



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

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CANDIDATE
NUMBER

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CHEMISTRY

0620/21

Paper 2

October/November 2010

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may need to use a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

A copy of the Periodic Table is printed on page 20.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
Total	

This document consists of **17** printed pages and **3** blank pages.



- 1 The diagram below shows the elements in a period of the Periodic Table.

Li	Be	B	C	N	O	F	Ne
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- (a) To which period of the Periodic Table do these elements belong?

..... [1]

- (b) Answer these questions using only the elements shown in the diagram.
Each element can be used once, more than once or not at all.

Write down the symbol for the element which

- (i) has six electrons in its outer shell.
- (ii) is a halogen.
- (iii) is a metal which reacts rapidly with cold water.
- (iv) has two forms, graphite and diamond.
- (v) is in Group II of the Periodic Table.
- (vi) makes up about 80% of the air. [6]

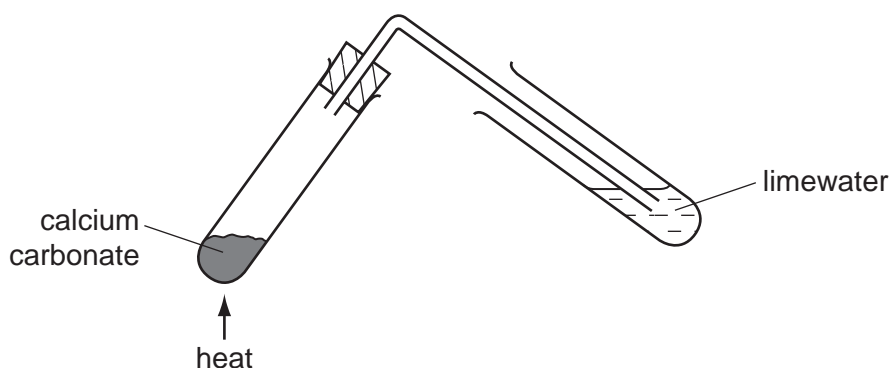
- (c) Complete the following sentence using words from the list below.

atoms electrons molecules neutrons protons

The of the elements in the Periodic Table are arranged in order of
increasing number of [2]

[Total: 9]

- 2 Calcium carbonate was heated strongly in a test-tube. The gas given off was bubbled through limewater.



- (a) What type of chemical reaction occurs when calcium carbonate is heated strongly?

Put a ring around the correct answer.

hydration

neutralisation

oxidation

thermal decomposition

[1]

- (b) (i) State the name of the gas given off when calcium carbonate is heated strongly.

..... [1]

- (ii) State the colour change of the limewater.

..... [1]

- (c) The product remaining in the test-tube is calcium oxide.

- (i) Calcium oxide is used in steelmaking.
Describe how and why calcium oxide is used in making steel.

.....
.....
..... [2]

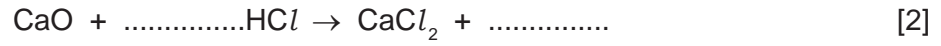
- (ii) Steel is an alloy. What do you understand by the term *alloy*?

.....
..... [1]

(iii) Give **one** other use of calcium oxide.

..... [1]

(iv) Complete the symbol equation for the reaction of calcium oxide with hydrochloric acid.



(v) State the chemical name of the compound CaCl_2 .

..... [1]

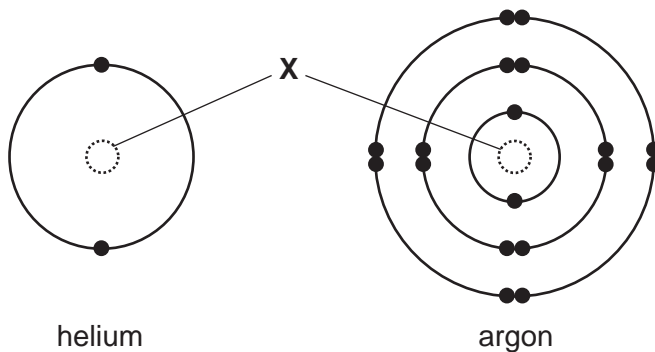
[Total: 10]

3 Helium and argon are noble gases.

(a) State **one** use of helium.

