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Surname			Other names			
Pearson Edexcel		Centre Number			Candidate Number	
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<h1>Chemistry</h1>						
Unit: 4CH0						
Paper: 2C						
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 ►

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THE PERIODIC TABLE

Group 1 2 3 4 5 6 7 0

Period

4	He	Helium	2
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1	H	Hydrogen	1
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1	7	Li	Lithium	3	9	Be	Beryllium	4	11	B	Boron	5	12	C	Carbon	6	13	Al	Aluminium	13	14	N	Nitrogen	7	15	P	Phosphorus	15	16	O	Oxygen	8	17	F	Fluorine	9	18	Ne	Neon	10				
2	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	40	Ar	Argon	18				
3	39	K	Potassium	19	40	Ca	Calcium	20	56	Fe	Iron	26	59	Co	Cobalt	27	59	Ni	Nickel	28	63.5	Cu	Copper	29	70	Ga	Gallium	31	73	Ge	Germanium	32	75	As	Arsenic	33	79	Se	Selenium	34				
4	86	Rb	Rubidium	37	88	Sr	Strontium	38	101	Ru	Ruthenium	44	103	Rh	Rhodium	45	106	Pd	Palladium	46	108	Ag	Silver	47	112	In	Indium	49	115	Sn	Tin	50	119	Sb	Antimony	51	122	Te	Tellurium	52				
5	133	Cs	Caesium	55	137	Ba	Barium	56	186	Re	Rhenium	75	188	Os	Osmium	76	192	Ir	Iridium	77	195	Pt	Platinum	78	201	Hg	Mercury	80	204	Tl	Thallium	81	207	Pb	Lead	82	209	Bi	Bismuth	83				
6	223	Fr	Francium	87	226	Ra	Radium	88	184	W	Tungsten	74	186	Re	Rhenium	75	192	Ir	Iridium	77	195	Pt	Platinum	78	201	Hg	Mercury	80	204	Tl	Thallium	81	207	Pb	Lead	82	210	Po	Polonium	84				
7	227	Ac	Actinium	89	227	Ac	Actinium	89	227	Fr	Francium	87	227	Ac	Actinium	89	227	Ac	Actinium	89	227	Ac	Actinium	89	227	Ac	Actinium	89	227	Ac	Actinium	89	227	Ac	Actinium	89	227	Ac	Actinium	89	227	Ac	Actinium	89

Key

Relative atomic mass
Symbol
Name
Atomic number

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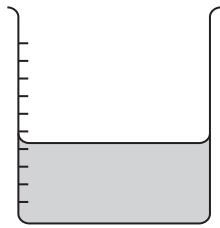
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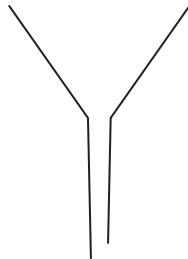


Answer ALL questions.

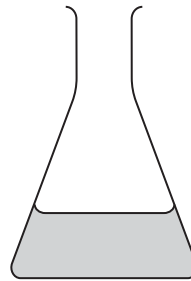
1 These pieces of apparatus are used in chemistry experiments.



P



Q



R



S

(a) Name these pieces of apparatus.

(4)

P

Q

R

S

(b) Apparatus P contains dilute hydrochloric acid.

Litmus indicator is added to this acid.

What is the final colour of the litmus?

A blue

B green

C orange

D red

(1)

(c) Apparatus R contains potassium hydroxide solution.

Litmus indicator is added to this alkaline solution.

What is the final colour of the litmus?

A blue

B green

C orange

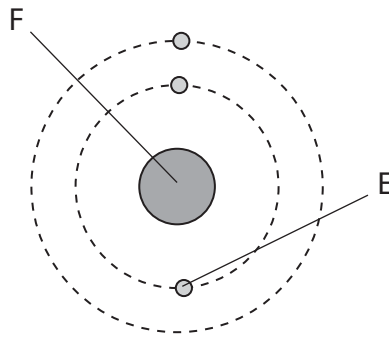
D red

(1)

(Total for Question 1 = 6 marks)



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



(a) Name the particle labelled E.

(1)

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

(1)

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

(2)

1

2

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(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)

- (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)

relative atomic mass =

(Total for Question 2 = 8 marks)

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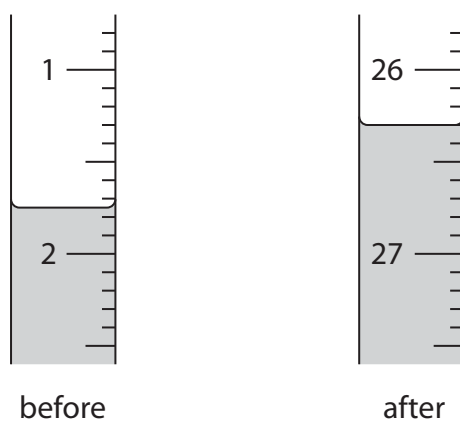
3 A student is provided with a solution of dilute sulfuric acid and a solution of sodium hydroxide. The student does a titration using 25.0 cm^3 of the sodium hydroxide solution. She adds the acid from a burette.

(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	
burette reading before adding acid	
volume in cm^3 of acid added	

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(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 cm³ of sodium hydroxide solution.

(2)

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(Total for Question 3 = 6 marks)

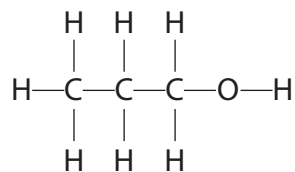
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- 4 (a) This is the displayed formula of an organic compound, X.



