Centre Number	Candidate Number

Candidate Name _____

International General Certificate of Secondary Education
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

CHEMISTRY 0620/3

PAPER 3

OCTOBER/NOVEMBER SESSION 2001 1 hour 15 minutes

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

TIME 1 hour 15 minutes

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.
A copy of the Periodic Table is printed on page 12.

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
TOTAL	

This question paper consists of 12 printed pages.

[Turn over

1 **(a)** The poisonous gas, carbon monoxide, is emitted by vehicle exhausts.

(i) How is this gas formed?

.....[2]

(ii) Explain how a catalytic converter reduces the emission of this gas.

.....

.....[2]

(iii) The following reaction is used to detect carbon monoxide.

$$CO + \underset{\text{orange}}{Pd^{2+}} + H_2O \longrightarrow CO_2 + \underset{\text{black}}{Pd} + 2H^+$$

What type of chemical reaction is the change Pd^{2+} to Pd? Give a reason for your answer.

.....[2]

(iv) Ethene will also give the above reaction. Describe another chemical test for this gas.

.....

.....[2]

(b) Carbon monoxide is used to purify nickel. Nickel reacts with carbon monoxide to form a gaseous compound.

$$Ni(s) + 4CO(g) \rightleftharpoons Ni(CO)_4(g) \qquad \text{forward reaction is exothermic}$$

(i) What reaction condition will favour the back reaction and reform nickel metal? Explain your choice.

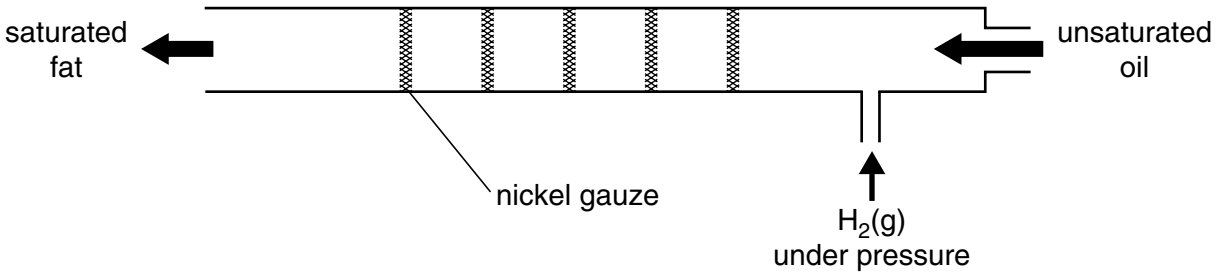
.....

.....[2]

(ii) The main impurity in the nickel is copper. What technique is used to purify copper after it has been separated from the nickel?

.....[1]

(c) Pure nickel is used to catalyse the reduction of unsaturated oils to saturated fats.



(i) What is meant by the terms *saturated* and *unsaturated*?

.....

.....[2]

(ii) Name the functional group in fats.

.....[1]

(iii) How can a soap be made from a fat?

.....[2]

2 **(a)** **(i)** Describe how oxygen is separated from air.

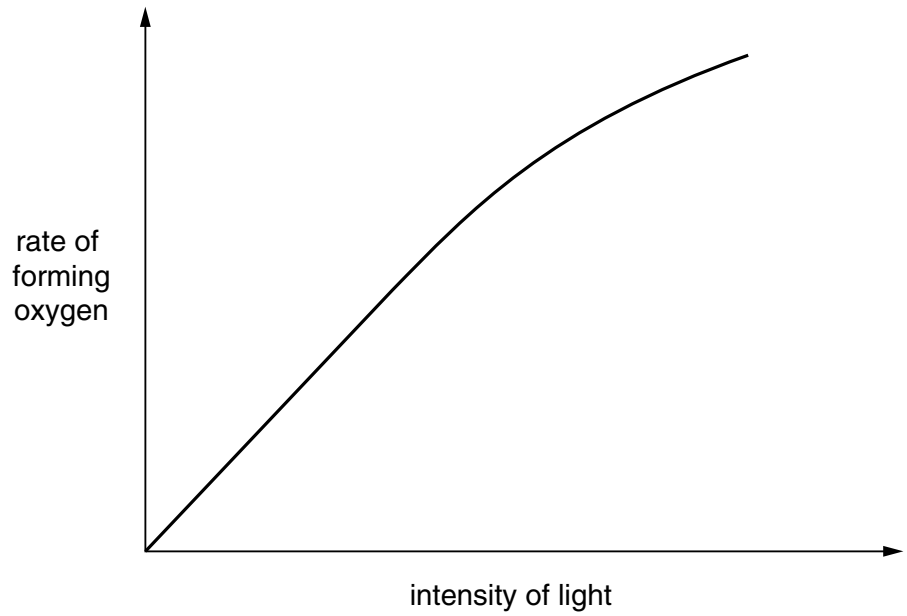
.....

