BOON LAY SECONDARY SCHOOL

END-OF-YEAR EXAMINATION

2019

Name	( )
Class/CCA	

Subject	:	**SCIENCE**
Level	:	**SECONDARY TWO EXPRESS**
Date/Day	:	**8 OCTOBER 2018 (MONDAY)**
Time	:	**0800 – 0930**
Duration	:	**1 HOUR 30 MINUTES**

READ THESE INSTRUCTIONS FIRST

Before you start your exam, check that you have received the correct paper and the number of printed pages are correct.
Write your name and index number on all the work you hand in.
Do not use staples, paper clips, glue or correction fluid.

Section A: Multiple Choice Questions [20 marks]
There are **twenty** questions in this section. Answer **all** questions. For each question there are four possible answers, **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate OMR Answer Sheet.

Section B: Structured Questions [40 marks]
Answer **all** the questions.
Write your answers in the spaces provided on the question paper.

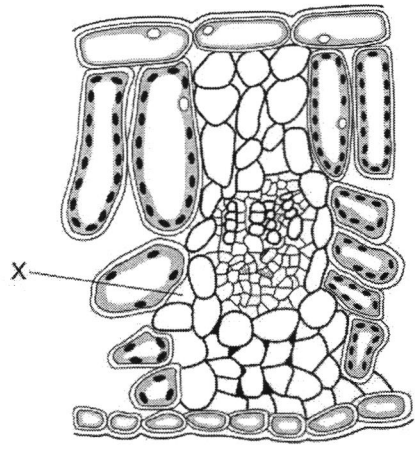
Section C: Free Response Questions [20 marks]
Answer any **two** out of three questions.
Write your answers in the spaces provided on the question paper.

The use of an approved scientific calculator is expected, where appropriate.

Section	Marks
A	20
B	40
C	20
Total	80

Section A [20 Marks]

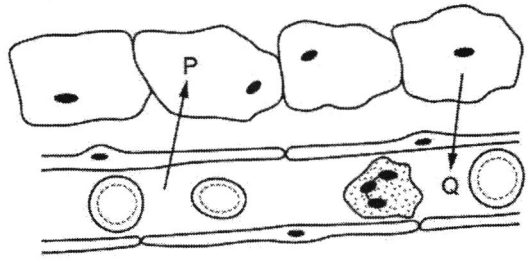
1 The diagram represents a cross-section of part of a leaf. X is the intercellular spaces between the cells inside the leaf.



How does the oxygen content of the air at X compare to the normal atmospheric air when the leaf is in the light and when it is in the dark?

	In the light	In the dark
A	higher	lower
B	higher	the same
C	lower	higher
D	lower	the same

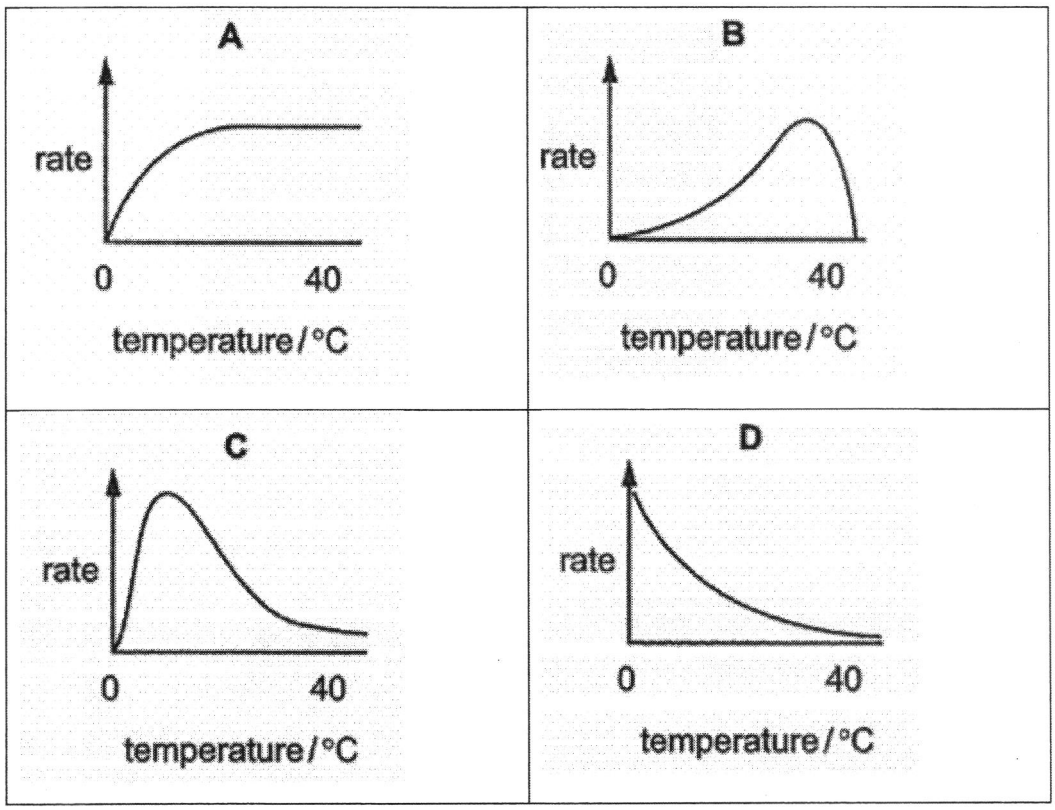
2 The diagram shows chemicals being exchanged between some cells and a blood capillary.



