

Write your name here

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**Pearson Edexcel**  
**International GCSE**

Centre Number

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Candidate Number

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# Chemistry

**Unit: 4CH0**

**Paper: 2CR**

Wednesday 15 June 2016 – 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.
- 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

4	He	Helium	2
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1	H	Hydrogen	1
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7	Li	Lithium	3	9	Be	Beryllium	4	20	Ne	Neon	10
23	Na	Sodium	11	24	Mg	Magnesium	12	31	P	Phosphorus	15
39	K	Potassium	19	40	Ca	Calcium	20	70	Ga	Gallium	31
86	Rb	Rubidium	37	88	Sr	Strontium	38	115	In	Indium	49
133	Cs	Caesium	55	137	Ba	Barium	56	204	Tl	Thallium	81
223	Fr	Francium	87	226	Ra	Radium	88	207	Pb	Lead	82
227	Ac	Actinium	89	227	AC	Actinium	89	208	Bi	Bismuth	83
45	Sc	Scandium	21	46	Ti	Titanium	22	59	Co	Cobalt	27
89	Y	Yttrium	39	90	Zr	Zirconium	40	106	Pd	Palladium	46
139	La	Lanthanum	57	140	Hf	Hafnium	72	195	Pt	Platinum	78
227	Ac	Actinium	89	227	Ra	Radium	88	208	Pb	Lead	82
51	V	Vanadium	23	52	Cr	Chromium	24	59	Co	Cobalt	27
93	Nb	Niobium	41	94	Mo	Molybdenum	42	106	Pd	Palladium	46
181	Ta	Tantalum	73	182	W	Tungsten	74	195	Pt	Platinum	78
179	Hf	Hafnium	72	180	Os	Osmium	76	197	Au	Gold	79
227	Ac	Actinium	89	227	Ra	Radium	88	208	Pb	Lead	82
56	Fe	Iron	26	57	Mn	Manganese	25	59	Ni	Nickel	28
101	Ru	Ruthenium	44	102	Rh	Rhodium	45	106	Pd	Palladium	46
201	Hg	Mercury	80	202	Tl	Thallium	81	208	Pb	Lead	82
112	Cd	Cadmium	48	113	In	Indium	49	120	Hg	Mercury	80
65	Zn	Zinc	30	66	Ga	Gallium	31	70	Ge	Germanium	32
128	Te	Tellurium	52	129	Sb	Antimony	51	122	Sb	Antimony	51
210	Po	Polonium	84	210	At	Astatine	85	210	Po	Polonium	84
127	I	Iodine	53	127	Xe	Xenon	54	128	Te	Tellurium	52
35.5	Cl	Chlorine	17	35.5	Br	Bromine	35	79	Se	Selenium	34
19	F	Fluorine	9	19	Ne	Neon	10	20	Ne	Neon	10

Key

Relative atomic mass
Symbol
Name
Atomic number

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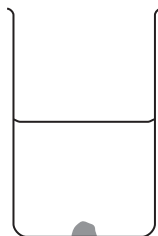
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**Answer ALL questions.**

- 1 Hydrated copper(II) sulfate is a soluble blue solid. A large crystal of this solid is placed at the bottom of a beaker of water.

The diagram shows the beaker immediately after placing the crystal in it, and after two days.



after placing the crystal



after two days

- (a) After two days, the crystal becomes smaller and the liquid near the bottom of the beaker becomes blue.

Which statement explains these observations?

(1)

- A the crystal dissolves
- B the crystal freezes
- C the crystal melts
- D the crystal sublimates

- (b) After two weeks, the crystal has disappeared.

Which statement best describes the appearance of the liquid in the beaker after two weeks?

(1)

- A it is all blue
- B it is all brown
- C only the lower part is blue
- D only the upper part is blue

- (c) The formula of the compound in the crystal is  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

(i) How many different elements are shown in the formula?

(1)

(ii) How many atoms are shown in the formula?

(1)

**(Total for Question 1 = 4 marks)**



2 Iron is a metal with many uses. One problem with using iron is that it rusts.

(a) Name two substances needed for iron to rust.

(2)

..... and .....

(b) State the name of the main compound present in rust.

(1)

(c) The table shows three methods used to protect iron from rusting.

