



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE
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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 $3\ \Omega$ and $6\ \Omega$.

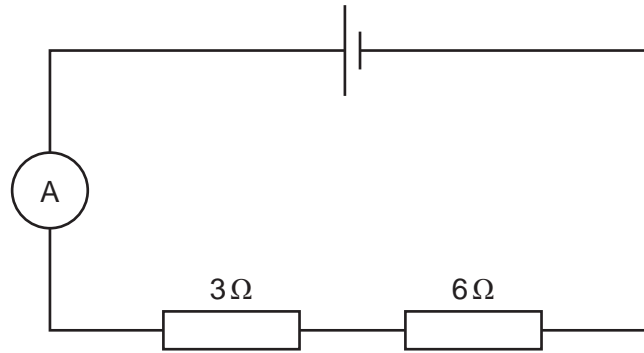


Fig. 1.1

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

- (b) The ammeter reading is $0.20\ \text{A}$.

Calculate

- (i) the potential difference across the $6\ \Omega$ 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.

(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]

- 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.

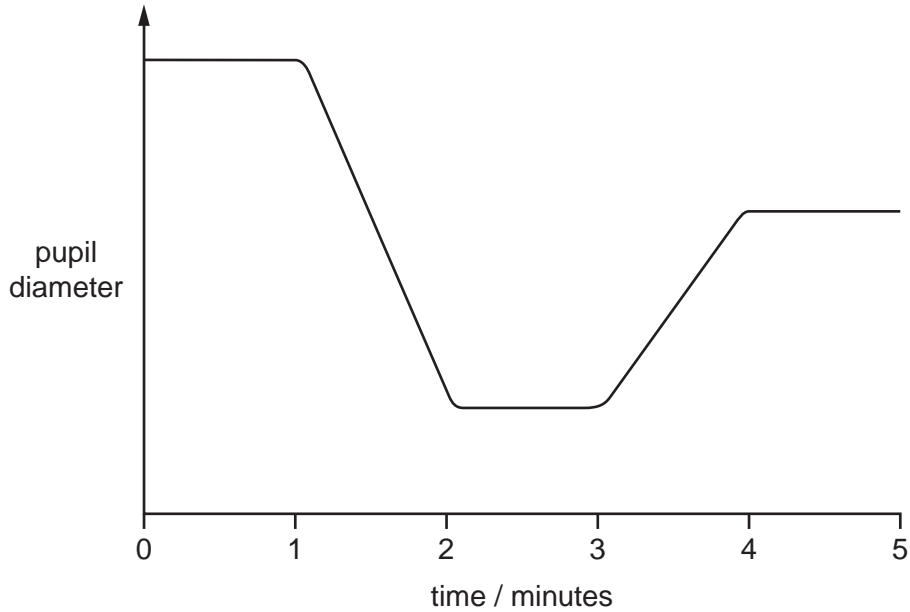


Fig. 3.1

- (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.

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

- (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.

amino-acids

bladder

fat

kidneys

liver

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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.

The equation for the reaction is



- (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 2.0kg of ammonium nitrate.

mass = kg [2]

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

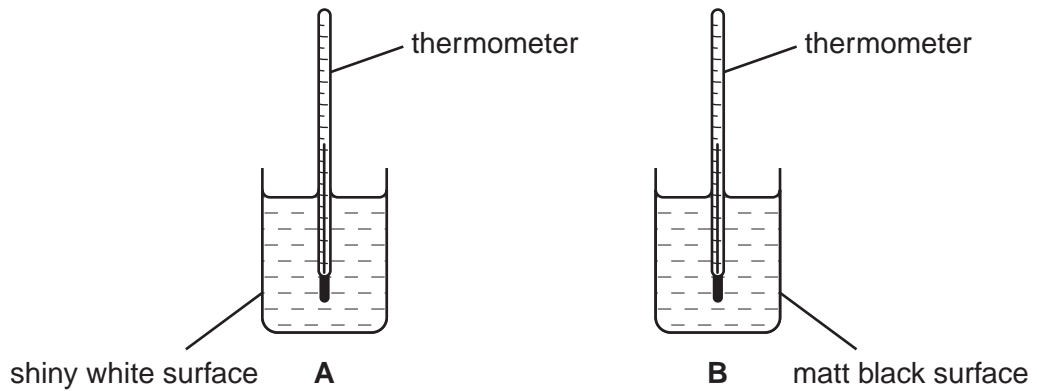


Fig. 7.1

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.

