

Write your name here

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Other names

**Pearson Edexcel  
International GCSE**

Centre Number

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Candidate Number

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# Chemistry

**Unit: 4CH0**

**Paper: 2CR**

Tuesday 9 June 2015 – Afternoon

**Time: 1 hour**

Paper Reference

**4CH0/2CR**

**You must have:**

Ruler, calculator

Total Marks

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## 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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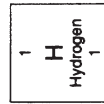
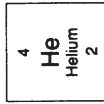


**PEARSON**

# THE PERIODIC TABLE

Period 1 2 3 4 5 6 7 0

Group



7	Li	Lithium	3	9	Be	Beryllium	4	11	B	Boron	5	12	C	Carbon	6	14	Si	Silicon	14	15	P	Phosphorus	16	S	Sulfur	17	Cl	Chlorine	18	Ar	Argon	18			
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	39	K	Potassium	19	40	Ca	Calcium	20
86	Rb	Rubidium	37	88	Sr	Strontium	38	89	Y	Yttrium	39	91	Zr	Zirconium	40	93	Nb	Niobium	41	94	Mo	Molybdenum	42	96	Cr	Chromium	24	51	V	Vanadium	23	48	Ti	Titanium	22
133	Cs	Caesium	55	137	Ba	Barium	56	139	La	Lanthanum	57	179	Hf	Hafnium	72	181	Ta	Tantalum	73	182	W	Tungsten	74	192	Ir	Iridium	77	195	Pt	Platinum	78	197	Au	Gold	79
223	Fr	Francium	87	226	Ra	Radium	88	227	Ac	Actinium	89	201	Hg	Mercury	80	204	Tl	Thallium	81	207	Pb	Lead	82	209	Bi	Bismuth	83	210	Po	Polonium	84	210	At	Astatine	85
112	Cd	Cadmium	48	112	Zn	Zinc	30	65	Zn	Zinc	30	63.5	Cu	Copper	29	59	Ni	Nickel	28	59	Co	Cobalt	27	56	Fe	Iron	26	55	Mn	Manganese	25	56	Fe	Iron	26
108	Ag	Silver	47	108	Ag	Silver	47	106	Pd	Palladium	46	103	Rh	Rhodium	45	101	Ru	Ruthenium	44	101	Ru	Ruthenium	44	103	Rh	Rhodium	45	106	Pd	Palladium	46	112	Cd	Cadmium	48
127	I	Iodine	53	127	I	Iodine	53	122	Sb	Antimony	51	119	Sn	Tin	50	115	In	Indium	49	115	In	Indium	49	119	Sn	Tin	50	122	Sb	Antimony	51	128	Te	Tellurium	52
131	Xe	Xenon	54	131	Xe	Xenon	54	122	Sb	Antimony	51	119	Sn	Tin	50	115	In	Indium	49	115	In	Indium	49	119	Sn	Tin	50	122	Sb	Antimony	51	128	Te	Tellurium	52
84	Kr	Krypton	36	84	Kr	Krypton	36	73	Ge	Germanium	32	73	Ge	Germanium	32	75	As	Arsenic	33	75	As	Arsenic	33	79	Se	Selenium	34	80	Br	Bromine	35	84	Kr	Krypton	36
20	Ne	Neon	10	20	Ne	Neon	10	70	Ga	Gallium	31	70	Ga	Gallium	31	75	As	Arsenic	33	75	As	Arsenic	33	79	Se	Selenium	34	80	Br	Bromine	35	84	Kr	Krypton	36

Key

Relative atomic mass
Symbol
Name
Atomic number



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**Answer ALL questions.**

**1** An atom of an element has an atomic number of 6 and a mass number of 12.

(a) Using this information, complete the table to show the numbers of protons, neutrons and electrons in one atom of this element.

(2)

number of protons	
number of neutrons	
number of electrons	

(b) The Periodic Table shows the positions of five elements, J, Q, T, X and Z.

The letters do **not** represent the symbols for the elements.

