ASSUMPTION ENGLISH SCHOOL
END OF YEAR EXAMINATION 2024

LOWER SECONDARY SCIENCE
BOOKLET B

LEVEL:	Sec 2 Express	**DATE:**	4 October 2024
TEACHING GROUPS:	TG1, TG2 and TG5	**DURATION:**	2 hours (For Booklets **A** and **B**)

Additional Materials provided: NIL

INSTRUCTIONS TO CANDIDATES
Do not open this booklet until you are told to do so.

Write your NAME, INDEX NUMBER and TEACHING GROUP at the top of this page

This paper consists of 2 sections in 2 booklets.

Section **A**: Multiple-Choice Questions
Section **B**: Structured Questions

SECTION B (70 marks)
Structured Questions
Answer **all** questions. Write your answers in the spaces provided on the question paper. For answers that are not exact, give your answers correct to 3 significant figures.

For Examiner's Use	
Section A	/30
Section B	/70
Total	/100

The Periodic Table is found on the last page of Booklet **B**.

At the end of the examination, hand in your OAS paper, Booklets **A** and **B** separately.

SECTION B: STRUCTURED QUESTIONS (70 marks)

Answer **ALL** the questions in the spaces provided. For questions involving calculations, all workings and units must be shown clearly. For answers that are not exact, give your answers correct to 3 significant figures.

1 Table 1.1 shows some information about four particles found in the Periodic Table. They are represented by the letters **P**, **Q**, **R** and **S**.

The letters are not the symbols of the elements.

Table 1.1

particle	protons	electrons	neutrons
P	2	2	2
Q	12	10	12
R	5	5	6
S	13	10	14

(a) Which particle belongs to the element Boron?

..... [1]

(b) Which particle has the greatest mass?

..... [1]

(c) **(i)** Which particle(s) is/are electrically neutral?

..... [1]

(ii) Explain your answer in **(c)(i)**.

.....

..... [1]

(d) "Two elements can have the same number of protons in their atoms."

Circle your answer in response to the above statement.

TRUE / FALSE [1]

2 A scientist investigates the melting points and boiling points of four pure substances.

The results were tabulated in Table 2.1.

Table 2.1

substance	melting point / °C	boiling point / °C
A	-80	-20
B	40	160
C	85	920
D	-20	60

(a) Which substance is a gas at room temperature (25 °C) and pressure?

..... [1]

(b) **(i)** Draw the arrangement of particles in substance **C** at 100 °C.

[1]

(ii) Substance **C** is cooled to 50 °C.

Describe the arrangement and movement of particles in substance **C** when it is cooled to 50 °C.

arrangement .....

.....

movement .....

..... [2]

3 A student accidentally mixes substance **X** with substance **Y**. Table 3.1 shows the properties of both substances.

Table 3.1

substance	boiling point / °C	solubility in water
X	decompose on heating	insoluble
Y	300	soluble

(a) Outline the steps required to obtain pure samples of both substance **X** and substance **Y**.

.....

.....

.....

.....

.....

.....

.....

..... [3]

(b) Can the same steps outlined in **(a)** be used to separate a mixture of sugar and water? Explain your answer.

.....

..... [1]

4 Fig 4.1 shows a fork-lift truck carrying a crate towards a high shelf.

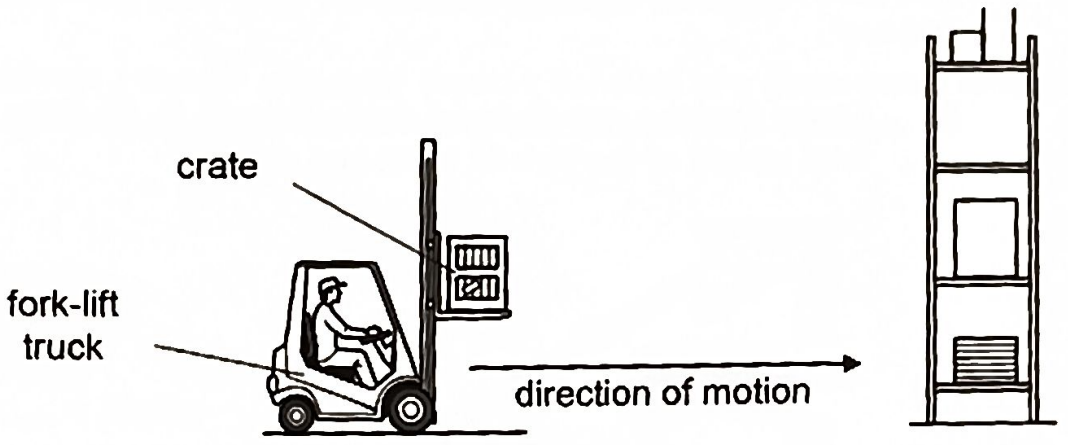


Fig 4.1

Fig 4.2 shows a stationary fork-lift truck lifting the same crate onto a high shelf.