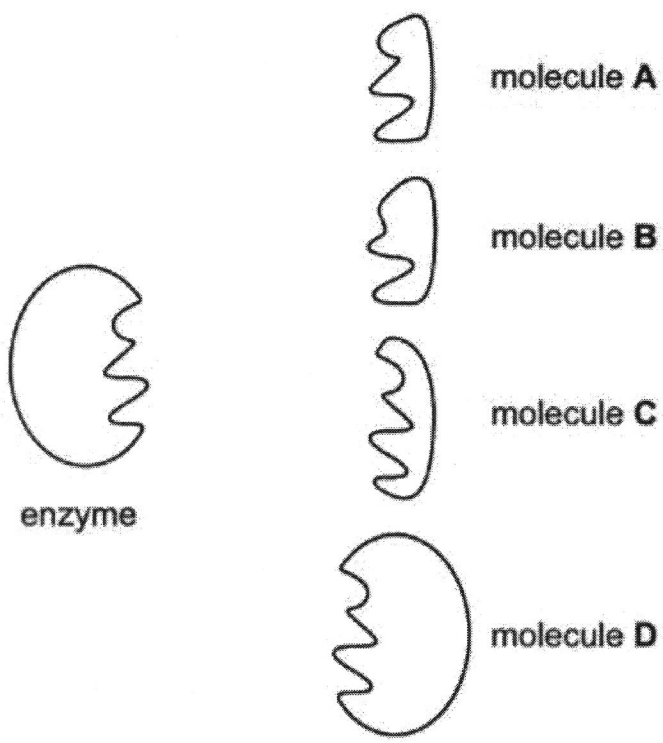
What could be the identities of chemicals P and Q?

	P	Q
A	amino acids and oxygen	carbon dioxide and maltose
B	carbon dioxide and glucose	alcohol and oxygen
C	carbon dixoide and urea	oxygen and protei
D	glucose and oxygen	carbon dioxide and water

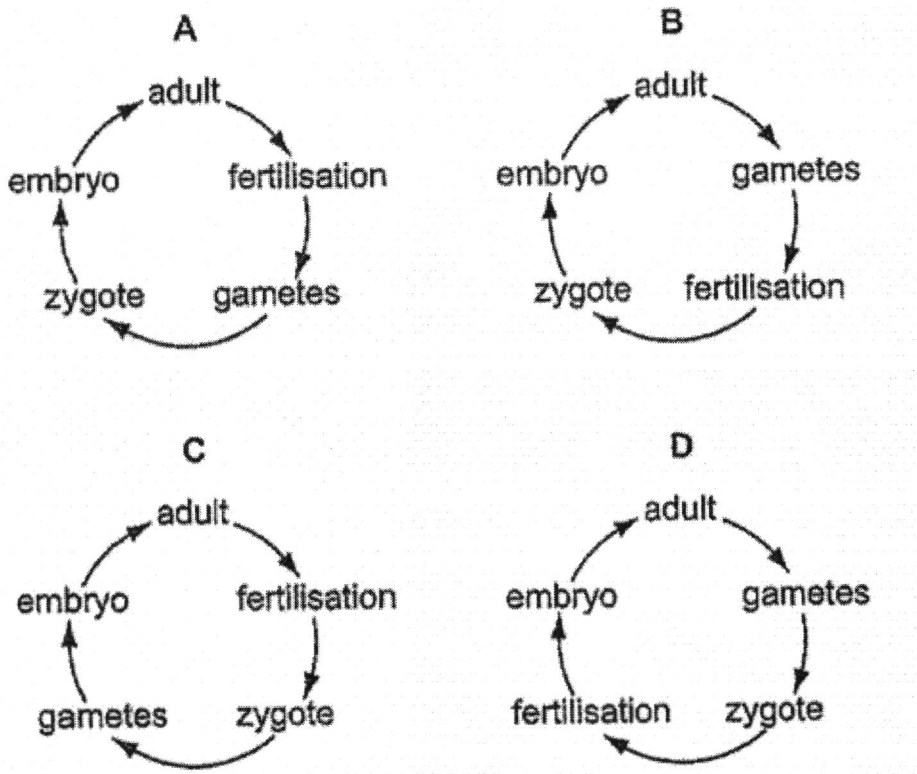
3 Which graph shows how temperature affects the rate of the digestion of protein by the enzyme protease in out bodies?



