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Write your name here

Surname	Other names

Pearson Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry

Unit: 4CH0
Paper: 2CR

Tuesday 9 June 2015 – Afternoon
Time: 1 hour

Paper Reference
4CH0/2CR

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 ▶

P44270A

1/1/1/1/1/

P 4 4 2 7 0 A 0 1 2 0

PEARSON

THE PERIODIC TABLE

Period	1	2					Group						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 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.

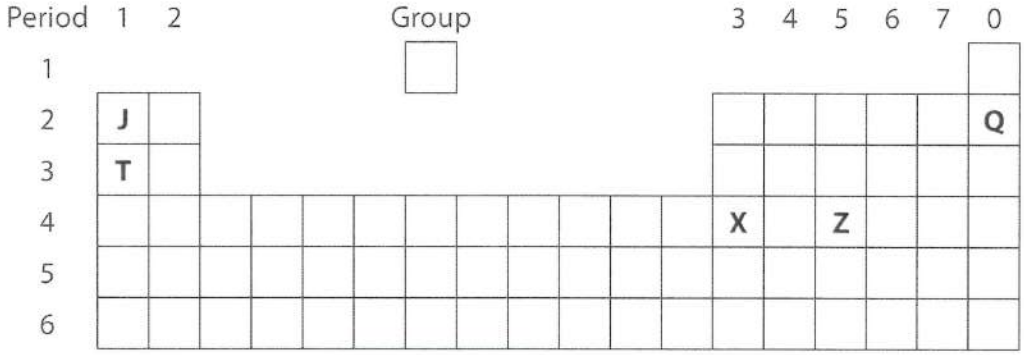
(2)

number of protons	6
number of neutrons	6
number of electrons	6

1.15

(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.



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

(1)

3

1.18

(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)

1.18

33, Z in group 5 and X in group 3

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

(1)

1.19

2.8

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

(2)

1.22

similarity Same no. of electrons in outer shell

difference Different no. of electron shells

(Total for Question 1 = 8 marks)

2 Ethene is an unsaturated hydrocarbon.

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

(1)

4.02

- ☐ **A** CH_4
- ☐ **B** C_2H_6
- ☒ **C** C_2H_4
- ☐ **D** C_3H_6

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

What is the appearance of the solution formed?

(1)

4.28

- ☐ **A** brown
- ☒ **B** colourless
- ☐ **C** purple
- ☐ **D** red

(iii) Ethene can be formed from ethanol.

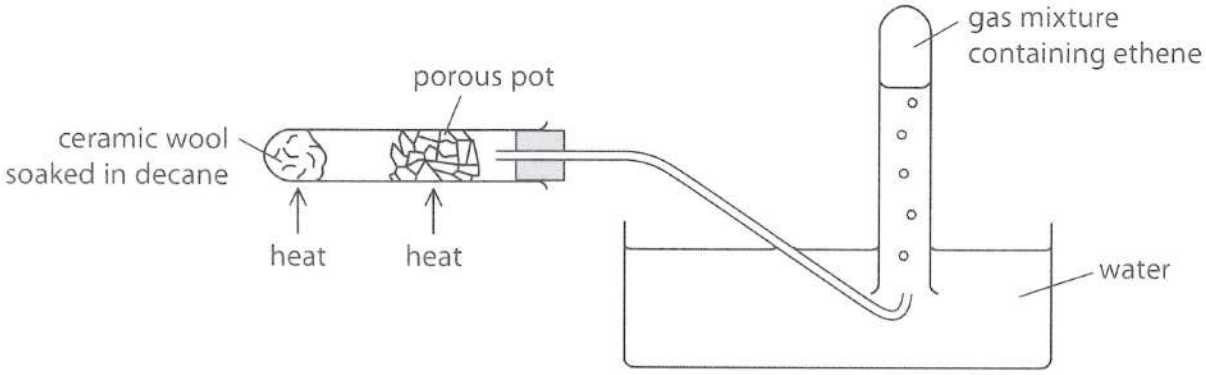
This type of reaction is called

(1)

NOT IN SPEC

- ☒ **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?

4.17

(1)

cracking

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

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

(1)

4.17

Act as a catalyst

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

(1)

4.17

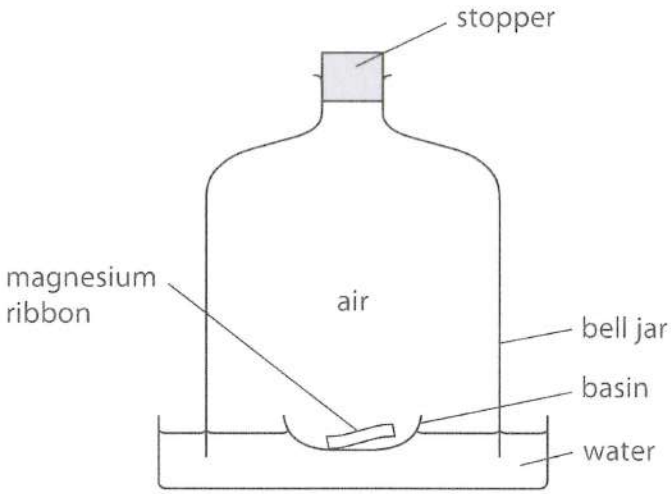
other products formed

(Total for Question 2 = 6 marks)

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

$$2Mg(s) + O_2(g) \rightarrow 2MgO(s)$$

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.