Choose three of the objects from the box to complete the table.  
You may choose an object only once.

(3)

bicycle chain	bucket	car body
car engine	food can	railway bridge

Method	Example of use
galvanising	
oiling	
painting	

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(d) An iron object is coated with zinc to protect it from rusting. This protection continues even if the zinc coating becomes scratched.

Explain how the zinc coating protects iron from rusting.

(2)

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**(Total for Question 2 = 8 marks)**

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3 This question is about some gases present in air.

(a) Which is the most common gas in dry air?

(1)

- A argon
- B carbon dioxide
- C nitrogen
- D oxygen

(b) Which gas makes up about 1 % of dry air?

(1)

- A argon
- B carbon dioxide
- C nitrogen
- D oxygen

(c) A piece of copper is heated in air.

State the formula and colour of the compound formed.

(2)

formula.....

colour.....

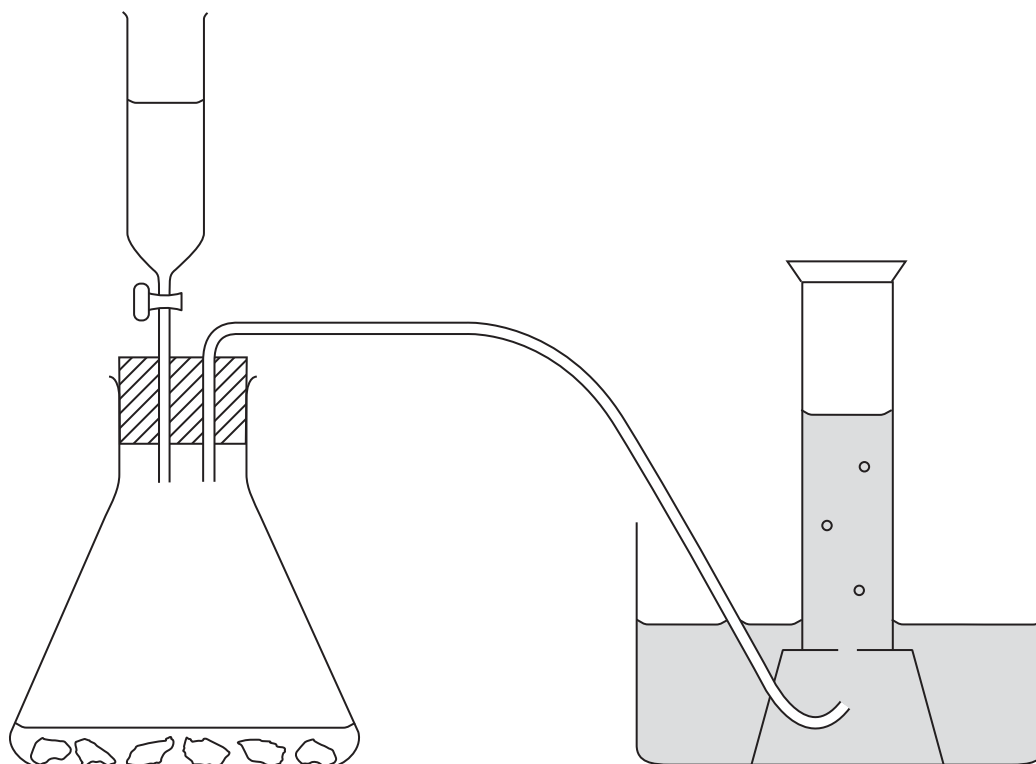
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- (d) The diagram shows apparatus that can be used to prepare carbon dioxide in the laboratory.

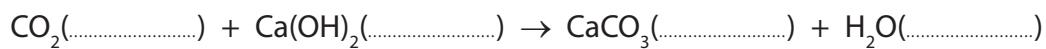


- (i) The liquid in the tap funnel is (1)
- A calcium chloride solution
- B concentrated sulfuric acid
- C dilute hydrochloric acid
- D hydrogen peroxide solution
- (ii) The solid in the conical flask is (1)
- A calcium carbonate
- B calcium sulfate
- C copper(II) oxide
- D manganese(IV) oxide
- (iii) The diagram shows the gas being collected over water. Suggest another way to collect the gas. (1)



(e) Limewater can be used in a test for carbon dioxide.

