

Candidate Name _____

Centre Number

--

www.PapaCambridge.com

International General Certificate of Secondary Education

CAMBRIDGE INTERNATIONAL EXAMINATIONS

CHEMISTRY

0620/2

PAPER 2

OCTOBER/NOVEMBER 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.

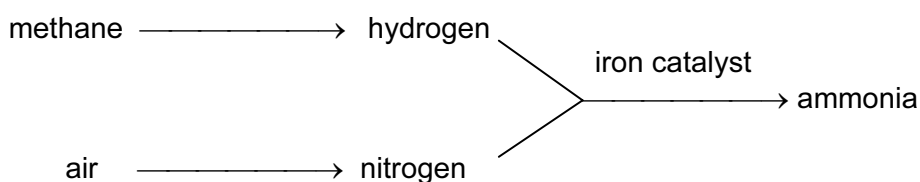
You may use a calculator.

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

FOR EXAMINER'S USE

1	
2	
3	
4	
5	
6	
TOTAL	

- 1 Ammonia, NH_3 , is synthesised by the following route.



- (a) (i) To which group of organic compounds does methane, CH_4 , belong?

Put a ring around the correct answer.

alkane **alcohol** **alkene** **carboxylic acid** [1]

- (ii) Draw the formula for methane, showing all atoms and bonds.

[1]

- (iii) State the most likely source of methane.

..... [1]

- (b) (i) State the percentage of nitrogen in clean air.

..... [1]

- (ii) Name another non-metal that is in the same Period as nitrogen.

..... [1]

- (c) Ammonia is made by heating hydrogen with nitrogen in the presence of a catalyst.

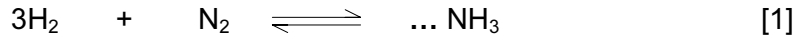
- (i) What is the purpose of the catalyst?

..... [1]

- (ii) What happens to the rate of a reaction when the temperature is increased?

..... [1]

(d) (i) Complete the following equation which shows the synthesis of ammonia from hydrogen and nitrogen.



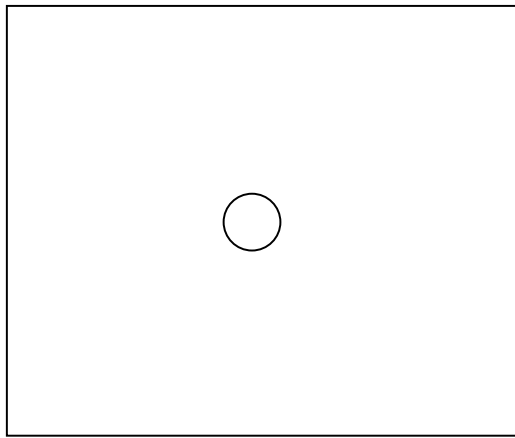
(ii) What does the sign \rightleftharpoons mean?

..... [1]

(e) The ammonia formed in the reaction is liquefied.

Complete the diagram below to show the arrangement of the molecules in liquid ammonia.

○ represents a single molecule of ammonia.



[2]

(f) How would you test for ammonia in the laboratory?

test

result [2]

(g) Ammonia is used to make fertilizers.

(i) Why are fertilizers used in agriculture?

..... [1]

(ii) Some fertilizers contain ammonium sulphate.

Complete the word equation to show how ammonium sulphate is formed.

ammonia + → ammonium sulphate

[1]

- 2 When rain water trickles through rocks, it dissolves some of the minerals present.

This water, which is bottled for drinking, is called mineral water.

The table shows the ions present in a litre of mineral water.

name of ion	formula of ion	mass of ion present in one litre of water/milligrams
calcium	Ca^{2+}	10
chloride	Cl^{-}	8
hydrogencarbonate	HCO_3^{-}	64
sodium	Na^{+}	8
sulphate	SO_4^{2-}	7

- (a) What do you understand by the term *ion*?

..... [1]

- (b) Which positive ion has the greatest concentration in this sample of water?

..... [1]

- (c) Complete the following equation to show how a calcium ion is formed from a calcium atom.