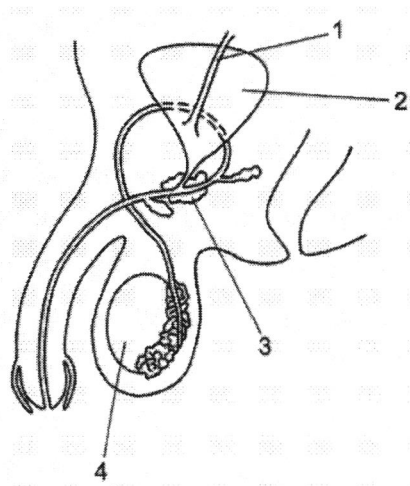
4 The diagram represents an enzyme and four molecules, A, B, C and D.
Which molecule is the substrate of this enzymes?



5 Which diagram shows the order of the main stages of the human reproductive cycle?



6 The diagram show the male reproductive and urinary systems.



Which two structures are involved in producing semen?

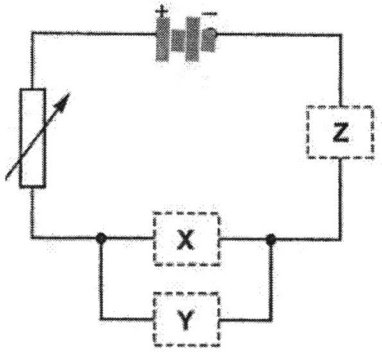
A 1 and 2

B 2 and 3

C 2 and 4

D 3 and 4

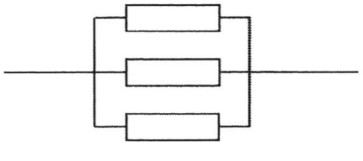
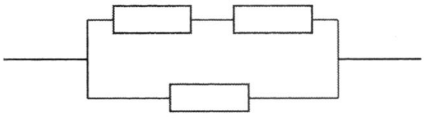
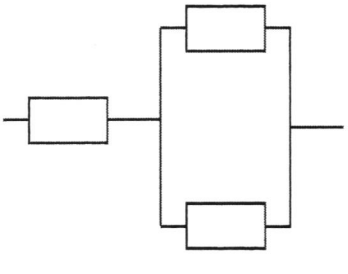
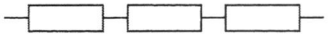
7 When this circuit is complete it can be used to find the resistance of a length of wire.



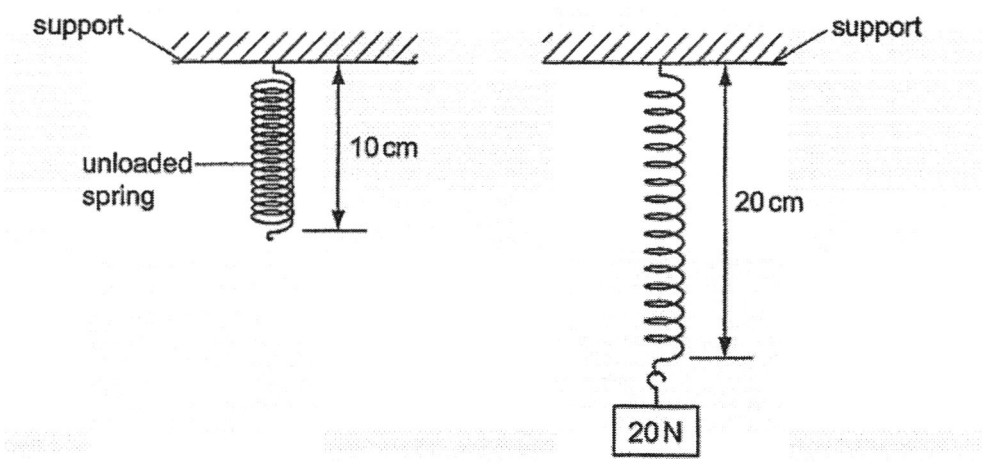
Which components should be placed at X, Y and Z?

