UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

6824241612

CO-ORDINATED SCIENCES **0654/22**

Paper 2 (Core) **October/November 2011**

2 hours

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	
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Total	

This document consists of **21** printed pages and **3** blank pages.

1 Fig. 1.1 shows five insects.

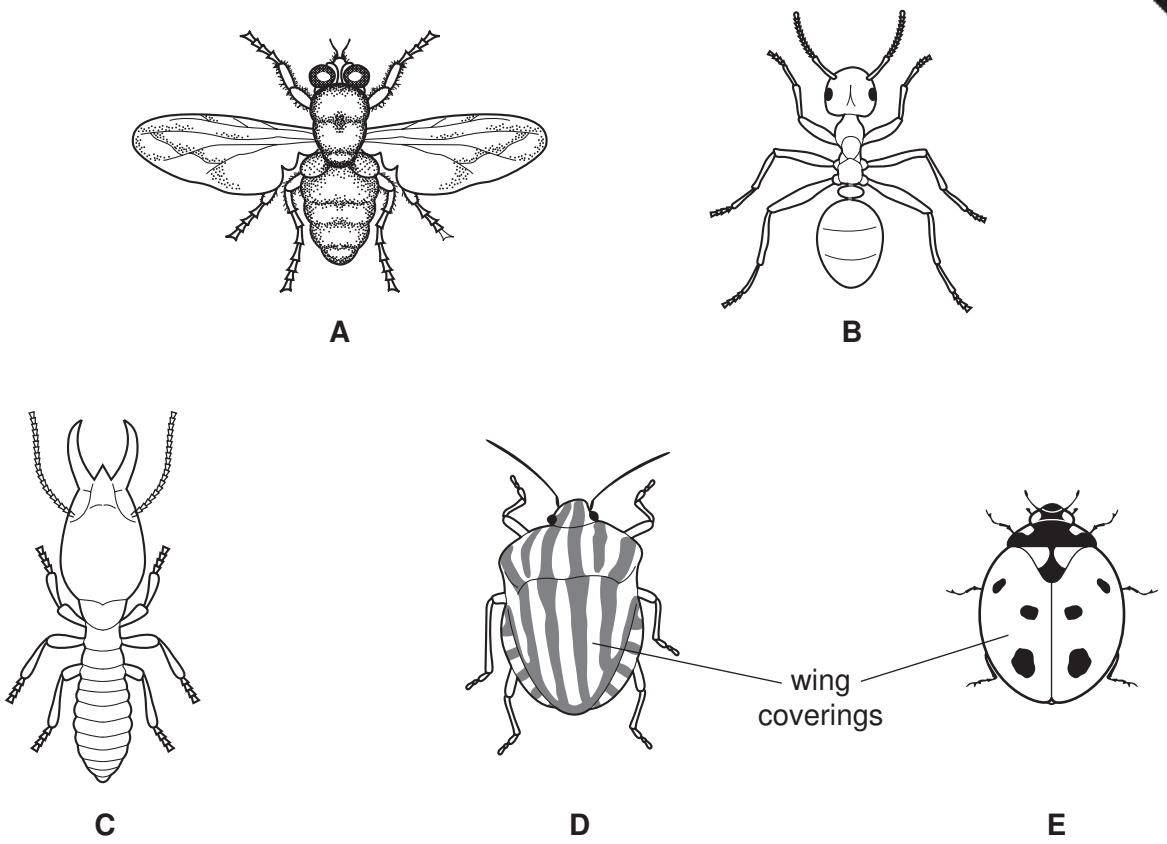

Fig. 1.1

(a) Use the key below to identify each insect. Fill in the table to show how you arrived at your identifications. The first one has been done for you.

1a	has wings	go to 2
b	does not have wings	go to 3
2a	wings are covered	go to 4
b	wings are not covered	*Musca*
3a	head longer than front leg	*Termes*
b	head shorter than front leg	*Formica*
4a	striped pattern on wing coverings	*Graphosoma*
b	spots on wing coverings	*Coccinella*

insect	**1**		**2**		**3**		**4**		**name**
	a	**b**	**a**	**b**	**a**	**b**	**a**	**b**	
A	✓			✓					*Musca*
B									
C									
D									
E									

[4]

(b) The common name for insect **A** is housefly. The complete binomial of insect **A** is *Musca domestica*.