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

(1)

White

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

(1)

White

(c) The volume of air in the bell jar at the start of the experiment is 1000 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)

1.34C

$(O_2)V = \frac{1000 \times 21}{100}$

$= 210 cm^3$

$V(\text{Remaining}) = 1000 - 210$

$= 790 cm^3$

volume of gas remaining = 790 cm^3

(d) In another experiment, the mass of magnesium that burned was 0.12 g.

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

(2)

1.34C

$n(Mg) = \frac{0.12}{24}$

$= 0.0050 mol$

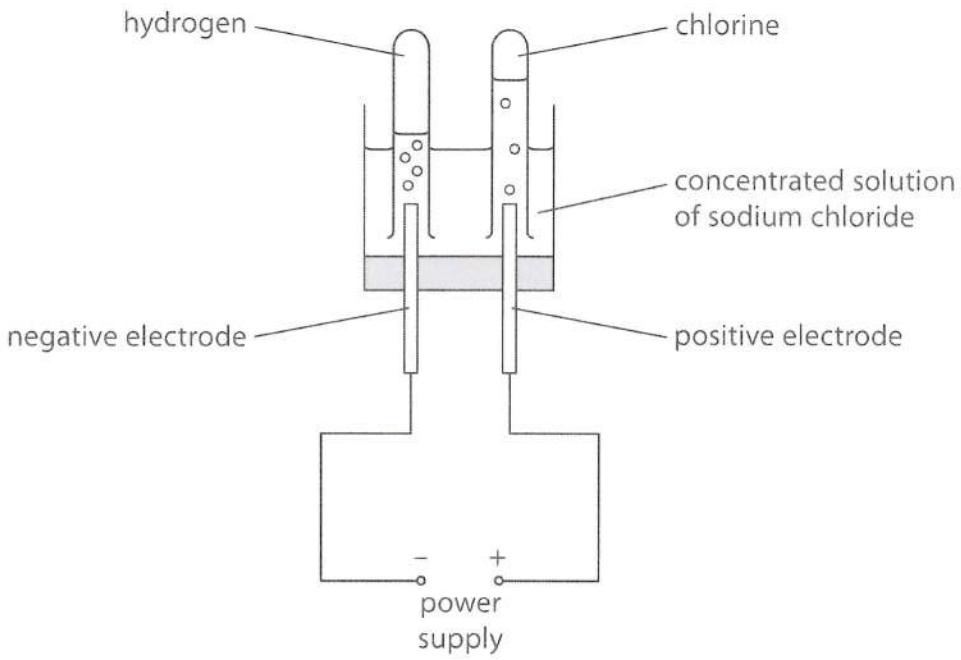
$\text{Mass} = 0.0050 \times 40$

$= 0.20 g$

mass of magnesium oxide formed = 0.20 g

(Total for Question 3 = 6 marks)

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

negative electrode $2H_2O(l) + 2e^- \rightarrow 2OH^-(aq) + H_2(g)$

positive electrode $2Cl^-(aq) \rightarrow Cl_2(g) + 2e^-$

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

1.60C

(1)

• No. of molecules equal

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

1.60C

(1)

chlorine soluble in water

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

Explain why the phenolphthalein turns pink.

2.28

(2)

• Solution alkaline as OH^- formed

(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	Bleaches
bubble chlorine into a solution of potassium iodide	Brown ppt

2.44

2.07

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

(1)

2.05

Sterilise the water

(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)

1.25

$H_2 + Cl_2 \rightarrow 2HCl$

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

(1)

0.00

Dissolved in water

(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).

ANY 2

3.08

(2)

1 • Volume of acid • Concentration of acid • Rate of Stirring

2 • concentration of alkali • Starting temp

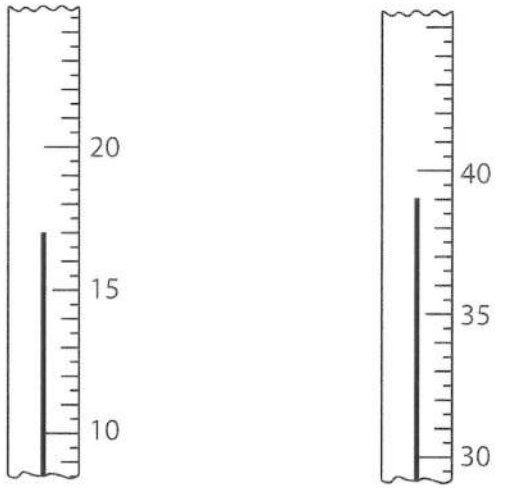
(b) Explain how the use of a polystyrene cup, in place of a glass beaker, will affect the accuracy of the results.