	X	Y	Z
A	ammeter	voltmeter	length of wire
B	voltmeter	ammeter	length of wire
C	length of wire	ammeter	voltmeter
D	length of wire	voltmeter	ammeter

8 A set of 3 identical resistors is connected in various configurations. Which configuration has the lowest effective resistance?

A	B
	
C	**D**
	

9 The diagrams show an unloaded spring hanging from a support and the same spring loaded with a 20N weight.



What will be the length of the spring when the 20N weight is replaced by a 40N weight?

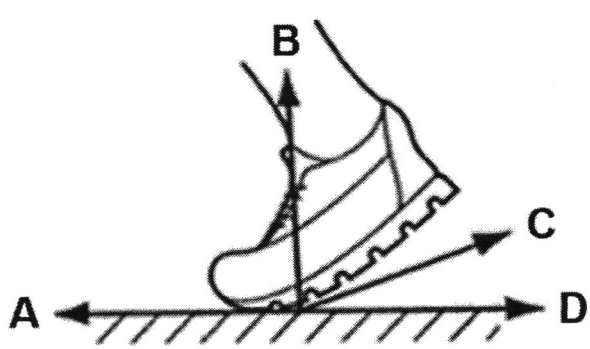
A 30 cm

B 40 cm

C 50 cm

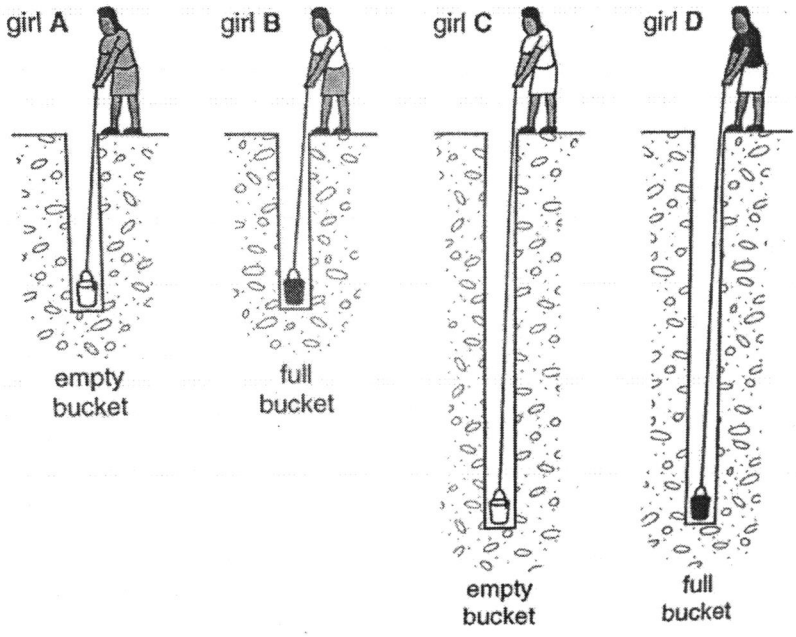
D 60 cm

10 The diagram shows the shoes of a marathon athlete at the start of a race. Which arrow indicates the direction of the frictional force acting on the athlete's shoes?



