



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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COMBINED SCIENCE

0653/21

Paper 2 (Core)

May/June 2010

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 on all the work you hand in.

Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs, tables 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 24.

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	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **22** printed pages and **2** blank pages.



1 Fig. 1.1 shows some of the animals and plants that live in or close to a pond.

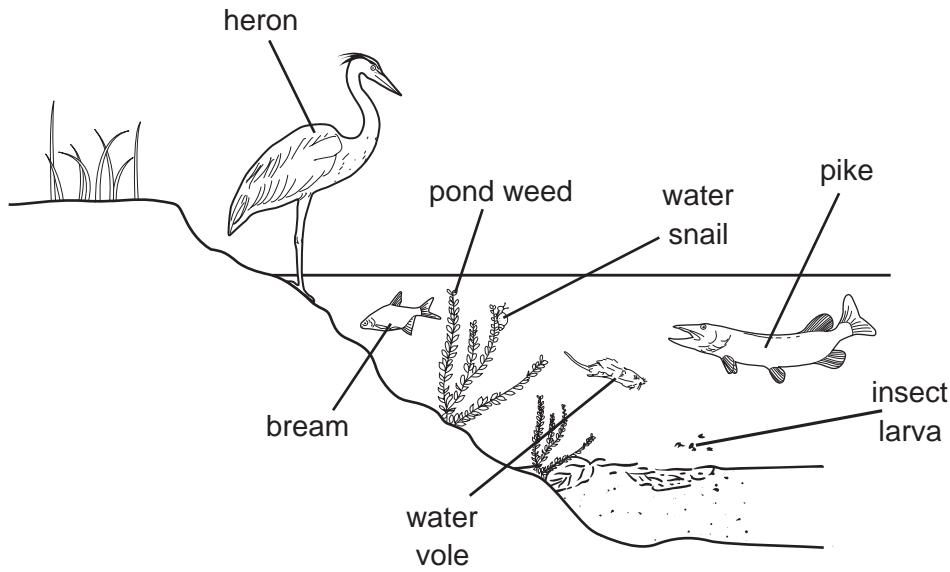


Fig. 1.1

(a) Choose the correct term from the list below for each of the following descriptions.

community

decomposer

ecosystem

habitat

photosynthesis

population

all the animals and plants that live in and around the pond

all the water voles living in and around the pond

all the living things, and their environment, interacting with each other

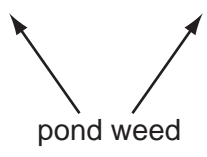
..... [3]

(b) The pond weed is a producer.

Water snails and water voles are primary consumers.

The heron and pike are secondary consumers.

Complete the diagram of a food web that includes only these five organisms.



[3]

(c) The pond is at the bottom of a sloping field which was ploughed.

During very heavy rain, a lot of soil from the field was washed into the pond.

It made the water cloudy and stopped the light from reaching the leaves of the water plants, so that the plants died.

After a while, the fish and other animals also died.

Give **two** reasons why the fish and other animals died.

1

.....

2

.....

[2]

(d) Fig. 1.2 shows a cell from the pond weed.

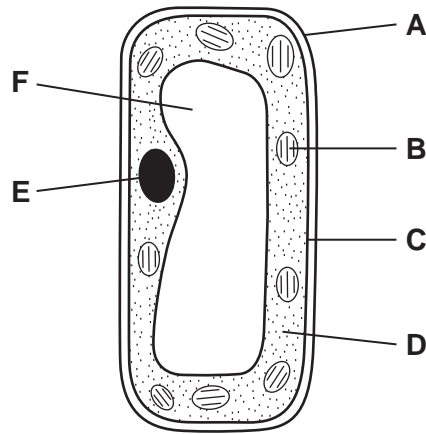


Fig. 1.2

- (i) Give the letter of the part of the cell that controls what enters and leaves the cell,
- is the place where photosynthesis happens,
- contains DNA. [3]

(ii) Describe **two** ways in which a cell from the heron would look different from the cell in Fig. 1.2.

- 1
-
- 2
- [2]

2 (a) Alpha, beta and gamma are three types of radiation emitted during radioactive decay.

Name a suitable detector for these three types of radiation.

..... [1]

(b) State **two** hazards to the human body from exposure to radiation.

1

2 [2]

(c) (i) Complete the table to compare alpha, beta and gamma radiations.

