



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**

**0620/02**

Paper 2

**October/November 2009**

**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	
<b>Total</b>	

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



1 The list shows some non-metallic elements.

bromine  
carbon  
fluorine  
krypton  
nitrogen  
oxygen

For  
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Use

(a) Which **two** elements in the list are in the same Group of the Periodic Table?

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

(b) Which element in the list has the highest proton number?

..... [1]

(c) Which **two** of these elements make up most of the air?

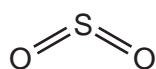
..... and ..... [1]

(d) Bromine and fluorine form a compound with the formula  $\text{BrF}_5$ .  
Calculate the relative molecular mass of  $\text{BrF}_5$ .

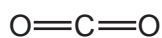
[1]

(e) The diagram shows the structure of some compounds containing oxygen.

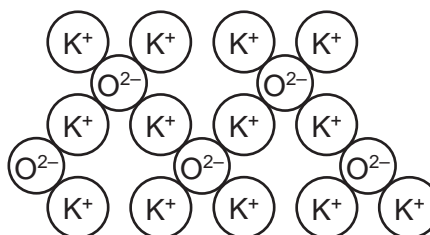
A



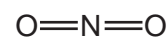
B



C



D



(i) What type of oxide is compound **C**?

..... [1]

- (ii) Compound **A** is an atmospheric pollutant.  
Describe the source of compound **A** and state its effect on the environment.

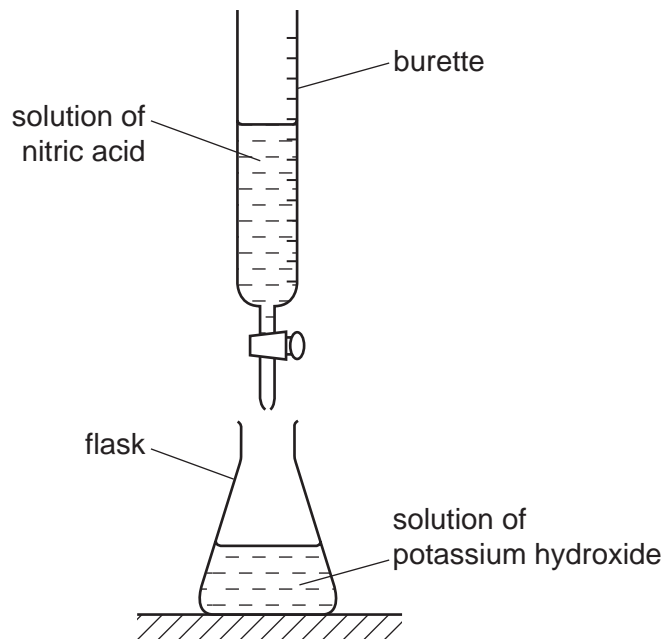
Source .....

Effect on the environment .....

..... [2]

- (iii) In the presence of air, compound **D** reacts with water to form nitric acid.

A student used the apparatus below to add an aqueous solution of nitric acid to an aqueous solution of potassium hydroxide. He added the acid until it was in excess.



Describe how the pH of the solution in the flask changes as the nitric acid is added until the acid is in excess.

.....

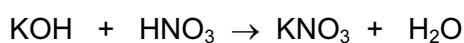
.....

..... [3]

- (iv) Describe how you can measure this pH change.

..... [1]

- (v) The equation for the reaction is



State the name of the salt formed in this reaction.

..... [1]

[Total: 12]

- 2 (a) Link the terms in the boxes on the left with the definitions on the right. The first one has been done for you.

atom	a substance containing different atoms or ions bonded together
compound	a substance made up of one type of atom
element	the smallest part of an element which takes part in a chemical reaction
ion	the smallest group of covalently bonded atoms which can exist on its own
molecule	a charged atom or group of atoms

[4]

- (b) Which **two** of the following are mixtures?  
Tick two boxes.

air

graphite

sodium chloride

steel

[1]

- (c) (i) Draw a labelled diagram to show the atomic structure of an atom of helium. In your diagram include the structure of the nucleus.

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[4]

- (ii) State a use for helium.

