



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 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	
<b>1</b>	
<b>2</b>	
<b>3</b>	
<b>4</b>	
<b>5</b>	
<b>6</b>	
<b>7</b>	
<b>Total</b>	

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'



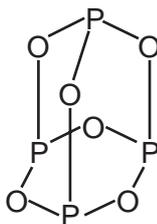
H            H

[1]

3

For  
Examiner's  
Use

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

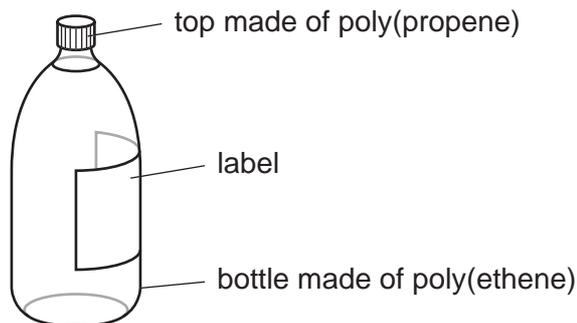


Write the **simplest** formula for phosphorus trioxide.

..... [1]

[Total: 8]

2 The diagram shows a bottle of mineral water.



(a) The poly(propene) top is made by polymerising propene molecules,  $\text{CH}_3\text{CH}=\text{CH}_2$ .

(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.



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.



(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

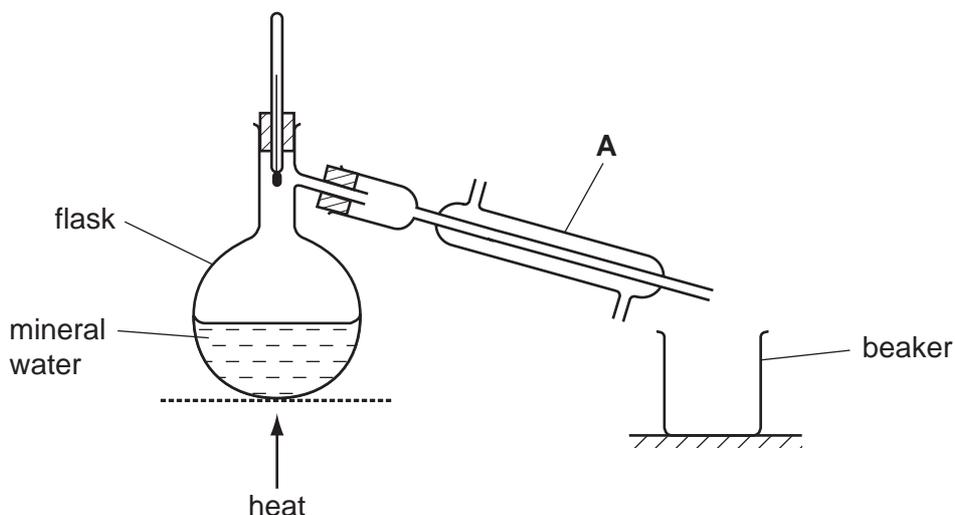
neutral

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]

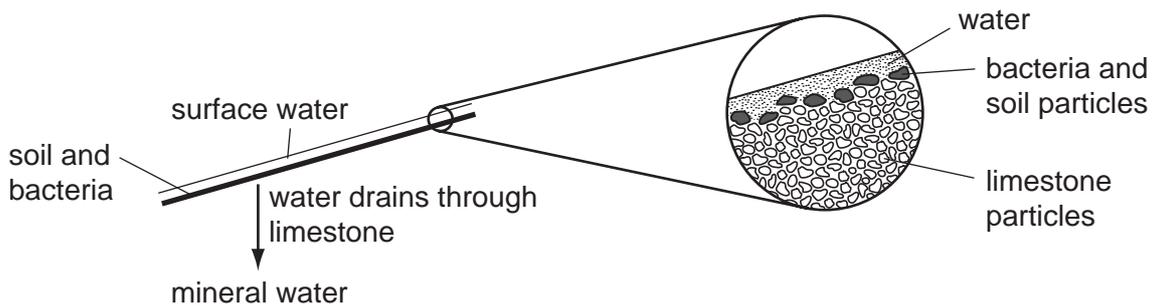
(ii) Where does the pure water collect?

..... [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]

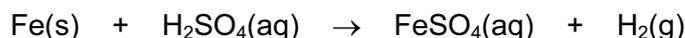
3 This question is about metals.

(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.

silver	a metal used to make aircraft bodies
aluminium	a metal used in jewellery
potassium	a metal extracted from haematite
platinum	a very soft metal
iron	an unreactive metal used for electrodes

[4]

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



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.

