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Surname		Other names	
Pearson Edexcel		Centre Number	Candidate Number
International GCSE		<div style="border: 1px solid black; width: 40px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; display: inline-block;"></div>	<div style="border: 1px solid black; width: 40px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; display: inline-block;"></div> <div style="border: 1px solid black; width: 40px; height: 20px; display: inline-block;"></div>
<h1 style="margin: 0;">Chemistry</h1> <p style="margin: 5px 0;">Unit: 4CH0</p> <p style="margin: 5px 0;">Paper: 2C</p>			
Wednesday 17 January 2018 – Afternoon		Paper Reference	
Time: 1 hour		4CH0/2C	
You must have: 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.
- 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 ►

P53146A

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THE PERIODIC TABLE

Period 1 2 3 4 5 6 7 0

Group

1

1
H
Hydrogen
1

4
He
Helium
2

7 Li Lithium 3	9 Be Beryllium 4
23 Na Sodium 11	24 Mg Magnesium 12
39 K Potassium 19	40 Ca Calcium 20
86 Rb Rubidium 37	88 Sr Strontium 38
133 Cs Caesium 55	137 Ba Barium 56
223 Fr Francium 87	226 Ra Radium 88
	227 Ac Actinium 89

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
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
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

11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
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
70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86

Key

Relative atomic
mass
Symbol
Name
Atomic number

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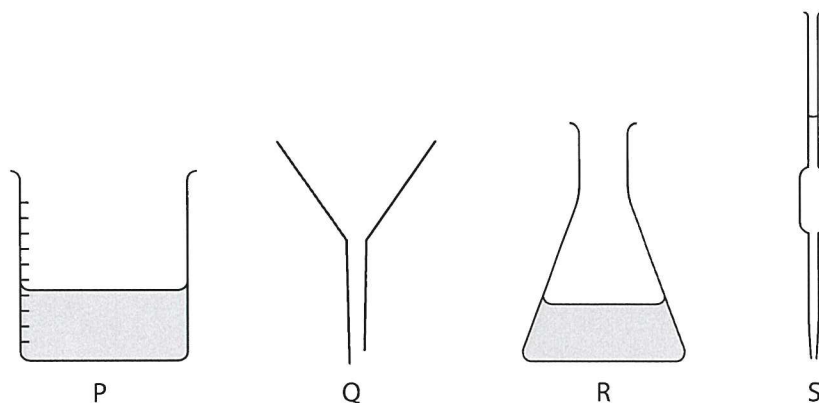
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Answer ALL questions.

1 These pieces of apparatus are used in chemistry experiments.



(a) Name these pieces of apparatus.

(4)

P Beaker
Q Funnel
R Conical flask
S Pipette

(b) Apparatus P contains dilute hydrochloric acid.

Litmus indicator is added to this acid.

What is the final colour of the litmus?

(1)

☐ A blue ☐ B green ☐ C orange ☒ D red

(c) Apparatus R contains potassium hydroxide solution.

Litmus indicator is added to this alkaline solution.

What is the final colour of the litmus?

(1)

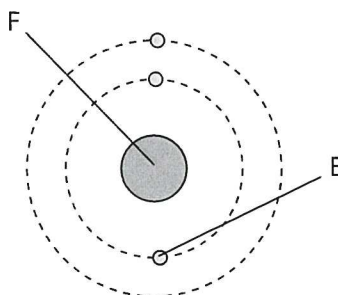
☒ A blue ☐ B green ☐ C orange ☐ D red

(Total for Question 1 = 6 marks)



P 5 3 1 4 6 A 0 3 1 6

2 The diagram shows an atom of lithium with atomic number 3 and mass number of 6.



(a) Name the particle labelled E.

(1)

Electron

(b) Name the part of the atom labelled F.

(1)

Nucleus

(c) Name the two types of particle found in part F.

(2)

1. Proton

2. Neutron



(d) Another type of lithium atom has atomic number 3 and mass number 7.