..... [1]

- (iii) Which one of these statements about helium is correct?

helium is in Period 2 of the Periodic Table

helium is a liquid at room temperature

helium is unreactive

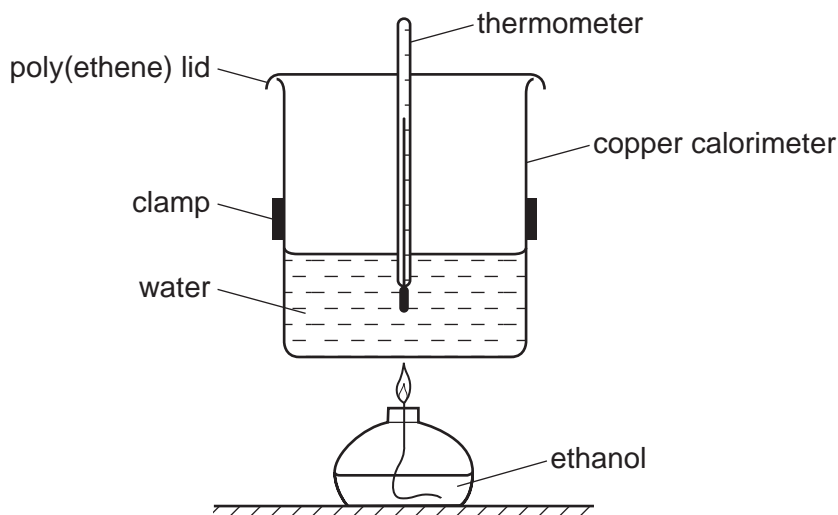
helium has an incomplete outer shell of electrons

[1]

[Total: 11]

- 3 A student used the apparatus shown to calculate the energy released when ethanol burns.

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Use



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

[1]

- (b) The energy released by the burning ethanol raises the temperature of the water in the copper calorimeter.

- (i) Which one of these words best describes the energy change when ethanol burns?  
Put a ring around the correct answer.

**electrolytic**

**electronic**

**endothermic**

**exothermic**

[1]

- (ii) When 4.6 g of ethanol is burnt, 5.4 g of water is formed.  
Calculate the mass of water formed when 13.8 g of ethanol is burnt.

[1]

(iii) Complete the equation for the combustion of ethanol.

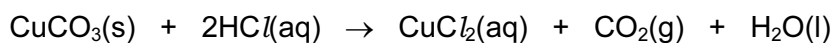


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Use

(c) The calorimeter is made of copper. Copper is a transition metal.  
State two properties which distinguish transition metals from Group I metals.

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

(d) When copper is left exposed to the air for some time, a coating of copper carbonate forms on its surface. The equation shows how copper carbonate reacts with hydrochloric acid.



(i) Describe two observations that can be made as this reaction happens.

1. .... [2]
2. .... [2]

(ii) State the meaning of the symbol (aq).

..... [1]

(e) The calorimeter lid is made of poly(ethene).  
Complete these sentences about poly(ethene) using words from the list.

<b>acids</b>	<b>addition</b>	<b>condensation</b>	<b>ethane</b>	<b>ethene</b>
	<b>monomers</b>		<b>polymer</b>	

Poly(ethene) is a ..... formed by the ..... of ethene molecules.

In this reaction the ethene molecules can be described as .....

[3]

[Total: 12]

4 Caesium is a metal in Group I of the Periodic Table.

For  
Examiner's  
Use

(a) State two physical properties of caesium.

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

(b) State the number of electrons in the outer shell of a caesium atom.

..... [1]

(c) An isotope of caesium has a mass number of 133.

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

..... [1]

(ii) Calculate the number of neutrons in this isotope of caesium.

..... [1]

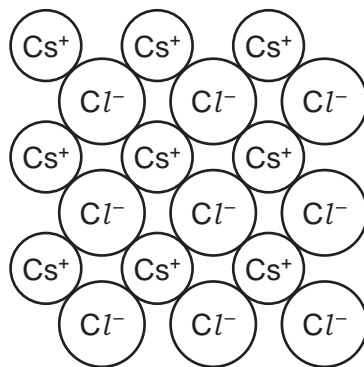
(d) Complete the following table to estimate the boiling point of caesium and predict the reactivity of caesium with water.

Group I metal	density / g/cm <sup>3</sup>	boiling point / °C	reactivity with water
sodium	0.97	883	fizzes quickly, disappears gradually and does not burst into flame
potassium	0.86	760	fizzes very quickly, disappears quickly and bursts into flame with a little spitting
rubidium	1.53	686	fizzes extremely quickly, bursts into flame then spits violently and may explode
caesium	1.88		

[2]



- (e) The diagram shows the structure of caesium chloride.



Use this diagram to work out the simplest formula for caesium chloride.

..... [1]

- (f) Caesium chloride dissolves in water to form a neutral solution.  
State the pH of a neutral solution.