(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.

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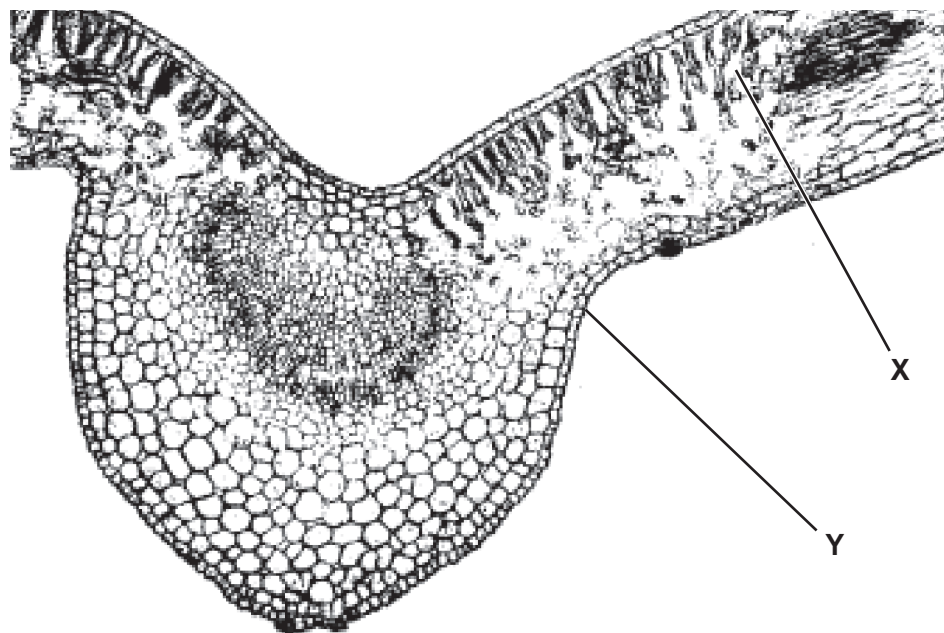


Fig. 9.1

(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.

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]

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

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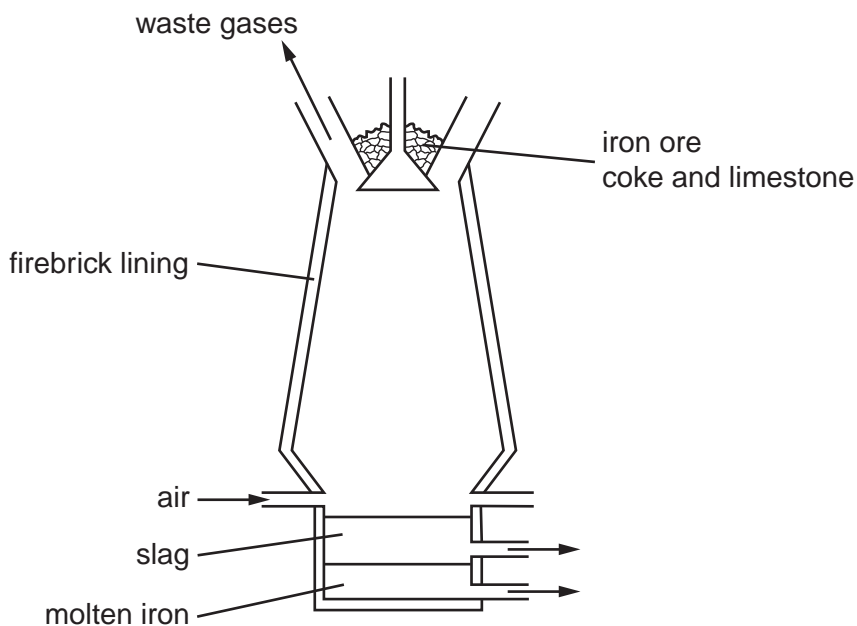


Fig. 11.1

(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.



