UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE **5129/02**

Paper 2 **May/June 2010**

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 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

This document consists of **23** printed pages and **1** blank page.

1 A series circuit is shown in Fig. 1.1. The resistors have values of 3 Ω and 6 Ω.

For Examiner's Use

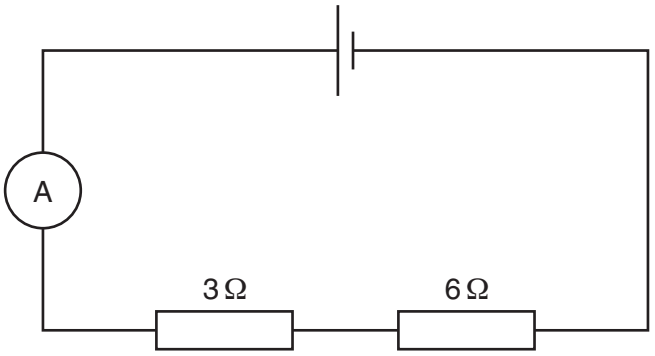

Fig. 1.1

(a) On Fig. 1.1, draw the symbol for a voltmeter connected to measure the potential difference across the 6 Ω resistor. [2]

(b) The ammeter reading is 0.20 A.

Calculate

(i) the potential difference across the 6 Ω resistor,

potential difference = ... unit ..... [3]

(ii) the combined resistance of the two resistors.

resistance = ... Ω [1]

2 Aluminium, chlorine, magnesium and silicon are in the same period of the Periodic Table.

For Examiner's Use

(a) Which **two** of these elements conduct electricity?
Give a reason for your choice.

elements .....

reason .....

.....[2]

(b) The oxides of magnesium and phosphorus are added to water and Universal Indicator paper is dipped into each solution.

State the colour of the indicator with each of the solutions.

magnesium oxide solution .....

phosphorus oxide solution .....[2]

(c) Strontium is in the same group of the Periodic Table as magnesium.

Explain why strontium and magnesium have similar chemical reactions.

.....

.....[1]

[Turn over

3 Measurements were made of the diameter of the pupil of a person's right eye over a period of five minutes in a darkened room.
During this time, a light of varying intensity was shone into the person's right eye.
The results are shown in Fig. 3.1.

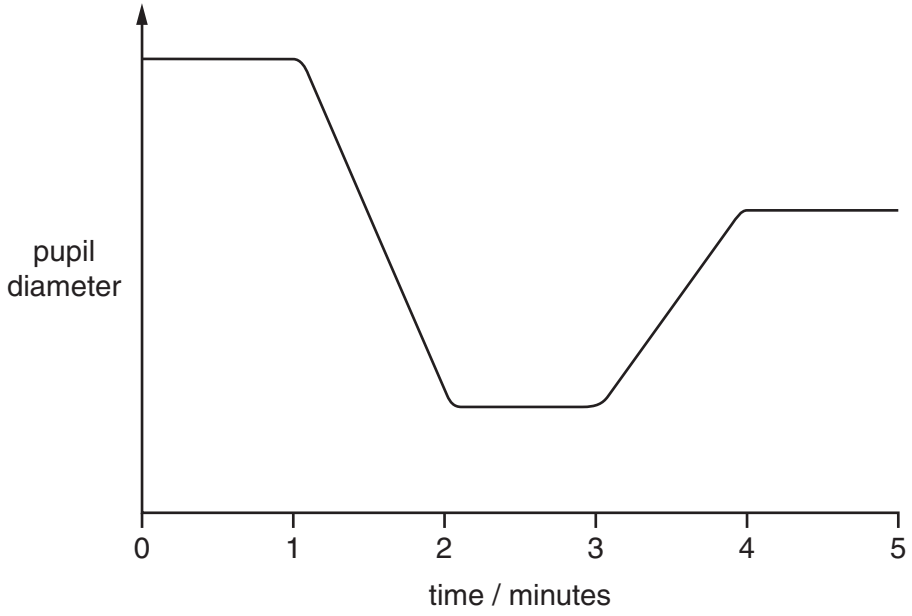

Fig. 3.1

(a) Use Fig. 3.1 to answer the following questions.