..... [1]

(b) The atomic structures of helium and argon are shown below.



(i) State the name of the central part of the atom, labelled X.

..... [1]

(ii) Which statement about helium and argon is correct?

Tick **one** box.

Argon has an incomplete inner shell of electrons.

An atom of argon has 16 electrons.

Helium has a complete outer shell of electrons.

Helium has an incomplete outer shell of electrons.

[1]

(iii) How many protons are there in an atom of argon?

..... [1]

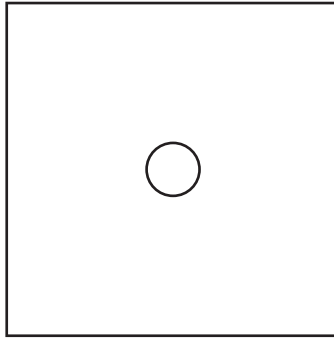
(iv) The symbol for a particular isotope of helium is written as ${}^4_2\text{He}$.

Write a similar symbol for the isotope of argon which has 16 neutrons.

[1]

- (c) Argon is a liquid at a temperature of -188°C .
Complete the diagram below to show how the atoms of argon are arranged at -188°C .

○ represents one atom of argon.



[2]

[Total: 7]

*For
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Use*

- 4 The table shows the mass of some ions present in a 500 cm³ bottle of mineral water.

name of ion	symbol	mass of ion / mg
calcium	Ca ²⁺	40.5
	Cl ⁻	8.1
magnesium	Mg ²⁺	11.6
nitrate	NO ₃ ⁻	2.4
potassium	K ⁺	0.9
	SO ₄ ²⁻	6.4

- (a) State the name of the following ions.

Cl⁻

SO₄²⁻ [2]

- (b) Calculate the mass of magnesium ions in 100 cm³ of this mineral water.

[1]

- (c) (i) Describe a test for nitrate ions.

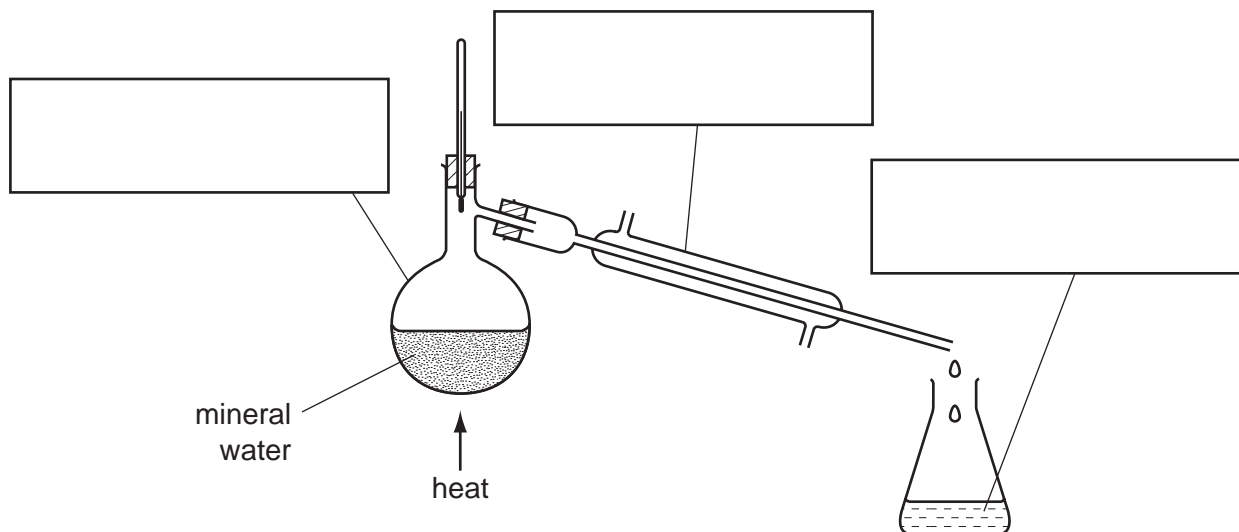
.....