Suggest why scientists may prefer to use the binomial of an insect, rather than its common name.

.....

..... [1]

(c) Houseflies feed by spitting saliva onto food, such as meat. Enzymes in the saliva turn insoluble substances into soluble ones. The flies can then suck the liquid into their digestive system.

(i) Suggest **one** enzyme in a housefly's saliva that could digest a substance in meat.

..... [1]

(ii) State the soluble product or products that this enzyme would produce.

..... [1]

(d) Houseflies spread diseases such as typhoid fever. They leave harmful microorganisms on food that will later be eaten by a person.

(i) Name the cells in the human body that can help to prevent microorganisms causing infections.

..... [1]

(ii) Pesticides are sometimes used to kill houseflies and therefore reduce the risk of spreading disease.

Give **one** reason why pesticides should **not** be used more than necessary.

.....

..... [1]

(e) When a housefly flies, its wings produce a buzzing sound.

(i) Suggest how a movement such as that of a fly's wings produces sound.

.....

.....

..... [2]

(ii) A housefly beats its wings about 200 times per second. A midge (a small [illegible] beats its wings about 1000 times per second.

State and explain how the sound produced by a flying midge will differ from the sound produced by a flying housefly.

.....

.....

..... [2]

2 **(a)** Fig. 2.1 shows an aircraft moving along a runway.

(i) Draw and label arrows on Fig. 2.1 to show the directions of the driving and friction forces acting on the aircraft. [1]

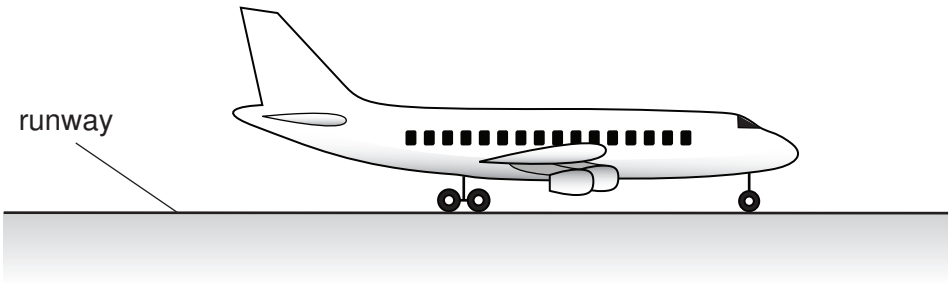

Fig. 2.1

(ii) The driving and friction forces are balanced.

Explain what is meant by the phrase *forces are balanced*.

.....

..... [1]

(iii) Describe the movement of the aircraft when these forces are balanced.

.....

..... [1]

(b) People who fly frequently have greater exposure to ionising radiation than those who do not fly.

(i) Explain why exposure to ionising radiation may be harmful.

.....

.....

..... [2]

(ii) This ionising radiation is cosmic radiation from outer space. This is one source of background radiation.

State **one** other natural source of background radiation.

..... [1]

(c) The aircraft is able to navigate using radar. This involves using microwaves. The
part of the electromagnetic spectrum.

Name **one** other wave which is part of the electromagnetic spectrum and give a use for this radiation.

name .....

use ..... [2]

(d) Potato snacks are packed in airtight packets and filled with nitrogen gas at atmospheric pressure.

(i) Suggest why nitrogen gas is used rather than air.

.....

..... [2]

(ii) A passenger has a packet of potato snacks in his hand luggage on the aircraft. During the flight, the aircraft cabin is at a pressure less than normal atmospheric pressure.

The passenger notices that the packet has expanded.

State why this happens.

.....

..... [1]

3 Hydrocarbons are compounds which contain only the elements hydrogen and carbon.

(a) (i) State the number of electrons in the outer shell of a carbon atom.

.....

.....

[1]

(ii) Another element, **X**, has atoms whose nuclei contain 14 protons.

