



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE
NAME

CENTRE
NUMBER

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CANDIDATE
NUMBER

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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

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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 $6\ \Omega$.

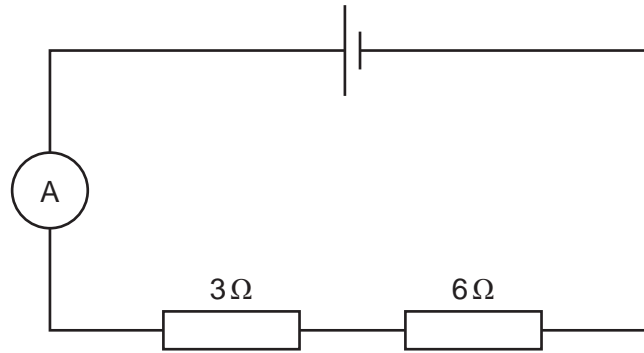


Fig. 1.1

- (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.

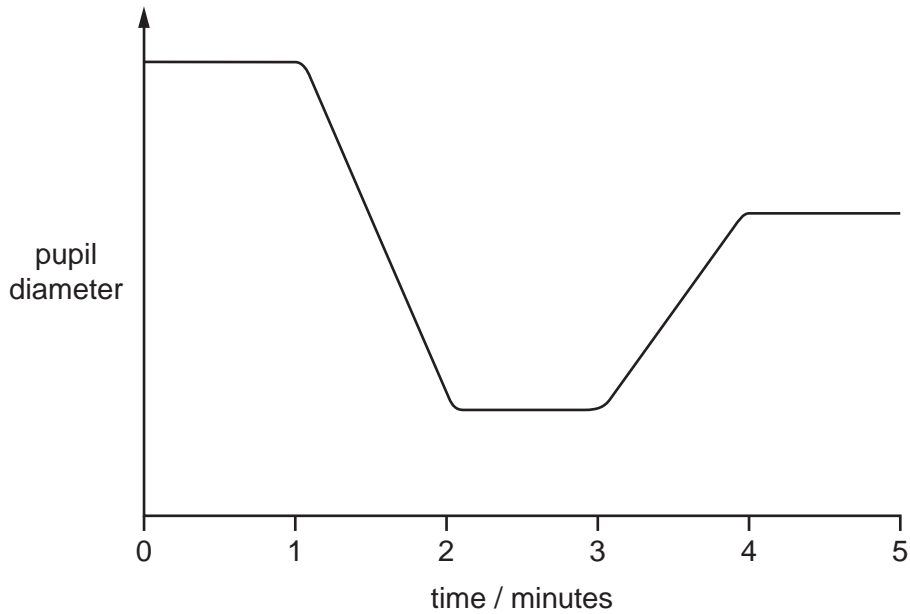


Fig. 3.1

- (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

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]

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

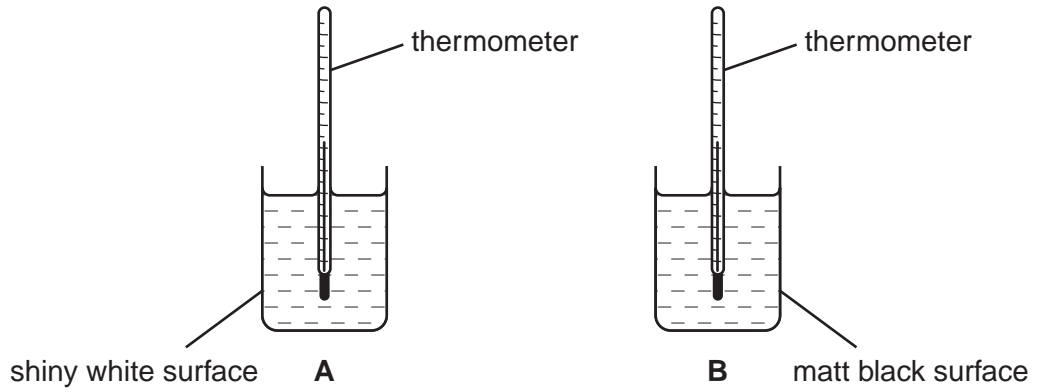


Fig. 7.1

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.