Period	1	2	Group										3	4	5	6	7	0	
1																			
2	J																		Q
3	T																		
4														X		Z			
5																			
6																			

(i) How many electrons are there in the outer shell of an atom of X?

(1)

(ii) There are 31 protons in an atom of X.

Using this information, explain how many protons there are in an atom of Z.

(2)

.....

.....

.....

.....

.....



(iii) What is the electronic configuration of an atom of Q?

(1)

(iv) State one similarity and one difference between the electronic configurations of atoms of J and T.

(2)

similarity .....

difference .....

**(Total for Question 1 = 8 marks)**



2 Ethene is an unsaturated hydrocarbon.

(a) (i) The molecular formula of ethene is

(1)

- A  $\text{CH}_4$
- B  $\text{C}_2\text{H}_6$
- C  $\text{C}_2\text{H}_4$
- D  $\text{C}_3\text{H}_6$

(ii) Ethene is bubbled into bromine water until there is no further change.

What is the appearance of the solution formed?

(1)

- A brown
- B colourless
- C purple
- D red

(iii) Ethene can be formed from ethanol.

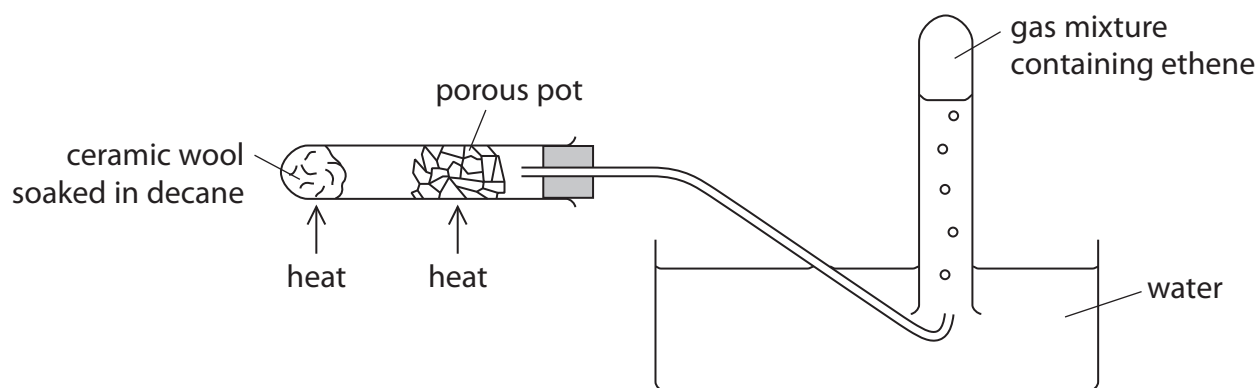
This type of reaction is called

(1)

- A dehydration
- B oxidation
- C reduction
- D substitution



(b) This apparatus can be used to decompose decane ( $C_{10}H_{22}$ ).



(i) What name is given to this type of thermal decomposition?

(1)

(ii) Porous pot contains oxides such as silica and alumina.

What is the purpose of the porous pot in this experiment?

(1)

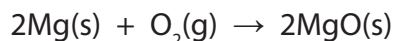
(iii) Suggest why the gas collected is a mixture and not pure ethene.

(1)

