UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

9241932394

CHEMISTRY **0620/02**

Paper 2 **October/November 2007**

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 16.

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	
Total	

This document consists of **16** printed pages.

1 Some oxides are listed below.

calcium oxide
carbon dioxide
carbon monoxide
phosphorus trioxide
sodium oxide
sulphur dioxide
water

(a) Which one of these oxides is most likely to contribute to acid rain?

..... [1]

(b) Which one of these oxides is a product of the reaction between an acid and a carbonate?

..... [1]

(c) Which one of these oxides is formed by the incomplete combustion of carbon?

..... [1]

(d) Which one of these oxides is a good solvent?

..... [1]

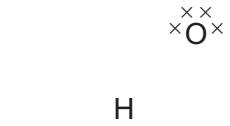
(e) Which one of these oxides is used to neutralise acidic industrial waste products?

..... [1]

(f) Which **two** of these oxides reacts with water to form an alkaline solution?

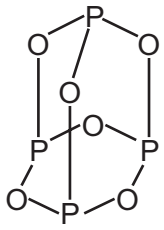
..... [1]

(g) Complete the diagram to show the electronic structure of water.
show hydrogen electrons by ‘o’
show oxygen electrons by ‘x’



[1]

(h) The structure of phosphorus trioxide is shown below.



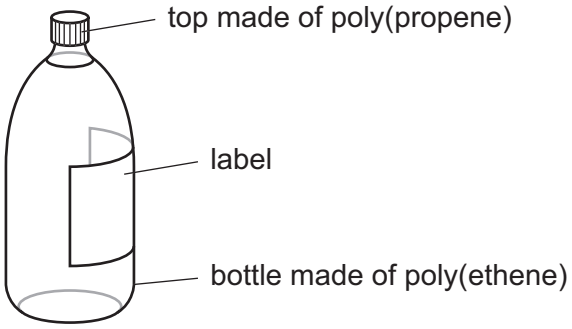
Write the **simplest** formula for phosphorus trioxide.

..... [1]

[Total: 8]

[Turn over

2 The diagram shows a bottle of mineral water.



(a) The poly(propene) top is made by polymerising propene molecules, $CH_3CH=CH_2$.

(i) Which one of the following best describes the propene molecules in this reaction? Put a ring around the correct answer.

alkanes **monomers** **polymers** **products** **salts**

[1]

(ii) State the name of the homologous series to which propene belongs.

..... [1]

(iii) Propene is an unsaturated hydrocarbon.
State the meaning of the following terms.

unsaturated .....

.....

hydrocarbon .....

..... [2]

(iv) Describe a chemical test to distinguish between an unsaturated hydrocarbon and a saturated hydrocarbon. State the results.

test .....

result with saturated hydrocarbon .....

result with unsaturated hydrocarbon ..... [3]

(b) The poly(ethene) bottle is made by polymerising ethene.

$$n CH_2=CH_2 \longrightarrow -(CH_2-CH_2)-_n$$

Complete the following sentence about this reaction by filling in the blank space.

The formation of poly(ethene) is an example of an ..... polymerisation reaction. [1]

(c) The label on the bottle lists the concentration of ions dissolved in the water in milligrams per litre.

concentration of ions in milligrams per litre			
calcium	32	nitrate	1
chloride	5	potassium	0.5
hydrogencarbonate	133	sodium	4.5
magnesium	8	sulphate	7

(i) State the name of **two** negative ions which appear in this list.

..... [1]

(ii) Which metal ion in this list is present in the highest concentration?

..... [1]

(iii) Calculate the amount of magnesium ions in 5 litres of this mineral water.

[1]

(iv) Which ion in the list reacts with aqueous silver nitrate to give a white precipitate?

..... [1]

(v) Which ion in the list gives off ammonia when warmed with sodium hydroxide and aluminium foil?