Name element **X** and explain whether or not atoms of **X** have the same number of outer electrons as a carbon atom.

name of element **X** .....

explanation .....

.....

.....

[2]

(iii) Name the **least** reactive element which is in the same period of the Periodic Table as carbon.

.....

[1]

(b) The simplest hydrocarbon is methane which is an important gaseous fuel.

(i) State **two** natural sources of methane.

1 .....

2 .....

[2]

(ii) A fuel such as methane combines with oxygen in a chemical reaction. When the reaction is occurring, a large amount of heat is given off each second.

Suggest and explain which **one** of the sentences, **A** to **D**, accurately describes the reaction between a typical fuel and oxygen.

A The reaction is endothermic and has a very high rate.

B The reaction is exothermic and has a very high rate.

C The reaction is exothermic and has a very low rate.

D The reaction is endothermic and has a very low rate.

sentence .....

explanation .....

.....

.....

.....

[2]

(c) Some types of oil and grease contain hydrocarbons. Oil and grease stick to cloth... make them look dirty. Washing with water alone does not remove oil and grease ... clothes.

For ...iner's

(i) State the type of substance which could be added to water so that washing does remove oil and grease.

..... [1]

(ii) Suggest **one** possible disadvantage, other than cost, of using large amounts of the substance given in answer **(c)(i)** over a long period of time.

.....

..... [1]

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Please turn over for Question 4.

4 Yaks are animals that live in the cold mountainous region of the Himalayas.

Fig. 4.1 shows a yak.

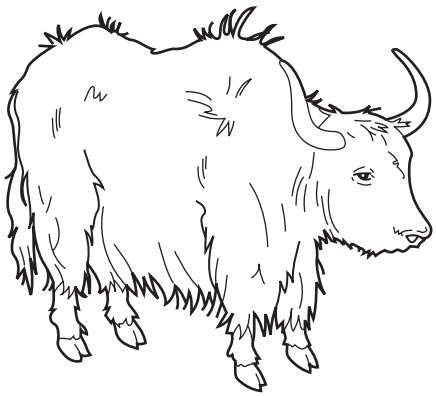

Fig. 4.1

(a) Explain how the long hair of the yak keeps it warm during the cold weather.

.....

.....

..... [2]

(b) Yaks are used as 'beasts of burden'. They can be ridden or used to carry or pull heavy objects.

A yak of mass 1000 kg is carrying a load of 80 kg.

(i) Calculate the combined weight of the yak and load.

The Earth's gravitational field strength is 10 N / kg.

..... N [1]

(ii) The yak carries its load up a mountain slope and finishes 100 m higher mountain.

Calculate the work done in gaining this height.

State the formula that you use and show your working.

formula used

working

..... J [2]

(iii) While the yak is carrying the load, it travels at a speed of 0.2 m / s.

Calculate the kinetic energy of the yak and its load at this time.

State the formula that you use and show your working.

formula used

working

..... J [2]

(iv) The yak then travels 1000 m in 4000 s.

Calculate the average speed of the yak.

State the formula that you use and show your working.

formula used

working

..... m/s [2]

(c) Yak dung is commonly burned as a fuel in the Himalayas. However, it is slowly replaced by kerosene.

State and explain **one** environmental reason why yak dung is a better fuel than kerosene.

.....

..... [1]

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Please turn over for Question 5.

