CANDIDATE NAME	

| CENTRE NUMBER | | | | | | CANDIDATE NUMBER | | | |

COMBINED SCIENCE   **5129/22**

Paper 2   **October/November 2011**

2 hours 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 on all the work you hand in.
Write in dark blue or black pen.
You may use a soft 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 20.

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

This document consists of **19** printed pages and **1** blank page.

UNIVERSITY *of* CAMBRIDGE
International Examinations

[Turn over

1   Study the following reaction scheme.
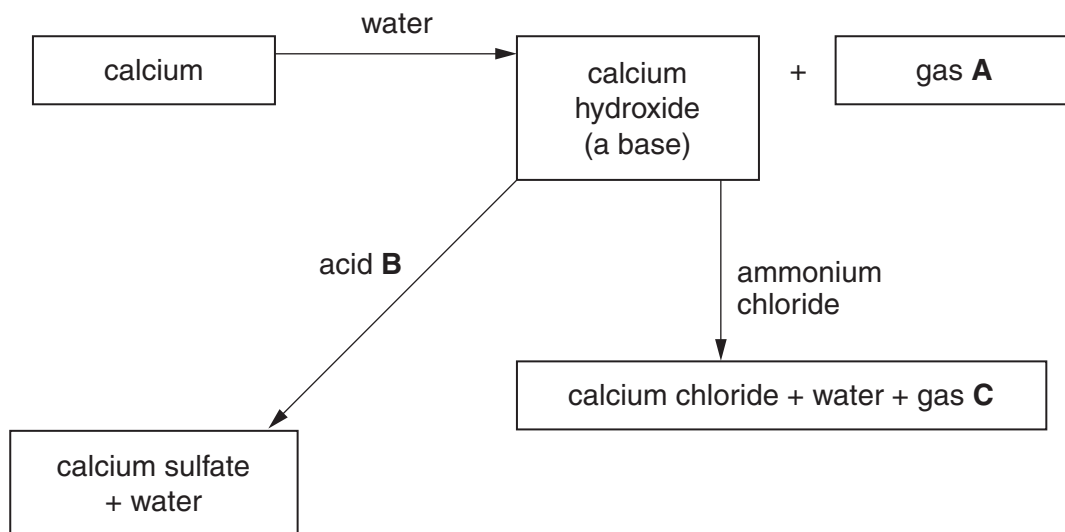
Fig. 1.1

(a) Identify **A**, **B** and **C**.

gas **A** ....

acid **B** ....

gas **C** ....   [3]

(b) Calcium hydroxide solution is sometimes called limewater.

State the gas for which limewater is the test. What would be the result of the test?

gas ....

result ....
                                                                                            [2]

2 Changes in the volume of a person's lungs are measured over a period of two minutes.
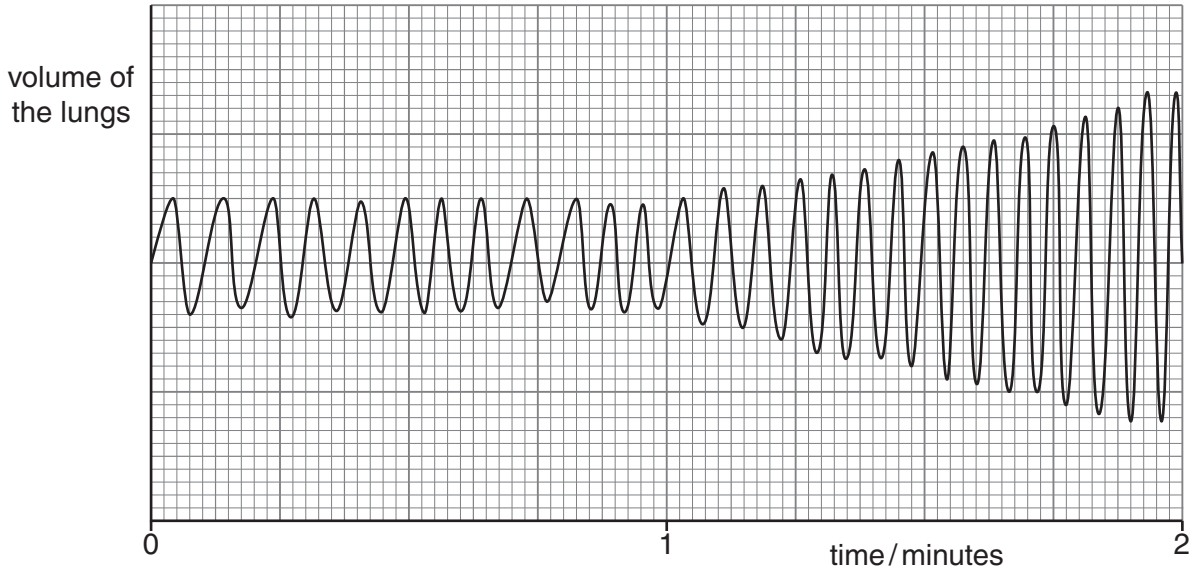
The results are shown in Fig. 2.1.