(i) When is the pupil most dilated?

from ..... mins to ..... mins [1]

(ii) When is the intensity of the light entering the eye at its greatest?

from ..... mins to ..... mins [1]

(iii) Suggest when the light intensity decreases most rapidly.

from ..... mins to ..... mins [1]

(b) Name the structure in the human eye which brings about changes in pupil size.

.....[1]

(c) During this experiment, the **left** eye stays in the dark.

On Fig. 3.1, draw a line to show the diameter of the pupil of the **left** eye. [1]

(d) In the pupil reflex, where are the receptors?

.....[1]

4 A nucleus of cobalt emits a beta-particle to form a nickel nucleus.

For Examiner's Use

The equation for the nuclear decay is $^{60}_{X}\text{Co} \rightarrow {}^{60}_{28}\text{Ni} + {}^{0}_{-1}\beta$.

(a) Calculate the value of x.

x = ...[1]

(b) State the nature of a beta-particle.

.....[1]

(c) Determine the number of neutrons in a nucleus of nickel-60 ($^{60}_{28}\text{Ni}$).

number of neutrons = ...[1]

(d) A nucleus of carbon $^{14}_{6}\text{C}$ emits a beta-particle.
The half-life of $^{14}_{6}\text{C}$ is 5700 years.
Initially, a sample of wood contains 1 000 000 atoms of $^{14}_{6}\text{C}$.
How long does it take for the number of $^{14}_{6}\text{C}$ atoms in the sample to decrease to 250 000?

..... years [2]

5 Use words from the list to complete the sentences below.

For Examiner's Use

amino-acids **bladder** **fat** **kidneys** **liver**

Each word may be used once, more than once, or not at all.

Urea is produced in the body by the ..... , during the breakdown of ..... .

The urea is excreted by the ..... .

If there is too much glucose in the blood, the extra glucose is removed by the ..... , and stored in the cells as insoluble carbohydrate.

[4]

6 Ammonium nitrate is made by adding ammonia solution to nitric acid.

For Examiner's Use

The equation for the reaction is

$$NH_3 + HNO_3 \longrightarrow NH_4NO_3$$

(a) State the type of reaction that occurs between ammonia and nitric acid.

.....[1]

(b) Calculate the relative molecular mass of

ammonia, ...

ammonium nitrate. ..... [2]

[A_r: N, 14; H, 1; O, 16.]

(c) Calculate the mass of ammonia required to make 2.0 kg of ammonium nitrate.

mass = ... kg [2]

7 Two similar metal cans **A** and **B** are shown in Fig. 7.1.

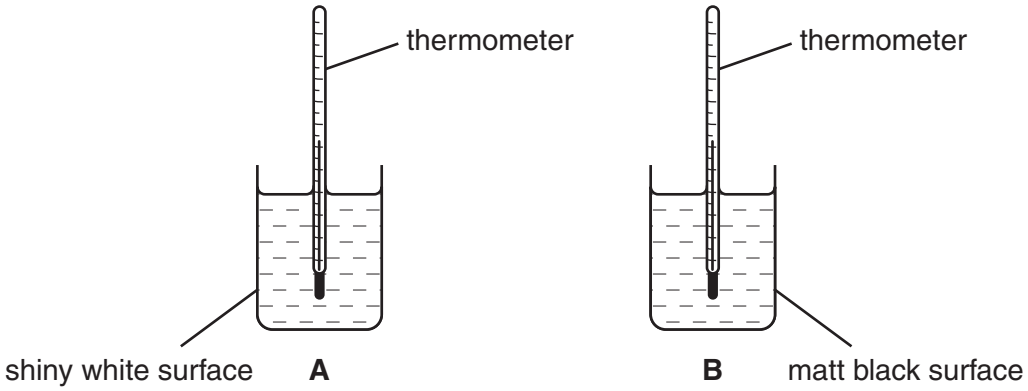

Fig. 7.1

Can **A** has a shiny white surface. Can **B** has a matt black surface.
Both cans contain equal masses of hot water.
Initially, the cans and water are all at the same temperature.

(a) Explain why the temperature of the water in can **B** falls more quickly than the water in can **A**.

.....

.....[1]

(b) State the process by which heat is transferred through the metal of the cans.

.....[1]

(c) Air around each can is heated and rises.

Explain why the air rises.

.....