5 Fig. 5.1 shows two plants that are grown as crops.

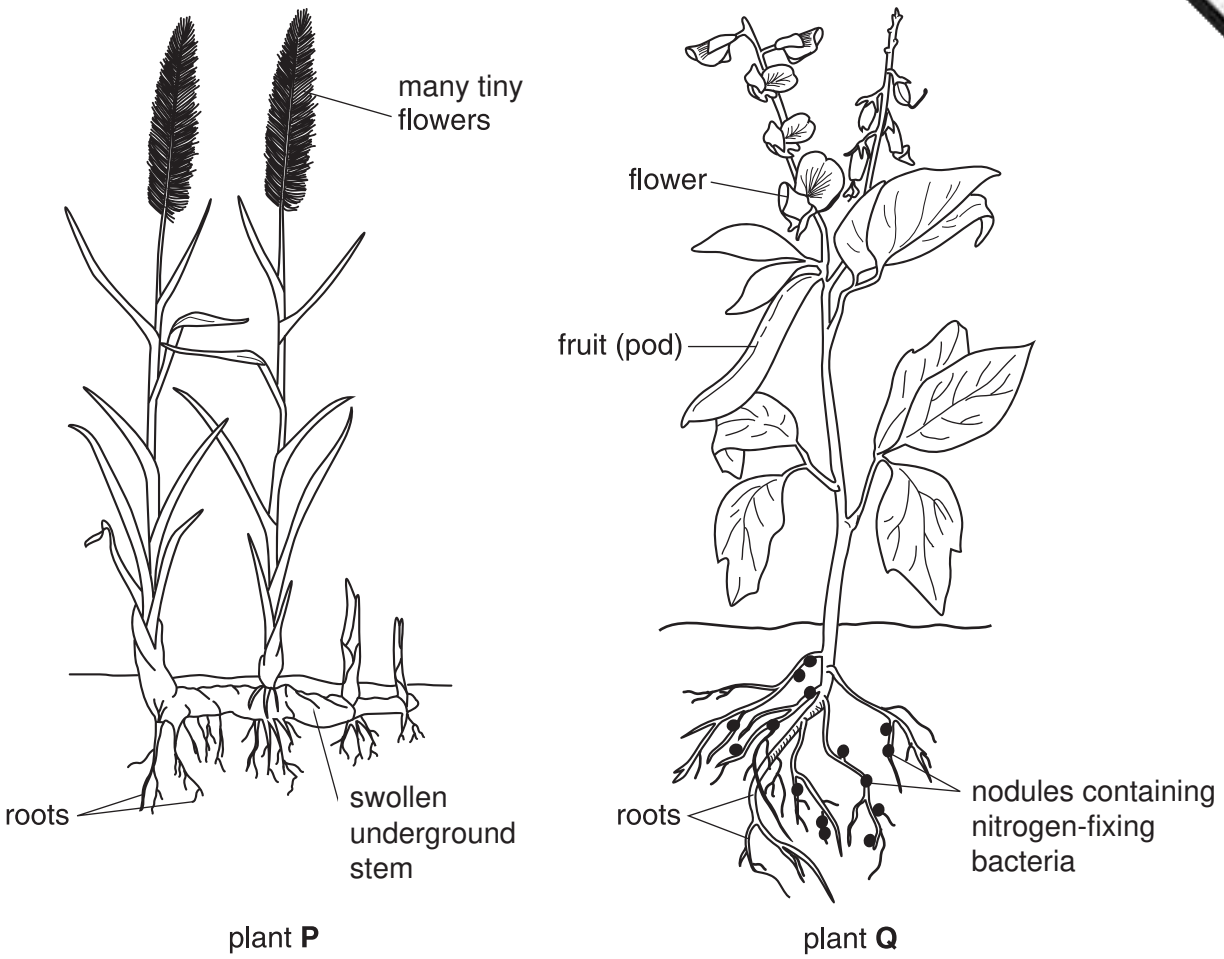

Fig. 5.1

(a) Plant **P** reproduces using flowers and also by growing new plants from its underground stem.

State the **type** of reproduction that each of these processes involves.

using flowers .....

growing new plants from underground stems ..... [1]

(b) The flowers of plant **Q** are pollinated by insects.

(i) State **one** feature, visible on Fig. 5.1, that would attract insects to the flowers.

..... [1]

(ii) After pollination, fertilisation takes place in the flower.

Describe what happens during fertilisation.

.....

.....

..... [2]

(iii) Name the part of the flower that would develop into a fruit, following fertilisation.

..... [1]

(iv) What structures are present inside all fruits?

..... [1]

(c) Farmers often add fertilisers containing nitrates to the soil where they grow crops.

(i) Explain why this is done.

.....

.....

..... [2]

(ii) Explain why fields in which plant **Q** is growing will require less nitrate fertiliser than fields in which plant **P** is growing.

.....

.....