volume of
the lungs

time / minutes

Fig. 2.1

(a) What is the breathing rate of this person during the first minute?

rate = ... breaths per minute   [1]

(b) (i) Describe **two** ways in which the person's breathing changes during the second minute.

1. ....

2. ....
     [2]

(ii) Suggest what caused these changes.

....

....

....[1]

3 A metre rule is pivoted at its centre of gravity.

A weight of 8.0 N is suspended from the rule at a distance of 0.20 m from the pivot, as shown in Fig. 3.1. The metre rule is held horizontally by means of a stretched spring that is 0.40 m from the pivot.

0.40 m   0.20 m

8.0 N
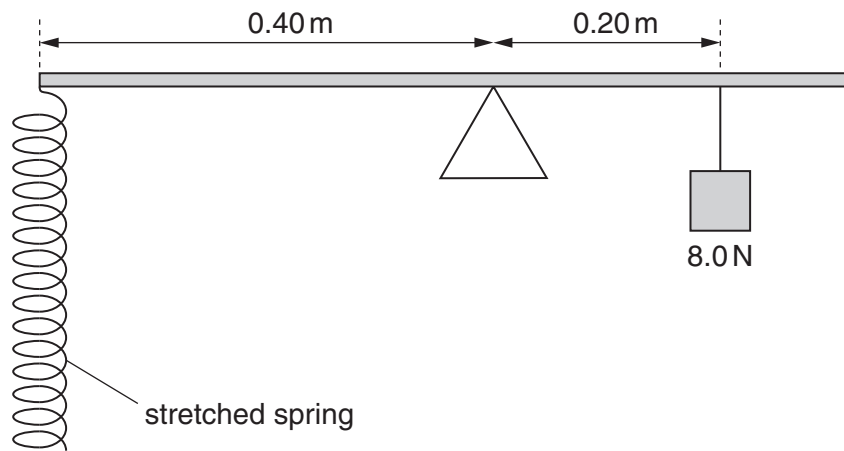
stretched spring

Fig. 3.1

(a) State the principle of moments.

....

....[2]

(b) Calculate

   (i) the moment of the 8.0 N weight about the pivot,

moment = ... unit .... [3]

   (ii) the force exerted on the metre rule by the spring.

force = ... N [1]

(c) The spring has an unstretched length of 10.0 cm. When a force of 2.0 N is used to stretch the spring, its length becomes 11.5 cm.

Calculate the force needed to give the spring a length of 13.0 cm.

force = ... N [2]

4 Microwaves, radio-waves and visible light are components of the electromagnetic spectrum.

(a) Name **two** other components of the electromagnetic spectrum.

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

(b) Radio-waves travel at a speed of 3.0×10^8 m/s in a vacuum.
A radio-wave has a wavelength of 1.5×10^3 m in a vacuum.

Calculate the frequency of this radio-wave.

frequency = ... unit .... [3]

5 Nitrogen is a gas that is the main constituent of air.

(a) State the approximate percentage of nitrogen in air. ....[1]

(b) Oxides of nitrogen are produced when a fuel is burned in a car engine.

State one adverse effect on the environment of oxides of nitrogen.

....[1]

(c) Nitrogen reacts with lithium to produce lithium nitride.

Balance the equation for this reaction.

.... Li + N_2 ⟶ .... Li_3N [1]

(d) Lithium nitride is an ionic substance made up of lithium ions, Li^+, and nitride ions.

(i) State the formula of a nitride ion. ....[1]

(ii) Suggest **two** properties of lithium nitride.

1. ....

2. ....

[2]

6 Fig. 6.1 shows the alimentary canal and associated structures in a rabbit.
The arrangement is similar to the human alimentary canal.

