

Candidate Name _____

Centre Number	Candidate Number

International General Certificate of Secondary Education

CAMBRIDGE INTERNATIONAL EXAMINATIONS

CHEMISTRY

0620/2

PAPER 2

MAY/JUNE SESSION 2002

1 hour

Candidates answer on the question paper.
No additional materials are required.

Time 1 hour

INSTRUCTIONS TO CANDIDATES

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

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

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

You may use a calculator.

A copy of the Periodic Table is printed on page 16.

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
6	
TOTAL	

This question paper consists of 16 printed pages.



1 This question is about gases and their properties.

(a) Complete the following table showing tests for various gases.

gas	test	result
oxygen	put a glowing splint into the gas	
chlorine	put a moist litmus paper into the gas	
carbon dioxide		the solution turns milky

[3]

(b) The table shows the percentage of various gases in the air.

gas	percentage of gas in the air
A	78
B	21
C	about 1
D	0.03

(i) Which one of these gases, **A**, **B**, **C** or **D**, is nitrogen?

..... [1]

(ii) Which one of these gases, **A**, **B**, **C** or **D**, is carbon dioxide?

..... [1]

(iii) Which gas in the air is a product of respiration?

..... [1]

(c) A chlorine atom has 17 electrons.

(i) Draw a diagram to show how the electrons are arranged in one atom of chlorine.

[2]

- (ii) Draw a diagram to show how the electrons are arranged in a chlorine molecule.

Show only the outer electron shells.

[2]

- (d) When sodium reacts with hydrogen, sodium hydride is formed.

Hydrogen has a molecular structure and sodium hydride has an ionic giant structure.

What does this information tell you about

- (i) the melting point of sodium hydride,

..... [1]

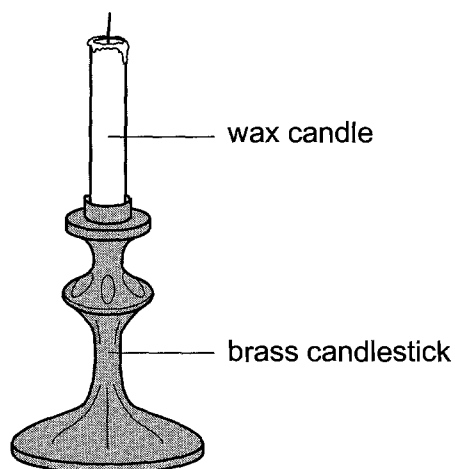
- (ii) the boiling point of hydrogen,

..... [1]

- (iii) the electrical conductivity of molten sodium hydride?

..... [1]

2 Candlesticks are often made of brass.



(a) Brass is an alloy of copper and zinc.

The composition of 50 g of aluminium brass is shown in the table.

element present in the brass	g of element in 50 g of brass
copper	38
zinc	11
aluminium	1
arsenic	trace

(i) Name an element from this table which is a transition element.

Use the Periodic Table to help you.

..... [1]

(ii) Which element in the table is most likely to show non-metallic properties?

..... [1]

(iii) Calculate the percentage of copper in this brass.

[1]

- (b) Suggest why an alloy of copper and zinc is used to make candlesticks rather than pure copper.

[1]

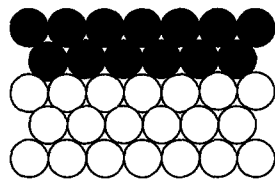
- (c) Gilding metal is a type of brass, which contains 90% copper and 10% zinc.

Which one of the following diagrams most accurately represents this alloy?

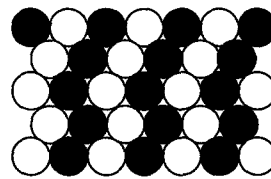
Put a ring around the correct answer.

○ copper atom

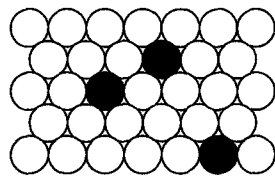
● zinc atom



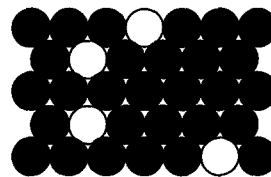
A



B



C



D

[1]

- (d) Brass ornaments tarnish after a time because the copper in them is gradually oxidised to copper(II) oxide.

- (i) Complete the symbol equation for this reaction.