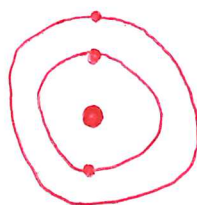
- (i) State the name given to atoms with the same atomic number but different mass numbers.

(1)

Isotope

- (ii) Draw a diagram to show the arrangement of electrons in an atom of lithium with atomic number 3 and mass number 7.

(1)



- (e) A sample of lithium contains 92.5% of atoms with mass number 7 and 7.5% of atoms with mass number 6.

Calculate the relative atomic mass of lithium.

(2)

$$\begin{aligned} M_r &= \frac{(92.5 \times 7) + (7.5 \times 6)}{100} \\ &= 6.9 \end{aligned}$$

relative atomic mass = 6.9

(Total for Question 2 = 8 marks)



P 5 3 1 4 6 A 0 5 1 6

2.32

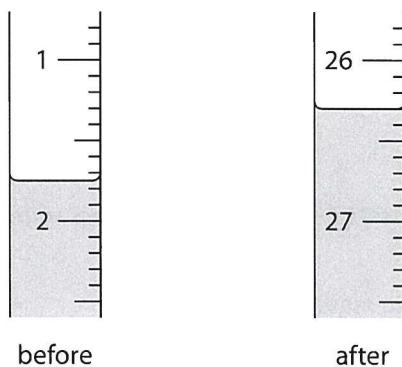
- 3 A student is provided with a solution of dilute sulfuric acid and a solution of sodium hydroxide. The student does a titration using 25.0 cm^3 of the sodium hydroxide solution.

She adds the acid from a burette.

- (a) Which type of reaction occurs between dilute sulfuric acid and sodium hydroxide? (1)

- ☐ A displacement
☒ B neutralisation
☐ C precipitation
☐ D redox

- (b) The diagram shows the student's burette readings for the titration.



- (i) Use the readings to complete the table, giving all values to the nearest 0.05 cm^3 . (3)

burette reading after adding acid	26.30
burette reading before adding acid	1.75
volume in cm^3 of acid added	24.55

2.33C



(ii) Explain why the student needs to repeat the titration in order to obtain a reliable value for the volume of acid required to react exactly with 25.0 cm^3 of sodium hydroxide solution.

(2)

- To obtain concordant results
- Identify anomalous results
- Calculate mean of concordant results

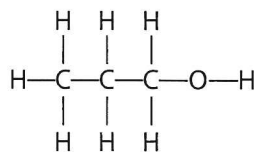
2.33C

(Total for Question 3 = 6 marks)



P 5 3 1 4 6 A 0 7 1 6

- 4 (a) This is the displayed formula of an organic compound, X.



- (i) Give the molecular formula of compound X.

(1)



- (ii) A student describes compound X as a saturated hydrocarbon.

Explain whether the student is correct.

(3)

- Correct as X only contains single bonds
- Not correct as X contains oxygen as a hydrocarbon contains H and C only

- (b) Compound X and ethanol are members of the homologous series of alcohols.

One property of members of a homologous series is that they have similar chemical reactions.

Give one other property of members of a homologous series.

(1)

Trends in physical properties

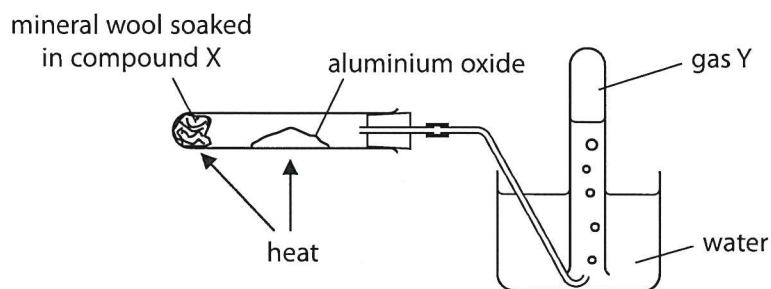
Also

- Have a general formula
- successive members differ by CH_2
- same functional group



(c) This apparatus is used for a dehydration reaction using compound X.

This reaction is similar to the dehydration reaction of ethanol.