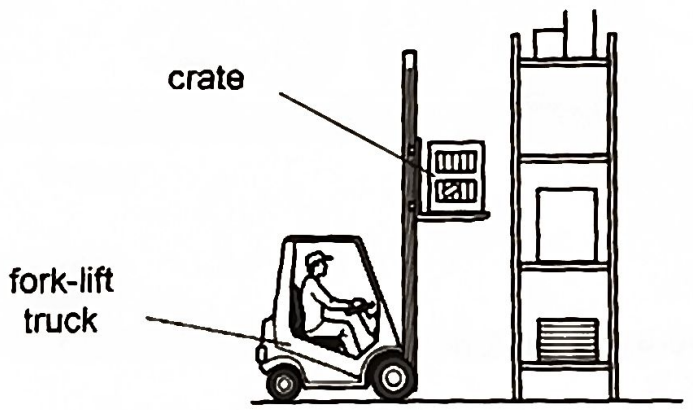


Fig 4.2

(a) State one criteria for work to be done.

..... [1]

(b) State and explain if work is done on the crate when,

(i) a fork-lift truck is carrying the crate towards a high shelf in Fig. 4.1,

.....

..... [1]

(ii) a stationary fork-lift truck is lifting the crate onto a high shelf in Fig. 4.2.

.....

..... [1]

(c) The fork-lift truck has a mass of 3000 kg and the driver has a mass of 80 kg. The total contact area of the tyres of the fork-lift truck with the ground is 600 cm^3.

(i) Given that the gravitational field strength is 10 N/kg, calculate the total weight of the fork-lift truck and driver.

weight = ... N [1]

(ii) Calculate the pressure exerted by the fork-lift truck and driver on the ground.

pressure = ... N/cm^2 [2]

(d) The tyres of the fork-lift truck can be inflated to two different sizes as shown in Fig. 4.3.

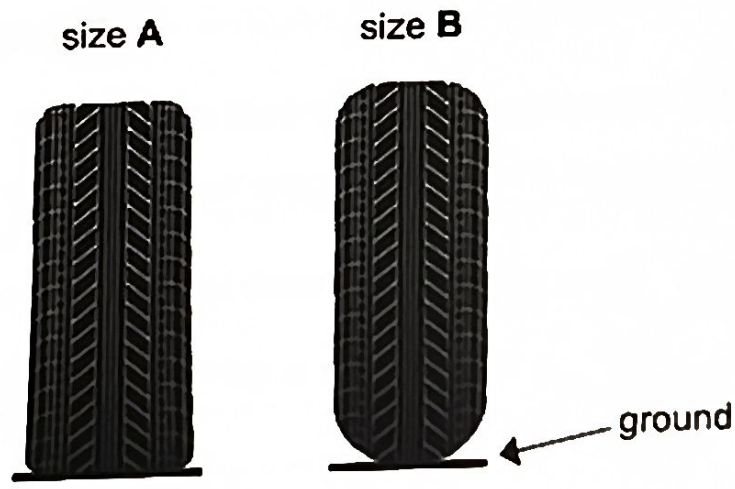


Fig. 4.3

Which size of tyre should be chosen if the fork-lift truck were to move across a large patch of soft soil?
Explain your reasoning.

.....

.....

..... [2]

5 Solar dryers are devices which make use of solar energy to dry fruits and vegetables. They expose the food to be dehydrated to direct sunlight.

Fig. 5.1 shows a design of a solar dryer. It consists of a glass panel to receive direct sunlight and a box coated with an inner black absorption surface.