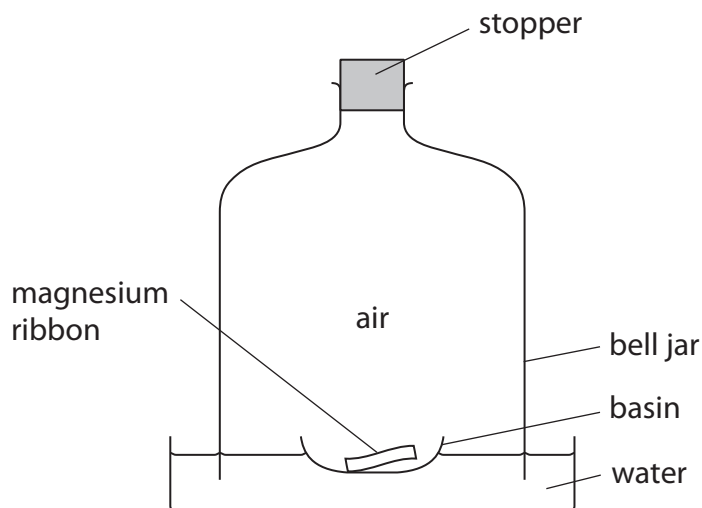
**(Total for Question 2 = 6 marks)**



3 Magnesium reacts with oxygen in the air to form magnesium oxide.



The apparatus in the diagram can be used to investigate the decrease in the volume of gas when magnesium burns in air.



The stopper is removed and the magnesium is lit. The stopper is then quickly replaced.

After the flame goes out there is some magnesium left in the basin.

After the apparatus has cooled to its original temperature, the water level in the bell jar is higher than shown in the diagram.

(a) What is the colour of the flame produced when the magnesium burns? (1)

(b) What is the colour of the solid produced when the magnesium burns? (1)





(c) The volume of air in the bell jar at the start of the experiment is  $1000 \text{ cm}^3$ .

Calculate the volume of gas you would expect to remain in the bell jar at the end of the experiment. Assume all the oxygen in the air is used up.

(2)

volume of gas remaining = .....  $\text{cm}^3$

(d) In another experiment, the mass of magnesium that burned was  $0.12 \text{ g}$ .

Calculate the maximum mass of magnesium oxide that could be formed in this experiment.

(2)

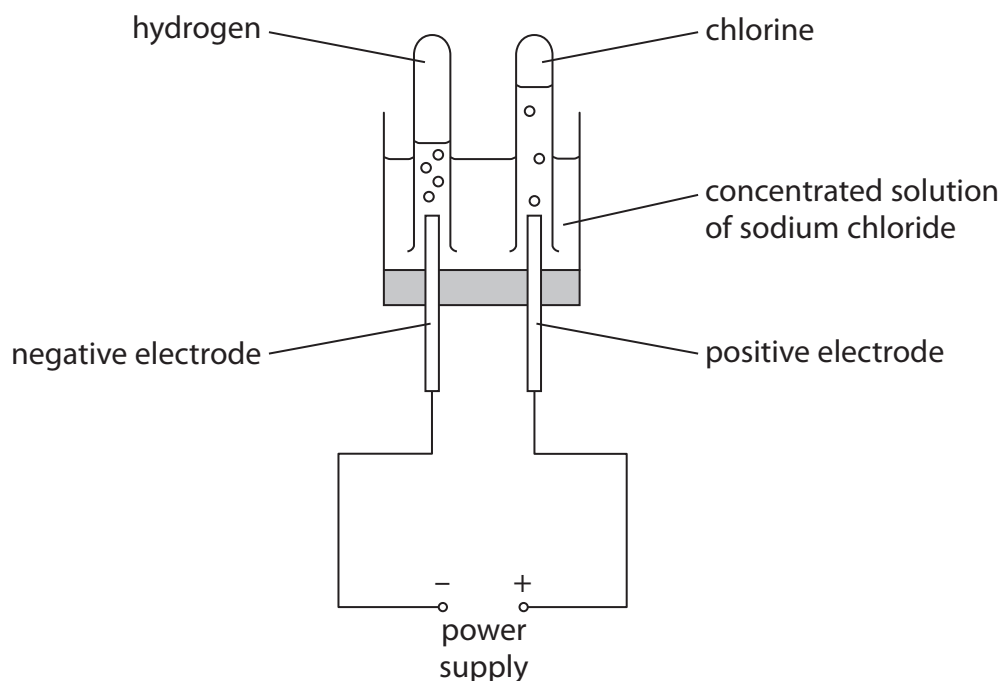
mass of magnesium oxide formed = ..... g

**(Total for Question 3 = 6 marks)**

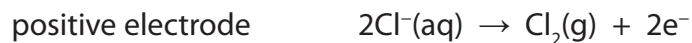
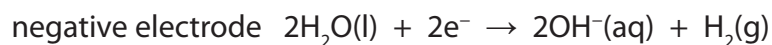
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4 This apparatus is used to electrolyse a concentrated solution of sodium chloride.