The reaction produces gas Y and one other product.

(i) State the purpose of the aluminium oxide.

(1)

Catalyst

3.09

(ii) State a property of gas Y that allows it to be collected over water.

(1)

Insoluble

0.00

(iii) Give a reason why the first sample of gas Y collected is not pure.

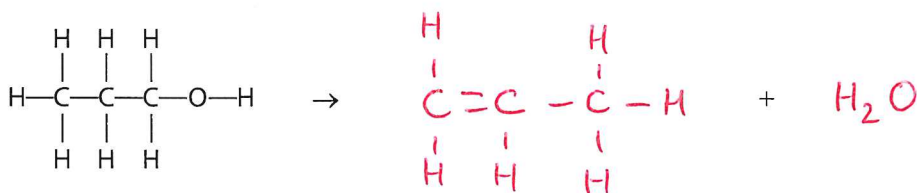
(1)

Contains air

0.00

(iv) Complete the equation for the dehydration reaction showing the displayed formula of gas Y and the molecular formula of the other product.

(2)



4.26

(v) Give the name of gas Y.

(1)

Propene

4.26

(Total for Question 4 = 11 marks)



P 5 3 1 4 6 A 0 9 1 6

5 Chromium is a shiny metal that has many uses.

Most chromium is extracted from the ore chromite, FeCr_2O_4

(a) Complete the table by giving the names of the elements in FeCr_2O_4

(1)

Chemical symbol	Name of element
Fe	Iron
Cr	chromium
O	Oxygen

(b) In the extraction process, chromite is converted into chromium(III) oxide, Cr_2O_3

Chromium is made by this reaction

chromium oxide + aluminium \rightarrow chromium + aluminium oxide

(i) Write a chemical equation for this reaction.

(2)



(ii) Explain what the reaction shows about the reactivity of chromium compared to the reactivity of aluminium.

(2)

• Aluminium displaces chromium
∴ Aluminium is more reactive

(iii) Explain why the reaction between chromium oxide and aluminium is described as a redox reaction.

(2)

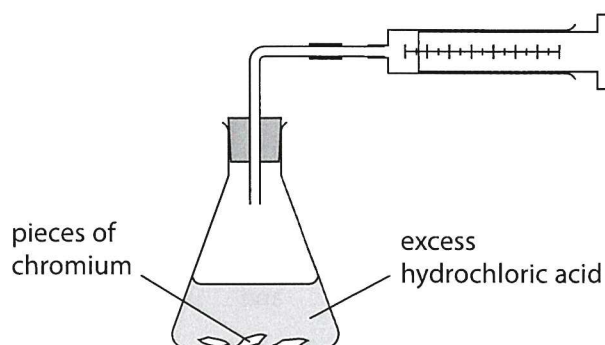
ANY TWO

• Redox means both reduction + oxidation
• Chromium reduced and Aluminium oxidised
• chromium loses oxygen and Aluminium gains oxygen



(c) Chromium metal reacts with dilute hydrochloric acid to form hydrogen gas.

This apparatus is used to investigate the reaction.



The equation for the reaction is



A student adds 0.13 g of a sample of chromium metal to excess dilute hydrochloric acid.

- (i) Calculate the maximum volume of hydrogen gas that the student could produce in this experiment at room temperature and pressure (rtp).

[molar volume of a gas is 24 dm^3 at rtp]

$$\text{Mol} = \frac{\text{Mass}}{\text{Mr}}$$

$$\text{Mol (Cr)} = \frac{0.13}{52}$$

Ratio 1:1

$$= 0.0025 \text{ mol}$$

$$\begin{aligned} \text{Volume (H}_2\text{)} &= 0.0025 \times 24 \\ &= 0.060 \text{ dm}^3 \end{aligned}$$

$$\text{maximum volume} = 0.060 \text{ dm}^3$$

- (ii) The student does the experiment at rtp and finds that the volume collected is less than the calculated maximum.

Give two possible reasons for this.