[1]

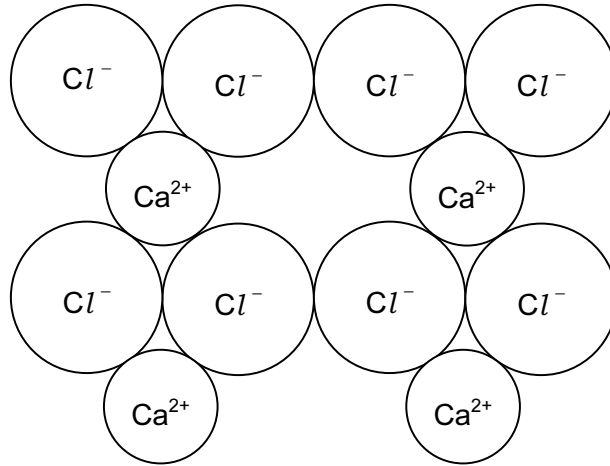
- (d) When this sample of mineral water is evaporated to dryness, various compounds are formed. One of these compounds is calcium chloride.

Suggest the name of **two** other compounds which could be formed.

compound 1

compound 2 [2]

(e) Part of the structure of calcium chloride is shown below.



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

formula [1]

(f) Complete the following table to show the electrical conductivity of calcium and calcium chloride in the solid and liquid states.

Put a ✓ if the substance conducts.

Put a ✗ if the substance does not conduct.

substance	state	electrical conductivity
calcium	solid	
calcium	liquid	
calcium chloride	solid	
calcium chloride	liquid	

[2]

(g) A sample of water was contaminated with clay, which is insoluble in water.

Explain with the help of a labelled diagram, how you would separate the clay from the water.

[3]

3 Fluorine, chlorine, bromine and iodine are halogens.

(a) Complete the table by filling in the blank spaces.

halogen	colour	melting point /°C	boiling point /°C	state at room temperature
fluorine	yellow	-220	-188	
chlorine		-101	-35	gas
bromine	reddish-brown	-7	+59	
iodine		+114		solid

[4]

(b) Predict the boiling point of iodine.

[1]

(c) When chlorine is bubbled through a solution of potassium bromide, the solution turns orange - red.

When iodine is mixed with potassium bromide, no colour change occurs.

(i) Write a word equation for the reaction between chlorine and potassium bromide.

[2]

(ii) Put the elements bromine, chlorine and iodine in order of reactivity.

most reactive	→	
least reactive	→	

[1]

(d) State a use of chlorine.

[1]

.....

(e) In the presence of sunlight, chlorine reacts with methane.

Hydrogen chloride gas, $\text{H} - \text{Cl}$, is given off during this reaction.

State the type of bonding in a hydrogen chloride molecule.

Put a ring around the correct answer.

covalent

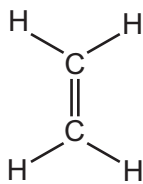
ionic

metallic

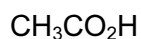
weak

[1]

- 4 Some organic compounds found in ripe fruits are shown below.



A



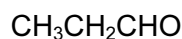
B



C



D



E

- (a) What do you understand by the term *organic compound*?

.....
 [1]

- (b) Which **two** of the compounds belong to the same homologous series?

compound and compound [1]

- (c) Which **one** of these compounds is an unsaturated hydrocarbon?

..... [1]

- (d) Which **one** of these compounds is an alcohol?

..... [1]

- (e) Which **one** of these compounds can be formed directly by cracking the paraffin fraction from petroleum?

..... [1]

- (f) Compound **D** burns readily.

- (i) Burning is an exothermic reaction.

Explain the meaning of the term *exothermic*.

..... [1]

- (ii) State the products formed when **D** burns in excess air.

..... [2]

- (iii) Name the carbon compound formed when **D** undergoes incomplete combustion.

..... [1]

- (g) Write down the molecular formula of compound **C**.

..... [1]

- (h) Calculate the relative molecular mass of compound **C**.