Tick **one** box in each of the two rows in the table.

	alpha	beta	gamma
most penetrating			
most ionising			

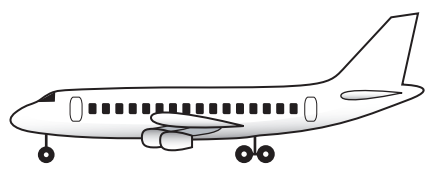
[2]

(ii) State which type of radiation

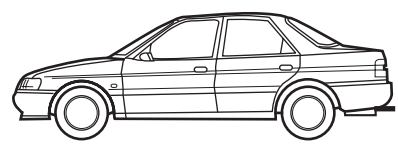
consists of particles with the greatest mass,

consists of electromagnetic waves. [2]

3 Aluminium, iron and sodium are metallic elements. Aluminium and iron are widely used in many useful objects but no useful objects can be made out of metallic sodium.



aluminium alloys are used in aircraft



iron is used to make steel for cars

(a) (i) State **one** property of a metallic element which is different from a non-metallic element.

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

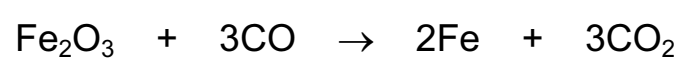
(ii) Use your knowledge of the metals in Group I of the Periodic Table to state **one** reason, other than cost, why no useful objects can be made out of metallic sodium.

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

(b) Aluminium and iron are mainly found as their oxides in rocks.

(i) In order to obtain metallic iron, iron oxide is heated strongly in a furnace with carbon monoxide.

One reaction which occurs in the furnace has the symbolic chemical equation shown below.



Explain whether or not this equation is balanced.

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

(ii) State the formula of the compound which has been reduced in the equation in (i).

Explain your answer.

formula

explanation

..... [2]

(c) Aluminium is produced by electrolysis in which the electrolyte contains aluminium oxide.

Aluminium oxide is a compound of a metal with a non-metal.

(i) Name the type of chemical bonding found in aluminium oxide.

..... [1]

(ii) State the meaning of the term *electrolyte*.

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

(iii) State the type of energy which must be supplied to decompose molten aluminium oxide.

..... [1]

(iv) Name **one** other metal which is produced industrially by electrolysis.

..... [1]

4 Fig. 4.1 shows part of the human nervous system.

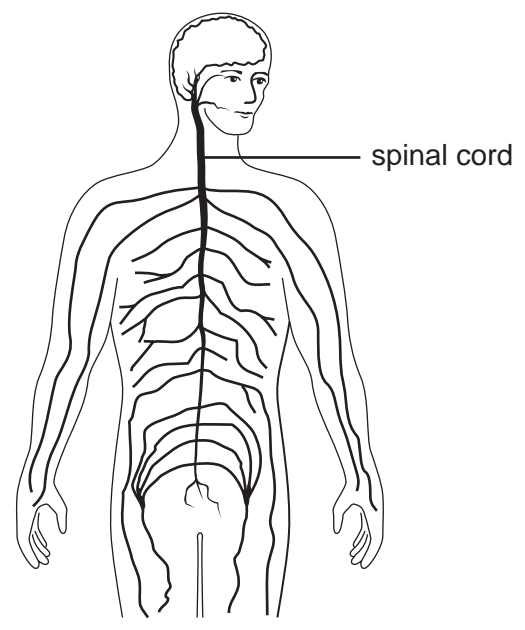


Fig. 4.1

(a) The spinal cord is part of the central nervous system.

(i) On Fig. 4.1, label and name **one** other part of the central nervous system. [1]

(ii) Complete the sentences below.

When a receptor receives a stimulus, signals pass along to
 the central nervous system. They then pass to which
 respond to the stimulus. [2]

(b) Messages can also be passed from one part of the body to another in the form of hormones.

Name the type of gland that produces hormones. [1]

(c) A hormone secreted by the pancreas helps to keep blood sugar levels constant.

(i) On Fig. 4.1, write the letter **P** to show the position of the pancreas in the body. [1]

(ii) Name the hormone that reduces the blood sugar level if it gets too high.
 [1]

(iii) Which body organ removes extra glucose from the blood when the blood sugar
 level gets too high?
 [1]

(iv) Suggest why it is harmful to the body if the blood sugar level falls very low.