.....[1]

8 Water for drinking is stored in reservoirs.

For Examiner's Use

(a) State the **two** processes used to purify water to make it fit to drink.

process 1 .....

process 2 .....[2]

(b) Suggest how these two processes purify water.

.....

.....

.....

.....[2]

9 A cross-section of part of a leaf, as it appears under the microscope, is shown in Fig. 9.1.

For Examiner's Use

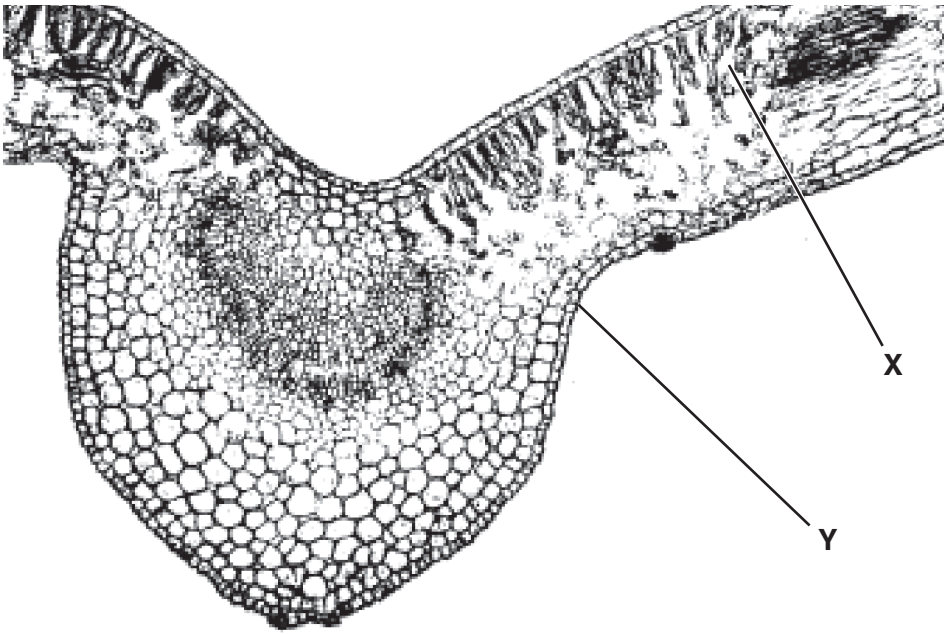

Fig. 9.1

(a) Name the tissues labelled **X** and **Y**.

X .....

Y ..... [2]

(b) The leaf contains air spaces.

Which tissue contains the most air spaces?

.....[1]

(c) Describe how carbon dioxide enters a leaf during photosynthesis.

.....

.....[2]

(d) The leaf is very thin.

Explain how this helps the leaf to make carbohydrates by photosynthesis.

.....

.....

.....[2]

10 **(a)** Complete Fig. 10.1 by inserting 'yes' or 'no' in the blank spaces.

For Examiner's Use

material	is the material magnetic?
aluminium	no
carbon	
iron	
plastic	
steel	

Fig. 10.1 [2]

(b) Using the materials in Fig. 10.1, name the material which is

(i) a poor electrical conductor, ...[1]

(ii) used for the core of a transformer. .....[1]