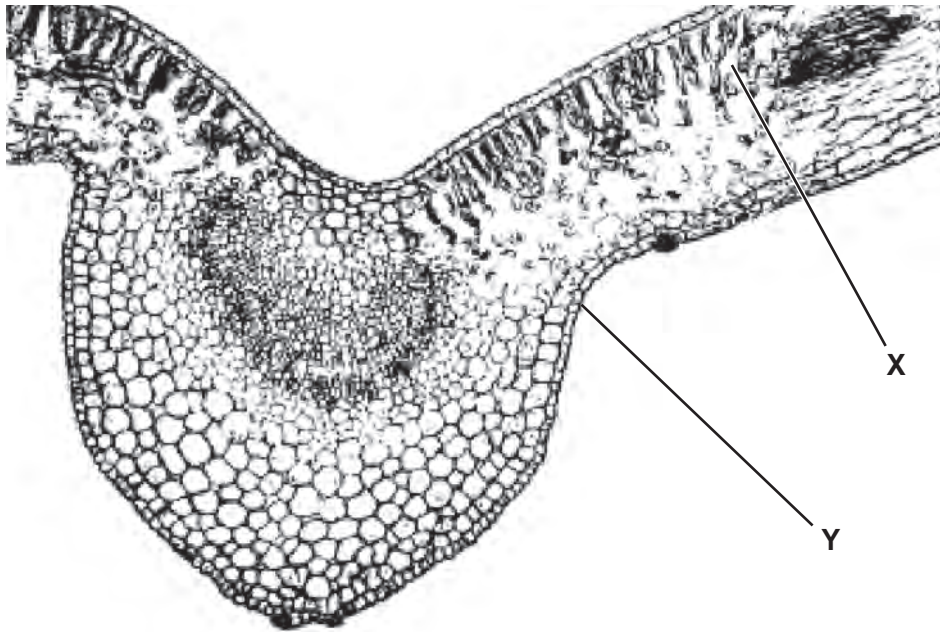


Fig. 9.1

(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.

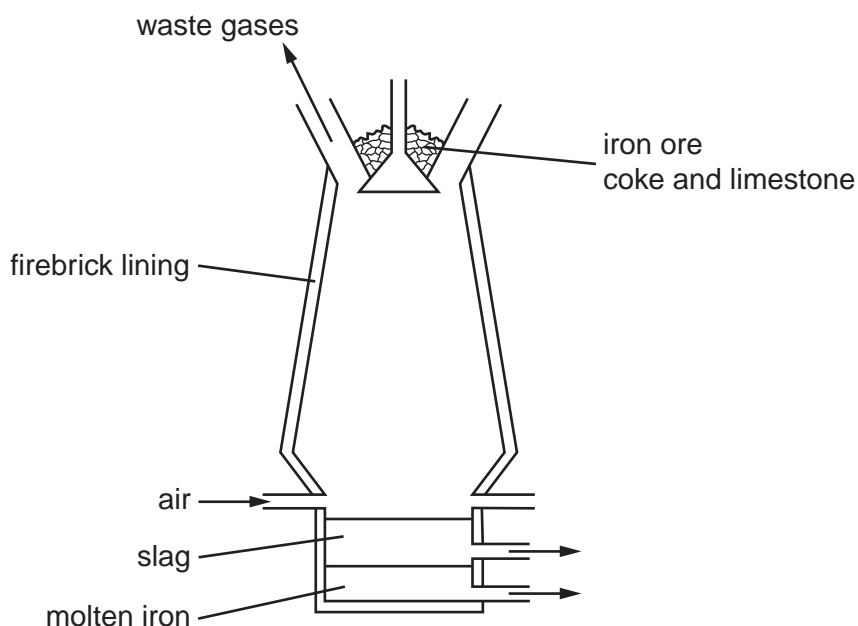


Fig. 11.1

(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.