..... [1]

- (g) Describe a test for chloride ions.

test .....

result .....

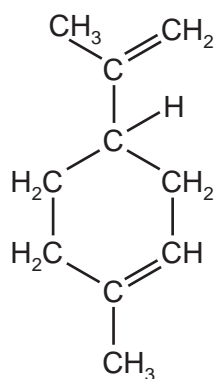
..... [2]

[Total: 11]

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- 5 Limonene is a colourless unsaturated hydrocarbon found in lemons. The structure of limonene is shown below.

For  
Examiner's  
Use



- (a) On the formula above, draw a circle around the bonds which make limonene an unsaturated compound. [1]

- (b) Write the molecular formula for a molecule of limonene.

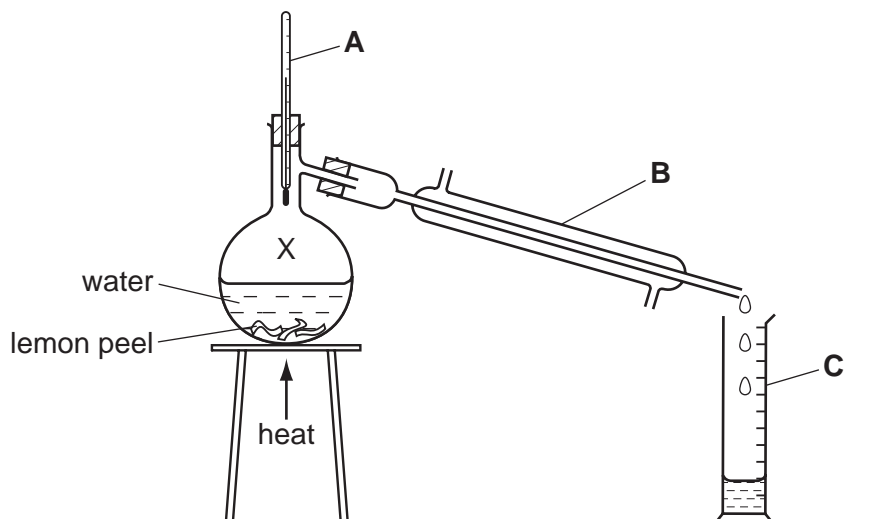
..... [1]

- (c) Describe the colour change which occurs when excess limonene is added to a few drops of bromine water.

..... [2]

(d) Limonene can be extracted from lemon peel by steam distillation.

For  
Examiner's  
Use



(i) State the name of the pieces of apparatus labelled **A**, **B** and **C**.

**A** .....

**B** .....

**C** ..... [3]

(ii) At point X on the diagram, the water is in the form of steam.  
Describe the arrangement and the movement of the particles in steam.

arrangement .....

movement ..... [2]

(e) When limonene undergoes incomplete combustion, carbon monoxide is formed.

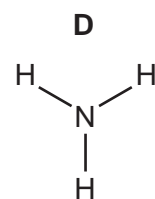
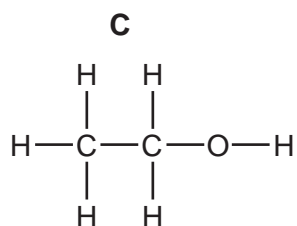
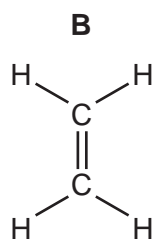
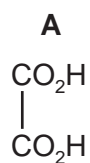
(i) What do you understand by the term *incomplete combustion*?

..... [1]

(ii) State an adverse effect of carbon monoxide on health.

..... [1]

(f) The structures of some compounds found in plants are shown below.



(i) Which one of these compounds is a carboxylic acid? ..... [1]

(ii) Which one of these compounds is produced by the fermentation of glucose?

..... [1]