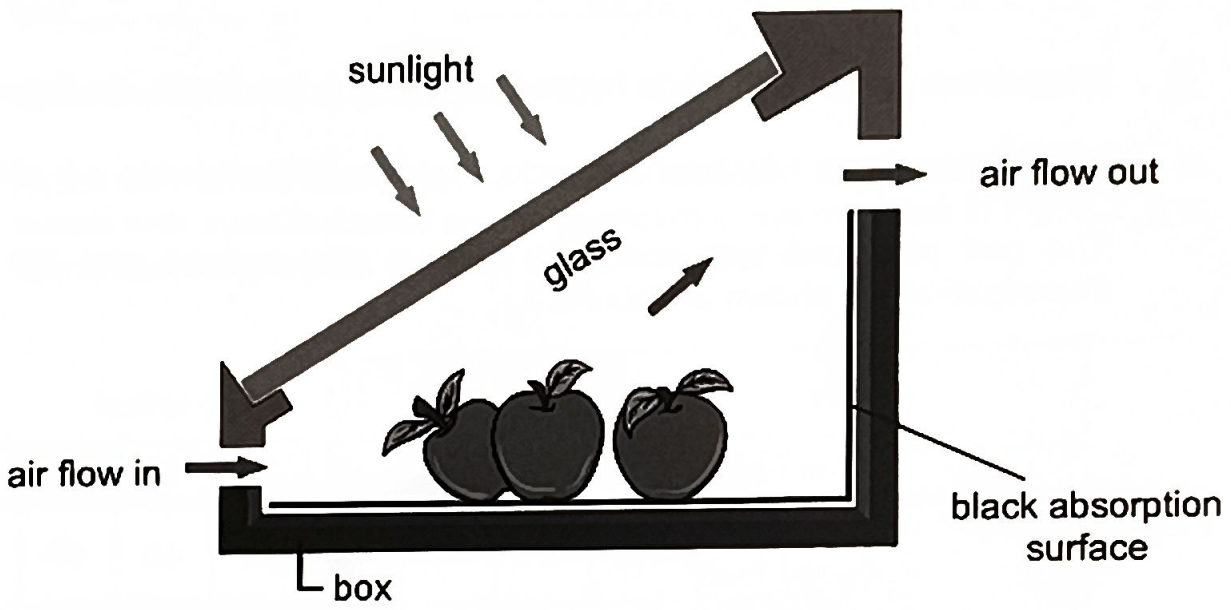


Fig. 5.1

(a) State the main method of heat transfer that heats up the solar dryer.

..... [1]

(b) Suggest a reason why the inner absorption surface of the solar dryer is coated black.

.....

..... [1]

(c) It is observed that air flows into the solar dryer from the bottom and exits at the top.

Explain how air flows in the solar dryer.

.....

.....

.....

..... [2]

(d) Should the box be made to be a good insulator or conductor of heat? Explain your answer.

.....

..... [1]

6 Magnesium reacts with dilute hydrochloric acid according to the following equation:

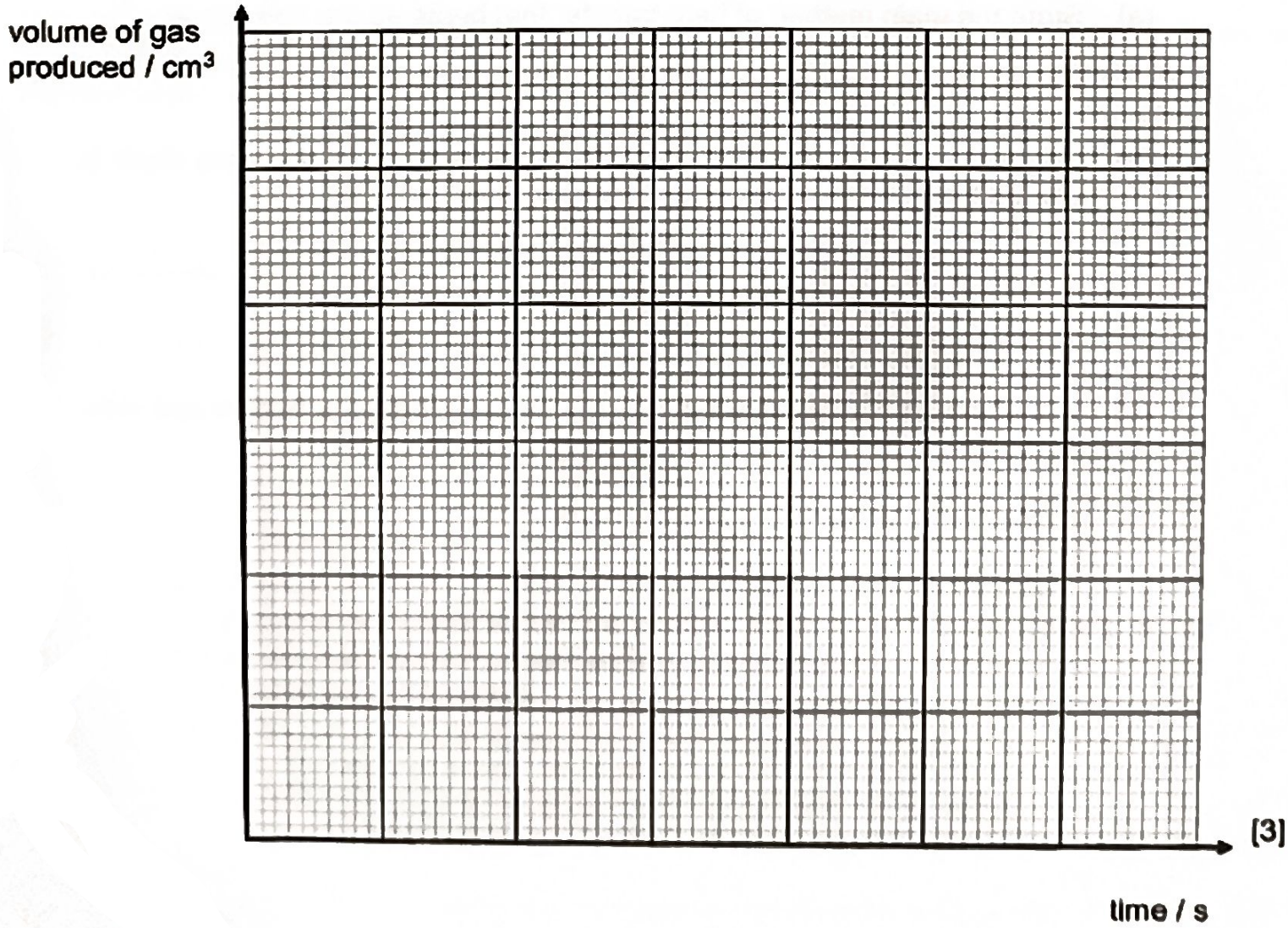
magnesium + hydrochloric acid → magnesium chloride + hydrogen gas