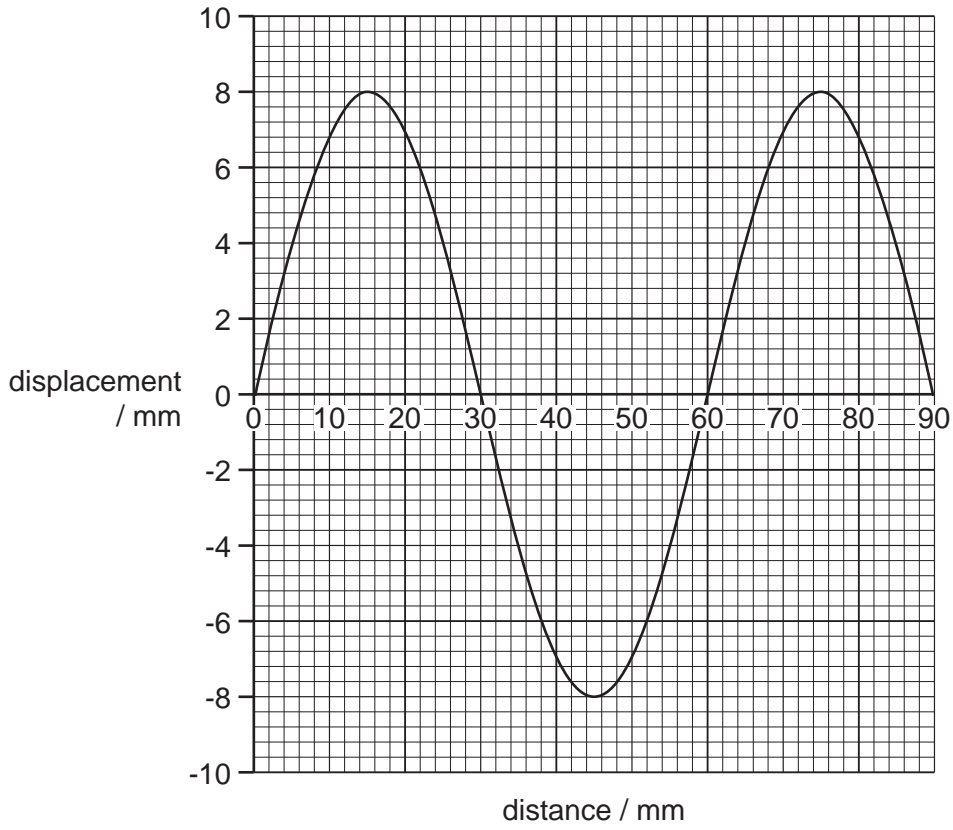


Fig. 12.1

(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.

.....
 [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.

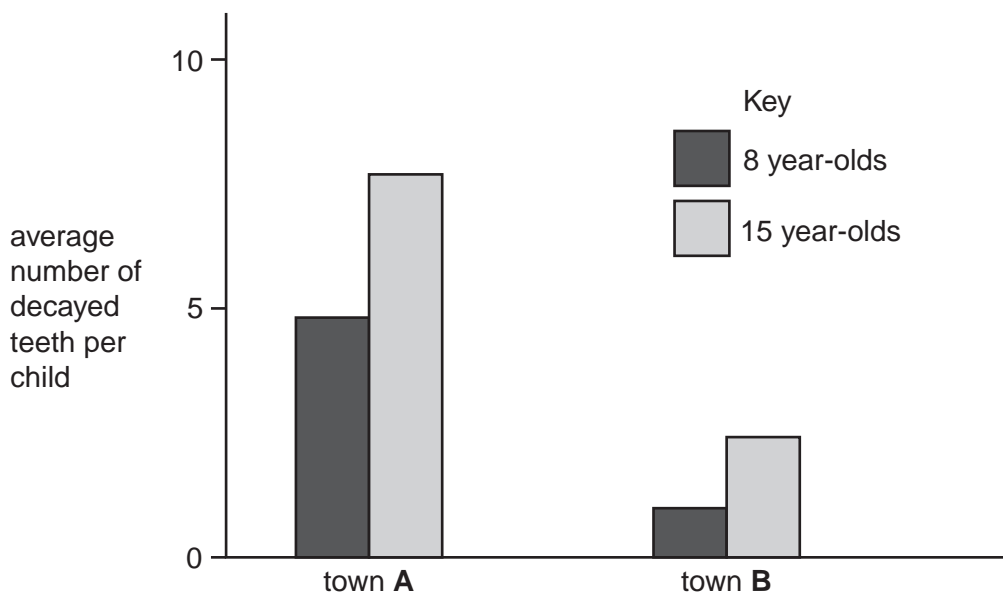


Fig. 13.1

(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.