For
inner's

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

5 Fig. 5.1 shows two dolphins communicating with each other using sound waves.

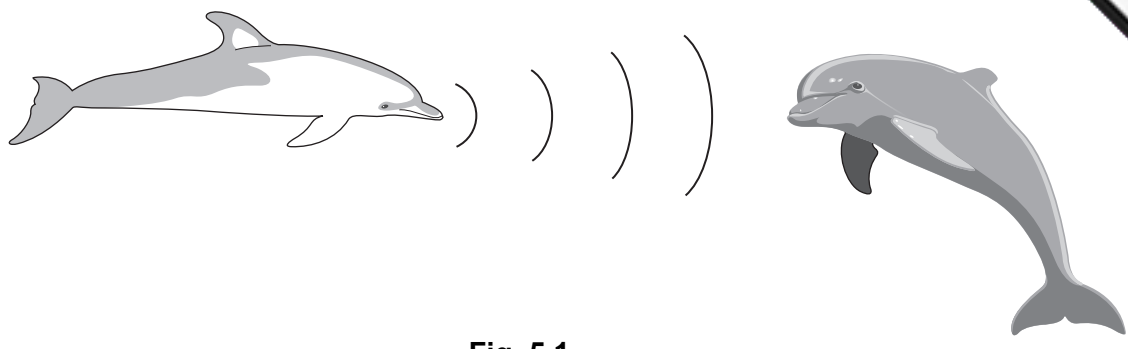


Fig. 5.1

(a) How does a sound wave travel through water?

.....

..... [1]

(b) Sound travels at different speeds through different substances.

substance	speed of sound (m/s)
air	340
steel	5200
water	1500

(i) Does sound travel fastest in a solid, a liquid or a gas?

..... [1]

(ii) It takes 0.5 seconds for the sound wave to travel from one dolphin to the other.

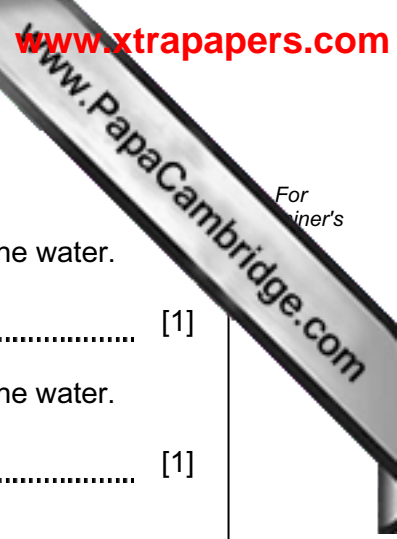
Calculate the distance between the two dolphins.

State the formula that you use and show your working.

formula

working

..... m [2]



(c) A student is measuring the density of water.

(i) Name a piece of apparatus he could use to measure the volume of the water.

..... [1]

(ii) Name the piece of apparatus he could use to measure the mass of the water.

..... [1]

(iii) Complete the formula that he would use to calculate the density.

density = [1]

6 Fig. 6.1 shows samples of three of the elements in Group VII (Group 7) of the Periodic Table.

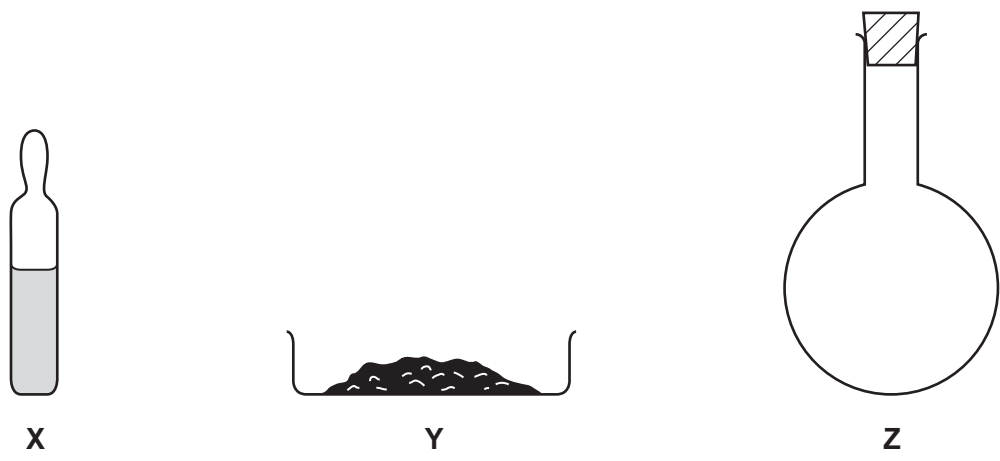


Fig. 6.1

(a) The elements in Fig. 6.1 are at the same temperature. One element is a solid, one is a liquid and one is a gas.