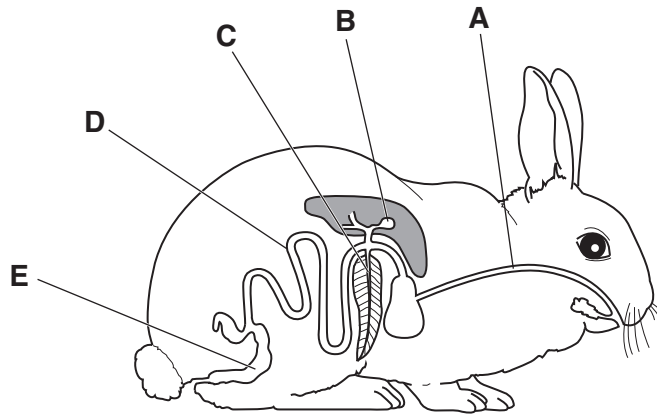**Fig. 6.1**

(a) Name the structures **A** to **E**.

A ....

B ....

C ....

D ....

E ....[5]

(b) State where the following processes occur in the alimentary canal.

(i) ingestion ....[1]

(ii) egestion ....[1]

(iii) absorption of the soluble products of digestion

....[1]

(c) Name a gland in the alimentary canal where amylase is secreted.

....[1]

[Turn over

7 A pupil lifts a book from the floor on to a table through a vertical distance of 1.2 m.

The book weighs 5.0 N.

(a) Calculate the useful work done by the pupil in lifting the book.

work done = ... J [2]

(b) It takes the pupil 0.50 s to lift the book.

Calculate the useful power developed by the pupil in lifting the book.

power = ... W [2]

(c) Lifting the same book through the same distance on the Moon would require the pupil to do less work than on the Earth.

Suggest why the work done would be less.

....

....[1]

8 Fig. 8.1 shows the reduction of copper(II) oxide by methane.

copper(II) oxide

excess methane
burning

methane

HEAT
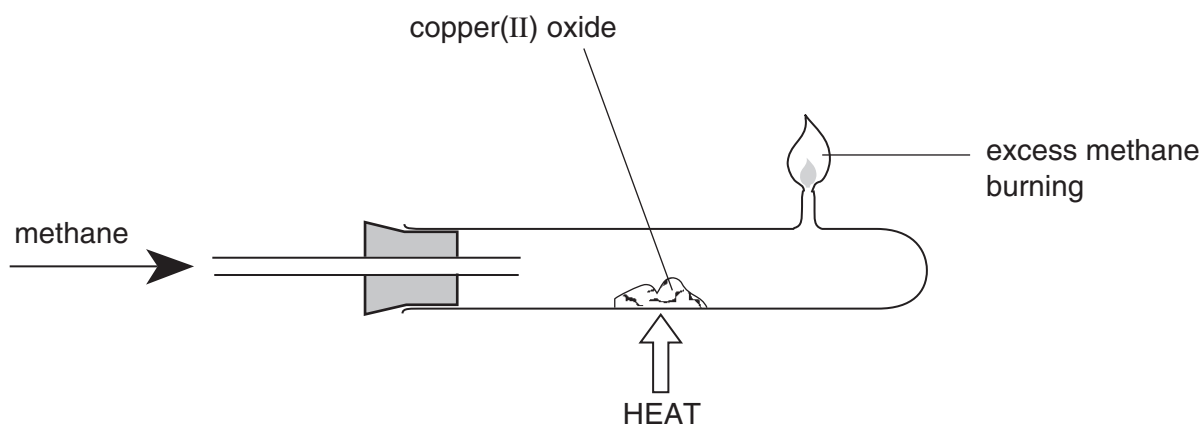
Fig. 8.1

(a) Explain the meaning of the word *reduction*.

....

....[1]

(b) The equation for the reaction is

$$4CuO + CH_4 \longrightarrow 4Cu + 2H_2O + CO_2$$

The relative molecular mass of copper(II) oxide is 80.
[A_r: C, 12; O, 16; H, 1]

Complete the following sentences.

320 g of copper(II) oxide produces .... g of water and .... g of carbon dioxide.

80 g of copper(II) oxide produces .... g of carbon dioxide.

4 g of copper(II) oxide produces .... g of carbon dioxide.   [4]

(c) Oxides are either acidic, amphoteric or basic.