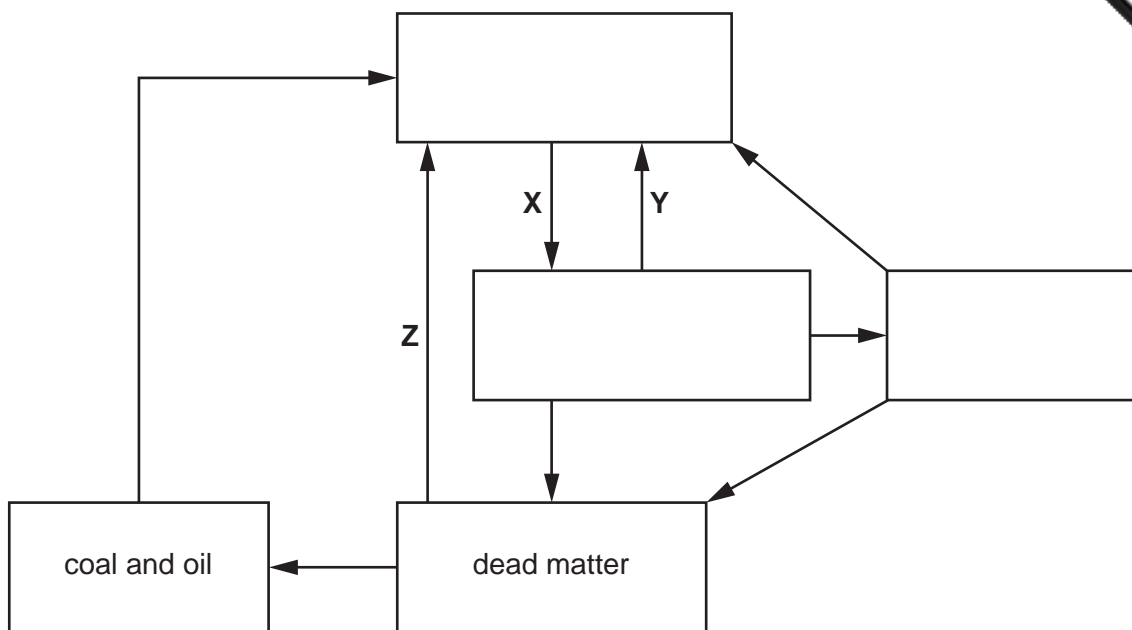


Fig. 15.1

(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.

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.

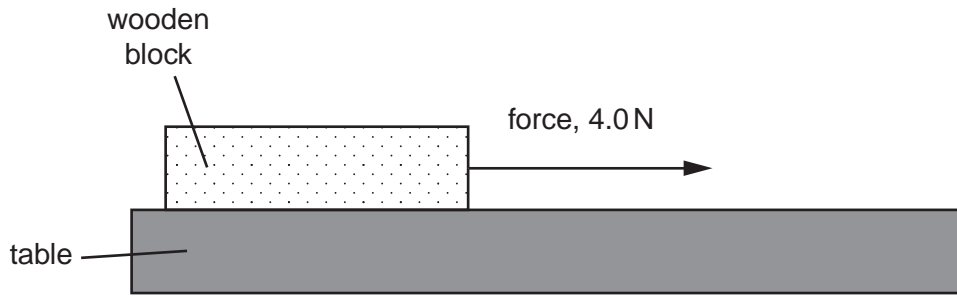


Fig. 17.1

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.

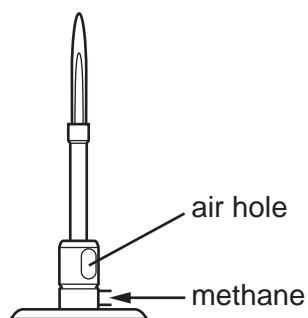


Fig. 18.1

(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.

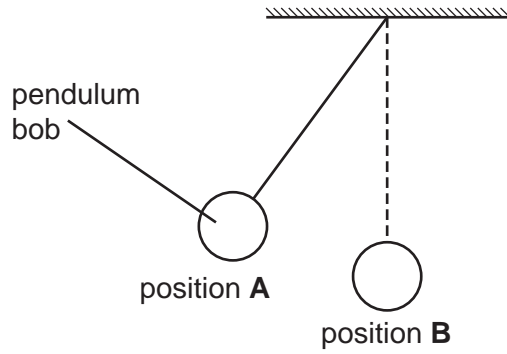


Fig. 19.1

(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.