[Turn over

11 Fig. 11.1 shows a blast furnace for the extraction of iron from iron ore.

For Examiner's Use

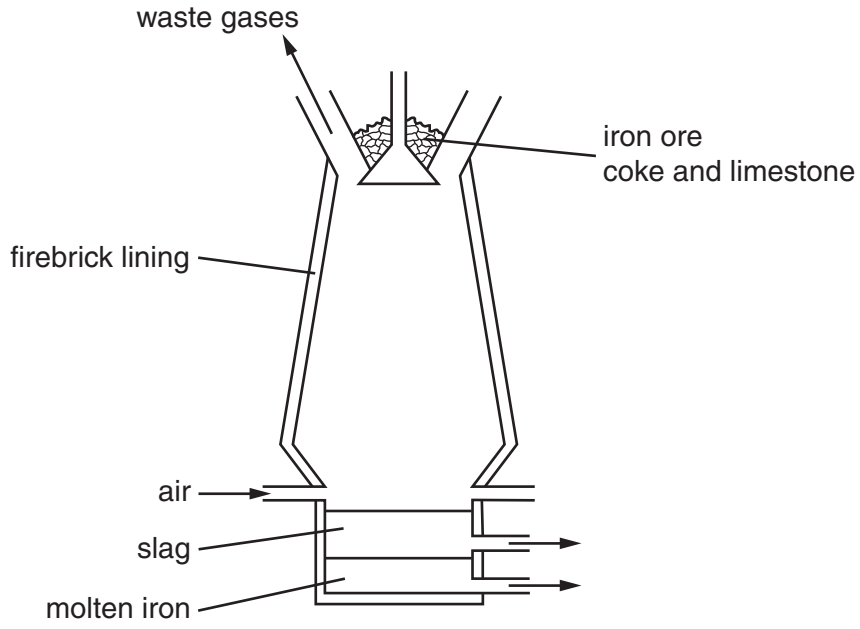

Fig. 11.1

(a) Name an ore from which iron is extracted. .....[1]

(b) In the extraction of iron, the iron ore is reduced by carbon monoxide.

(i) Balance the equation for the reduction of iron ore.

$$Fe_2O_3 + \text{.....}\ CO \longrightarrow \text{.....}\ Fe + \text{.....}\ CO_2$$ [1]

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

.....[1]

(iii) Describe how carbon monoxide is produced from the coke added to the furnace.

.....

.....

.....[2]

(c) Suggest why sodium is not extracted using the same process as iron.

.....[1]

12 Fig. 12.1 shows how the displacement of particles in a wave varies with distance along the wave.

For Examiner's Use

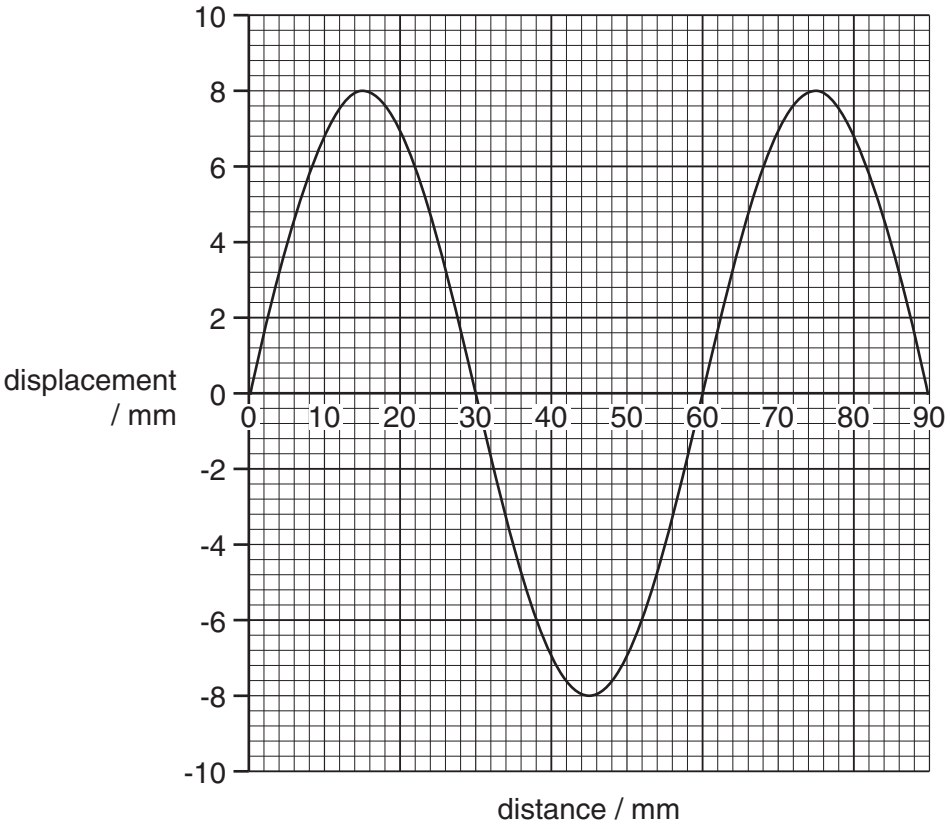

Fig. 12.1

(a) Use Fig. 12.1 to determine for this wave

(i) the wavelength, ... mm [1]

(ii) the amplitude. ..... mm [1]

(b) Waves on the surface of water are transverse waves.