The gas produced was collected using a gas syringe and the results of the investigation are shown in Table 6.1.

Table 6.1

time / s	0	10	20	30	40	50	60	70
volume of gas produced / cm^3	0	23	34	40	44	47	48	48

(a) Plot a graph of volume of gas produced against time.



[3]

(b) Deduce from the graph how long it took for the reaction to be completed.

..... [1]

(c) Describe a test to confirm that the gas collected is hydrogen gas.

test .....

observation ..... [2]

(d) A solution of the salt produced in the reaction, magnesium chloride, is tested with three indicator solutions shown in the pH chart in Fig. 6.2. It is found that magnesium chloride forms a neutral solution.

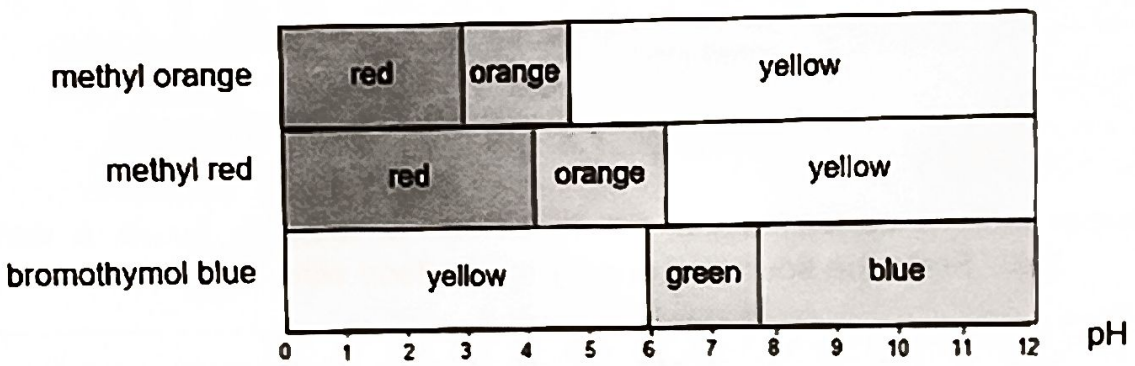


Fig. 6.2

State the colours of the three indicators after they are added separately to a salt solution of magnesium chloride.

methyl orange	
methyl red	
bromothymol blue	

[1]