(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.

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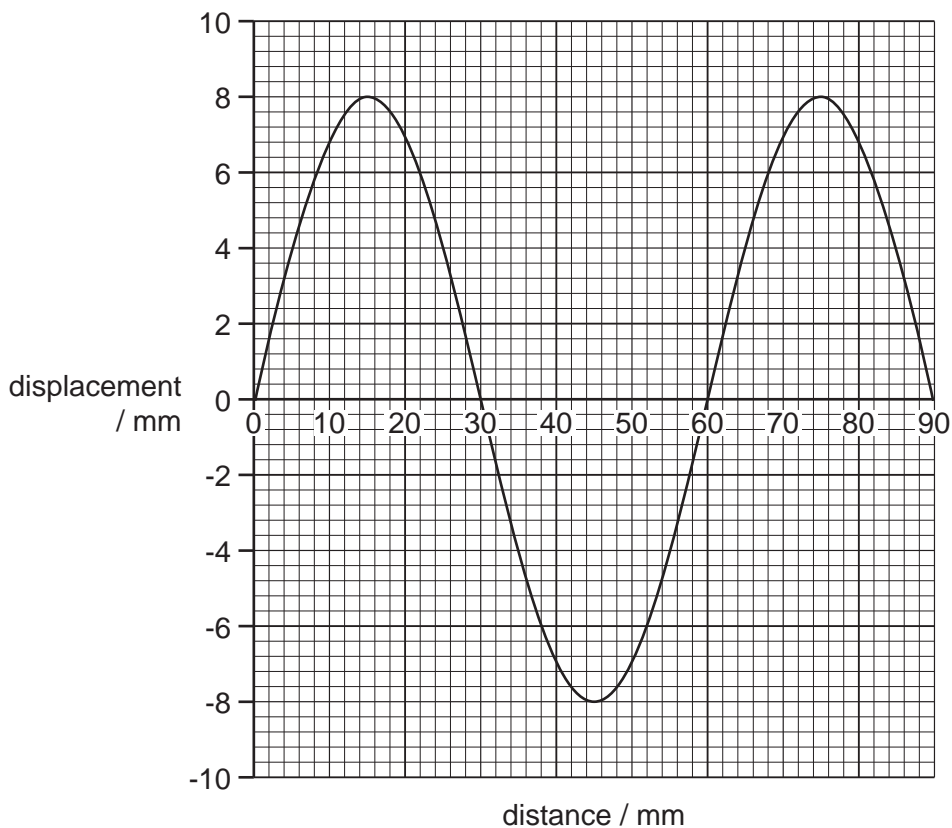


Fig. 12.1

(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.

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.....
..... [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.