- (i) Complete this equation, by inserting state symbols, for the reaction used to test for carbon dioxide. (1)



- (ii) State the observation made in this test. (1)

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**(Total for Question 3 = 9 marks)**





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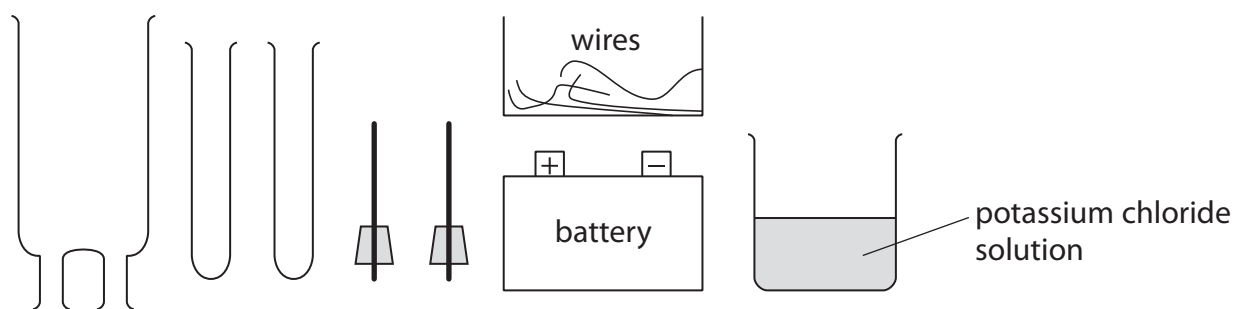
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4 A student investigates electrolysis using this apparatus.



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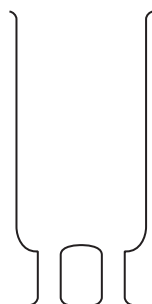
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(a) The student electrolyses  $\text{KCl(aq)}$  and collects samples of any gases formed.

Complete the following diagram to show how to assemble the apparatus.  
Label the diagram to show the potassium chloride solution.

(3)



(b) The table shows the half-equation for the reaction at one electrode.

Complete the table to show the half-equation for the reaction at the other electrode  
and the polarity (+ or -) of each electrode.

(2)

Polarity	Equation
	$2\text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{OH}^-$



(c) Describe a test to show that the gas collected is hydrogen.

(1)

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**(Total for Question 4 = 6 marks)**

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5 Potassium and lithium are Group 1 metals that exist as isotopes.

(a) (i) Complete the table of information about two isotopes of potassium.

(3)

Atomic number	Mass number	Number of protons	Number of neutrons
19	39		
		19	22

(ii) A sample of lithium has this percentage composition by mass.

$${}^6\text{Li} = 7.4\% \quad {}^7\text{Li} = 92.6\%$$

Use this information to calculate the relative atomic mass of lithium.  
Give your answer to one decimal place.

(2)

relative atomic mass of lithium = .....

(b) A reaction occurs when a small piece of potassium is added to water in a trough.

State two observations that could be made during the reaction.

(2)

1 .....

2 .....

(c) A few drops of phenolphthalein are added to the liquid in the trough at the end of the reaction. A colour change occurs.

(i) State the final colour of the liquid in the trough.

(1)

(ii) Give the formula of the ion formed during the reaction that causes this colour change.

(1)

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(d) The electronic configurations of lithium and potassium are

Li 2,1                      K 2,8,8,1

Explain why potassium is more reactive than lithium.

(2)

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**(Total for Question 5 = 11 marks)**

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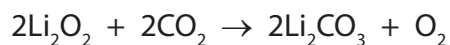
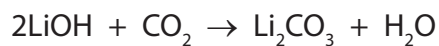
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- 6 Lithium hydroxide (LiOH) and lithium peroxide (Li<sub>2</sub>O<sub>2</sub>) have been used in spacecraft to remove the carbon dioxide astronauts breathe out.

The equations for the reactions with carbon dioxide are



- (a) Explain, with reference to these equations, two advantages of using lithium peroxide, rather than lithium hydroxide, to remove carbon dioxide from the air in a spacecraft.

(2)

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- (b) (i) Calculate the mass of lithium hydroxide needed to react with 100 g of carbon dioxide.