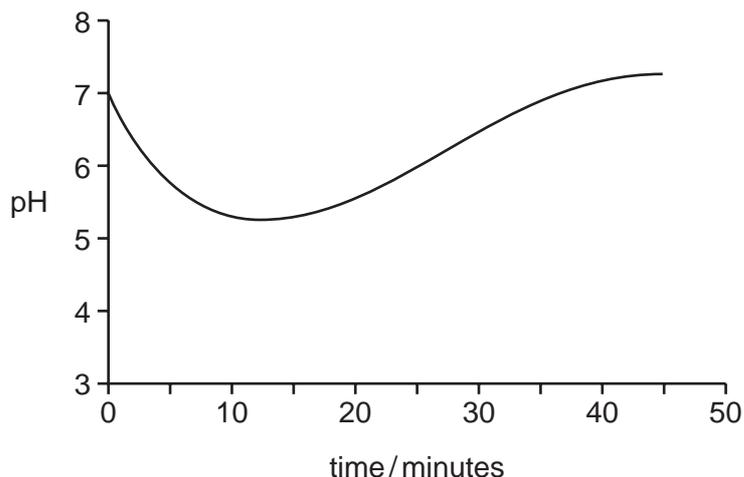
..... [1]

(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]

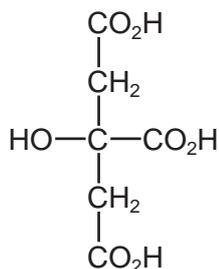
- (b) (i) Chewing a sweet stimulates the formation of saliva. Saliva is slightly alkaline. Use this information to explain the shape of the graph.

.....  
 .....  
 ..... [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  $-\text{CO}_2\text{H}$  functional group in citric acid.

..... [1]

- (iii) Ethanoic acid also has a  $-\text{CO}_2\text{H}$  functional group. Write down the formula for ethanoic acid.

..... [1]

(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]

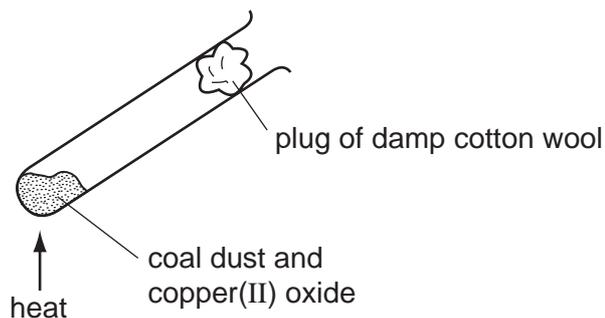
(v) Nowadays, citric acid is usually made by the fermentation of sugars.  
 Which one of the following is required for fermentation?  
 Put a ring around the correct answer.

**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	Cl	Co, Ni	Br
Li	Na	K	Cu	Rb
Be	Mg	Ca	Zn	Sr
B	Al	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]

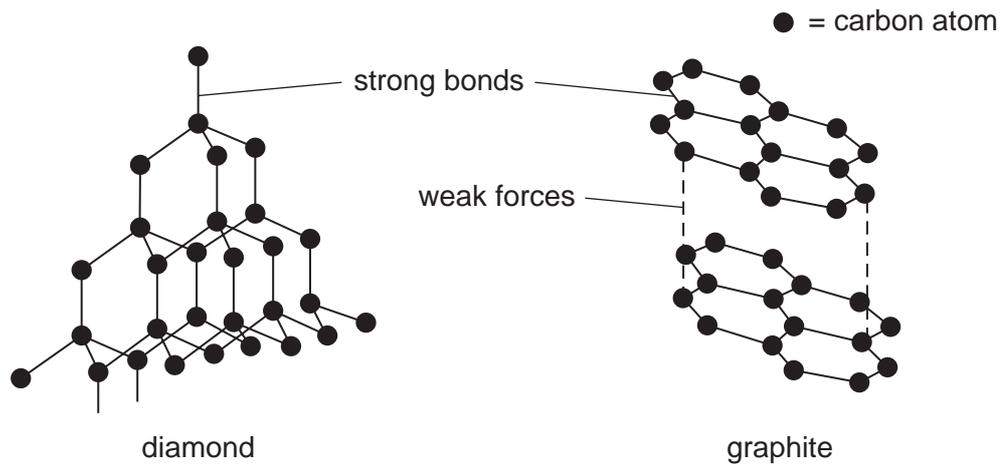
- (c) Which group of elements is missing from Newlands' table?