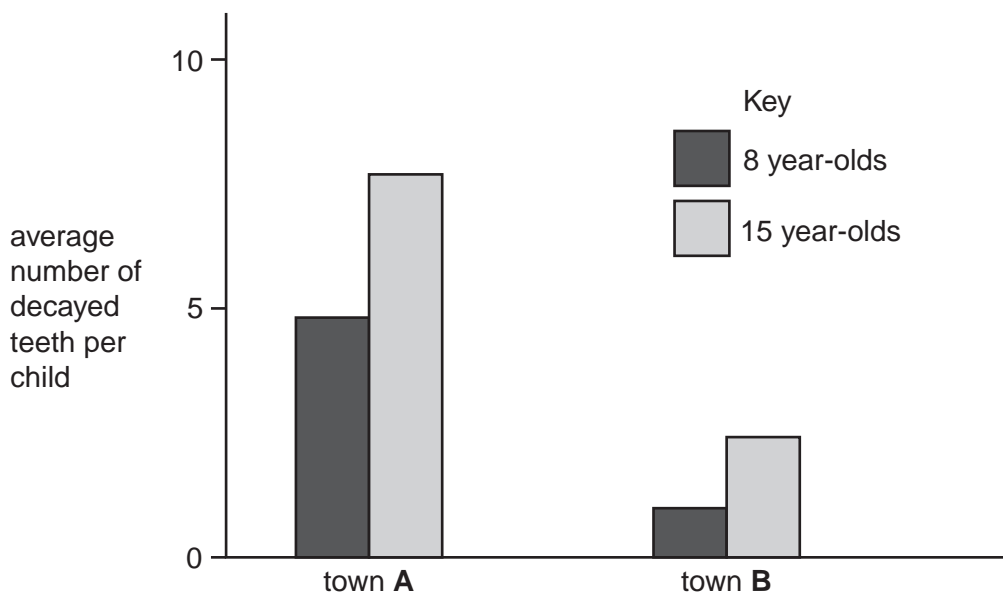


Fig. 13.1

(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.

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]

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

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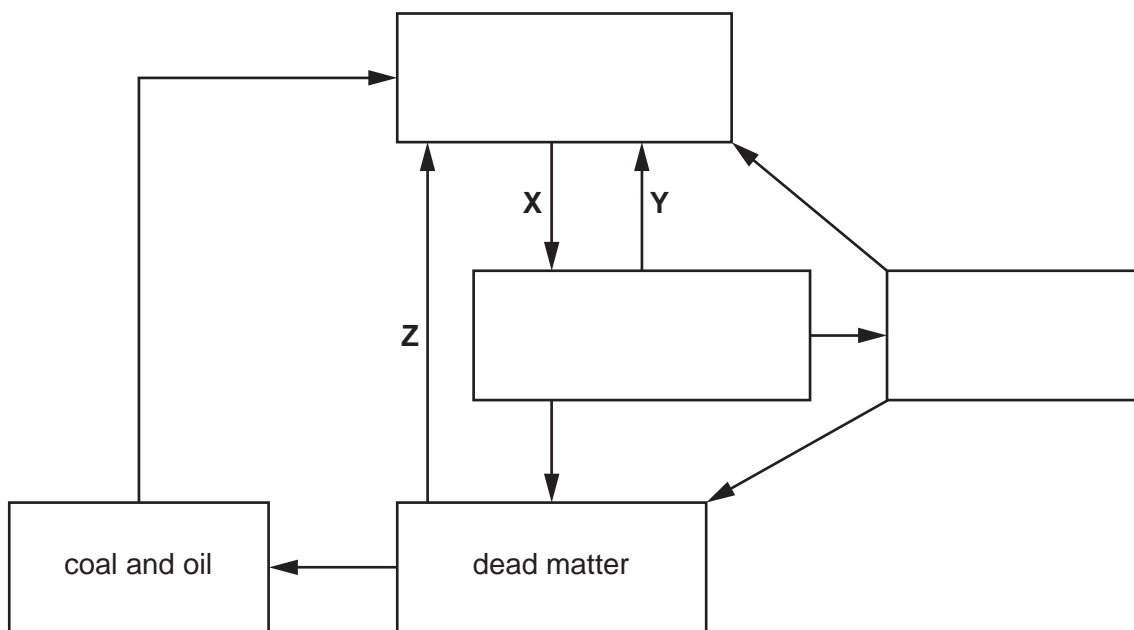


Fig. 15.1

(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.

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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.

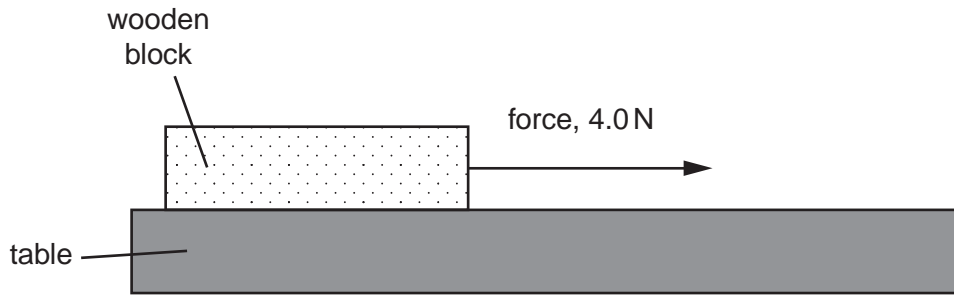


Fig. 17.1

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.