(i) State which element, X, Y or Z, has the highest melting point.

..... [1]

(ii) Suggest the names of the elements, X, Y and Z.

X

Y

Z [2]

(b) An atom of fluorine has a proton (atomic) number of 9 and a nucleon (mass) number of 19.

(i) A diagram of this fluorine atom is shown in Fig. 6.2.

Complete the labelling of the diagram by writing the words **electrons**, **neutrons** and **protons** in the spaces.

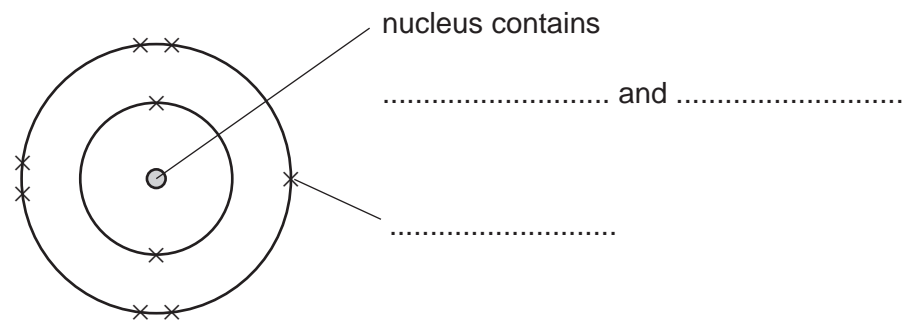
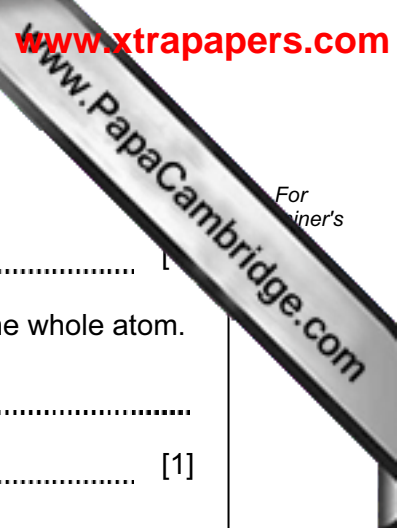


Fig. 6.2

[1]



(ii) State the number of neutrons in the fluorine atom in Fig. 6.2.

..... [1]

(iii) Explain why the nucleus of an atom has almost the same mass as the whole atom.

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

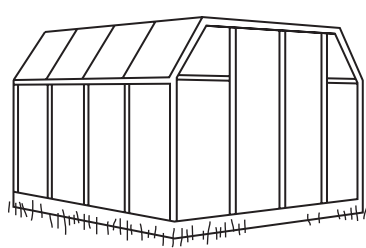
(c) Many people use solutions which contain chlorine to clean some parts of their homes.

Suggest **one** advantage of using a solution containing chlorine rather than water alone when cleaning homes.

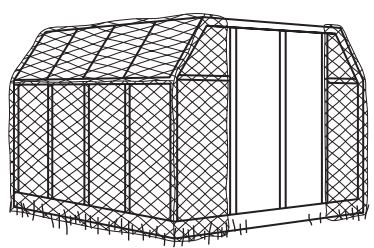
.....
.....
..... [2]

7 An investigation was carried out in Tamil Nadu, India, into the best conditions for growing tomatoes.

The tomato plants were grown in unheated glasshouses or outside. Netting was used to provide shade in one of the glasshouses.



glasshouse A
no shade



glasshouse B
all four side walls shaded



outside
no shade

Table 7.1 shows the mean temperature, and the mass of tomatoes produced, in the two glasshouses and outside.

Table 7.1

	mean temperature / °C	mass of tomatoes produced per plant / g
glasshouse A	38	1020
glasshouse B	36	2310
outside	34	1380

(a) Which temperature gave the greatest mass of tomatoes?

..... °C [1]

(b) Use your knowledge of convection to explain why the air inside the glasshouses stayed warmer than the air outside.

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

(c) Tomatoes are a fruit, produced from the fertilised flowers of tomato plants.

Bees are most active in temperatures between 35°C and 36°C.

Suggest why the mass of tomatoes produced was greater in glasshouse **B** than in glasshouse **A**.

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

(d) Suggest **two** factors, other than temperature, that could account for the lower mass of tomatoes produced outside than in glasshouse **B**.