..... [2]

6 Nordic gold is an alloy of four metals used to make coins.

Table 6.1 shows information about the metals contained in Nordic gold.

Table 6.1

metal	% by mass in Nordic gold
aluminium	5
copper	
tin	1
zinc	5

(a) (i) Complete Table 6.1 by stating the percentage of copper in Nordic gold. [1]

(ii) Suggest how Nordic gold could be made.

.....

..... [1]

(iii) Nordic gold has properties which make it suitable for making coins.

Suggest **one** property Nordic gold is likely to have, other than its appearance, that makes it suitable for making coins.

Explain briefly why this property is important.

property .....

importance .....

..... [2]

(b) (i) Tin may be extracted from tin oxide by heating a mixture of tin oxide and carbon. The other product of this reaction is carbon monoxide.

Write a **word** chemical equation for this reaction.

..... [1]

(ii) State and explain which substance is **oxidised** when tin is extracted from tin

substance which is oxidised .....

explanation .....

..... [2]

(c) Aluminium is extracted from aluminium oxide, Al_2O_3 , by electrolysis. Aluminium oxide is an ionic compound.

(i) Explain the meanings of the following terms.

cathode .....

electrolyte .....

..... [2]

(ii) Describe briefly the change in electronic structure which occurs when an aluminium atom becomes an aluminium **ion**.

.....

..... [1]

(iii) Calculate the number of oxide ions which will be combined with 10 aluminium ions in aluminium oxide.

..... [1]

(d) Zinc oxide is a white solid used in sunscreen to protect human skin from the harmful effects of ultraviolet light from the sun.

(i) In a typical sunscreen, tiny pieces of zinc oxide are dispersed in a liquid.

Name the type of mixture in which a solid is dispersed in a liquid.

..... [1]

(ii) Suggest why a sunscreen is able to protect human skin from ultraviolet light.

.....

..... [1]

7 Most cells obtain energy from carbohydrates and other nutrients by aerobic respiratio

(a) Describe how a cell in a human muscle obtains the oxygen that it needs for respiratio

.....

.....

..... [2]

(b) When a person carries out exercise, muscle cells use energy to contract and produce movement.

(i) State **two** uses of energy in the human body, other than the contraction of muscles.

1 .....

2 ..... [2]

(ii) Some of the energy in exercising muscles is released as heat. Sweating helps to prevent the internal body temperature from rising too high.

State the correct biological term for the maintenance of a constant internal environment.

..... [1]

(iii) Suggest why an athlete running a long race, such as a marathon, needs to drink fluids during the run.

.....

.....

..... [2]

(c) Regular exercise can help to reduce the risk of having a heart attack.

Describe the events that lead to a heart attack.

.....

.....

.....

.....

..... [3]

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Please turn over for Question 8.

8 Fig. 8.1 shows the inside of a refrigerator. The temperature inside the freezing compa is -20 °C and the temperature in the rest of the refrigerator is +5 °C.

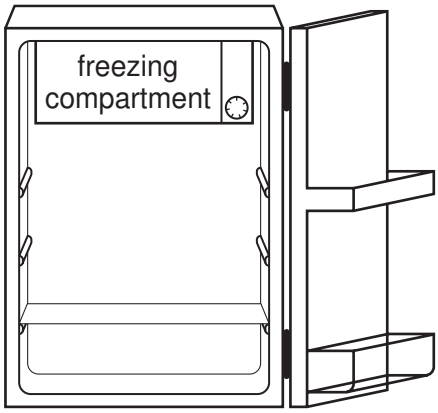


Fig. 8.1

(a) (i) Draw arrows on Fig. 8.1 to show what happens to the air cooled by the freezing compartment. [1]

(ii) Name this method of heat transfer. ..... [1]

(iii) Explain why this happens, using the idea of density.

.....

..... [1]

(b) Fig. 8.2 shows an ice cube with sides of 2 cm. The ice cube has a mass of 7.4 g.

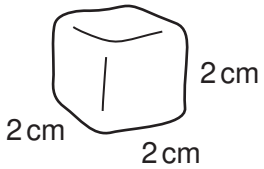


Fig. 8.2

(i) Calculate the density of the ice.

