

Please check the examination details below before entering your candidate information

Candidate surname			Other names		
Centre Number			Candidate Number		
<b>Pearson Edexcel</b> <b>International GCSE (9–1)</b>			<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>		
Sample Assessment Materials for first teaching September 2017					
(Time: 1 hour 15 minutes)			Paper Reference <b>4CH1/2C</b>		
<b>Chemistry</b> <b>Unit: 4CH1</b> <b>Paper: 2C</b>					
<b>You must have:</b> 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																								
		<div>1Hhydrogen1</div>																																	
<div>Key</div>																																			
		<div>relative atomic mass atomic symbol name atomic (proton) number</div>																																	
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													

1

H

hydrogen

1

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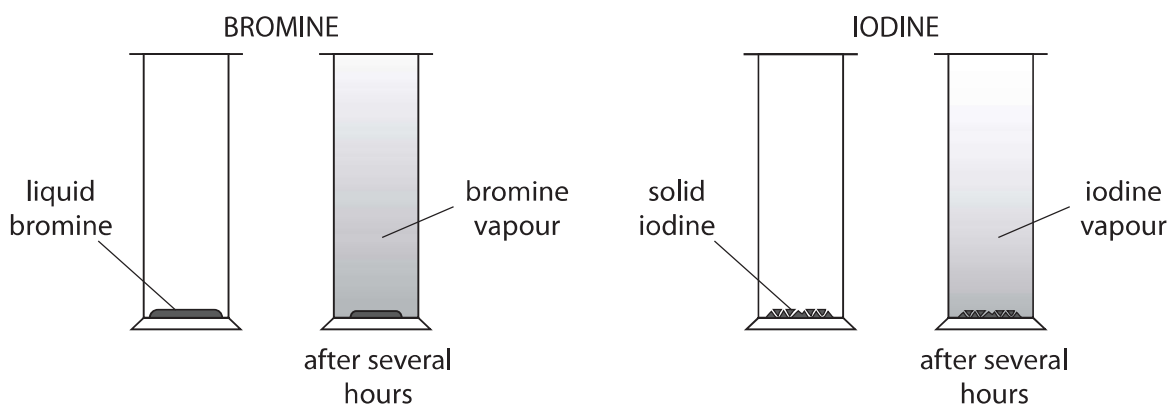
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Answer ALL questions. Write your answers in the spaces provided.

- 1 A few drops of liquid bromine are placed at the bottom of a gas jar.  
A few crystals of solid iodine are placed in the bottom of a different gas jar.  
The open ends of the gas jars are covered with lids.  
The gas jars are left for several hours under the same conditions.

The diagram shows the gas jars just after the bromine and iodine are added, and after several hours.



- (a) State the colour of bromine vapour and of iodine vapour.

(2)

bromine vapour .....

iodine vapour .....

- (b) (i) The diagram shows that the molecules of bromine and iodine have spread out in the gas jars.

Name this process.

(1)

.....

- (ii) The liquid bromine evaporates before this process occurs.

The chemical equation for this change is



The change involving iodine is called sublimation.

Write a chemical equation, including state symbols, for the sublimation of iodine.

(1)