What type of oxide is copper(II) oxide? Give a reason for your choice.

type of oxide ....

reason ....
                                                                                                                                    [2]

9 An experiment is carried out to investigate conditions that affect the germination of cress seeds.

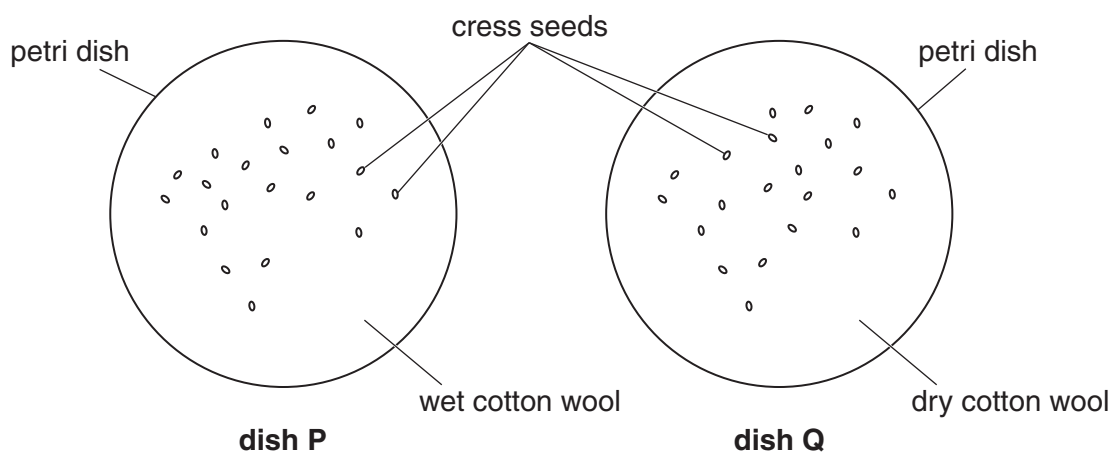Two petri dishes are set up as shown in Fig. 9.1.

Fig. 9.1

The petri dishes are left for three days.

The number of seeds that have germinated in each of the two dishes is noted.

(a) State the results you would expect after three days. Explain why you would expect these results.

results ....

....

....

explanation ....

....

....
                                                                                                                    [3]

(b) Explain why 20 seeds were placed in each dish, rather than one seed.

....

....[1]

(c) State **two** environmental conditions that should be kept the same in the two dishes.

1. ....

2. ....
                                                                                                                    [2]

10 An electric heater has a label attached to it, as shown in Fig. 10.1.

```
240 V
50 Hz
600 W
```

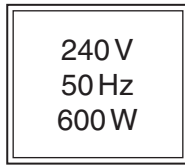**Fig. 10.1**

(a) Use information from Fig. 10.1 to calculate the current in the electric heater when it is working normally.

current = ... unit .... [3]

(b) Another electric heater has a metal case. It has been wired incorrectly because the live wire is touching the metal case.

The live wire is fitted with a fuse and the heater has an earth connection.

Explain how a person is protected from an electric shock when the heater is switched on.

....

....

....[3]

11   Fig. 11.1 shows the apparatus used to separate petroleum (crude oil) into useful products.
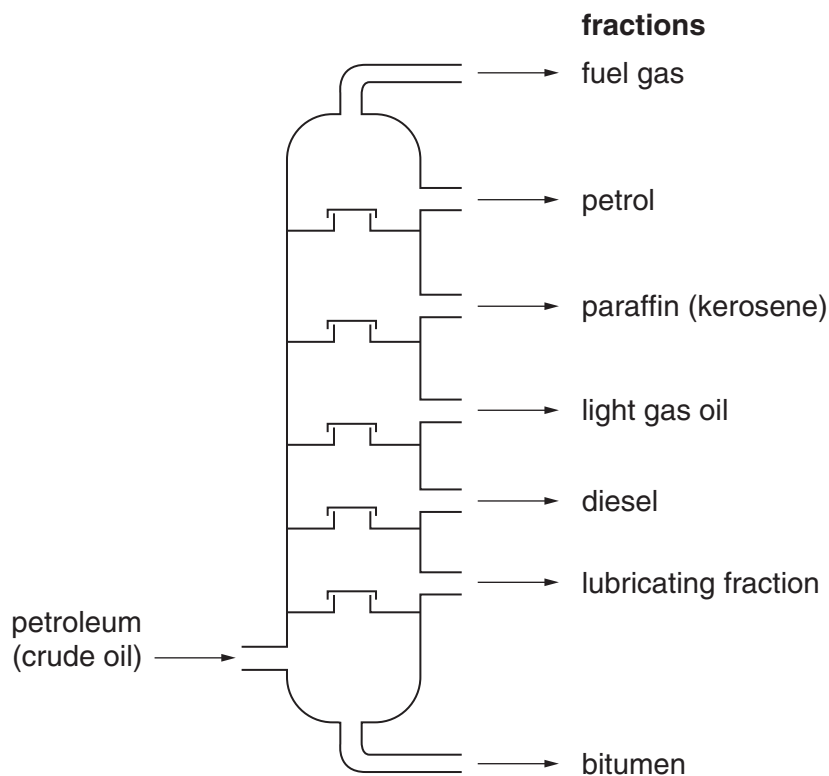
fractions