..... [2]

- (ii) The gas produced in this test turns damp red litmus paper blue.
State the name of this gas.

..... [1]

(d) The apparatus shown is used to get pure water from impure mineral water.



(i) Complete the diagram by putting the correct labels in the three boxes. [3]

(ii) Describe how this apparatus separates pure water from dissolved ionic solids.

.....

 [2]

(iii) Water purity is important in everyday life.
 Describe **one** other area of everyday life where purity of substances is important.

..... [1]

[Total: 12]

5 A solution of calcium hydroxide in water is alkaline.

- (a) Which **one** of the pH values below is alkaline?
Put a ring around the correct answer.

pH 3

pH 6

pH 7

pH 11

[1]

- (b) Which of the following is the common name for calcium hydroxide?
Tick **one** box.

cement

limestone

quicklime

slaked lime

[1]

(c) Some farmers use calcium hydroxide to control soil acidity.

- (i) Why is it important to control soil acidity?

..... [1]

- (ii) Acid rain can cause soil to become acidic.
Describe how acid rain is formed.

.....
.....
.....
..... [3]

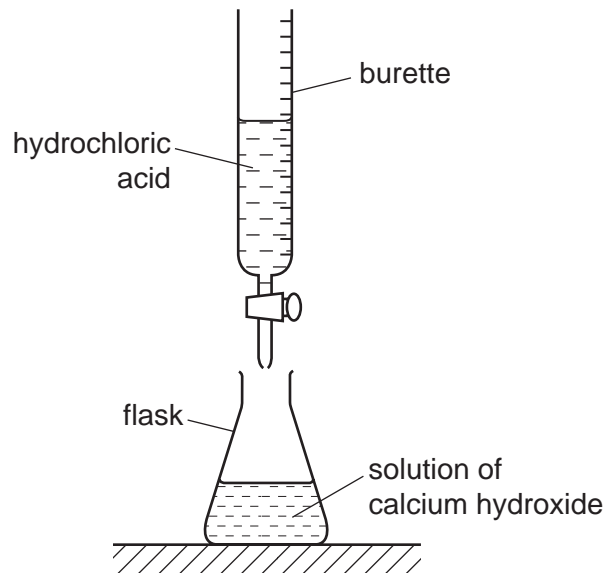
(d) Calcium hydroxide reacts with hydrochloric acid.

calcium hydroxide + hydrochloric acid → calcium chloride + water

- (i) State the name of this type of chemical reaction.

..... [1]

- (ii) A dilute solution of calcium hydroxide can be titrated with hydrochloric acid using the apparatus shown.



Describe how you would carry out this titration.

.....

.....

.....

..... [3]

[Total: 10]

- 6 Iron is extracted from its ore by reduction with carbon. Aluminium is extracted from its ore by electrolysis.

(a) (i) State the name of an ore of aluminium.

..... [1]

(ii) What do you understand by the term *reduction*?

..... [1]

(iii) Suggest why aluminium is **not** extracted from its ore by reduction with carbon.

..... [1]

(b) The table gives information about the reduction of four different metal oxides by heating with carbon.

metal oxide	reduction conditions
lead(II) oxide	reduced very easily using a Bunsen burner
magnesium oxide	reduced with difficulty in a furnace above 2000 °C
nickel(II) oxide	reduced very easily in a furnace above 680 °C
zinc oxide	reduced fairly easily in a furnace above 1200 °C

Use the information in the table to suggest the order of reactivity of these metals.

least reactive \longrightarrow most reactive

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[2]

(c) Zinc powder reacts with hydrochloric acid.