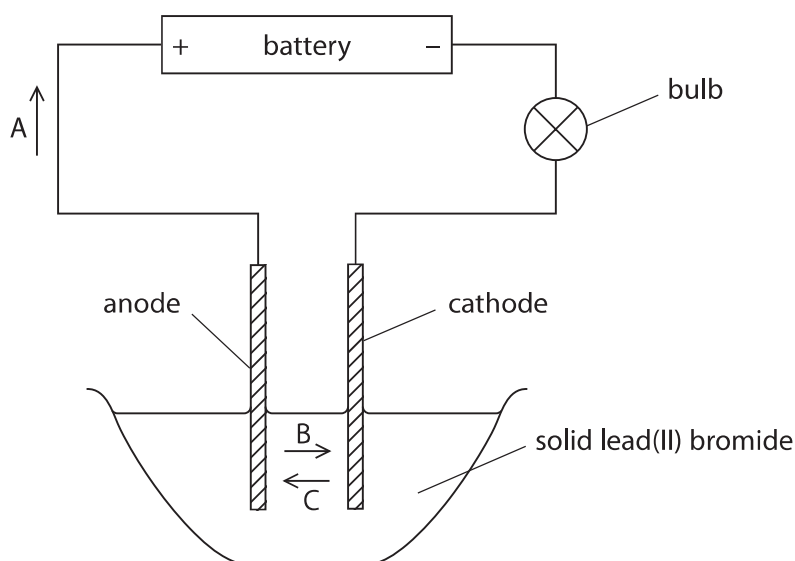
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(Total for Question 1 = 4 marks)



S 6 0 1 0 7 A 0 3 2 0

- 2 This apparatus is used to electrolyse the ionic compound lead(II) bromide,  $\text{PbBr}_2$ .  
Lead(II) bromide is insoluble in water.



- (a) When the apparatus is set up as shown, electrolysis does not occur.

State what must be done for electrolysis to occur.

(1)

- (b) When the necessary change is made and electrolysis occurs, particles A, B and C move in the directions shown by the arrows.

Identify each of the particles A, B and C.

(3)

A.....

B.....

C.....



(c) (i) Write an ionic half-equation for the reaction at the cathode.

(1)

.....

(ii) State why the reaction at the cathode is described as reduction.

(1)

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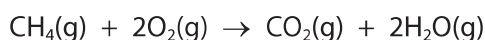
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**(Total for Question 2 = 6 marks)**

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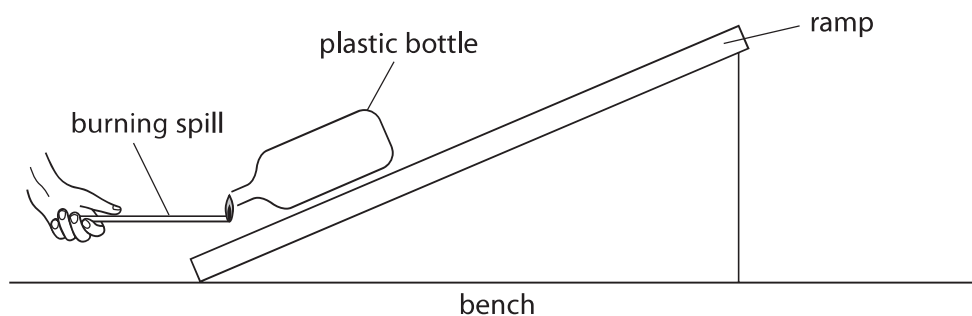


3 Methane reacts with oxygen in an exothermic reaction.



If a burning spill is placed near a mixture of methane and oxygen there is an explosion.

- A teacher fills a plastic bottle with a mixture of methane and oxygen.
- He places the bottle on a sloping ramp and then puts a burning spill near to the open end of the bottle.



- The explosion causes the bottle to move up the ramp and shoot off the end.
- The teacher measures the distance the bottle travels before it hits the bench.

The teacher wants to find the volumes of methane and oxygen that will send the bottle the greatest distance. He repeats the experiment using the same bottle, but changing the volumes of methane and oxygen.

The volume of the bottle is  $1000\text{ cm}^3$ .

The table shows his results.

Volume of methane used in $\text{cm}^3$	Volume of oxygen used in $\text{cm}^3$	Distance travelled by bottle in m
0	1000	0.00
100		2.50
200		5.00
600		5.00
800		2.50
1000		0.00

(a) Complete the table to show the volume of oxygen used in each experiment.