State the formula that you use and show your working. State the units of your answer.

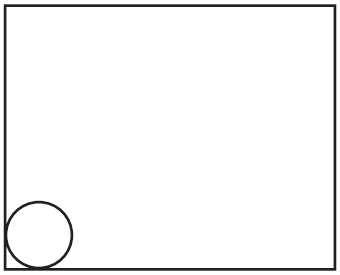
formula used

working

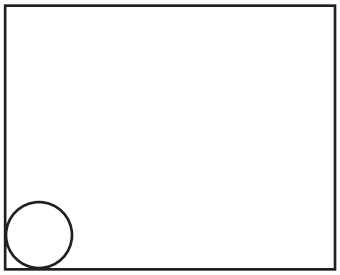
..... [3]

(ii) The ice cube has been made by freezing some water.

Draw diagrams to show the arrangement of water molecules in solid ice and liquid water. One molecule has been drawn for you in each box.



solid ice



liquid water

[2]

(c) The refrigerator has a lamp inside. The supply voltage is 250 V and the current passing through the lamp when lit is 0.05 A.

(i) Show that the resistance of the lamp when lit is 5000 Ω.

State the formula that you use and show your working.

formula used

working

..... [2]

(ii) Two lamps with a resistance of 5000 Ω are connected together in series.

Calculate the combined resistance of the two lamps.

State the formula that you use and show your working.

formula used

working

..... Ω [2]

9 Coral reefs are large rocky structures found in shallow seawater. The reefs are formed from the skeletons of small animals (coral polyps).

(a) Seawater is a mixture which contains many dissolved compounds. The coral polyps extract the compound calcium carbonate from seawater and use it to build their skeletons.

Choose **two** statements from the list below that describe compounds but which do **not** describe mixtures.

A They have a chemical formula.

B They can contain any amounts of two or more substances.

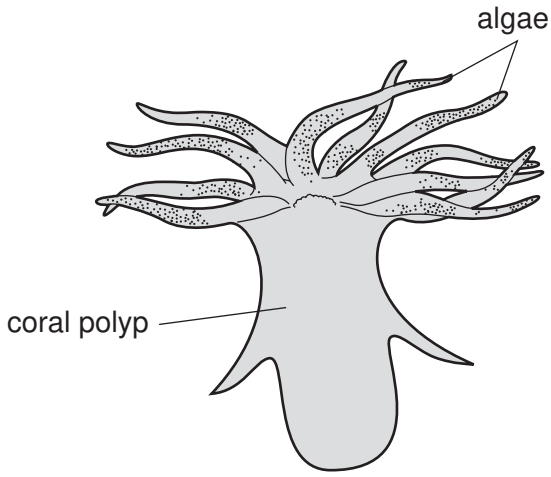
C Their properties are different from those of the substances used to make them.

D Their formation does **not** normally produce a significant change in temperature.

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

(b) Certain algae (microscopic plants) live in the coral polyps, and these organisms help each other to survive.

The algae produce oxygen in the presence of sunlight. The coral polyps use oxygen and produce carbon dioxide as a waste product.



(i) Name the processes which are occurring

in the algae to produce oxygen,

.....

in the coral polyps to produce carbon dioxide.

..... [2]

(ii) Name the compound which is produced by the algae in addition to oxygen.

..... [1]

(iii) Suggest **one** way that the coral polyps and the algae help each other to surv

.....

..... [1]

(c) In recent years, the amount of carbon dioxide in the atmosphere has increased. This has caused a decrease in the average pH of seawater.

During this period, many coral reefs have become damaged or have stopped growing.

(i) State and explain **one** example of human activity which has caused the amount of carbon dioxide in the atmosphere to increase in recent years.

.....

.....

..... [2]

(ii) Explain why increased levels of carbon dioxide in the atmosphere cause the average pH of seawater to decrease.

.....

.....

..... [2]

(iii) Suggest a possible reason why a decrease in the average pH of seawater could damage coral reefs.

.....

..... [1]

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

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

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

Key: box with a (top), **X** (centre), b (bottom left)

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.).