(a) The ionic half-equations for the reactions at the electrodes are



(i) State how these ionic half-equations show that equal volumes of the two gases should be collected.

(1)

.....

.....

.....

(ii) Suggest why the volume of chlorine collected is less than expected.

(1)

.....

.....

.....



(iii) A sample of the solution near to the negative electrode is tested with phenolphthalein indicator.

Explain why the phenolphthalein turns pink.

(2)

.....

.....

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.....

(b) The table shows two methods of testing for chlorine.

Complete the table by giving the observation made in each test.

(2)

Test	Observation
add damp blue litmus paper	
bubble chlorine into a solution of potassium iodide	

(c) (i) State why chlorine is sometimes added to water supplies.

(1)

.....

.....

(ii) Chlorine is used to manufacture hydrogen chloride gas, HCl(g).

Write a chemical equation to show the formation of hydrogen chloride from hydrogen and chlorine.

(1)

.....

.....

(iii) How is hydrogen chloride gas converted into hydrochloric acid?

(1)

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.....

**(Total for Question 4 = 9 marks)**



5 A teacher investigates the temperature changes that occur when sodium hydroxide solution is added to dilute hydrochloric acid.

This is the method she uses.

- place some of the acid in a glass beaker and measure its temperature
- add a known volume of sodium hydroxide solution
- stir the mixture and record the highest temperature reached
- repeat the experiment with different volumes of sodium hydroxide solution

(a) State two factors that the teacher must keep constant to make this a valid investigation (a fair test).

(2)

1 .....

2 .....

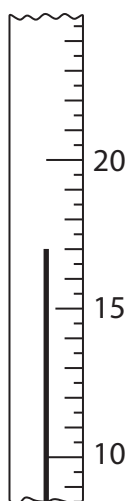
(b) Explain how the use of a polystyrene cup, in place of a glass beaker, will affect the accuracy of the results.

(2)

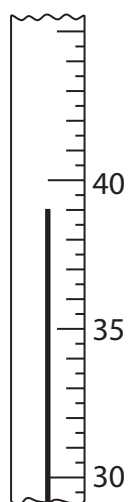
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(c) (i) The diagram shows the thermometer readings for one of the experiments.



initial temperature



final temperature

Record the temperatures and calculate the temperature change.

(3)

final temperature of mixture	..... °C
initial temperature of acid	..... °C
temperature change	..... °C

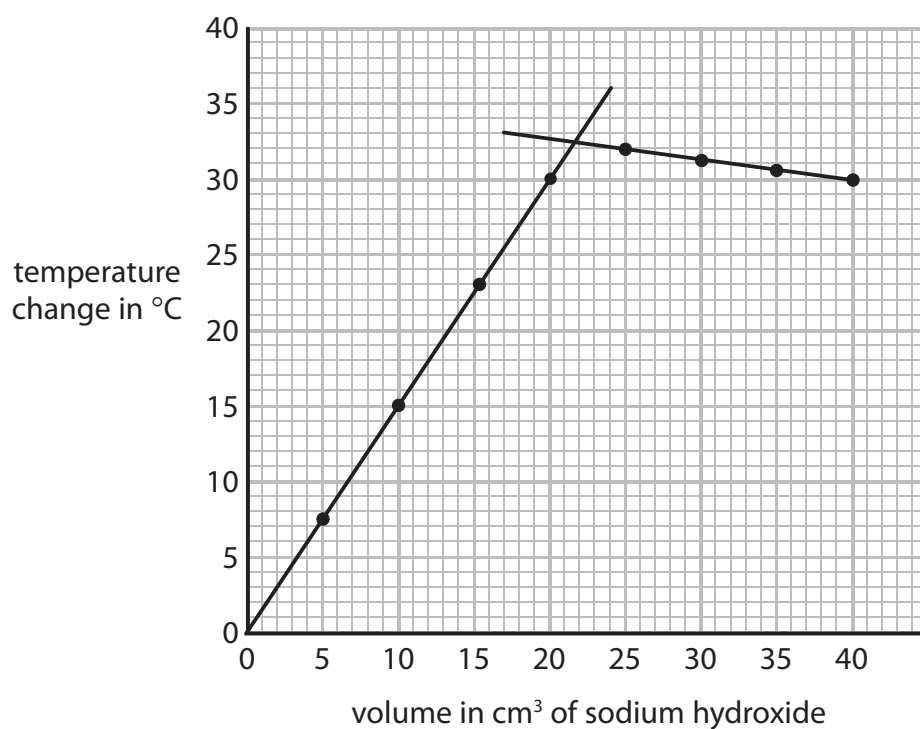
(ii) State how the temperature change shows whether the reaction between sodium hydroxide and hydrochloric acid is exothermic or endothermic.