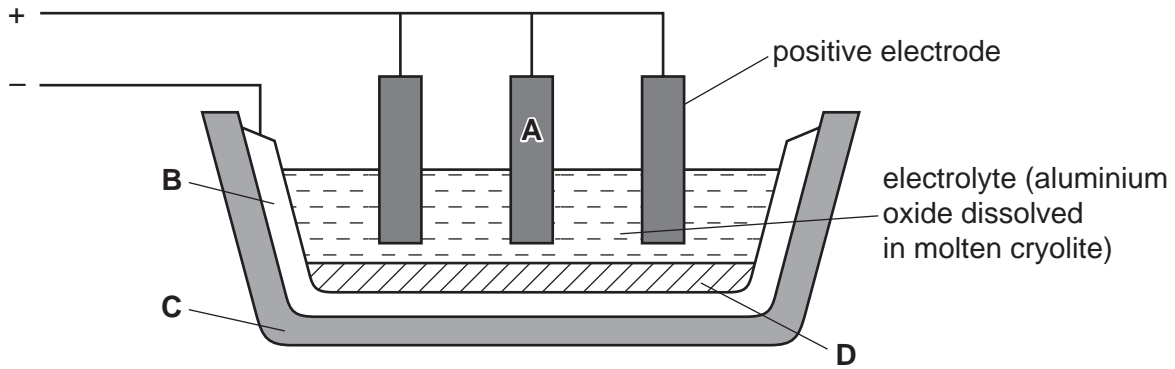
(iii) Which one of these compounds is a hydrocarbon? ..... [1]

[Total: 14]

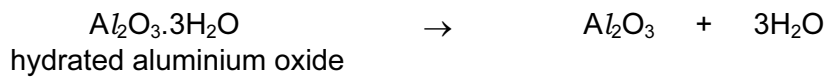
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Use

6 Aluminium is extracted by the electrolysis of aluminium oxide.

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Use



(a) Hydrated aluminium oxide is heated to produce pure aluminium oxide.



What type of reaction is this?  
Put a ring around the correct answer.

- decompositon      neutralisation      oxidation      reduction**

[1]

(b) Explain why the electrolyte must be molten for electrolysis to occur.

..... [1]

(c) What is the purpose of the cryolite?

..... [1]

(d) Which letter in the diagram, **A**, **B**, **C** or **D**, represents the cathode?

..... [1]

(e) State the name of the products formed at the anode and cathode during this electrolysis.

anode .....

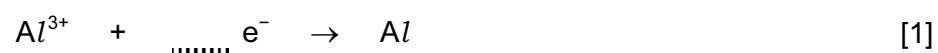
cathode ..... [2]

(f) Why do the anodes have to be renewed periodically?

.....

..... [2]

(g) Complete the equation for the formation of aluminium from aluminium ions.



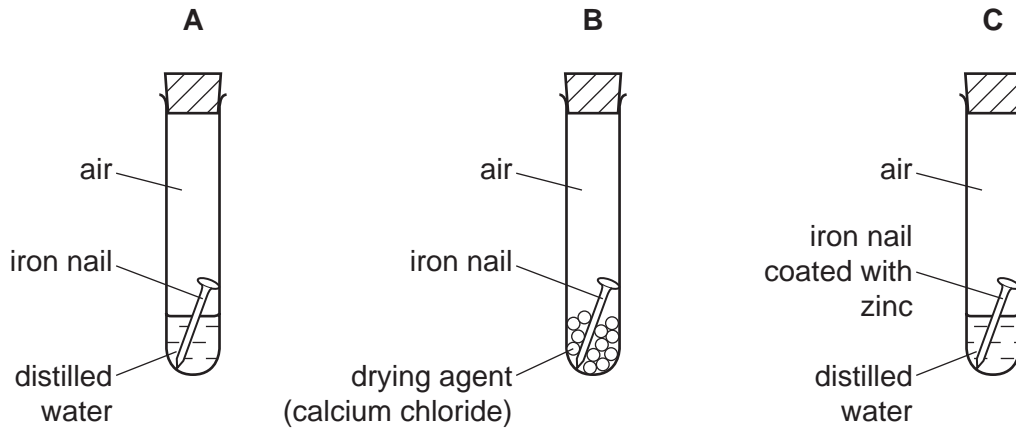
(h) State one use of aluminium.

..... [1]

[Total: 10]

*For  
Examiner's  
Use*

7 The diagram shows an experiment to investigate the rusting of some iron nails.



(a) For each tube **A**, **B** and **C** predict whether the nails will rust. In each case give a reason.

tube **A**: does the nail rust? .....

reason .....

tube **B**: does the nail rust? .....

reason .....

tube **C**: does the nail rust? .....

reason .....

[3]

(b) Iron from the blast furnace contains impurities such as carbon, phosphorus, silicon and sulfur.

Describe how the level of these impurities is decreased when steel is made from impure iron.

.....  
 .....  
 .....  
 .....

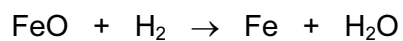
[3]

(c) State a use for stainless steel.

.....

[1]

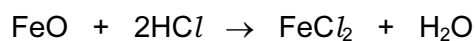
(d) Pure iron can be prepared by the reduction of iron(II) oxide, FeO.