ANY TWO

1. Chromium impure
- Less than 0.13g Cr used / not excess acid
2. Reaction not completed / volume measured early
- Gas leakage
- Gas dissolved in acid/solution

(Total for Question 5 = 12 marks)



P 5 3 1 4 6 A 0 1 1 1 6

6 Lithium fluoride, LiF, and magnesium oxide, MgO, are ionic compounds.

(a) (i) Calculate the relative formula mass (M_r) of MgO.

$$M_r = 24 + 16 \\ = 40$$

(1)

$$M_r = 40$$

(ii) Give the formulae of the two ions in LiF.

(1)

Li^+

and

F^-

(b) Explain why

- ionic compounds have high melting points
- the melting point of magnesium oxide is much higher than the melting point of lithium fluoride

ANY FOUR

(4)

(M1)

• Strong electrostatic forces between oppositely charged ions (M2)

(M3)

• Large amount of energy needed to overcome attraction

• Greater charge on $\text{Mg}^{2+} / \text{O}^{2-}$ (M4)

∴ Stronger attraction OR More energy required to overcome attraction (M5)



(c) Explain why ionic compounds do not conduct electricity when solid, but do conduct electricity when molten or in aqueous solution.

(2)

- (solid) ions in fixed positions so only vibrate
- (molten or solution) ions can move

(Total for Question 6 = 8 marks)

1.43

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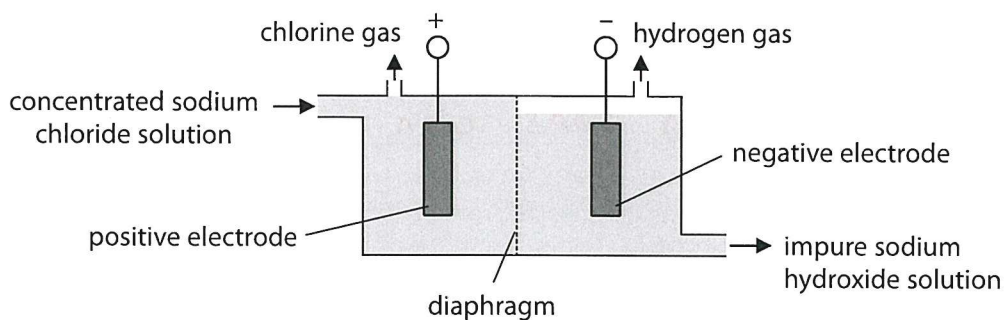
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- 7 The diagram shows the electrolysis of concentrated sodium chloride solution in a diaphragm cell.



- (a) (i) The ionic half-equation for the reaction at the positive electrode is



Use this equation to explain why oxidation occurs at the positive electrode.

(2)

- Oxidation is loss of electrons
- Cl^- lose electrons

- (ii) At the negative electrode, water molecules gain electrons to form hydroxide ions and hydrogen gas.

Complete the ionic half-equation for this reaction.

(2)



- (b) Chlorine reacts with sodium hydroxide to produce a mixture of water, sodium chloride and sodium chlorate(I), NaOCl .

Write a chemical equation for this reaction.

(1)



(c) Chlorine is used in the manufacture of the addition polymer poly(chloroethene).

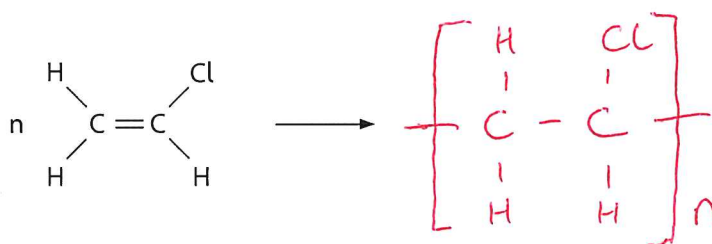
(i) Explain how an addition polymer is formed from its monomers.

(2)

- Double bonds broken / monomers join together
- Form a long chain molecule

(ii) Complete this equation by drawing the displayed formula of poly(chloroethene).

(2)



(Total for Question 7 = 9 marks)

TOTAL FOR PAPER = 60 MARKS



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