7 Fig. 7.1 shows part of a food web for a grassland ecosystem.

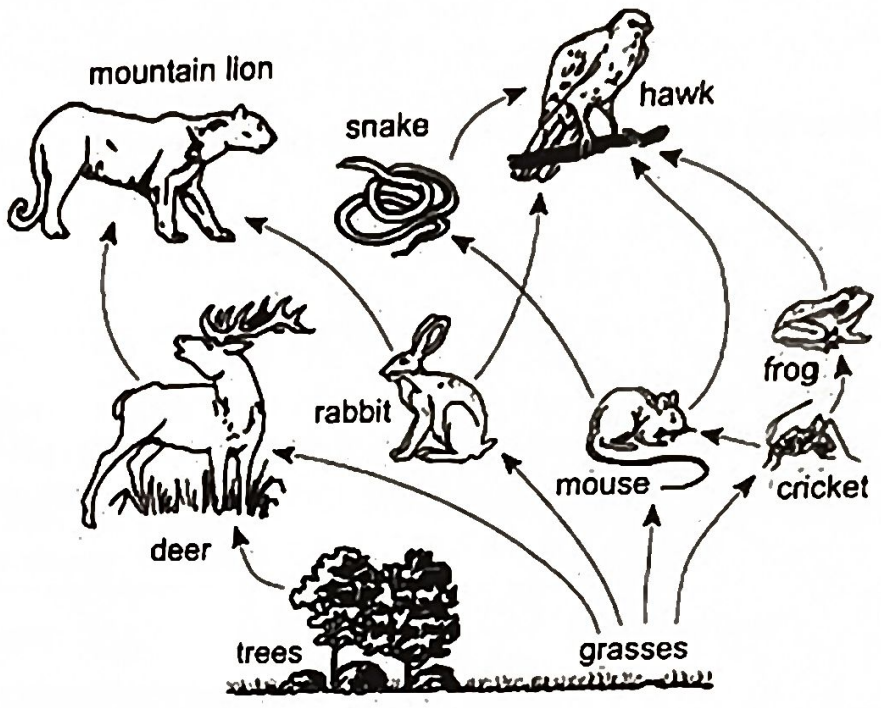


Fig. 7.1

(a) State the source of energy for the food web.

..... [1]

(b) List one food chain in which the hawk receives the most amount of energy.

[1]

(c) In the month of February, the population of mouse decreased due to a disease outbreak. Describe and explain **one key impact** this has on the population of another organism in this grassland ecosystem.

.....

.....

.....

..... [2]

8 Fig. 8.1 shows a circuit set-up with different electrical components.

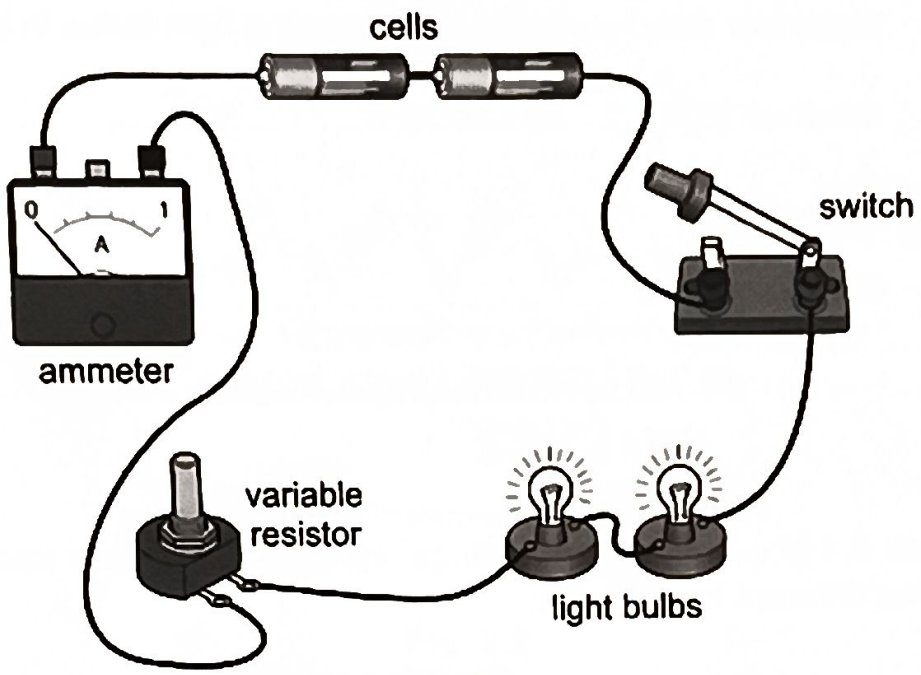


Fig. 8.1

(a) Draw a circuit diagram to represent the above set-up in the space provided.

[2]

(b) Explain the function of the variable resistor in this circuit.

.....

.....

..... [2]

(c) The light bulbs in Fig. 8.1 are connected in series.

State two disadvantages of connecting light bulbs in this way in a house.

disadvantage 1 .....

.....

disadvantage 2 .....