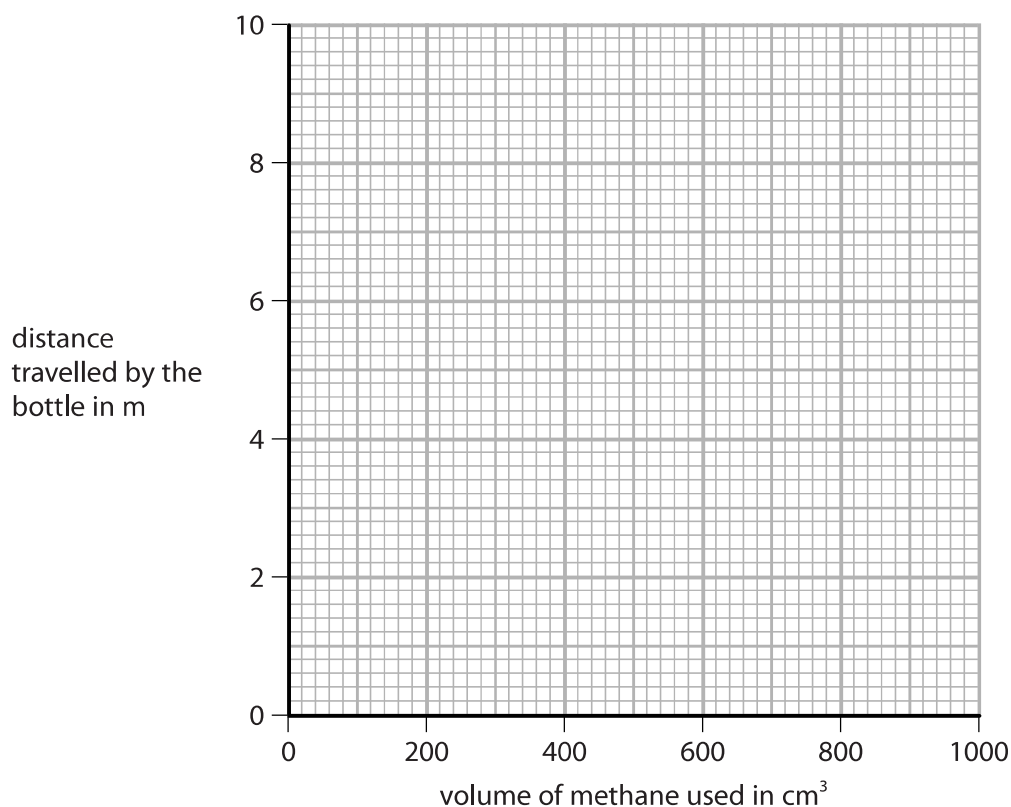
(1)



- (b) (i) Plot the teacher's results on the grid.

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

(3)



- (ii) Use the graph to determine the volume of methane needed to produce the greatest distance travelled by the bottle.

Show on the graph how you obtained your answer.

(2)

volume = ..... cm<sup>3</sup>

- (c) Suggest why the teacher should obtain more results between 200 cm<sup>3</sup> and 600 cm<sup>3</sup> of methane used.

(1)

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



S 6 0 1 0 7 A 0 7 2 0



4 This question is about ethanoic acid.

(a) What is the structural formula for ethanoic acid?

(1)

☐ A  $\text{CH}_3\text{CH}_2\text{OH}$

☐ B  $\text{HCOOCH}_3$

☐ C  $\text{CH}_3\text{COOH}$

☐ D  $\text{CH}_3\text{OCH}_3$

(b) An aqueous solution of ethanoic acid is weakly acidic.

What is a possible value for the pH of an aqueous solution of ethanoic acid?

(1)

☐ A 0

☐ B 5

☐ C 8

☐ D 14

(c) Effervescence occurs when an aqueous solution of ethanoic acid is added to solid sodium carbonate.

Which gas causes the effervescence?

(1)

☐ A ammonia

☐ B carbon dioxide

☐ C hydrogen

☐ D oxygen

(d) Ethanoic acid reacts with ethanol to form an ester.