[1]

- (ii) Brass ornaments which have become tarnished can be cleaned with a dilute solution of hydrochloric acid.

The copper(II) oxide reacts with the hydrochloric acid.

Complete the word equation for this reaction.

copper(II) oxide + hydrochloric acid \longrightarrow +

.....

[2]

(iii) Explain why copper(II) oxide is behaving as a basic oxide in this reaction.

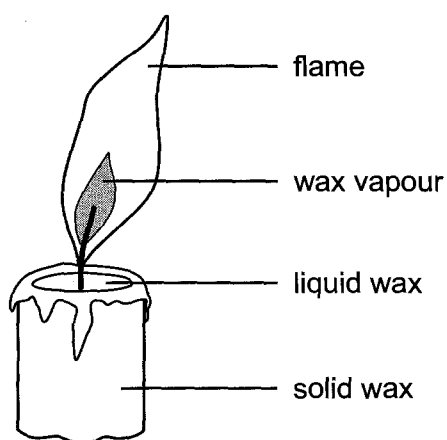
.....
 [1]

(e) Candle wax can be made from a hydrocarbon fraction obtained from petroleum.

What process is used to separate the different fractions of petroleum?

..... [1]

(f) The diagram shows part of a burning candle.



Use the particle theory to describe the changes that occur as the wax turns from solid to liquid and then from liquid to gas, in terms of

(i) the movement of the wax particles,

.....
 [1]

(ii) the distance of the wax particles from each other,

.....
 [2]

(iii) the arrangement of the wax particles.

.....
 [2]

- 3 Lithium, sodium and potassium are a group of relatively soft metals with similar properties. They are called the alkali metals.

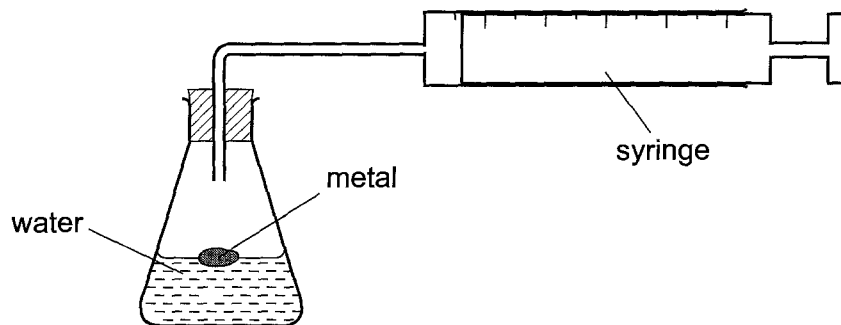
(a) Complete the table below to show the number of subatomic particles present in one atom of potassium.

Use the Periodic Table to help you.

number of protons	
number of neutrons	
number of electrons	

[3]

(b) The apparatus below can be used to compare the reactivity of the alkali metals with water.



(i) State the name of the gas formed when the alkali metals react with water.

..... [1]

(ii) Explain how this apparatus could be used to compare the rates of reaction of the alkali metals.

.....

 [3]

(iii) How does the rate of reaction of the alkali metals with water change as you go down Group I?

..... [1]

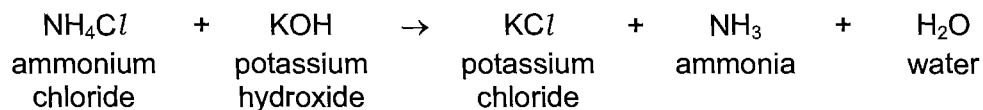
(c) When potassium reacts with water, a solution of potassium hydroxide is formed.

Potassium hydroxide reacts with hydrochloric acid.

(i) What type of reaction is this?

.....

(ii) Potassium hydroxide reacts with ammonium chloride on heating.



What type of reagent is potassium hydroxide in this reaction?

Put a ring around the correct answer.

acid

addition

base

salt

(iii) Ammonia is given off in this reaction.

Which **two** statements about ammonia in the table are correct?