.....[2]

(ii) Give **one** use of oxygen.

.....[1]

(b) When a green plant is exposed to bright light it photosynthesises and forms oxygen. The rate at which oxygen is formed was measured at 25 °C. The intensity of the light is changed and the new rate measured. The results of experiments of this type are shown on the graph below.



(i) Write a word equation for the reaction that produces oxygen.

.....[1]

(ii) Name the catalyst for photosynthesis.

.....[1]

(iii) What can be deduced from this experiment about the relationship between photosynthesis and light?

.....

.....[2]

(iv) The experiment was repeated at 30 °C. Predict the effect this would have on the rate of reaction and sketch the new graph on the same axes. [2]

(v) Give another example of a reaction that is influenced by light. Describe **one** important application of this reaction.

reaction .....

application .....[3]

(c) Potassium chlorate, which has a formula of the type, $KClO_n$, decomposes to form oxygen. 2.45 g of the chlorate produced 1.49 g of potassium chloride and 0.72 dm^3 of oxygen at r.t.p. Find the value of n.

$$KClO_n \longrightarrow KCl + \frac{n}{2}O_2$$

Mass of one mole of KCl = 74.5 g

Number of moles of KCl formed = ...

Number of moles of oxygen molecules formed = ...

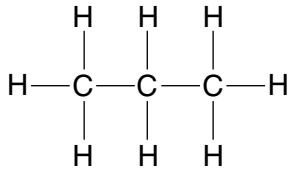
Number of moles of oxygen atoms = ...

Mole ratio KCl : O is .....

n = ...
[4]

[Turn over

3 Propane is an alkane. It has the structural formula:



(a) The equation for the complete combustion of propane is given below. Insert the two missing volumes.

$$C_3H_8(g) + 5O_2(g) \longrightarrow 3CO_2(g) + 4H_2O(l)$$

volume of gas/cm^3 .... 15 [2]

(b) Propane reacts with chlorine to form two chloropropanes with the formula C_3H_7Cl.

(i) Write an equation for this reaction.

.....[1]

(ii) What type of reaction is this?

.....[1]

(c) The two chloropropanes react with sodium hydroxide to form different alcohols.

(i) These alcohols are isomers. Using the propanols as an example explain the term *isomer*.

.....

.....

.....[3]

(ii) Fractional distillation can separate the two propanols. Suggest a reason why this method is effective.

.....[1]

(iii) Oxygen can oxidise propanol to propanoic acid. Name another reagent that will bring about this reaction.

.....[1]

(iv) Propanol and propanoic acid react to form an ester. Give the name and structural formula of an ester.

name .....

structural formula

[3]

(d) Propene can be made by heating propane and sulphur.

(i) Outline another method of making alkenes from alkanes.

.....

.....[2]

(ii) Outline how propanol could be made from propene.

.....

.....[2]

[Turn over

4 **(a)** Zinc is made by reducing zinc oxide. In 1695 Homberg obtained zinc from calamine, zinc carbonate. At present zinc is extracted from the ore, zinc blende.

(i) Suggest a way of changing calamine into zinc oxide.

.....[1]

(ii) Describe how zinc is extracted from zinc blende.

.....

.....

.....[3]

(b) Zinc oxide is used to make aqueous zinc chloride. This can be used to preserve wood. Describe how this solution could be made.

.....

.....

.....[3]

(c) Zinc is used to make alloys.

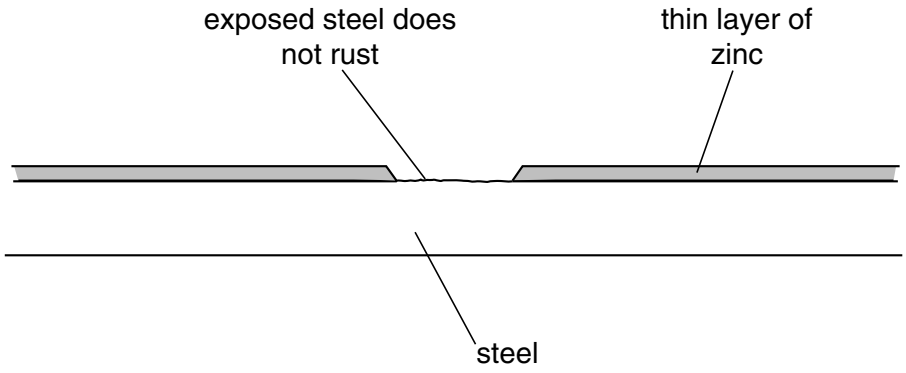
(i) Name an alloy that contains zinc.

.....[1]

(ii) What is the other metal in this alloy?

.....[1]

(d) Another use of zinc is galvanising. When the zinc layer is broken, the steel is exposed.