Give the name of this ester.

(1)

(e) Draw the displayed formula of the functional group in esters.

(1)

(Total for Question 4 = 5 marks)





- 5 The table gives some information about the first four members of the homologous series of alcohols.

Name of alcohol	Molecular formula	Structural formula	Displayed formula
methanol	CH <sub>4</sub> O	CH <sub>3</sub> OH	
ethanol	C <sub>2</sub> H <sub>6</sub> O		<pre>       H   H             H — C — C — O — H                   H   H           </pre>
propanol		CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> OH	<pre>       H   H   H                 H — C — C — C — O — H                       H   H   H           </pre>
butanol	C <sub>4</sub> H <sub>10</sub> O	CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> OH	<pre>       H   H   H   H                     H — C — C — C — C — O — H                           H   H   H   H           </pre>

- (a) Complete the table by giving the missing information.

(3)

- (b) Ethanol is manufactured in industry by reacting ethene with steam in the presence of a catalyst.

- (i) Give the name of the catalyst used in this process.

(1)

- (ii) State the temperature and pressure used in this process.

(2)

temperature .....

pressure .....

(Total for Question 5 = 6 marks)



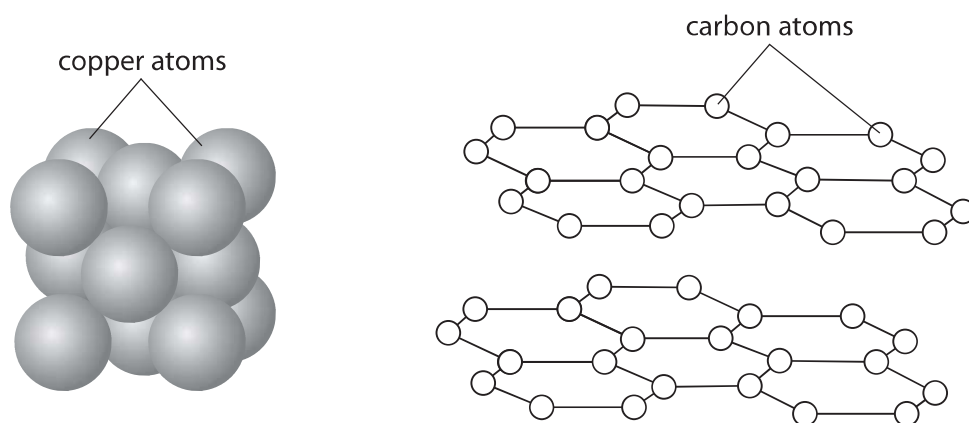
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6 Copper is a metal.

Graphite is a form of carbon and is a non-metal.

Both copper and graphite have high melting points and both conduct electricity.

The diagram shows the arrangement of the atoms in copper and in graphite.



(a) Describe, in terms of electrostatic attractions, the bonding between the atoms in copper and the bonding between the atoms in graphite.

(2)

copper .....

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graphite .....

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.....

(b) Explain how copper conducts electricity.

(2)

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(c) Explain why graphite has a high melting point.

(2)

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



S 6 0 1 0 7 A 0 1 1 2 0

- 7 The most common ore of chromium is chromite.

Chromite contains iron, chromium and oxygen in these proportions by mass.

Fe 25.0%    Cr 46.4%    O 28.6%

- (a) Show, by calculation, that the empirical formula of chromite is  $\text{FeCr}_2\text{O}_4$   
[The relative atomic masses are Fe = 56   Cr = 52   O = 16]

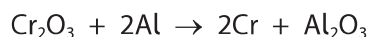
(3)

- (b) The stages involved in the extraction of chromium from chromite are

Stage 1   Chromite is reacted with potassium hydroxide, KOH, and oxygen to form potassium dichromate(VI),  $\text{K}_2\text{Cr}_2\text{O}_7$

Stage 2   Potassium dichromate(VI) is heated with carbon to form chromium(III) oxide,  $\text{Cr}_2\text{O}_3$ , potassium carbonate,  $\text{K}_2\text{CO}_3$ , and carbon monoxide.