What is meant by a *transverse* wave?

.....

.....[2]

13 **(a)** Explain the function of teeth in the digestion of food.

For Examiner's Use

.....

.....[2]

(b) Rates of dental decay amongst children in towns **A** and **B** were surveyed. The results are shown in Fig. 13.1.

It is suggested that the difference between the rates of dental decay in town **A** and in town **B** is due to a difference in the fluoride content of the water.

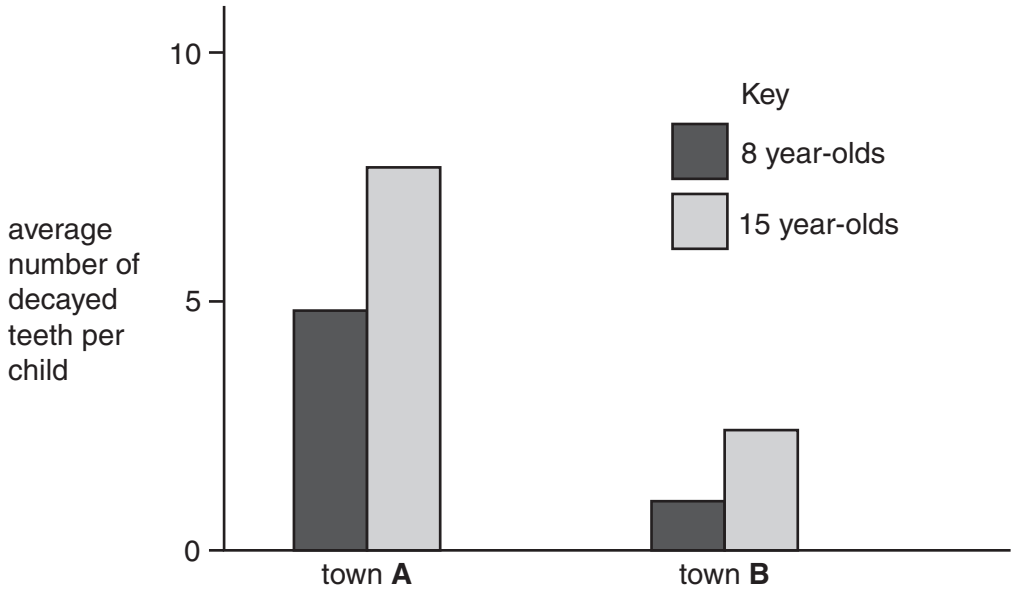

Fig. 13.1

(i) Use the information in Fig. 13.1 to suggest which town has the higher water fluoride concentration.

Explain your answer.

town .....

explanation .....

.....[1]

(ii) Suggest **two** other possible reasons for the difference in rates of dental decay in the two towns.

.....

.....

.....[2]

14 Regions of the electromagnetic spectrum are shown in Fig. 14.1.

For Examiner's Use

radiowaves	microwaves	**A**	visible light	ultraviolet light	X-rays	gamma-rays

Fig. 14.1

(a) Name the region of the spectrum labelled **A**.

.....[1]

(b) Which region of the spectrum has the longest wavelength?

.....[1]

(c) All electromagnetic waves travel at the same speed in a vacuum.

State the magnitude of this speed.

speed = ... m/s [1]