..... [2]

9 Table 9.1 shows the power ratings and duration of daily usage of the air conditioner in two different households.

Table 9.1

household	power rating of air conditioner	duration of daily usage
X	900 W	8 h
Y	1.1 kW	7 h

(a) Deduce which household consumed more energy from its daily use of the air conditioner. Show your working clearly.

household : ..... [3]

(b) Fig. 9.2 shows the energy efficiency rating of another air-conditioner unit.

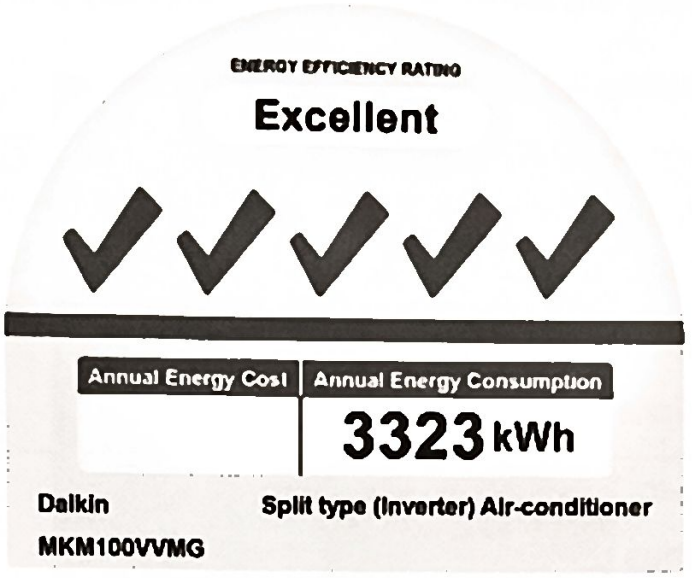


Fig. 9.2

(i) Calculate the annual energy cost of using this air-conditioner unit if the electricity tariff is 27 cents per kWh.
Express your answer to the nearest cent.

annual energy cost = $ ..... [1]

(ii) Suggest one way to reduce the electrical energy consumption of the air-conditioner.

.....

..... [1]

10 A student eats a set meal of fried chicken and fries for lunch. It gets digested as it passes along the alimentary canal in his body.

(a) Complete the table below.

food	main class of nutrient	region of alimentary canal where digestion begins	final product of digestion
fried chicken	protein		
fries			glucose

[2]

(b) Fig. 10.1 shows a food lump containing the fried chicken and fries just before it enters the stomach and the same food as it leaves the stomach four hours later.

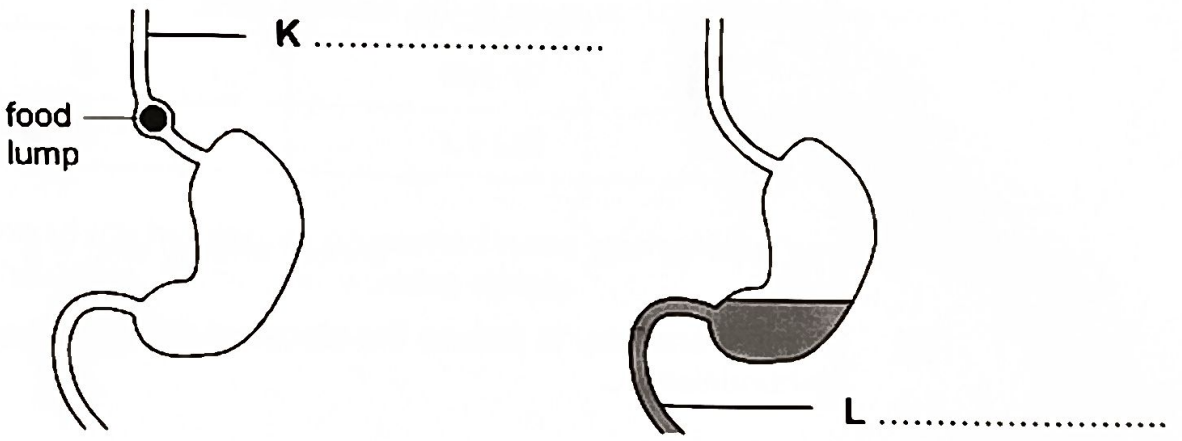


Fig. 10.1

(i) On Fig. 10.1, label structures **K** and **L** of the digestive system. [1]

(ii) Describe how the fried chicken and fries are digested (both physically and chemically) in the stomach.

.....

.....

.....

.....

.....

..... [3]

11 *Ipomoea batatas* is a sweet potato plant containing fibrous and storage roots. The growth of these roots is shown in Fig 11.1 below.