..... [1]

(vi) Complete the equation to show the formation of a potassium ion from a potassium atom.

$$K \rightarrow K^+ + ...$$ [1]

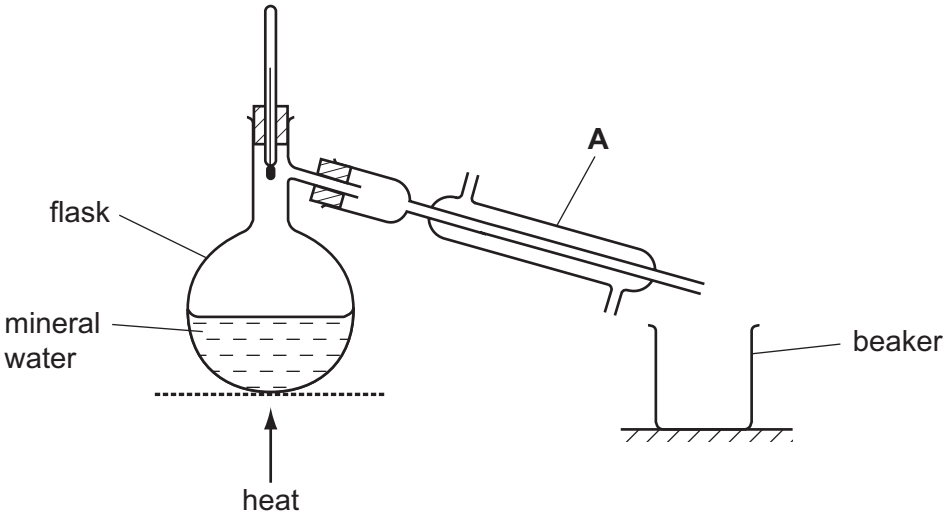
[Turn over

(d) The pH of the mineral water is 7.8.
Which one of the following best describes this pH?
Tick one box.

slightly acidic	☐
slightly alkaline	☐
neutral	☐
very acidic	☐
very alkaline	☐

[1]

(e) Pure water can be obtained by distilling the mineral water using the apparatus shown below.



(i) State the name of the piece of apparatus labelled **A**.

..... [1]

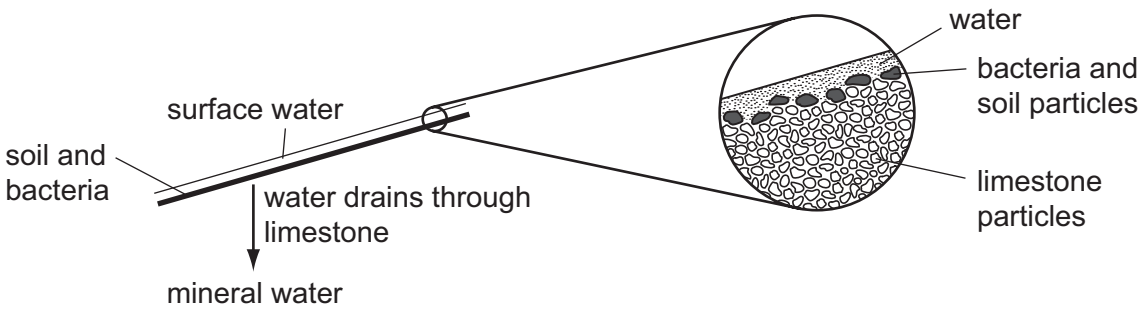
(ii) Where does the pure water collect?

..... [1]

(iii) How does the boiling point of the mineral water in the flask compare with the boiling point of pure water?

..... [1]

(f) The diagram shows how mineral water is formed. Mineral water contains no bacteria or particles of earth.



Use the diagram to explain how the water is purified from bacteria and particles of earth.