Tick **two** boxes.

ammonia turns damp blue litmus paper red	
ammonia is liquid at room temperature	
ammonia reacts with acids to form ammonium salts	
ammonia is an alkaline gas	

[4]

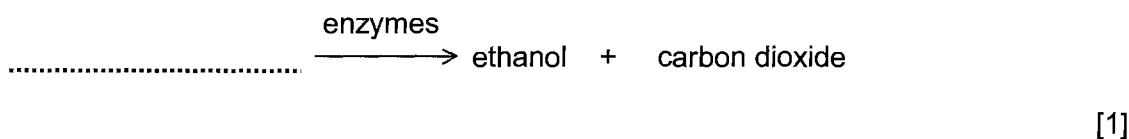
4 In some parts of the world, ethanol has replaced petrol as a fuel for cars.

(a) What is the meaning of the word *fuel*?

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

(b) The alcohol is made by fermentation of sugar cane or sugar beet extract.

(i) Complete the word equation for fermentation.



(ii) What are *enzymes*?

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

(c) The boiling point of ethanol is 79°C. Sugar cane extract is largely water.

How could the ethanol be separated from fermented sugar cane extract?

..... [1]

(d) Suggest **two** advantages of using alcohol as a fuel in cars rather than petrol.

advantage 1
advantage 2 [2]

(e) Name a fuel, other than alcohol, which could be used in cars in place of petrol.

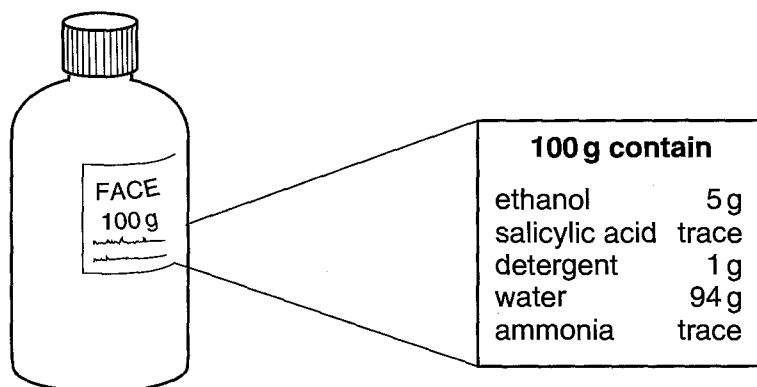
..... [1]

(f) Nitrogen oxides and lead compounds are sometimes found in the gases from car exhausts.

What problems are associated with these compounds if they get into the atmosphere?

nitrogen oxides
.....
lead compounds
..... [2]

- 5 The diagram shows the contents label from a bottle of face-cleaning liquid.



- (a) How many grams of ethanol are there in 20 g of the face cleaning liquid?

[1]

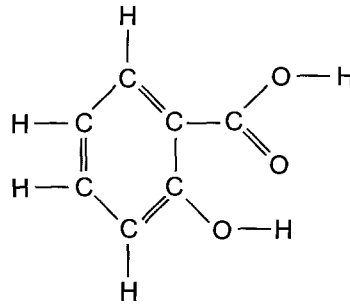
- (b) (i) Draw the structural formula for ethanol, showing all atoms and bonds.

[2]

- (ii) Which functional group gives ethanol its characteristic chemical properties?

[1]

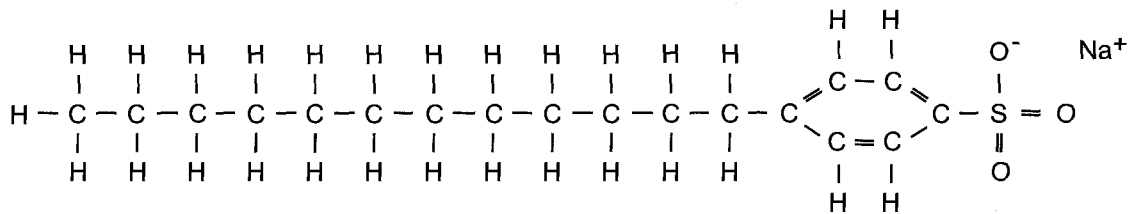
(c) The formula for salicylic acid is as shown



Put a ring around the carboxylic acid group in this formula.

[1]

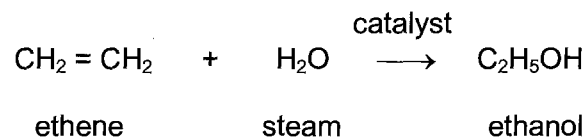
(d) The formula for a detergent is shown below.



Name the elements present in this compound.

[2]

(e) Ethanol can be made by the reaction of ethene with steam.