Explain how this equation shows that the iron(II) oxide has been reduced.

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

(e) Iron(II) oxide reacts with acids.



Write a word equation for this reaction.

..... [2]

[Total: 10]

For  
Examiner's  
Use









**DATA SHEET**  
**The Periodic Table of the Elements**

		Group																																																																																														
I	II	III	IV	V	VI	VII	0																																																																																									
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4	1 <b>H</b> Hydrogen 1	11 <b>B</b> Boron 5	12 <b>C</b> Carbon 6	14 <b>N</b> Nitrogen 7	16 <b>O</b> Oxygen 8	19 <b>F</b> Fluorine 9	20 <b>Ne</b> Neon 10	13 <b>Al</b> Aluminium 13	14 <b>Si</b> Silicon 14	15 <b>P</b> Phosphorus 15	17 <b>Cl</b> Chlorine 17	18 <b>Ar</b> Argon 18	27 <b>Co</b> Cobalt 27	28 <b>Ni</b> Nickel 28	29 <b>Cu</b> Copper 29	30 <b>Zn</b> Zinc 30	31 <b>Ga</b> Gallium 31	32 <b>Ge</b> Germanium 32	33 <b>As</b> Arsenic 33	34 <b>Se</b> Selenium 34	35 <b>Br</b> Bromine 35	36 <b>Kr</b> Krypton 36	41 <b>Nb</b> Niobium 41	42 <b>Mo</b> Molybdenum 42	43 <b>Tc</b> Technetium 43	44 <b>Ru</b> Ruthenium 44	45 <b>Rh</b> Rhodium 45	46 <b>Pd</b> Palladium 46	47 <b>Ag</b> Silver 47	48 <b>Cd</b> Cadmium 48	49 <b>In</b> Indium 49	50 <b>Sn</b> Tin 50	51 <b>Sb</b> Antimony 51	52 <b>Te</b> Tellurium 52	53 <b>I</b> Iodine 53	54 <b>Xe</b> Xenon 54	55 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	89 <b>Y</b> Yttrium 39	90 <b>Zr</b> Zirconium 40	91 <b>Ni</b> Nickel 41	92 <b>Mo</b> Molybdenum 42	93 <b>Nb</b> Niobium 43	94 <b>Zr</b> Zirconium 44	95 <b>Hf</b> Hafnium 72	96 <b>Ta</b> Tantalum 73	97 <b>W</b> Tungsten 74	98 <b>Re</b> Rhenium 75	99 <b>Os</b> Osmium 76	100 <b>Ir</b> Iridium 77	101 <b>Pt</b> Platinum 78	102 <b>Au</b> Gold 79	103 <b>Hg</b> Mercury 80	104 <b>Tl</b> Thallium 81	105 <b>Pb</b> Lead 82	106 <b>Bi</b> Bismuth 83	107 <b>Po</b> Polonium 84	108 <b>At</b> Astatine 85	109 <b>Rn</b> Radon 86	133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	138 <b>La</b> Lanthanum 57	139 <b>Pr</b> Praseodymium 59	140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	142 <b>Nd</b> Neodymium 60	143 <b>Pm</b> Promethium 61	144 <b>Nd</b> Neodymium 60	145 <b>Sm</b> Samarium 62	146 <b>Eu</b> Europium 63	147 <b>Gd</b> Gadolinium 64	148 <b>Tb</b> Terbium 65	149 <b>Dy</b> Dysprosium 66	150 <b>Ho</b> Holmium 67	151 <b>Er</b> Erbium 68	152 <b>Tm</b> Thulium 69	153 <b>Yb</b> Ytterbium 70	154 <b>Lu</b> Lutetium 71	197 <b>Fr</b> Francium 87	226 <b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89	228 <b>Th</b> Thorium 90	232 <b>Pa</b> Protactinium 91	233 <b>U</b> Uranium 92	234 <b>Np</b> Neptunium 93	235 <b>Pu</b> Plutonium 94	236 <b>Am</b> Americium 95	237 <b>Cm</b> Curium 96	238 <b>Bk</b> Berkelium 97	239 <b>Cf</b> Californium 98	240 <b>Es</b> Einsteinium 99	241 <b>Fm</b> Fermium 100	242 <b>Md</b> Mendelevium 101	243 <b>No</b> Nobelium 102	244 <b>Lr</b> Lawrencium 103

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

a	<b>X</b>
b	

Key

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

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).

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