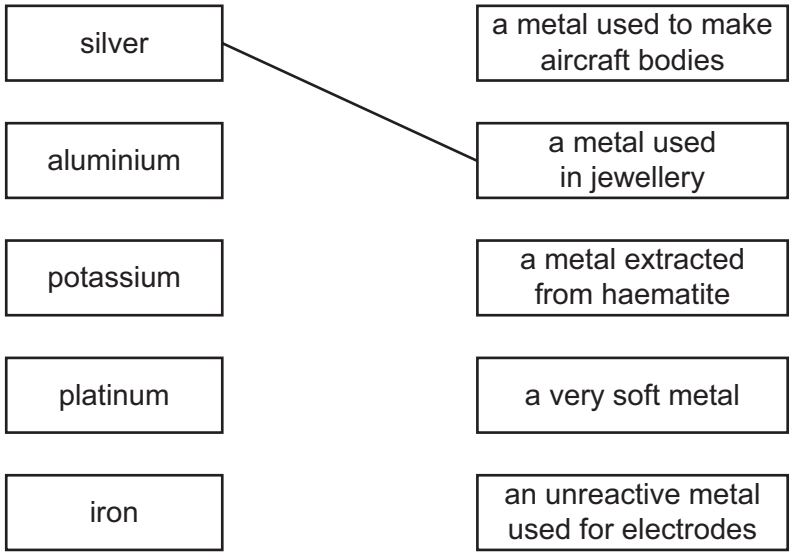
.....

..... [2]

[Total: 20]

3 This question is about metals.

(a) Match up the metals in the boxes on the left with the descriptions in the boxes on the right. The first one has been done for you.



[4]

(b) Iron powder reacts rapidly with sulphuric acid to form aqueous iron(II) sulphate and hydrogen.

$$Fe(s) + H_2SO_4(aq) \rightarrow FeSO_4(aq) + H_2(g)$$

Describe **two** things that you would see happening as this reaction takes place.

.....

..... [2]

(c) Alloys are often more useful than pure metals.

(i) Complete the following sentences by filling in the blank spaces.

An alloy is a ..... of a metal with other elements. The properties of ..... can be changed by the controlled use of additives to form steel alloys. Increasing the amount of carbon in a steel makes it ..... [3]

(ii) Name one other alloy apart from steel.

..... [1]

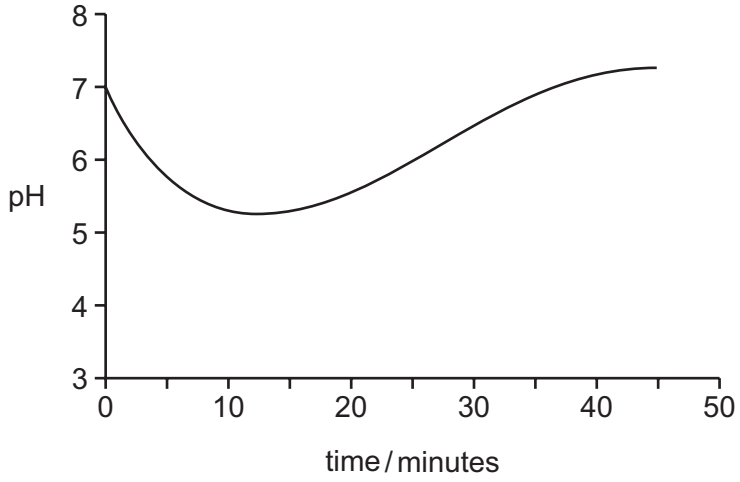
(iii) Iron rusts very easily. Describe two methods of preventing rusting.

1. .....

2. ..... [2]

[Total:12]

4 The diagram shows the changes in pH in a student's mouth after she has eaten a sweet.



(a) Describe how the acidity in the student's mouth changes after she has eaten the sweet.

.....

..... [2]

(b) **(i)** Chewing a sweet stimulates the formation of saliva. Saliva is slightly alkaline. Use this information to explain the shape of the graph.

.....

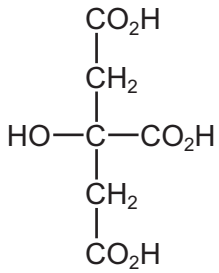
.....