The speed of reaction can be followed by measuring the volume of hydrogen gas produced per minute.

What happens to the volume of gas produced per minute when

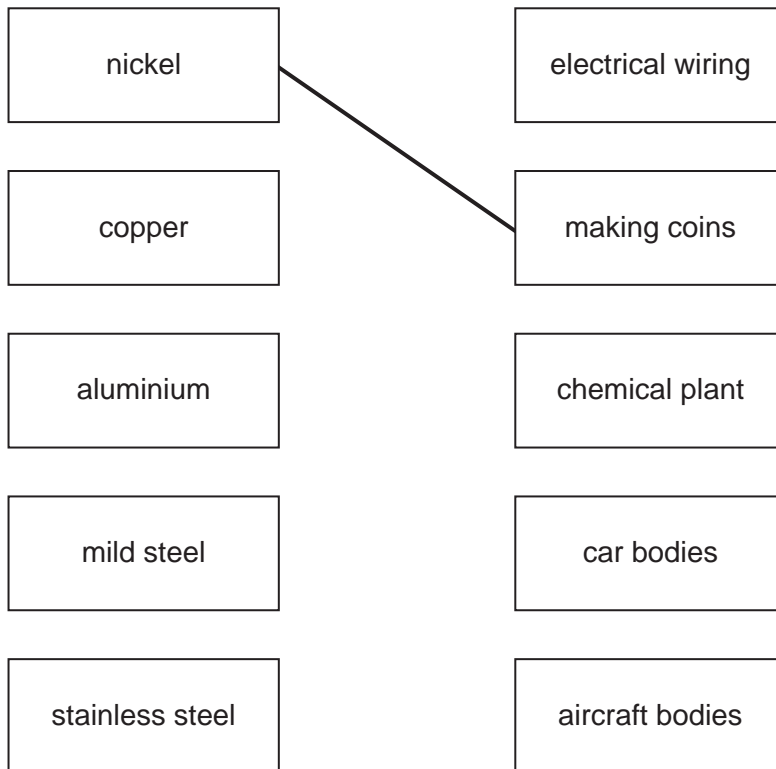
(i) large lumps of zinc are used instead of zinc powder?

..... [1]

(ii) the reaction is carried out at a higher temperature?

..... [1]

- (d) Match the metals on the left with their uses on the right.
The first one has been done for you.



[4]

[Total: 11]

7 Ethene, C_2H_4 , is manufactured by cracking petroleum fractions.

(a) (i) What do you understand by the term *petroleum fraction*?

.....
 [1]

(ii) Complete the equation for the manufacture of ethene from dodecane, $C_{12}H_{26}$.



(b) Two fractions obtained from the distillation of petroleum are refinery gas and gasoline. State **one** use of each of these fractions.

refinery gas

gasoline [2]

(c) Ethene is an unsaturated hydrocarbon. What do you understand by the following terms?

unsaturated

hydrocarbon [2]

(d) Ethene is used to make ethanol.

(i) Which of these reactions is used to make ethanol from ethene?
 Tick **one** box.

- | | |
|-----------------------------|--------------------------|
| catalytic addition of steam | <input type="checkbox"/> |
| fermentation | <input type="checkbox"/> |
| oxidation using oxygen | <input type="checkbox"/> |
| reduction using hydrogen | <input type="checkbox"/> |

[1]

(ii) Draw the structure of ethanol showing all atoms and bonds.