..... [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	→	

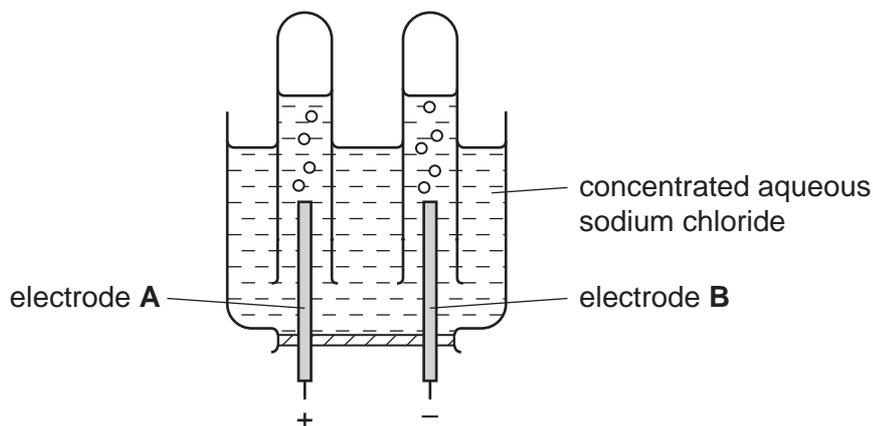
[1]

(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]

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

		Group															
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII					
	1 <b>H</b> Hydrogen 1																
7	9											4					
<b>Li</b> Lithium 3	<b>Be</b> Beryllium 4											<b>He</b> Helium 2					
23	24											20					
<b>Na</b> Sodium 11	<b>Mg</b> Magnesium 12											<b>Ne</b> Neon 10					
39	40	45	48	51	52	55	56	59	59	64	65	70	73	75	79	80	84
<b>K</b> Potassium 19	<b>Ca</b> Calcium 20	<b>Sc</b> Scandium 21	<b>Ti</b> Titanium 22	<b>V</b> Vanadium 23	<b>Cr</b> Chromium 24	<b>Mn</b> Manganese 25	<b>Fe</b> Iron 26	<b>Co</b> Cobalt 27	<b>Ni</b> Nickel 28	<b>Cu</b> Copper 29	<b>Zn</b> Zinc 30	<b>Ga</b> Gallium 31	<b>Ge</b> Germanium 32	<b>As</b> Arsenic 33	<b>Se</b> Selenium 34	<b>Br</b> Bromine 35	<b>Kr</b> Krypton 36
85	88	89	91	93	96	101	101	103	106	108	112	115	119	122	128	127	131
<b>Rb</b> Rubidium 37	<b>Sr</b> Strontium 38	<b>Y</b> Yttrium 39	<b>Zr</b> Zirconium 40	<b>Nb</b> Niobium 41	<b>Mo</b> Molybdenum 42	<b>Tc</b> Technetium 43	<b>Ru</b> Ruthenium 44	<b>Rh</b> Rhodium 45	<b>Pd</b> Palladium 46	<b>Ag</b> Silver 47	<b>Cd</b> Cadmium 48	<b>In</b> Indium 49	<b>Sn</b> Tin 50	<b>Sb</b> Antimony 51	<b>Te</b> Tellurium 52	<b>I</b> Iodine 53	<b>Xe</b> Xenon 54
133	137	139	178	181	184	186	190	192	195	197	201	204	207	209	208	210	222
<b>Cs</b> Caesium 55	<b>Ba</b> Barium 56	<b>La</b> Lanthanum 57	<b>Hf</b> Hafnium 72	<b>Ta</b> Tantalum 73	<b>W</b> Tungsten 74	<b>Re</b> Rhenium 75	<b>Os</b> Osmium 76	<b>Ir</b> Iridium 77	<b>Pt</b> Platinum 78	<b>Au</b> Gold 79	<b>Hg</b> Mercury 80	<b>Tl</b> Thallium 81	<b>Pb</b> Lead 82	<b>Bi</b> Bismuth 83	<b>Po</b> Polonium 84	<b>At</b> Astatine 85	<b>Rn</b> Radon 86
226	227											227					
<b>Fr</b> Francium 87	<b>Ra</b> Radium 88	<b>Ac</b> Actinium 89											<b>Ac</b> Actinium 89				
												*58-71 Lanthanoid series †90-103 Actinoid series					
												140					
												<b>Ce</b> Cerium 58					
												141					
												<b>Pr</b> Praseodymium 59					
												144					
												<b>Nd</b> Neodymium 60					
												145					
												<b>Pm</b> Promethium 61					
												150					
												<b>Sm</b> Samarium 62					
												152					
												<b>Eu</b> Europium 63					
												157					
												<b>Gd</b> Gadolinium 64					
												162					
												<b>Dy</b> Dysprosium 66					
												165					
												<b>Ho</b> Holmium 67					
												167					
												<b>Er</b> Erbium 68					
												169					
												<b>Tm</b> Thulium 69					
												173					
												<b>Yb</b> Ytterbium 70					
												175					
												<b>Lu</b> Lutetium 71					
												101					
												<b>Md</b> Mendelevium 101					
												102					
												<b>No</b> Nobelium 102					
												103					
												<b>Lr</b> Lawrencium 103					

a = relative atomic mass

X = atomic symbol

b = proton (atomic) number

Key

a	<b>X</b>	b

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