(i) What type of reaction is this?

Put a ring around the correct answer.

addition

neutralisation

oxidation

reduction

[1]

(ii) What colour change would you observe when a few drops of aqueous bromine are shaken in a test-tube of ethene?

[2]

- (iii) What does the result of the aqueous bromine test tell you about the structure and bonding in ethene?

..... [1]

- (iv) Which **two** words from the list below describe the structure and bonding in ethene?

atomic

covalent

giant

ionic

metallic

molecular

[2]

- (v) Ethene belongs to the homologous series called the alkenes.

Complete the definition of a homologous series by filling in the blank spaces.

You may **only** choose words from the list below.

alkane

compounds

elements

functional

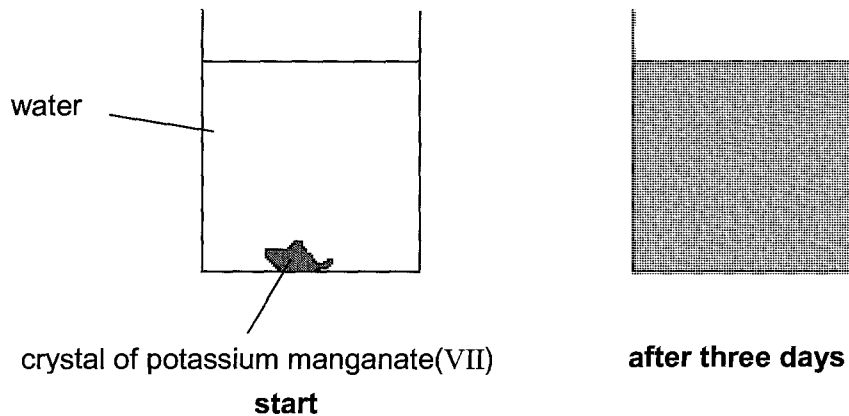
mixtures

unreactive

A homologous series is a family of similarwith similar properties due to the presence of the same group.

[2]

- 6 A student dropped a purple crystal of potassium manganate(VII) into a beaker of water. The beaker was left for three days without shaking.



- (a) After three days, the purple colour had spread throughout the water.

Use ideas about particles to explain this observation.

.....

.....

.....

.....

[3]

- (b) Name the process you can use to obtain a sample of solid potassium manganate(VII) from a solution of potassium manganate(VII) in water.

..... [1]

- (c) The formula of potassium manganate(VII) is KMnO_4 .

Calculate the relative formula mass of potassium manganate(VII).

Use the Periodic Table to help you.

[1]

- (d) When potassium manganate(VII) is heated, oxygen is given off.

Complete the equation for this reaction.



[1]

- (e) Potassium manganate(VII) contains manganese.

Manganese is a transition element.

Describe three properties of the transition elements which are not shown by metals such as sodium or aluminium.

1

2

3

[3]

- (f) The salts of many transition elements occur in a hydrated form.

Hydrated salts give off water vapour when heated.

- (i) Draw a labelled diagram to show how you could condense and collect the water vapour produced when a hydrated salt is heated.

[3]

- (ii) Heating a hydrated salt is a reversible reaction.

Explain what is meant by the term *reversible reaction*.

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

- (iii) Describe the colour change when hydrated copper(II) sulphate is heated.

..... [2]