1
2 [2]

8 (a) (i) The air is a mixture of gases.

Complete Table 8.1 to show the percentages of the two main gases in the air.

Table 8.1

name of gas	percentage in the air
oxygen	
nitrogen	

[2]

(ii) Name **one** other gas which is found in unpolluted air.

..... [1]

(b) Sulfur dioxide is a gas which causes air pollution.

Sulfur dioxide enters the air when volcanoes erupt.



(i) Write the chemical formula of sulfur dioxide.

..... [1]

(ii) Describe **one** environmental problem which can occur when large amounts of sulfur dioxide are released into the air.

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

(c) When gasoline burns, the two main gases which are formed are carbon dioxide and water vapour. Both of these compounds are made of non-metallic elements bonded together.

(i) Name the type of chemical bonding in molecules of carbon dioxide and water.

..... [1]

(ii) The displayed (graphical) formula of a water molecule is shown below.



Draw the displayed formula of a carbon dioxide molecule.

[2]

9 (a) A rider on his bicycle roll down a constant slope onto level ground. The rider uses the brakes to stop the bicycle. Fig. 9.1 shows the motion of the bicycle.

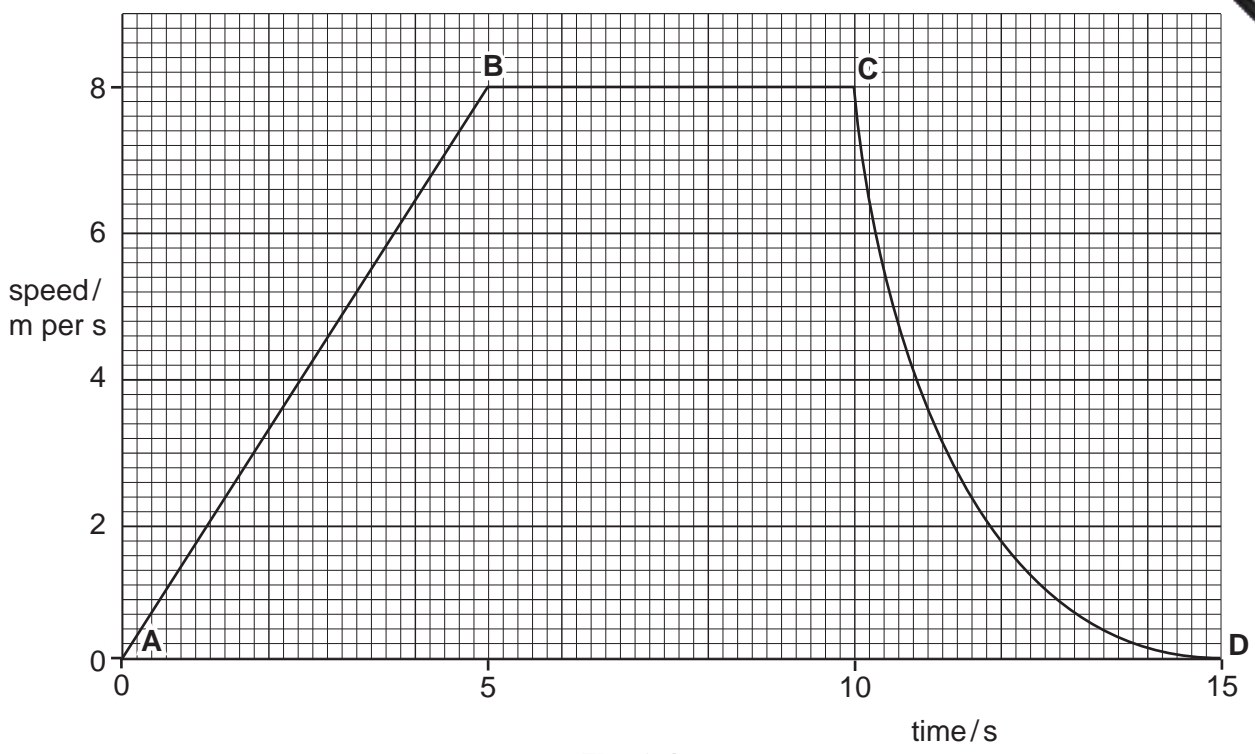


Fig. 9.1

(i) Over which section of the graph was the speed of the bicycle constant?
..... [1]

(ii) How long did it take the bicycle to stop after the brakes were used?
..... s [1]

(b) As the bicycle moves along a level road, the brakes are suddenly applied. The bicycle comes to a stop after 10 m.