Stage 3   Chromium(III) oxide is heated with aluminium.



- (i) Complete the equation for the reaction in stage 1.

(1)



- (ii) Write a chemical equation for the reaction in stage 2.

(1)



(2)

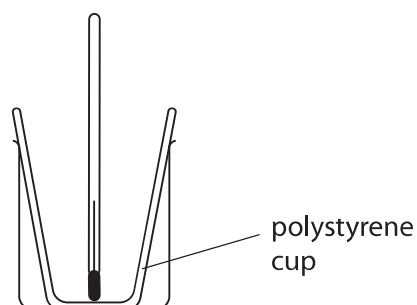
(2)

(1)

(1)

S 6 0 1 0 7 A 0 1 3 2 0

- 8 A student uses this apparatus to measure the temperature change when solid sodium hydrogencarbonate is added to an aqueous solution of citric acid.



This is her method.

- use a measuring cylinder to add  $35 \text{ cm}^3$  of  $1.00 \text{ mol/dm}^3$  citric acid to the polystyrene cup and record the initial temperature of the solution
- add 7 g (an excess) of solid sodium hydrogencarbonate and stir the mixture
- record the lowest temperature reached

The table shows her results.

Initial temperature of the solution in $^{\circ}\text{C}$	21.0
Lowest temperature reached by the mixture in $^{\circ}\text{C}$	4.1

- (a) Show that the heat energy change ( $Q$ ) during this reaction is about 2500 J.  
[assume  $1 \text{ cm}^3$  of solution has a mass of 1 g and  $c$  for the solution =  $4.18 \text{ J/g}^{\circ}\text{C}$ ]

(3)

$Q = \dots\dots\dots \text{ J}$



- (b) Calculate the enthalpy change for the reaction,  $\Delta H$ , in kilojoules per mole of citric acid.

Include a sign in your answer.

(3)

$\Delta H =$  ..... kJ/mol

- (c) Draw an energy level diagram for the reaction between citric acid and sodium hydrogencarbonate.

(3)

- (d) Explain why it is better to use a burette rather than a measuring cylinder to measure the volume of aqueous citric acid.

(2)

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(Total for Question 8 = 11 marks)



S 6 0 1 0 7 A 0 1 5 2 0



- 9 A student is asked to find the concentration of a solution of sulfuric acid.

He plans to titrate a known volume of sulfuric acid in a conical flask with  $0.400 \text{ mol/dm}^3$  sodium hydroxide solution using phenolphthalein as an indicator.

- (a) Describe how to do this titration.

Assume all glassware is clean and does not need rinsing.

(5)

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- (b) (i) In this titration,  $23.85 \text{ cm}^3$  of the sodium hydroxide solution are needed to neutralise the sulfuric acid.

Calculate the amount, in moles, of NaOH in  $23.85 \text{ cm}^3$  of the sodium hydroxide solution.

(2)

amount = ..... mol

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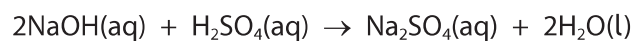
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(ii) The student used 25.0 cm<sup>3</sup> of sulfuric acid in his titration.

The equation for the reaction is



Calculate the concentration, in mol/dm<sup>3</sup>, of the sulfuric acid.

(3)

concentration = ..... mol/dm<sup>3</sup>

(c) A solution of sodium sulfate is formed by neutralising some dilute sulfuric acid with aqueous sodium hydroxide.

Describe, using the method of crystallisation, how you would obtain a pure, dry sample of sodium sulfate from this solution.

(4)

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(Total for Question 9 = 14 marks)

**TOTAL FOR PAPER = 70 MARKS**



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