3.08

(2)

Accuracy improved as polystyrene reduces heat loss

(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)

3.08

final temperature of mixture	39.0 °C
initial temperature of acid	17.0 °C
temperature change	22.0 °C

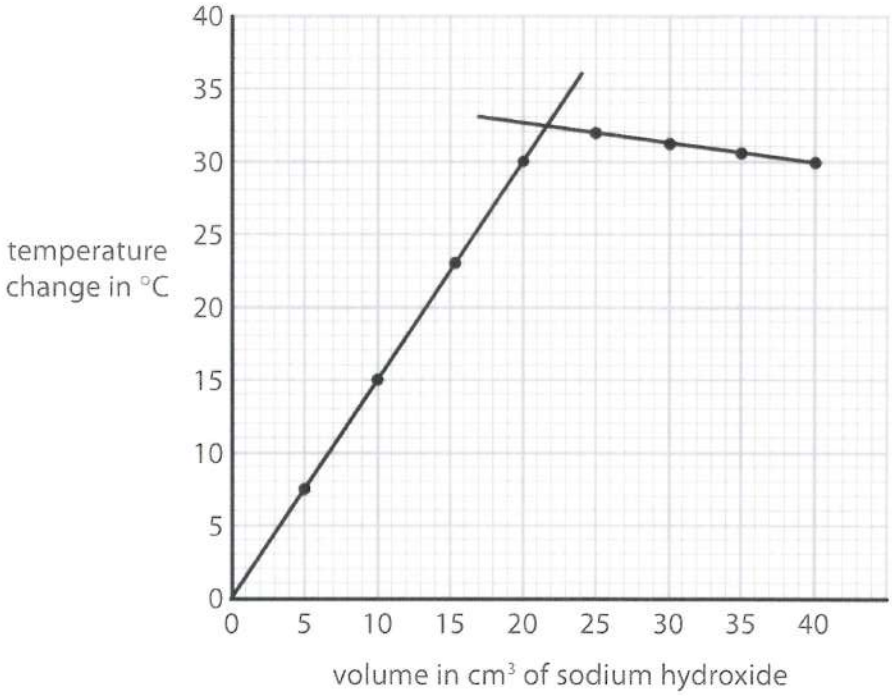
(ii) State how the temperature change shows whether the reaction between sodium hydroxide and hydrochloric acid is exothermic or endothermic.

3.01

(1)

Exothermic and temperature increased

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



Explain the shape of the graph. ANY 2

(2)

3.08

- Positive gradient, acid being neutralised
- Lines intersect, neutralisation point reached
- Negative gradient, Sodium hydroxide absorbs heat

(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 (Sb_2O_4) by heating it with carbon.

The equation for this reaction is

$$Sb_2O_4(s) + 4C(s) \rightarrow 2Sb(s) + 4CO(g)$$

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

(1)

4.13

carbon monoxide

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

(1)

4.13

decreases capacity of blood to transport oxygen

(b) Phosphorus sulfide (P_4S_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)

1.25

$6KClO_3(s) + \ldots S(s) + \ldots P_4S_3(s) \rightarrow \ldots 6 \ldots KCl(s) + \ldots 4 \ldots SO_2(g) + \ldots P_4O_{10}(s)$

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

(1)

3.13

Activation

(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	liquid
iodine	black	solid

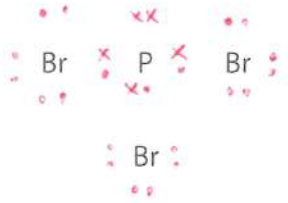
2.05

(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)

1.46



(c) Phosphorus tribromide reacts with water to form a mixture of two acids, HBr and H_3PO_3

Write a chemical equation for this reaction.

(2)

1.25

$PBr_3 + 3H_2O \rightarrow 3HBr + H_3PO_3$

(Total for Question 7 = 6 marks)

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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 H_2 to produce impure nickel

$$NiO(s) + H_2(g) \rightarrow Ni(s) + H_2O(g)$$

stage 2 the impure nickel is reacted with CO

$$Ni(s) + 4CO(g) \rightleftharpoons Ni(CO)_4(g)$$

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

$$Ni(CO)_4(g) \rightarrow Ni(s) + 4CO(g)$$

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

(1)

2.20 Ni lost oxygen OR Ni ions gain electrons

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

(2)

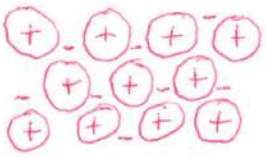
3.22C
- Eqm shifts to right
- Forward reaction exothermic

(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)

1.52C



+ Nickel ion
- Electron

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

1.54C

(4)

(M1) (M2)
• Layers of ions slide over each other

• Delocalised electrons can flow/move
(M3) (M4)

(Total for Question 8 = 10 marks)

TOTAL FOR PAPER = 60 MARKS

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