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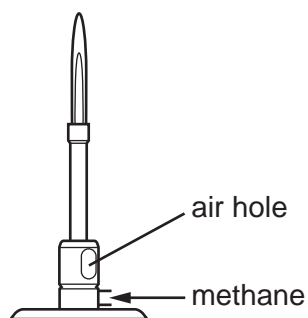


Fig. 18.1

(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.

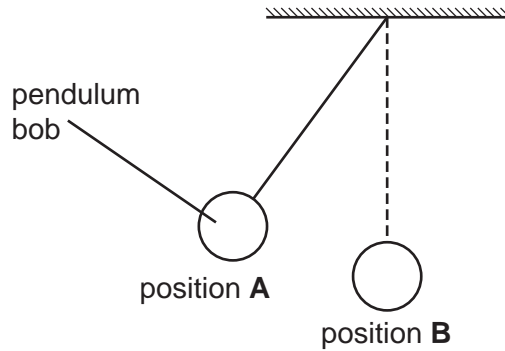


Fig. 19.1

(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 2.0s.

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.

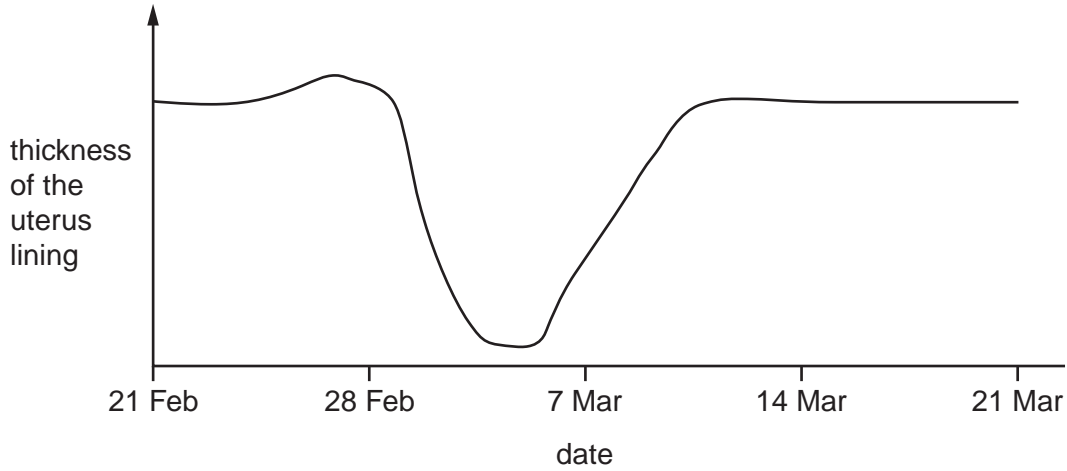


Fig. 20.1

(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																																																																																																																																																																																																																																																																																													
7 Li Lithium 3	9 Be Beryllium 4	1 H Hydrogen 1	11 B Boron 5	12 C Carbon 6	13 Al Aluminium 13	14 N Nitrogen 7	15 O Oxygen 8	16 F Fluorine 9	17 Ne Neon 10	18 Ar Argon 18	19 K Potassium 19	20 Ca Calcium 20	21 Sc Scandium 21	22 Ti Titanium 22	23 V Vanadium 23	24 Cr Chromium 24	25 Mn Manganese 25	26 Fe Iron 26	27 Co Cobalt 27	28 Ni Nickel 28	29 Cu Copper 29	30 Zn Zinc 30	31 Ga Gallium 31	32 Ge Germanium 32	33 As Arsenic 33	34 Se Selenium 34	35 Br Bromine 35	36 Kr Krypton 36	37 Rb Rubidium 37	38 Sr Strontium 38	39 Y Yttrium 39	40 Zr Zirconium 40	41 Nb Niobium 41	42 Mo Molybdenum 42	43 Tc Technetium 43	44 Ru Ruthenium 44	45 Rh Rhodium 45	46 Pd Palladium 46	47 Ag Silver 47	48 Cd Cadmium 48	49 In Indium 49	50 Sn Tin 50	51 Sb Antimony 51	52 Te Tellurium 52	53 I Iodine 53	54 Xe Xenon 54	55 Cs Caesium 55	56 Ba Barium 56	57 La Lanthanum 57	58 Ce Cerium 58	59 Pr Praseodymium 59	60 Nd Neodymium 60	61 Pm Promethium 61	62 Sm Samarium 62	63 Eu Europium 63	64 Gd Gadolinium 64	65 Tb Terbium 65	66 Dy Dysprosium 66	67 Ho Holmium 67	68 Er Erbium 68	69 Tm Thulium 69	70 Yb Ytterbium 70	71 Lu Lutetium 71	72 Fr Francium 87	73 Ra Radium 88	74 Ac Actinium 89	75 Th Thorium 90	76 Pa Protactinium 91	77 U Uranium 92	78 Np Neptunium 93	79 Pu Plutonium 94	