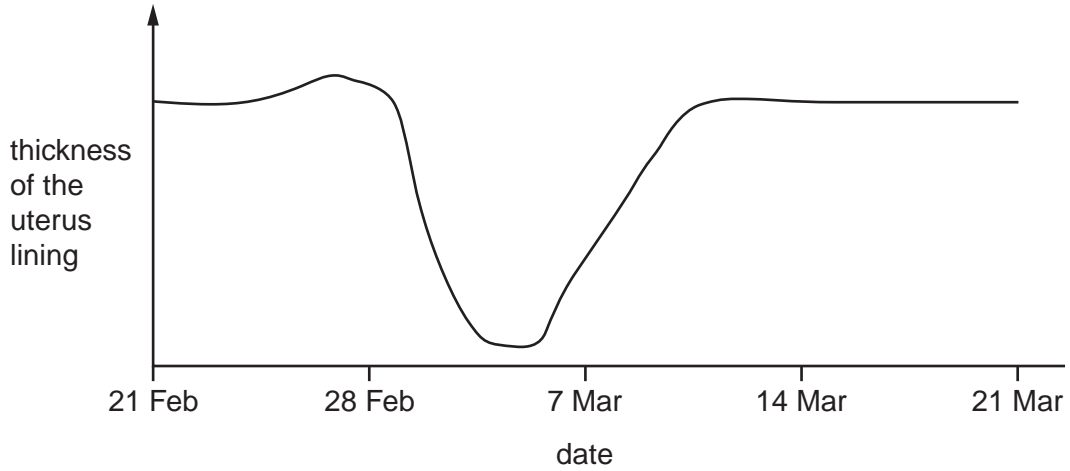


Fig. 20.1

(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]

DATA SHEET
The Periodic Table of the Elements

		Group											
		I	II	III	IV	V	VI	VII	VIII	IX	X		
		<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px;">1</td> <td style="padding: 2px;">H Hydrogen 1</td> </tr> </table>										1	H Hydrogen 1
1	H Hydrogen 1												
		<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px;">4</td> <td style="padding: 2px;">He Helium 2</td> </tr> </table>										4	He Helium 2
4	He Helium 2												
7	9	23	24	39	40	85	88	133	223	226	227		
Li Lithium 4	Be Beryllium	Na Sodium 12	Mg Magnesium 12	K Potassium 20	Ca Calcium 20	Rb Rubidium 38	Sr Strontium 38	Cs Caesium 56	Fr Francium 88	Ra Radium 88	Ac Actinium 89		
39	45	51	52	55	56	59	59	64	65	70	73		
Zn Zinc 30	Ga Gallium 31	Ge Germanium 32	As Arsenic 33	Se Selenium 34	Br Bromine 35	Kr Krypton 36	Rb Rubidium 38	Sr Strontium 38	Y Yttrium 39	Zr Zirconium 40	Nb Niobium 41		
85	89	93	96	101	101	106	108	112	115	119	122		
Ag Silver 47	Cd Cadmium 48	In Indium 49	Sn Tin 50	Sb Antimony 51	Te Tellurium 52	Xe Xenon 54	Pb Lead 82	Tl Thallium 81	Po Polonium 84	At Astatine 85	Rn Radon 86		
137	139	178	184	190	192	195	197	201	204	207	209		
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	Pb Lead 82	Bi Bismuth 83	Po Polonium 84		
140	141	144	147	150	152	157	159	162	165	167	169		
Ce Cerium 58	Pr Praseodymium 59	Nd Neodymium 60	Pm Promethium 61	Sm Samarium 62	Eu Europium 63	Gd Gadolinium 64	Tb Terbium 65	Dy Dysprosium 66	Ho Holmium 67	Er Erbium 68	Tm Thulium 69		
232	231	238	237	244	243	247	247	251	252	257	258		
Th Thorium 90	Pa Protactinium 91	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		
262	261	268	267	274	273	277	277	281	282	287	288		
Lr Lawrencium 103	104	105	106	107	108	109	110	111	112	113	114		
Lu Lutetium 71	Yb Ytterbium 70	Tm Thulium 69	Er Erbium 68	Ho Holmium 67	Dy Dysprosium 66	Ho Holmium 67	Er Erbium 68	Tm Thulium 69	Yb Ytterbium 70	Lu Lutetium 71	175		

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

58–71 Lanthanoid series
90–103 Actinoid series

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