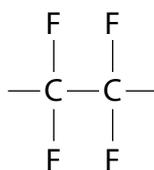
(i) Name this monomer.

(1)

(ii) Name the addition polymer formed from this monomer.

(1)

(b) The diagram shows the repeat unit of a different addition polymer.

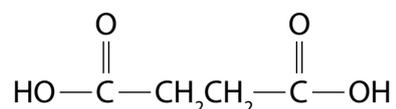


Draw the displayed formula of the monomer used to make this polymer.

(1)

(c) Polyesters are condensation polymers.

The structures of two monomers that are used to make a polyester are:



(i) Draw the structure of the repeat unit of the polyester formed from these two monomers.

(2)

(ii) Identify the small molecule formed when these two monomers form the polyester.

(1)

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**(Total for Question 8 = 6 marks)**

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9 Grapes contain glucose that can be fermented to make ethanol.



(a) The grapes are collected and crushed to produce an aqueous solution containing glucose. Yeast is added to the solution and the mixture is left to ferment at a temperature of about 30 °C in the absence of air.

(i) State why yeast is added.

(2)

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(ii) Explain why another organic compound may also be formed if fermentation is carried out in the presence of air.

(2)

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(iii) Explain why 30°C is considered to be an optimum temperature for this reaction. (2)

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(b) Ethanol can also be manufactured by reacting ethene with steam.

(i) Write the chemical equation for this reaction. (1)

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(ii) Name the type of reaction that occurs. (1)

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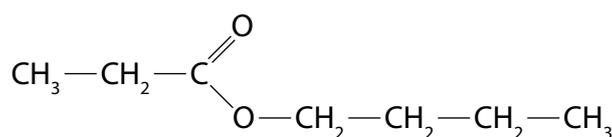
(iii) State **two** conditions used for this reaction in industry. (2)

1.....

2.....

(c) Grapes also contain esters.

The formula of an ester is shown.



Deduce the name of the carboxylic acid and the alcohol that can react together to make this ester. (2)

carboxylic acid.....

alcohol.....

**(Total for Question 9 = 12 marks)**

**TOTAL FOR PAPER = 70 MARKS**

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