80 Am Americium 95	81 Cm Curium 96	82 Bk Berkelium 97	83 Cf Californium 98	84 Es Einsteinium 99	85 Fm Fermium 100	86 Md Mendelevium 101	87 No Nobelium 102	88 Lr Lawrencium 103	89 Fr Francium 87	90 Ra Radium 88	91 Ac Actinium 89	92 Th Thorium 90	93 Pa Protactinium 91	94 U Uranium 92	95 Np Neptunium 93	96 Pu Plutonium 94	97 Am Americium 95	98 Cm Curium 96	99 Bk Berkelium 97	100 Cf Californium 98	101 Es Einsteinium 99	102 Fm Fermium 100	103 Md Mendelevium 101	104 No Nobelium 102	105 Lr Lawrencium 103	106 Rn Radon 86	107 At Astatine 85	108 Po Polonium 84	109 Bi Bismuth 83	110 Pb Lead 82	111 Tl Thallium 81	112 Hg Mercury 80	113 Pt Platinum 78	114 Au Gold 79	115 Ir Iridium 77	116 Pt Platinum 78	117 Au Gold 79	118 Hg Mercury 80	119 Tl Thallium 81	120 Pb Lead 82	121 Bi Bismuth 83	122 Po Polonium 84	123 At Astatine 85	124 Rn Radon 86	125 Lu Lutetium 71	126 Yb Ytterbium 70	127 Lu Lutetium 71	128 Lu Lutetium 71	129 Lu Lutetium 71	130 Lu Lutetium 71	131 Lu Lutetium 71	132 Lu Lutetium 71	133 Lu Lutetium 71	134 Lu Lutetium 71	135 Lu Lutetium 71	136 Lu Lutetium 71	137 Lu Lutetium 71	138 Lu Lutetium 71	139 Lu Lutetium 71	140 Lu Lutetium 71	141 Lu Lutetium 71	142 Lu Lutetium 71	143 Lu Lutetium 71	144 Lu Lutetium 71	145 Lu Lutetium 71	146 Lu Lutetium 71	147 Lu Lutetium 71	148 Lu Lutetium 71	149 Lu Lutetium 71	150 Lu Lutetium 71	151 Lu Lutetium 71	152 Lu Lutetium 71	153 Lu Lutetium 71	154 Lu Lutetium 71	155 Lu Lutetium 71	156 Lu Lutetium 71	157 Lu Lutetium 71	158 Lu Lutetium 71	159 Lu Lutetium 71	160 Lu Lutetium 71	161 Lu Lutetium 71	162 Lu Lutetium 71	163 Lu Lutetium 71	164 Lu Lutetium 71	165 Lu Lutetium 71	166 Lu Lutetium 71	167 Lu Lutetium 71	168 Lu Lutetium 71	169 Lu Lutetium 71	170 Lu Lutetium 71	171 Lu Lutetium 71	172 Lu Lutetium 71	173 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* 58–71 Lanthanoid series
† 90–103 Actinoid series

Key

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

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