- (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)

- (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)

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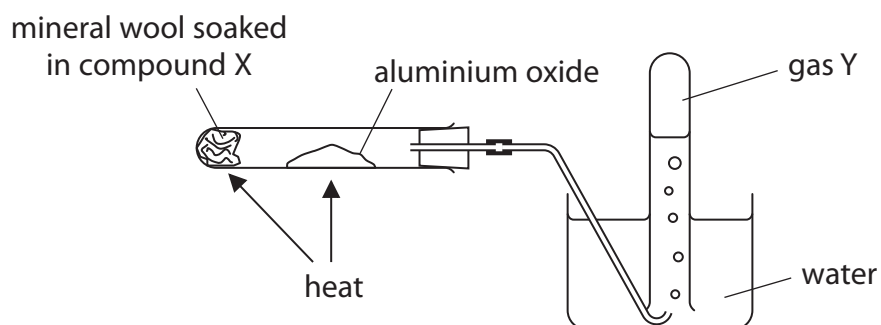
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(c) This apparatus is used for a dehydration reaction using compound X.

This reaction is similar to the dehydration reaction of ethanol.



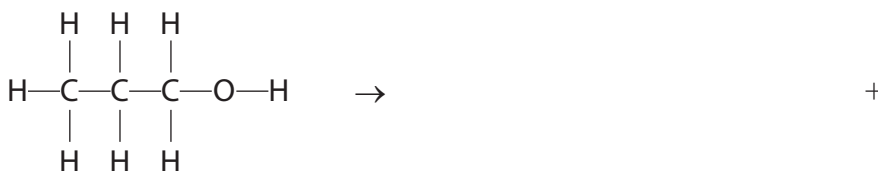
The reaction produces gas Y and one other product.

(i) State the purpose of the aluminium oxide. (1)

(ii) State a property of gas Y that allows it to be collected over water. (1)

(iii) Give a reason why the first sample of gas Y collected is not pure. (1)

(iv) Complete the equation for the dehydration reaction showing the displayed formula of gas Y and the molecular formula of the other product. (2)



(v) Give the name of gas Y. (1)

(Total for Question 4 = 11 marks)



5 Chromium is a shiny metal that has many uses.

Most chromium is extracted from the ore chromite, FeCr_2O_4

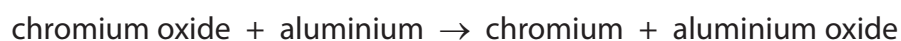
(a) Complete the table by giving the names of the elements in FeCr_2O_4

(1)

Chemical symbol	Name of element
Fe	
Cr	
O	

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

Chromium is made by this reaction



(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)

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

(2)

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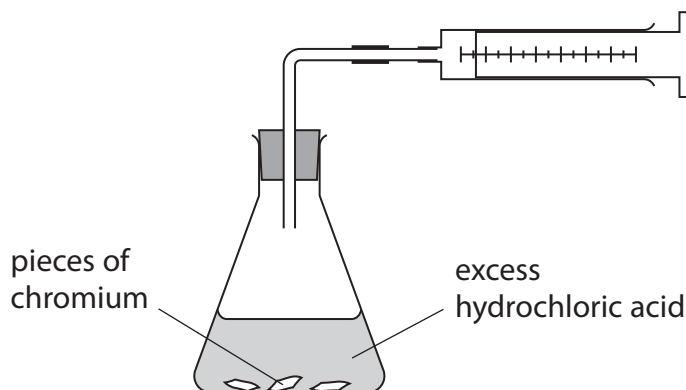
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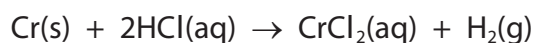


(c) Chromium metal reacts with dilute hydrochloric acid to form hydrogen gas.

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]

(3)

maximum volume = 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.

(2)

1

2

(Total for Question 5 = 12 marks)



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

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

(1)

$M_r =$

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

(1)

..... and

(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

(4)

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

(2)

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(Total for Question 6 = 8 marks)

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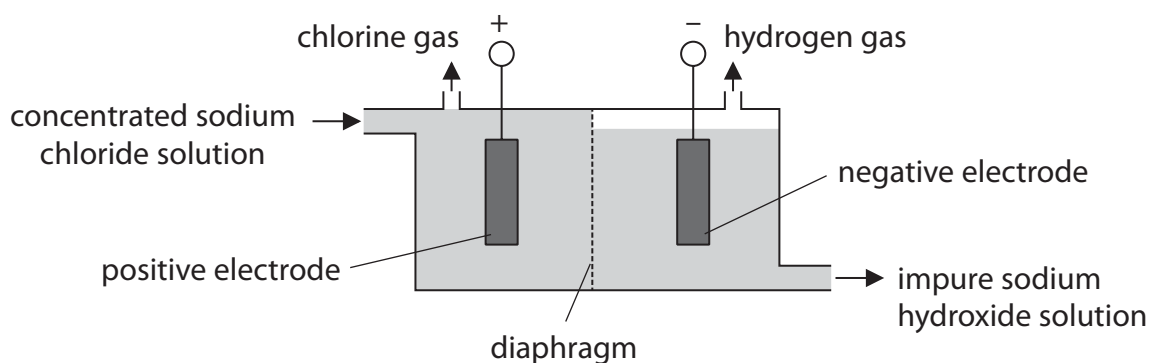
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P 5 3 1 4 6 A 0 1 3 1 6

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



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- (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)

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- (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)

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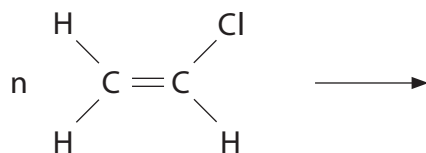
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(ii) Complete this equation by drawing the displayed formula of poly(chloroethene).

(2)



(Total for Question 7 = 9 marks)

TOTAL FOR PAPER = 60 MARKS

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