..... [1]

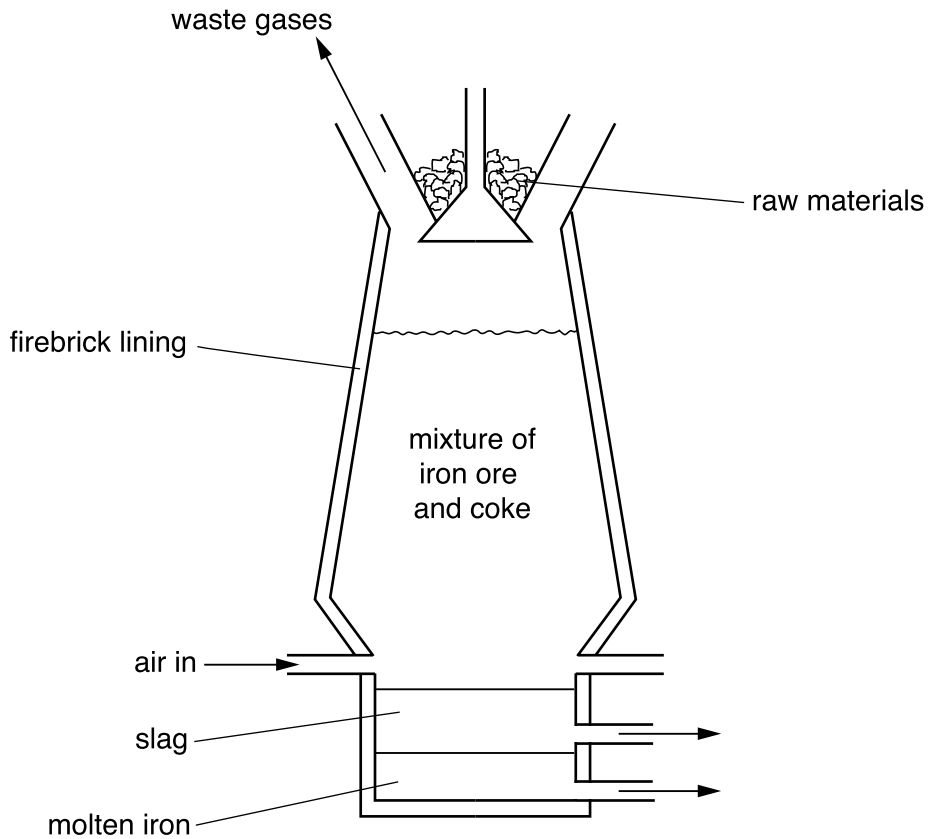
- (i) Many fruits contain a variety of different coloured compounds.

What separation technique can you use to separate these different coloured compounds?

..... [1]

5 Iron is extracted from the ore, haematite.

The iron ore is put in a blast furnace with coke and a current of air is blown through the heated mixture.



(a) What do you understand by the term *ore*?

.....
 [1]

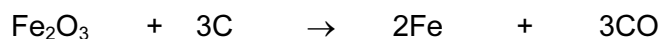
(b) What other raw material needs to be added to the blast furnace?

Put a ring around the correct answer.

- cement** **limewater** **limestone** **slag**

[1]

(c) Near the bottom of the furnace, iron(III) oxide is reduced by carbon.



(i) Write a word equation for this reaction.

[1]

(ii) Explain what is meant by the term *reduction*.

.....
 [1]

(d) The table shows the composition of the waste gases leaving the blast furnace.

gas	percentage of gas in the mixture
carbon dioxide	12
carbon monoxide	24
hydrogen	4
nitrogen	60

(i) The hydrogen in the waste gas is formed by the reaction of hot carbon with water vapour.

There is no water in the materials added to the top of the furnace.

Suggest where this water vapour comes from.

..... [1]

(ii) The reaction of hot carbon with water vapour is endothermic.

What is meant by the term *endothermic*?

..... [1]

(e) Iron can be converted into steel, which is more resistant to corrosion.

(i) Describe briefly how iron is converted into steel.

.....