[Turn over

15 Part of the carbon cycle is shown in Fig. 15.1.

For Examiner's Use

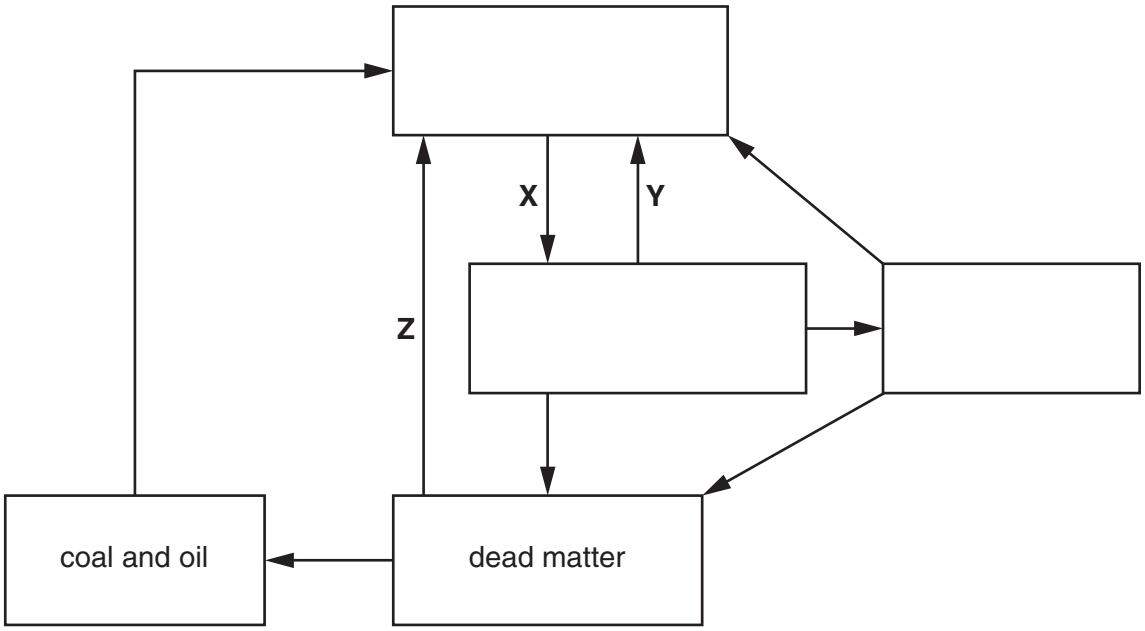

Fig. 15.1

(a) Use words from the list to complete the three empty boxes in Fig. 15.1.

animals **bacteria** **carbon dioxide** **fossil fuels** **oxygen** **plants**

Each word may be used once, more than once, or not at all. [3]

(b) Which processes are represented by the arrows labelled **X**, **Y** and **Z**?

X .....

Y .....

Z .....[3]

16 Fig. 16.1. shows properties of four substances.

For Examiner's Use

substance	melting point °C	boiling point °C	density g/cm^3
A	–219	–183	0.0015
B	–114	78	0.79
C	119	445	1.96
D	1083	2582	8.94

Fig. 16.1

Use the letters in Fig. 16.1 to answer the questions below.
Each letter may be used once, more than once or not at all.

Which substance is most likely to be

(a) a metal, ... [1]

(b) a liquid at room temperature, ... [1]

(c) a covalent solid at room temperature? .....[1]

17 A wooden block is pulled across a horizontal table at a constant speed of 0.20 m / s as shown in Fig. 17.1.

For Examiner's Use

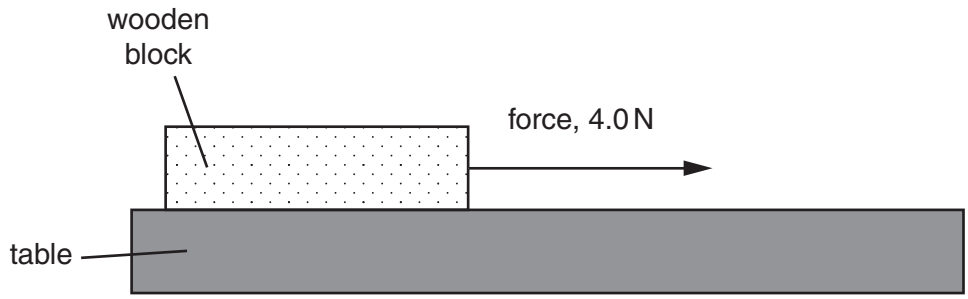

Fig. 17.1

The block is pulled a distance of 0.80 m by the horizontal force of 4.0 N.

(a) Calculate the time taken for the block to move 0.80 m.

time = ... s [2]

(b) Calculate the work done by the force of 4.0 N to move the block through 0.80 m.

work done = ... unit ..... [3]

18 Fig. 18.1 shows methane burning using a Bunsen burner with the air hole open.

For Examiner's Use

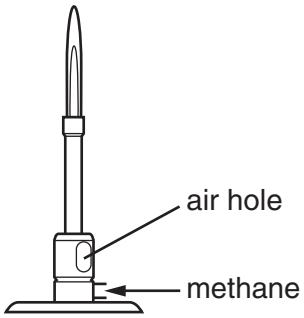

Fig. 18.1

(a) Methane burns completely when the air hole is open.