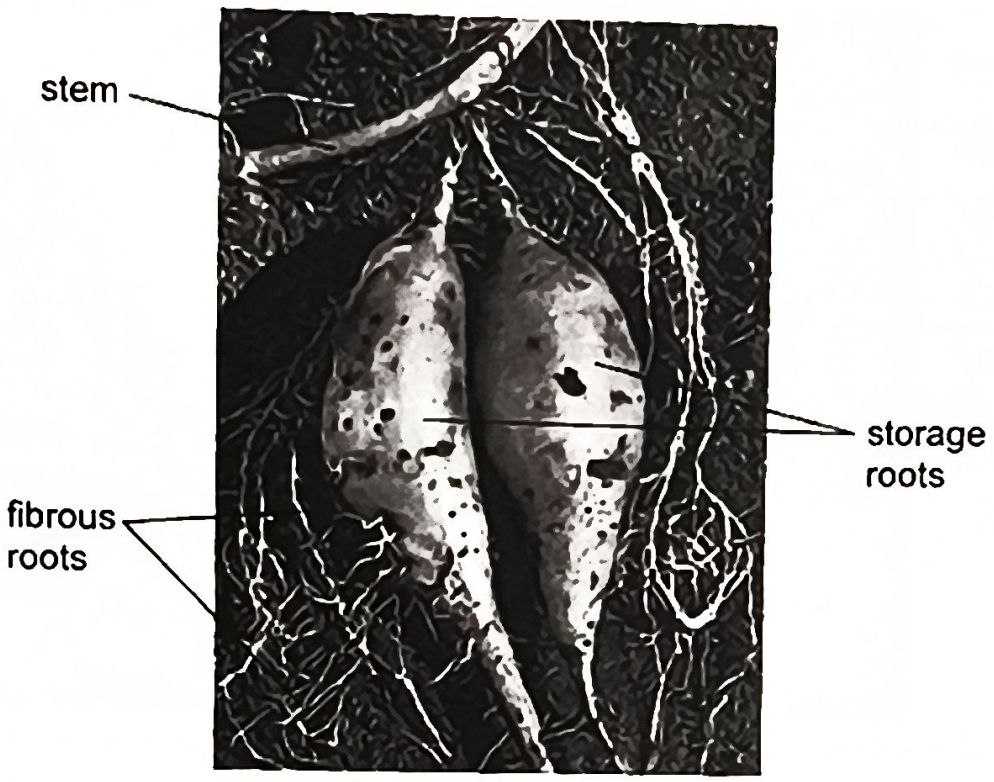


Fig. 11.1

Fibrous roots allow the plant to absorb water and mineral salts from the soil while storage roots help to store insoluble carbohydrates.

(a) (i) Explain how fibrous roots absorb water from the soil.

.....

.....

..... [2]

(ii) From Fig. 11.1, the fibrous roots are threadlike and covered with root hairs.

Suggest how these features help the fibrous roots better absorb water and mineral salts from the soil.

.....

..... [1]

(b) A cross-section of part of the stem of the sweet potato plant, *Ipomoea batatas*, is shown in Fig. 11.2.