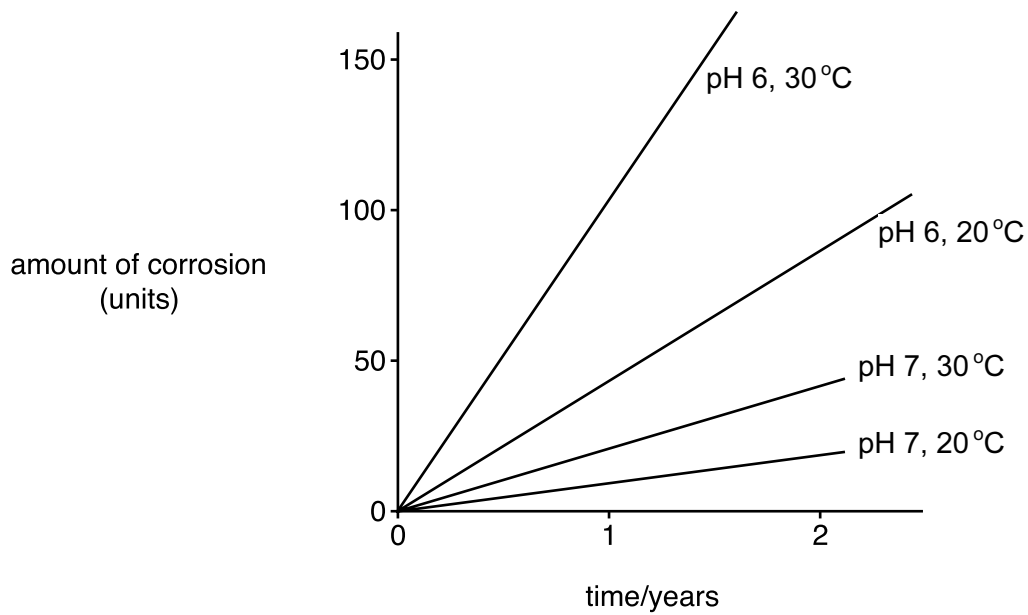
 [2]

(ii) State **one** use of mild steel.

..... [1]

(f) In some conditions, steel corrodes more quickly than in others.

The graphs show the rate of corrosion of a particular type of steel under different controlled conditions.



(i) How does pH affect the rate of corrosion?

..... [1]

(ii) How does temperature affect the rate of corrosion?

..... [1]

Explain this in terms of moving particles.

..... [2]

(iii) The presence of acidic gases in the air may increase the rate of corrosion.

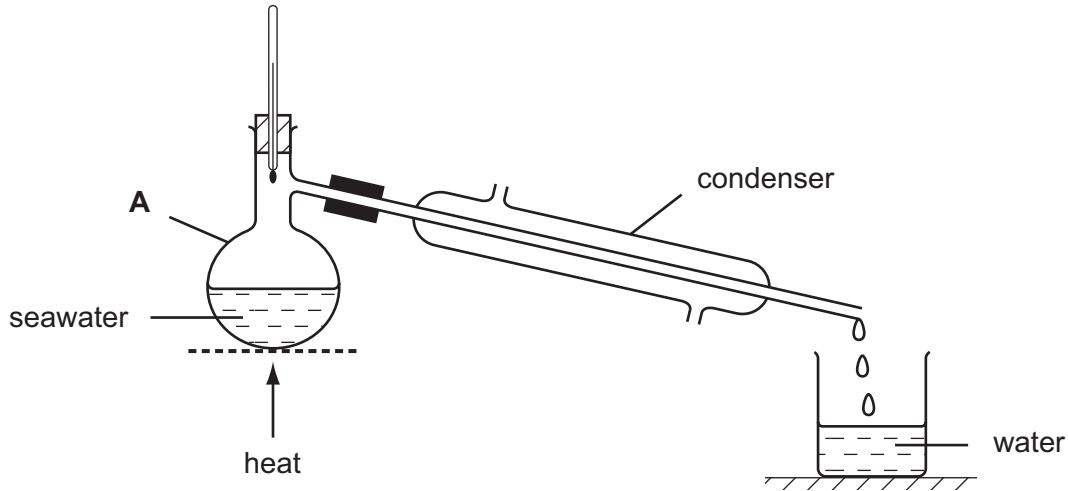
State the name and source of **one** acidic gas found in the air as a result of pollution.

name

source

[2]

6 A student took a sample of seawater and heated it using the apparatus shown below.



(a) What is the name given to the process shown in the diagram?