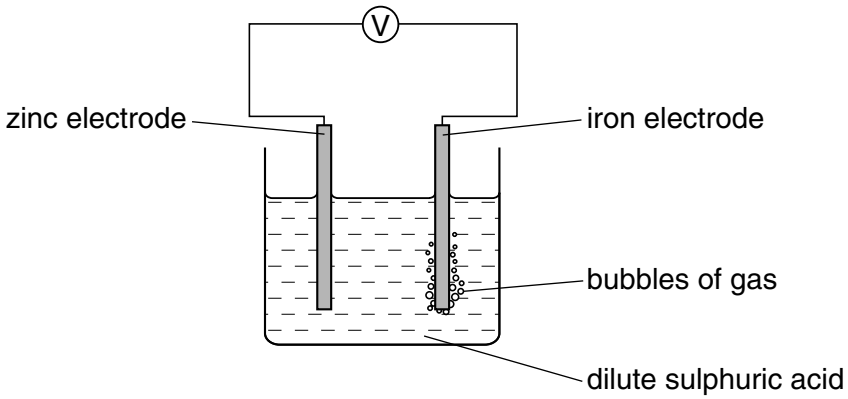
Explain why the **exposed** steel does **not** rust.

.....

.....

.....[3]

(e) The diagram below represents a simple cell.



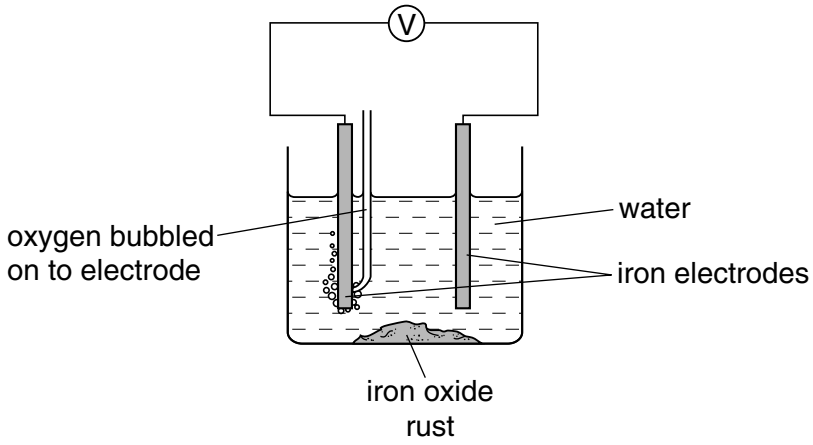
(i) Write an ionic equation for the reaction that occurs at the zinc electrode.

.....[1]

(ii) How could the voltage of the cell be increased?

.....[1]

(f) A different type of cell is drawn below.



(i) The pH of the solution increases. Give the name of the ion formed.

.....[1]

(ii) Complete the equation that represents the formation of this ion.

O_2 + ... H_2O + ... $\rightarrow$ ..... [2]

[Turn over

5 **(a)** In the USA, sulphur is obtained from underground deposits. It burns to form sulphur dioxide. This is used in paper making, to preserve food and in the manufacture of sulphuric acid.

(i) Why is sulphur dioxide needed in paper making?

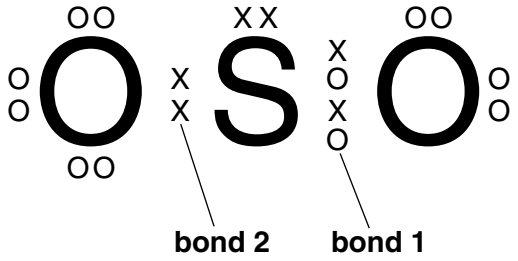
.....[1]

(ii) How does sulphur dioxide preserve food?

.....[1]

(b) The diagram shows a possible arrangement of the valency electrons in a molecule of sulphur dioxide.

O represents an electron from an oxygen atom
X represents an electron from a sulphur atom



(i) What type of covalent bond is labelled **bond 1**?

.....[1]

(ii) What is unusual about the covalent bond labelled **bond 2**?

.....[1]

(c) Sulphur reacts violently with magnesium to form the ionic compound magnesium sulphide. Draw a diagram that shows the arrangement of the valency electrons in this compound.

Use O to represent an electron from a magnesium atom.
Use X to represent an electron from a sulphur atom. [3]

(d) Sulphuric acid is a typical strong acid.

(i) Explain the term *strong acid*.

.....[2]

(ii) Write a word equation for the reaction between zinc carbonate and sulphuric acid.

.....[2]

(iii) Write an equation for the reaction between sodium hydroxide and sulphuric acid.

.....[2]

(iv) Write an ionic equation for the reaction between magnesium and sulphuric acid.

.....[2]

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 = 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.).