..... [2]

(ii) State the name of the type of reaction which occurs when an acid reacts with an alkali.

..... [1]

(c) Many sweets contain citric acid. The formula of citric acid is shown below.



(i) Put a ring around the alcohol functional group on the above formula. [1]

(ii) State the name of the – CO_2H functional group in citric acid.

..... [1]

(iii) Ethanoic acid also has a – CO_2H functional group.
Write down the formula for ethanoic acid.

..... [1]

[Turn over

(d) Citric acid can be extracted from lemon juice as follows:

stage 1: add calcium carbonate to hot lemon juice
stage 2: filter off the precipitate which is formed (calcium citrate)
stage 3: wash the calcium citrate precipitate with water
stage 4: add sulphuric acid to the calcium citrate to make a solution of citric acid
stage 5: crystallise the citric acid

(i) When calcium carbonate is added to lemon juice a fizzing is observed.
Explain why there is a fizzing.

..... [1]

(ii) Draw a diagram to show step 2. Label your diagram.

[2]

(iii) Suggest why the calcium citrate precipitate is washed with water.

..... [1]

(iv) Describe how you would carry out step 5.

.....

..... [1]

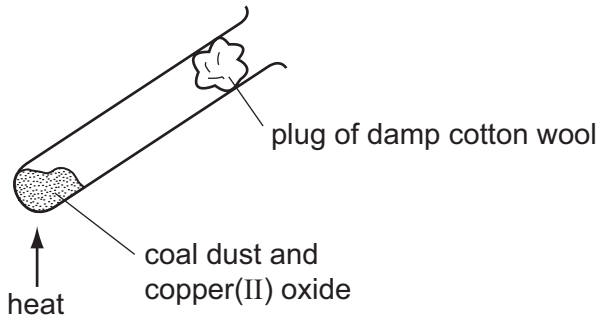
(v) Nowadays, citric acid is usually made by the fermentation of sugars.
Which one of the following is required for fermentation?
Put a ring around the correct answer.

acid **high temperature** **light** **microorganisms** **nitrogen**

[1]

[Total: 14]

5 Some coal dust was heated with copper(II) oxide using the apparatus shown below.



(a) Coal contains carbon and various hydrocarbons. The carbon reduces the copper(II) oxide when heated.

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

.....

[1]

(ii) At the end of the experiment a reddish-brown solid remained in the tube.
State the name of this reddish-brown solid.

.....

[1]

(iii) The reddish brown solid conducts electricity.
How could you show that it conducts electricity?

.....

.....

[2]

(b) During the experiment, water collected on the cooler parts of the test tube.

(i) Suggest where the hydrogen in the water comes from.

.....

[1]

(ii) Water is a liquid.
Describe the arrangement and motion of the particles in a liquid.

.....

.....

[2]

[Total: 7]

6 The table below shows an early form of the Periodic Table made by John Newlands in 1866.

H	F	C*l*	Co, Ni	Br
Li	Na	K	Cu	Rb
Be	Mg	Ca	Zn	Sr
B	A*l*	Cr	Y	
C	Si	Ti	In	
N	P	Mn	As	
O	S	Fe	Sc	

(a) Newlands arranged the elements according to their relative atomic masses. What governs the order of the elements in the modern Periodic Table?

.....

[1]

(b) Use your modern Periodic Table to suggest why Newlands put cobalt and nickel in the same place.

.....

[1]

(c) Which group of elements is missing from Newlands' table?

.....

[1]

(d) Describe **three other** differences between Newlands' table and the modern Periodic Table. You must not give any of the answers you mentioned in parts (a), (b) or (c).

.....