..... [1]

(b) State the name of the piece of apparatus labelled A.

..... [1]

(c) Explain the function of the condenser.

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

(d) Pure water collects in the beaker.

(i) State the pH of pure water.

..... [1]

(ii) State the boiling point of pure water.

..... [1]

- (e) The table shows the mass of various compounds obtained when 1 litre of seawater is evaporated.

compound	formula	mass of solid present / g
sodium chloride	NaCl	28.0
	MgCl_2	8.0
magnesium sulphate	MgSO_4	6.0
calcium sulphate	CaSO_4	2.0
potassium chloride	KCl	1.0
calcium carbonate	CaCO_3	
potassium bromide	KBr	
		total mass = 45.0

- (i) How many grams of magnesium sulphate are present in 180 g of solid left by evaporation of seawater?

[1]

- (ii) Which compound in the table reacts with acids to release carbon dioxide?

[1]

.....

- (iii) State the name of the compound which has the formula MgCl_2 .

[1]

.....

- (iv) Calcium sulphate contains sulphate ions.

Describe a test for sulphate ions.

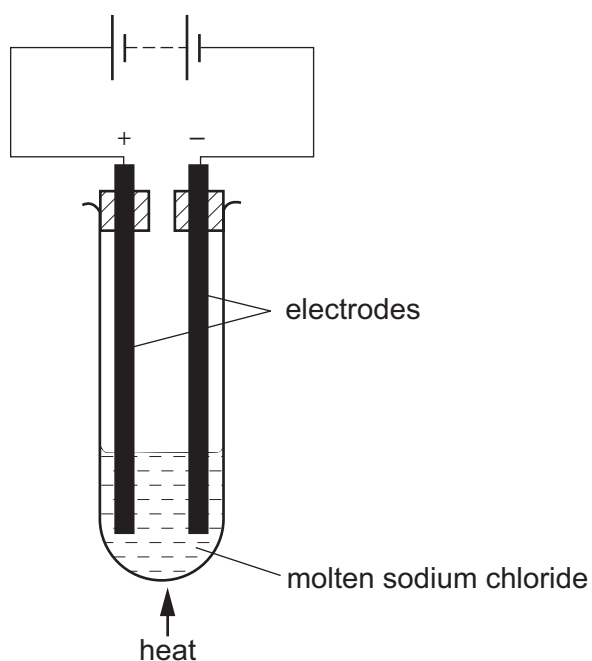
test

.....

result

..... [3]

(f) Pure sodium chloride can be electrolysed using the apparatus shown below.



(i) Why does the sodium chloride have to be molten for electrolysis to occur?

.....
 [2]

(ii) State the name of the product formed during electrolysis at

the anode (positive electrode)

the cathode (negative electrode) [2]

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

..... [1]

DATA SHEET The Periodic Table of the Elements

Group		I	II	III	IV	V	VI	VII	0	
7	9	1							4	2
3	4	1							9	10
23	24	11	12	13	14	15	16	17	18	
39	40	51	52	55	56	59	64	65	70	
85	88	91	96	101	106	112	115	119	122	
133	137	178	184	190	195	201	204	207	209	
55	56	72	74	76	78	80	81	82	83	
87	88	89	91	93	95	97	98	99	100	
226	227	232	238	238	238	238	238	238	238	
87	88	90	91	92	93	94	95	96	97	
175	173	169	167	165	162	159	157	152	150	
71	70	69	68	67	66	65	64	63	62	
108	102	101	100	99	98	97	96	95	94	
108	102	101	100	99	98	97	96	95	94	

*58-71 Lanthanoid series
90-103 Actinoid series

Key

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

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