[ $M_r$  of LiOH = 24]

(3)

mass of lithium hydroxide = ..... g

- (ii) Calculate the volume of carbon dioxide, at room temperature and pressure, removed by 100 g of lithium peroxide.

[ $M_r$  of  $\text{Li}_2\text{O}_2$  = 46]

Assume that one mole of gas has a volume of 24 000  $\text{cm}^3$  at rtp.

(3)

volume of carbon dioxide = .....  $\text{cm}^3$

**(Total for Question 6 = 8 marks)**

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7 This question is about the laboratory preparation of salts.

(a) A student writes this plan for preparing a sample of hydrated magnesium sulfate crystals.

- step 1 Pour about 100 cm<sup>3</sup> of dilute nitric acid into a 250 cm<sup>3</sup> beaker.
- step 2 Add a solution of magnesium carbonate to the acid until there is no more effervescence.
- step 3 Heat the solution until all of the water has boiled off.

This plan will not succeed because there is one mistake in each step.

Identify the mistake in each of the steps.

(3)

step 1 .....

.....

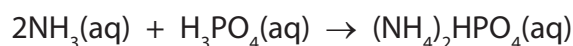
step 2 .....

.....

step 3 .....

.....

(b) Another student uses the following plan to prepare a sample of ammonium hydrogenphosphate, formed in this reaction between aqueous ammonia and dilute phosphoric acid



- use a pipette to transfer 25.0 cm<sup>3</sup> of phosphoric acid to a conical flask
- add 3 drops of indicator
- use a burette to add aqueous ammonia until the indicator just changes colour permanently

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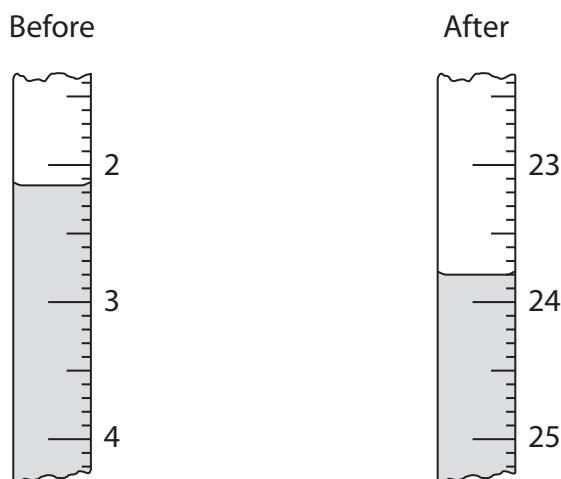
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- (i) The diagram shows the burette readings in one experiment before and after adding aqueous ammonia.



Use the readings to complete the table, entering all values to the nearest  $0.05 \text{ cm}^3$ . (3)

burette reading in $\text{cm}^3$ after adding aqueous ammonia	
burette reading in $\text{cm}^3$ before adding aqueous ammonia	
volume in $\text{cm}^3$ of aqueous ammonia added	

- (ii) In another titration, the student made a mistake. After he filled the burette, he noticed that the space between the tap of the burette and the tip contained air. After adding the aqueous ammonia, he noticed that it now contained liquid.

Explain how, if at all, this mistake affects the calculated volume of aqueous ammonia added. (2)

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(c) He repeats the experiment until he obtains concordant results.

The table shows the results.

burette reading in $\text{cm}^3$ after adding ammonia	27.95	28.05	28.00	26.75
burette reading in $\text{cm}^3$ before adding ammonia	0.80	1.60	1.20	0.50
volume in $\text{cm}^3$ of aqueous ammonia added	27.15	26.45	26.80	26.25
concordant results (✓)				

Concordant results are those volumes that differ from each other by  $0.20 \text{ cm}^3$  or less.

(i) Identify the concordant results by placing ticks (✓) in the table where appropriate. (1)

(ii) Use the concordant results to calculate the average (mean) volume of aqueous ammonia added. (2)

average volume of aqueous ammonia = .....  $\text{cm}^3$



(d) The student then mixed the volumes of aqueous ammonia and phosphoric acid found in the titration.

Describe how to use the method of crystallisation to obtain a pure dry sample of the salt from this mixture.

(3)

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**(Total for Question 7 = 14 marks)**

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**TOTAL FOR PAPER = 60 MARKS**

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