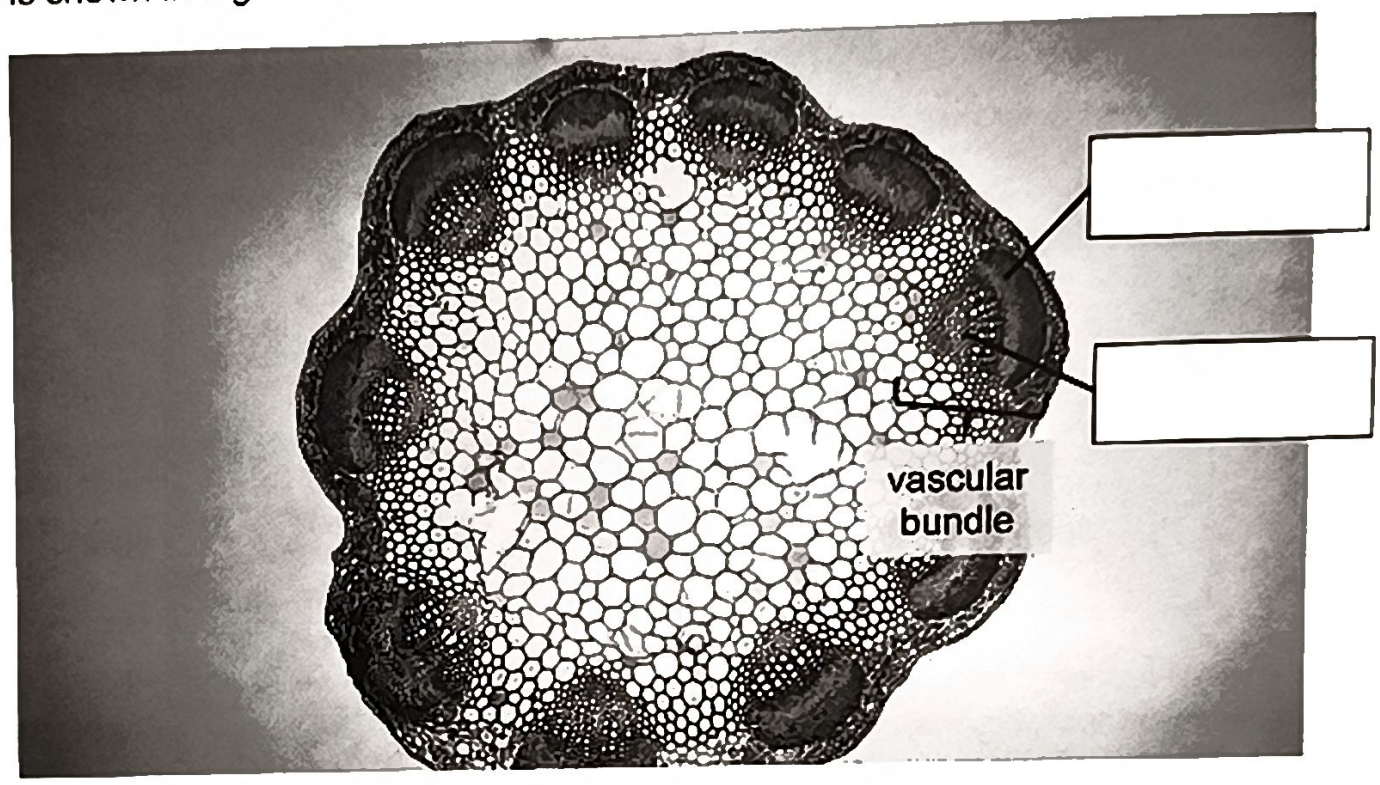


Fig. 11.2

(i) A vascular bundle consists of the xylem and phloem.
On the boxes provided in Fig. 11.2, label the xylem and phloem in the vascular bundle. [1]

(ii) Substances are observed to be transported upwards and downwards in the phloem of the sweet potato plant at some points in the day and only upwards at other times.

With reference to Fig. 11.1 and your understanding of plant transport system, provide a possible explanation for the observed phenomena.

.....

.....

.....

..... [2]

12 Fig. 12.1 shows a calendar for the month of August in 2023. Mrs Koh is a woman with a 28-day menstrual cycle and she circled the first day of her menstruation on the calendar.

August 2023						
Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
		1	2	(3)	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Fig 12.1

(a) State what is meant by *menstruation*.

.....

..... [1]

(b) State the date(s)

(i) when Mrs Koh expects ovulation to occur;

..... [1]

(ii) when Mrs Koh is fertile in this menstrual cycle.

..... [1]

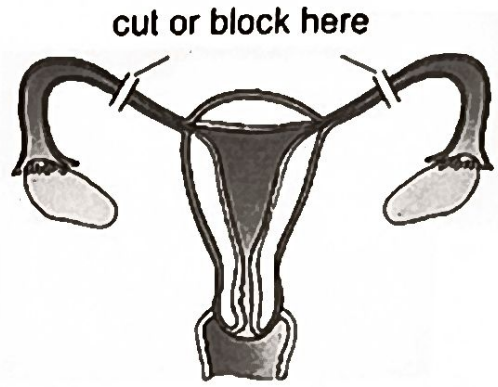
(c) Explain why the fertile period is longer than the day of ovulation.

.....

..... [1]

(d) Birth control methods can be used to prevent pregnancies. Fig. 12.2 shows two possible birth control methods for females.

birth control pills



tubal ligation

Fig 12.2

(i) Describe how each birth control method prevents fertilisation.

.....

.....

.....

..... [2]

(ii) Mrs Koh is newly married and intends to wait for the completion of her HDB flat in three years' time before conceiving a baby.

Comparing the two birth control methods, suggest which one would be more suitable for her. Explain why.

.....

.....

..... [2]

(iii) The following statement about birth control methods and Sexually Transmitted Infections (STIs) is made.

"All birth control methods prevent the spread of STIs".

Discuss whether the statement made is correct.

.....

.....

..... [2]

– End of Booklet B –