[2]

- (e) Ethene is used to make poly(ethene).
Complete the following sentences about this reaction.
Use words from the list below.

additions carbohydrates catalysts monomers polymers

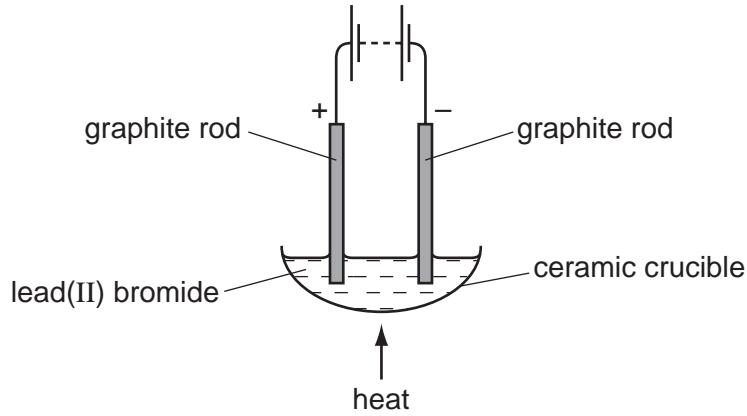
The ethene molecules which join to form poly(ethene) are the

The poly(ethene) molecules formed are

[2]

[Total: 11]

8 Lead(II) bromide can be electrolysed using the apparatus shown below.



(a) Choose **one** word from the list below which describes the graphite rods.
Put a ring around the correct answer.

cations **electrodes** **electrons** **insulators** **metals** [1]

(b) State the name of the products formed during this electrolysis at

the negative graphite rod.

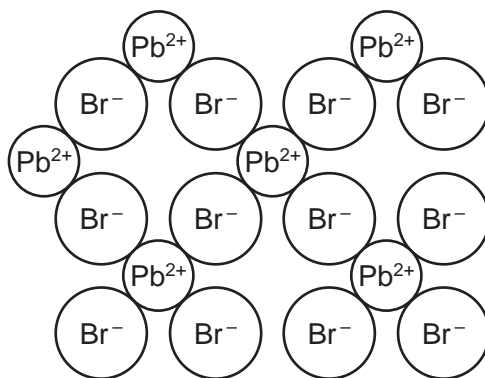
the positive graphite rod. [2]

(c) Which of the following conduct electricity?
Tick **two** boxes.

- ceramic crucible
- graphite rod
- molten lead(II) bromide
- solid lead(II) bromide

[2]

(d) The structure of lead(II) bromide is shown below.



Write the simplest formula for lead(II) bromide.

..... [1]

(e) Lead(II) bromide is formed as a precipitate when aqueous solutions of lead(II) nitrate and potassium bromide are mixed.

(i) What do you understand by the term *precipitate*?

.....
..... [1]

(ii) The formula of lead(II) nitrate is $\text{Pb}(\text{NO}_3)_2$.
State the number of different types of atom present in this formula.

..... [1]

(iii) State the total number of oxygen atoms present in this formula.

..... [1]

(iv) Lead compounds are pollutants in the air.
State one harmful effect of lead compounds on health.

..... [1]

[Total: 10]

DATA SHEET
The Periodic Table of the Elements

		Group																
I	II	III	IV	V	VI	VII	0											
		1 H Hydrogen 1					4 He Helium 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										
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										
39 K Potassium 19	40 Ca Calcium 20		51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 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		
85 Rb Rubidium 37	88 Sr Strontium 38		93 Nb Niobium 41	96 Mo Molybdenum 42	101 Ru Ruthenium 44	101 Rh Rhodium 45	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		
133 Cs Caesium 55	137 Ba Barium 56		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	212 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86		
87 Fr Francium	226 Ra Radium		227 Ac Actinium															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71		
232 Th Thorium 90	238 U Uranium 92	238 Pa Protactinium 91	238 Np Neptunium 93	238 Pu Plutonium 94	238 Am Americium 95	238 Cm Curium 96	238 Bk Berkelium 97	238 Cf Californium 98	238 Es Einsteinium 99	238 Fm Fermium 100	238 Md Mendelevium 101	238 No Nobelium 102	238 Lr Lawrencium 103

a	X	b
Key	a = relative atomic mass	X = atomic symbol
	b = proton (atomic) number	

*58-71 Lanthanoid series
†90-103 Actinoid series

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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