Fig. 11.1

(a) (i) Name the process used to separate petroleum (crude oil).

....[1]

(ii) State **one** use of paraffin (kerosene) and **one** use of bitumen.

paraffin ....

bitumen ....   [2]

(b) Octane is a component of petrol. It belongs to a homologous series of hydrocarbons.

(i) Name the homologous series. ....[1]

(ii) Octane contains eight carbon atoms.

Complete the formula of octane. C_8H ....   [1]

(iii) What type of bonding is present in a molecule of octane?

....[1]

12 Gonorrhoea is a sexually transmitted bacterial disease.

(a) State **two** symptoms of gonorrhoea.

1. ....

....

2. ....

....

[2]

(b) Name one other bacterial disease that is usually sexually transmitted.

....[1]

(c) How are these bacterial diseases usually treated?

....

....[1]

(d) Name a sexually transmitted disease that is caused by a virus.

....[1]

13 (a) Name a piece of apparatus used to measure the volume of a liquid.

....[1]

(b) A stone has an irregular shape.

Describe how the method of displacement may be used to find the volume of the stone.

....

....

....[3]

14 (a) Copper is an element.

Sodium chloride is a compound.

Brass is an alloy.

Using these substances as examples, define the terms *element*, *compound* and *alloy*.

element ....

....[1]

compound ....

....[2]

alloy ....

....[2]

(b) State **one** test to show that copper is a metal.

....[1]

BLANK PAGE

TURN OVER FOR QUESTION 15

 [Turn over

15 Fig. 15.1 is a map of an island where famines frequently occur.

scale: 50 km

river

key:

mountains

agricultural land

other non-agricultural land

area frequently flooded

forest

town
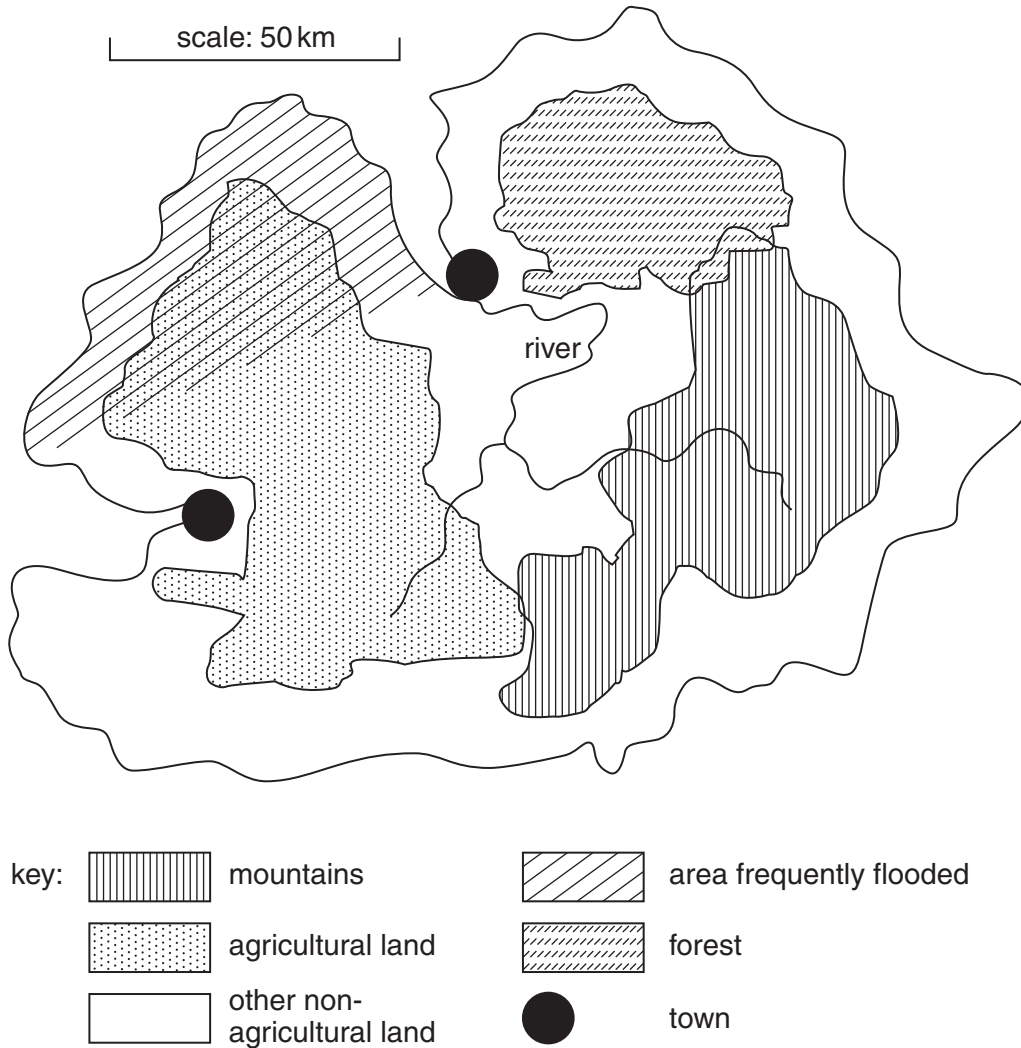
Fig. 15.1

(a) What is meant by *famine*?

....[1]

(b) Use information from the map to suggest why famines often occur on this island.

....

....

....[2]

(c) What effect would each of the following have on the probability of famine occurring on this island? In each case, explain your answer.

    (i) a rapid increase in population

    ....

    ....

    ....[1]

    (ii) a decrease in annual rainfall

    ....

    ....

    ....[1]

16 Fig. 16.1 shows a bar magnet being pushed into a coil of wire.
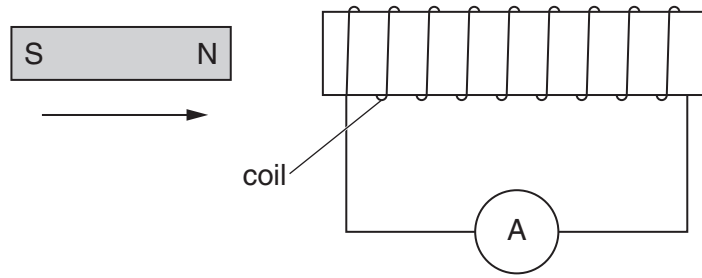
Fig. 16.1

The ammeter shows that there is a small current in the coil.

(a) Name this electrical effect.

.... [1]

(b) State **two** factors affecting the size of the current when a magnet is pushed into a coil.

1. ....

2. ....
[2]

(c) The current in the coil produces a magnetic field.

What effect does this magnetic field have on the bar magnet?

....[1]

17 The following is a list of gases.

ammonia   **carbon dioxide**   **ethane**   **ethene**

helium   **hydrogen**   **oxygen**   **sulphur dioxide**

Use the list to complete the following sentences.

Each gas from the list may be used once, more than once, or not at all.

(a) The gas that is used in the manufacture of steel is ....[1]

(b) The gas used for filling balloons is ....[1]

(c) The gas that undergoes polymerisation is ....[1]

(d) The gas that relights a glowing splint is ....[1]

18 Alcohol is a drug.

(a) Explain what is meant by the term *drug*.

....

....

....[2]

(b) Describe **three** harmful physical effects on a person who drinks excessive amounts of alcohol.

1. ....

....

2. ....

....

3. ....

....
[3]

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** Sulfur 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	209 **Po** Polonium 84	210 **At** Astatine 85	222 **Rn** Radon 86
223 **Fr** Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	147 **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	231 **Pa** Protactinium 91	238 **U** Uranium 92	237 **Np** Neptunium 93	244 **Pu** Plutonium 94	243 **Am** Americium 95	247 **Cm** Curium 96	247 **Bk** Berkelium 97	251 **Cf** Californium 98	252 **Es** Einsteinium 99	257 **Fm** Fermium 100	258 **Md** Mendelevium 101	259 **No** Nobelium 102	260 **Lr** Lawrencium 103

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

Key

a
X
b

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

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

5129/22/O/N/11