DATA SHEET
The Periodic Table of the Elements

Group		I	II	III	IV	V	VI	VII	0
		1 H Hydrogen 1							2 He Helium 4
7 Li Lithium 3	9 Be Beryllium 4			5 B Boron 5	6 C Carbon 6	7 N Nitrogen 7	8 O Oxygen 8	9 F Fluorine 9	10 Ne Neon 10
11 Na Sodium 11	12 Mg Magnesium 12			13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulphur 16	17 Cl Chlorine 17	18 Ar Argon 18
19 K Potassium 19	20 Ca Calcium 20			21 V Vanadium 21	22 Ti Titanium 22	23 Cr Chromium 24	24 Mn Manganese 25	25 Fe Iron 26	26 Ni Nickel 28
37 Rb Rubidium 37	38 Sr Strontium 38			39 K Potassium 19	40 Ca Calcium 20	41 Nb Niobium 41	42 Mo Molybdenum 42	43 Tc Technetium 43	44 Ru Ruthenium 44
55 Cs Caesium 55	56 Ba Barium 56			45 Sc Scandium 21	46 Ti Titanium 22	47 V Vanadium 23	48 Cr Chromium 24	49 Mn Manganese 25	50 Fe Iron 26
87 Fr Francium 87	88 Ra Radium 88			49 Zr Zirconium 40	50 Nb Niobium 41	51 Mo Molybdenum 42	52 Tc Technetium 43	53 Ru Ruthenium 44	54 Rh Rhodium 45
				55 Y Yttrium 39	56 Zr Zirconium 40	57 Nb Niobium 41	58 Mo Molybdenum 42	59 Tc Technetium 43	60 Ru Ruthenium 44
				63 La Lanthanum 57	64 Ce Cerium 58	65 Pr Praseodymium 59	66 Nd Neodymium 60	67 Pm Promethium 61	68 Sm Samarium 62
				71 Lu Lutetium 71	72 Hf Hafnium 72	73 Ta Tantalum 73	74 W Tungsten 74	75 Re Rhenium 75	76 Os Osmium 76
				79 Ir Iridium 77	80 Pt Platinum 78	81 Au Gold 79	82 Hg Mercury 80	83 Tl Thallium 81	84 Pb Lead 82
				85 Bi Bismuth 83	86 Po Polonium 84	87 At Astatine 85	88 Rn Radon 86	89 Ac Actinium 89	
				89 La Lanthanum 57	90 Ce Cerium 58	91 Pr Praseodymium 59	92 Nd Neodymium 60	93 Pm Promethium 61	94 Sm Samarium 62
				95 Eu Europium 63	96 Gd Gadolinium 64	97 Tb Terbium 65	98 Dy Dysprosium 66	99 Ho Holmium 67	100 Er Erbium 68
				101 Md Mendelevium 101	102 No Nobelium 102	103 Lr Lawrencium 103	104 U Uranium 92	105 Np Neptunium 93	106 Pu Plutonium 94
				107 Fr Francium 87	108 Ra Radium 88	109 Ac Actinium 89	110 Th Thorium 90	111 Pa Protactinium 91	112 U Uranium 92
				113 Tl Thallium 81	114 Pb Lead 82	115 Bi Bismuth 83	116 Po Polonium 84	117 At Astatine 85	118 Rn Radon 86
				119 Fr Francium 87	120 Ra Radium 88	121 Ac Actinium 89	122 Th Thorium 90	123 Pa Protactinium 91	124 U Uranium 92
				125 Th Thorium 90	126 Pa Protactinium 91	127 U Uranium 92	128 Np Neptunium 93	129 Pu Plutonium 94	130 Am Americium 95
				131 Ce Cerium 58	132 Pr Praseodymium 59	133 Nd Neodymium 60	134 Pm Promethium 61	135 Sm Samarium 62	136 Eu Europium 63
				137 Gd Gadolinium 64	138 Tb Terbium 65	139 Dy Dysprosium 66	140 Ho Holmium 67	141 Er Erbium 68	142 Tm Thulium 69
				143 Lu Lutetium 71	144 Yb Ytterbium 70	145 La Lanthanum 57	146 Ce Cerium 58	147 Pr Praseodymium 59	148 Nd Neodymium 60
				149 Lu Lutetium 71	150 Yb Ytterbium 70	151 La Lanthanum 57	152 Ce Cerium 58	153 Pr Praseodymium 59	154 Nd Neodymium 60
				155 Lu Lutetium 71	156 Yb Ytterbium 70	157 La Lanthanum 57	158 Ce Cerium 58	159 Pr Praseodymium 59	160 Nd Neodymium 60
				161 Lu Lutetium 71	162 Yb Ytterbium 70	163 La Lanthanum 57	164 Ce Cerium 58	165 Pr Praseodymium 59	166 Nd Neodymium 60
				167 Lu Lutetium 71	168 Yb Ytterbium 70	169 La Lanthanum 57	170 Ce Cerium 58	171 Pr Praseodymium 59	172 Nd Neodymium 60
				173 Lu Lutetium 71	174 Yb Ytterbium 70	175 La Lanthanum 57	176 Ce Cerium 58	177 Pr Praseodymium 59	178 Nd Neodymium 60

*58-71 Lanthanoid series
90-103 Actinoid series

Key

a	X
b	X

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

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