(1)

.....  
.....



(d) The graph shows the result of the teacher's investigation.



Explain the shape of the graph.

(2)

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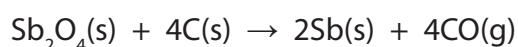
**(Total for Question 5 = 10 marks)**



6 This question is about the reactions of compounds of antimony and phosphorus.

(a) Antimony (Sb) can be obtained from its oxide ( $\text{Sb}_2\text{O}_4$ ) by heating it with carbon.

The equation for this reaction is



(i) Give the name of the gas produced in this reaction.

(1)

(ii) State why this gas is poisonous to humans.

(1)

(b) Phosphorus sulfide ( $\text{P}_4\text{S}_3$ ) is one of the reactants used in match heads.

When a match is struck, energy is transferred to the reactants in the match head, starting a reaction.

(i) Balance the equation that represents this reaction.

(2)



(ii) What term is used to describe the energy required to start a reaction?

(1)

**(Total for Question 6 = 5 marks)**



7 Bromine and iodine are halogens.

(a) Complete the table by giving the colour and physical state of each of these halogens at room temperature.

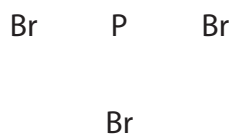
(2)

Halogen	Colour	Physical state
bromine	red-brown	
iodine		solid

(b) Bromine reacts with phosphorus to form the covalent compound phosphorus tribromide.

Draw a dot and cross diagram to show the outer electrons in a molecule of phosphorus tribromide.

(2)



(c) Phosphorus tribromide reacts with water to form a mixture of two acids, HBr and  $\text{H}_3\text{PO}_3$

Write a chemical equation for this reaction.

(2)

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(Total for Question 7 = 6 marks)

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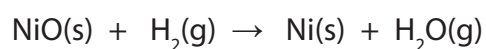
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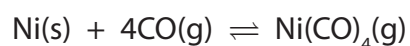
**8** Nickel is an important metal.

(a) Three of the stages in the extraction of nickel from its ore are

stage 1 nickel(II) oxide is reduced by heating with  $\text{H}_2$  to produce impure nickel



stage 2 the impure nickel is reacted with CO



stage 3  $\text{Ni(CO)}_4$  is decomposed by heating to produce pure nickel



(i) State why the reaction in stage 1 is described as reduction.

(1)

.....

.....

(ii) Suggest why a low temperature produces a high yield of  $\text{Ni(CO)}_4$  in stage 2.

(2)

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.....



(b) Nickel has a melting point of 1455 °C and is a good conductor of electricity.

(i) Draw a labelled diagram to show the arrangement of the particles in nickel.

(3)

(ii) Explain, in terms of its structure, why nickel is malleable and is a good conductor of electricity.

(4)

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**(Total for Question 8 = 10 marks)**

**TOTAL FOR PAPER = 60 MARKS**



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