When the brakes are applied, the average frictional force stopping the bicycle is 250 N.

Work is done and energy is transferred.

(i) Calculate the work done as the bicycle slows down to a stop.

State the formula that you use and show your working.

formula

working

..... J [2]

(ii) Identify the energy transfer which takes place.

from energy to energy [2]

(c) Fig. 9.2 shows a bicycle with two lamps at the front.



Fig. 9.2

Fig. 9.3 shows the circuit used to power the two lamps.

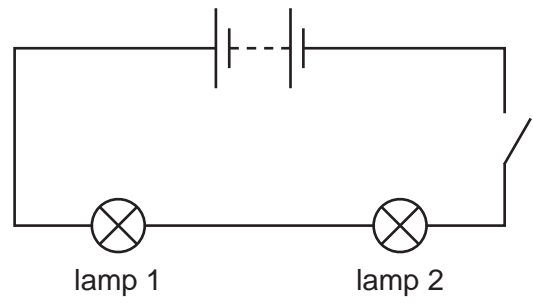


Fig. 9.3

(i) What name is given to this type of circuit?

..... [1]

(ii) The resistance of each lamp in the circuit is 4Ω .

State the combined resistance of the two lamps.

..... Ω [1]

(d) Fig. 9.4 shows a metal nut on the bicycle wheel which is difficult to unscrew.

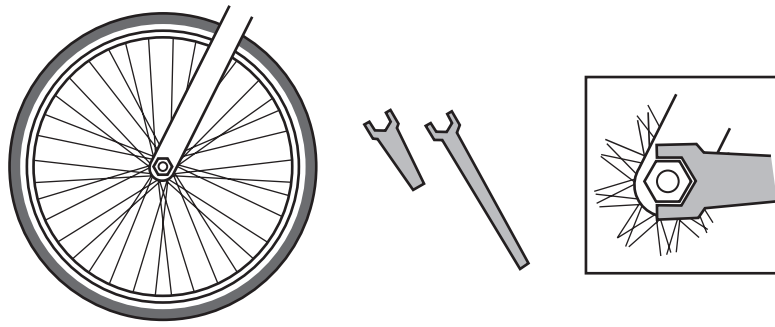


Fig. 9.4

Explain why a long spanner is better than a short spanner to unscrew the nut.

.....

.....

..... [2]

DATA SHEET
The Periodic Table of the Elements

		Group																	
		I	II	III	IV	V	VI	VII	VIII	IX	X								
		1 H Hydrogen 1																	
7	9	Li Lithium 3	Be Beryllium 4																
23	24	Na Sodium 11	Mg Magnesium 12																
39	40	K Potassium 19	Ca Calcium 20	45	48	51	52	55	56	59	59	64	65	70	73	75	79	80	84
85	88	Rb Rubidium 37	Sr Strontium 38	Y Yttrium 39	Zr Zirconium 40	Nb Niobium 41	Mo Molybdenum 42	Tc Technetium 43	Ru Ruthenium 44	Rh Rhodium 45	Pd Palladium 46	Ag Silver 47	Cd Cadmium 48	In Indium 49	Sn Tin 50	Sb Antimony 51	Te Tellurium 52	I Iodine 53	Xe Xenon 54
133	137	Cs Caesium 55	Ba Barium 56	La Lanthanum 57	Hf Hafnium 72	Ta Tantalum 73	W Tungsten 74	Re Rhenium 75	Os Osmium 76	Ir Iridium 77	Pt Platinum 78	Au Gold 79	Hg Mercury 80	Tl Thallium 81	Pb Lead 82	Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
	226	Fr Francium 87	Ra Radium 88	Ac Actinium 89															
		*58-71 Lanthanoid series †90-103 Actinoid series																	
		a		X		b													
		Key		a = relative atomic mass		X = atomic symbol		b = proton (atomic) number											
		140	141	144	150	152	157	159	162	165	167	169	173	175					
		Ce Cerium 58	Pr Praseodymium 59	Nd Neodymium 60	Pm Promethium 61	Sm Samarium 62	Gd Gadolinium 64	Tb Terbium 65	Dy Dysprosium 66	Ho Holmium 67	Er Erbium 68	Tm Thulium 69	Yb Ytterbium 70	Lu Lutetium 71					
		232	238	238	238	238	238	238	238	238	238	238	238	238					
		Th Thorium 90	Pa Protactinium 91	U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103					

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