State the **two** products when methane burns completely.

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

(b) Methane burns incompletely when the air hole is closed.

Explain why it is dangerous to use a Bunsen burner in a poorly ventilated room with the air hole closed.

.....

.....[2]

(c) Organic compounds are grouped into families called homologous series.

Describe the characteristics of a homologous series.

.....

.....

.....[2]

19 Fig. 19.1. shows a swinging pendulum in two different positions.

At position **A**, the pendulum bob changes the direction in which it was moving.

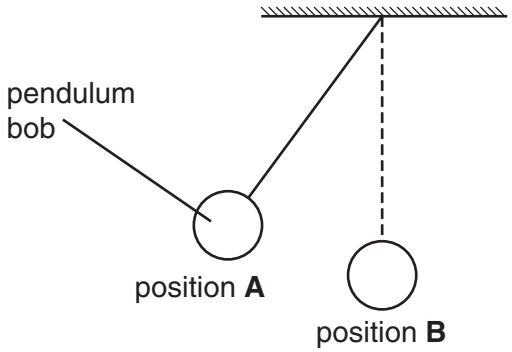

Fig. 19.1

(a) State the energy change that takes place as the pendulum swings from position **A** to position **B**.

..... energy changes to ..... energy. [2]

(b) The period of the pendulum is 2.0 s.

Calculate the shortest time for the pendulum to move from position **A** to position **B**.

time = ... s [1]

20 Changes in the thickness of the lining of a woman's uterus during the menstrual cycle are shown in Fig. 20.1.

For Examiner's Use

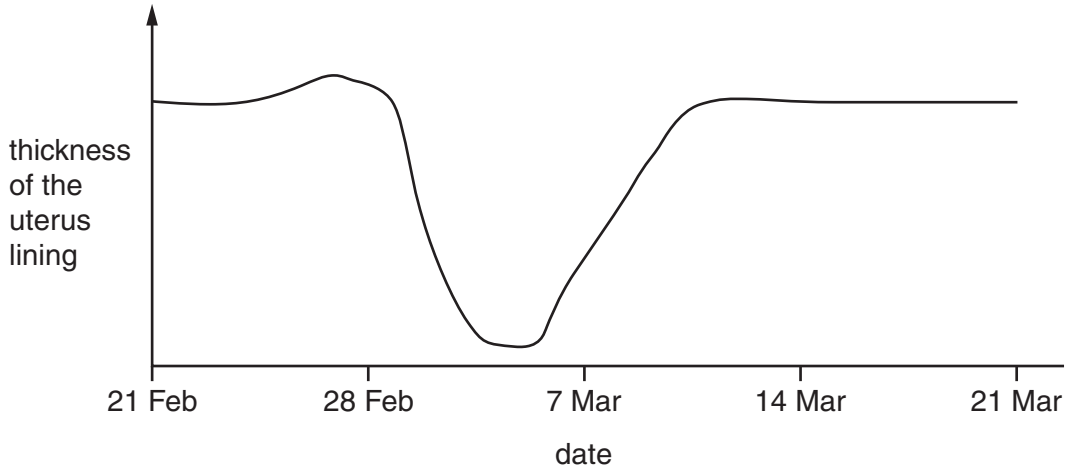

Fig. 20.1

(a) From Fig. 20.1, choose dates when

(i) menstruation is occurring,

.....[1]

(ii) ovulation is likely to occur.

.....[1]

(b) (i) State the average length of a menstrual cycle.

.....[1]

(ii) Suggest **two** factors that might cause the length of a woman's menstrual cycle to be longer or shorter than the average.

1. .....

2. .....[2]

21 Ethanol is manufactured from glucose.
The process is carried out in the presence of yeast in an air-free container.
The reaction produces a solution of ethanol in water.

(a) State the name of the process. .....[1]

(b) Explain why

(i) yeast is used in this process,

.....

.....[1]

(ii) the container should be air-free.

.....

.....[1]

(c) Water boils at 100 °C. Ethanol boils at 78 °C.

Suggest the name of the method used to separate ethanol from a mixture of ethanol and water.

.....[1]

(d) Draw the structure of a molecule of ethanol.

[1]

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

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).