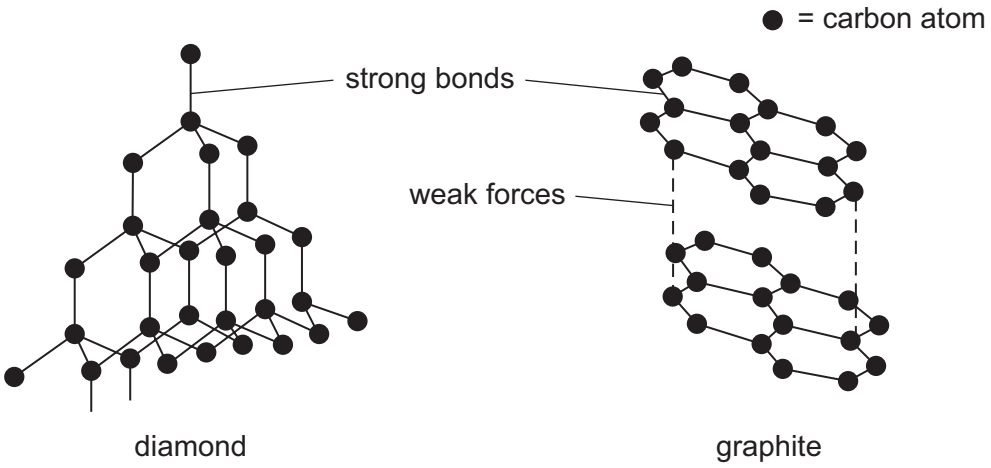
.....

.....

.....

[3]

(e) Carbon exists in two forms, graphite and diamond.



Use ideas about structure and bonding to suggest

(i) why graphite is used as a lubricant,

..... [1]

(ii) why diamond is very hard.

..... [1]

[Total: 8]

7 Compounds and elements vary in their volatility, solubility in water and electrical conductivity depending on their bonding.

(a) Place copper, methane and water in order of their volatility.

most volatile →	
least volatile →	

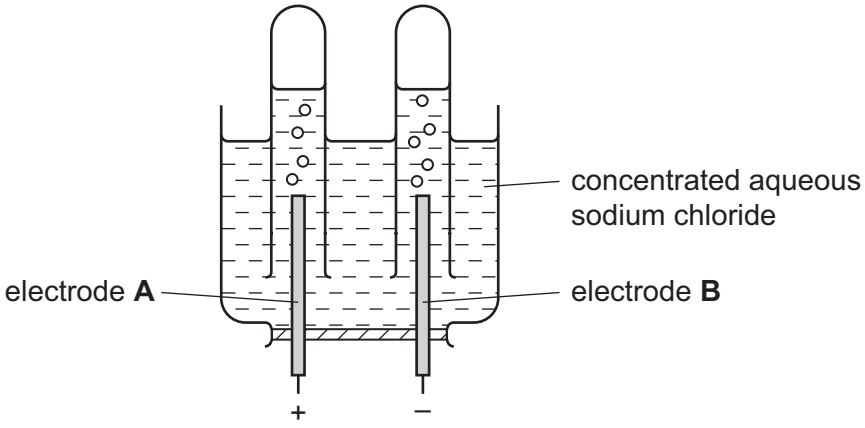
[1]

(b) Complete the table to show the solubility in water and electrical conductivity of various solids.

solid	structure	soluble or insoluble	does it conduct electricity?
silver	metallic	insoluble	
sodium chloride	ionic		no
sulphur	covalent		no
copper sulphate	ionic	soluble	

[4]

(c) The apparatus shown below is used to electrolyse concentrated aqueous sodium chloride.



(i) Suggest a suitable substance which could be used for the electrodes.

..... [1]

(ii) State the name of the gas given off

at electrode **A**, ...

at electrode **B**. ..... [2]

(iii) State the name given to electrode **A**.

.....

[1]

(iv) Explain why aqueous sodium chloride conducts electricity but solid sodium chloride does not.

.....

.....

[2]

[Total: 11]

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 Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	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	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	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	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	139 La Lanthanum 57 *	178 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	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	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	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

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

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

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