11 Four girls each lift a bucket from the bottom of a well.

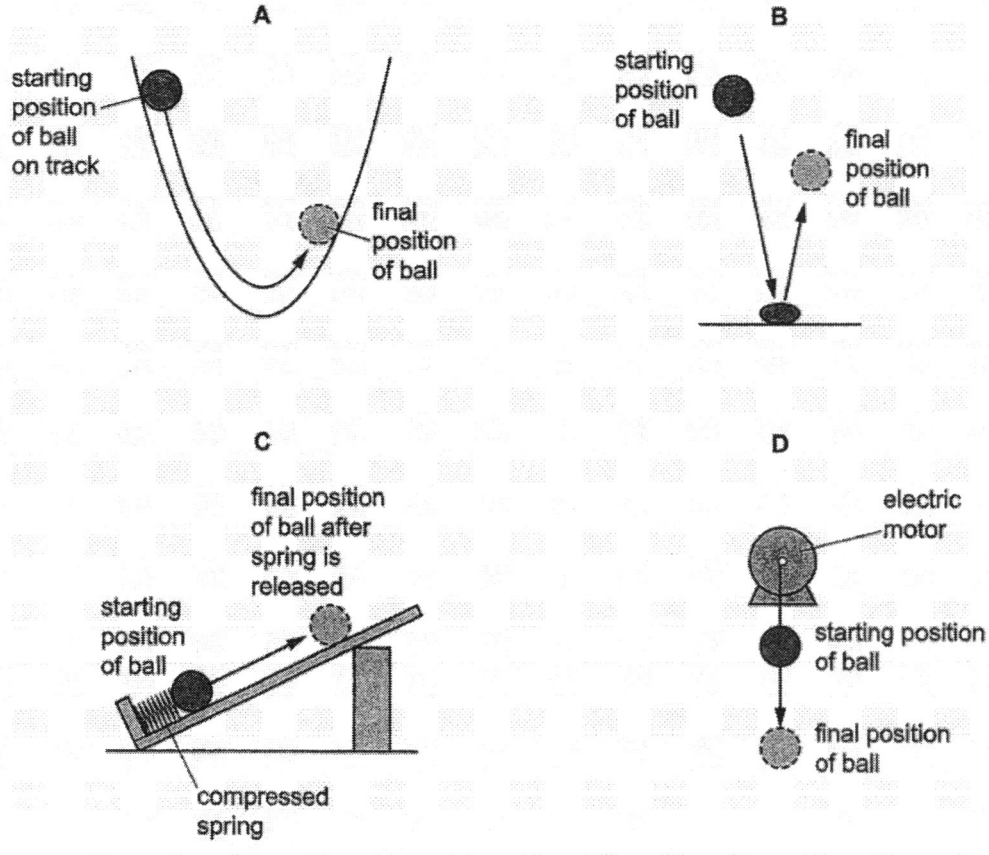
Which girl does the most work?



12 A series of energy conversions is shown below.

Elastic potential energy → kinetic energy → gravitational potential energy

Which diagram shows a situation where this series of conversions takes place?



13 A gardener is working in the garden of a large house. His spade strikes a stone and makes a loud noise. The time taken before he hears the echo is 0.80s.
What is the distance from the gardener to the house?
(The speed of sound in the air is 330 m/s)

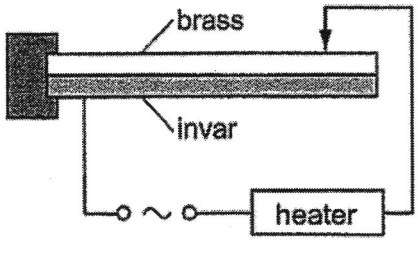
A 132 m
B 210 m
C 264 m
D 530 m

14 Some ringtones for mobile phones can only be heard by young people. What is the likely frequency of these ringtones?

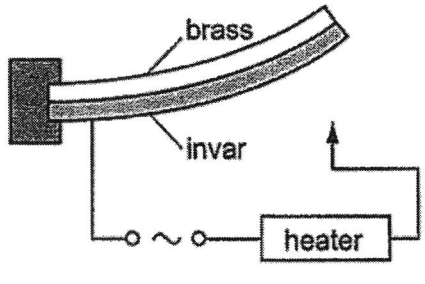
A 260 Hz
B 5 000 Hz
C 10 000 Hz
D 17 000 Hz

15 The diagrams show a bimetallic strip being used in a thermostat to control the temperature of an oven. Brass expands more than invar per degree rise in temperature. Each diagram shows the strip when the oven is cold.
Which diagram shows the correct arrangement?

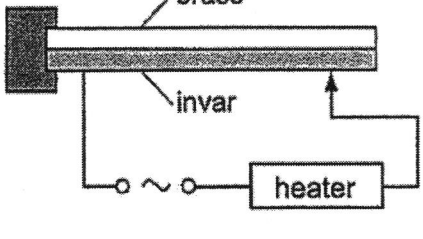
A



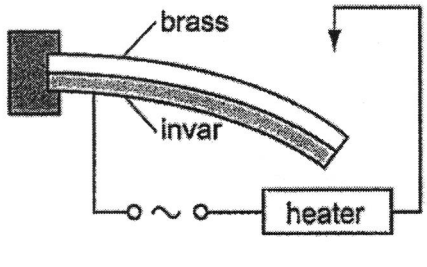
B



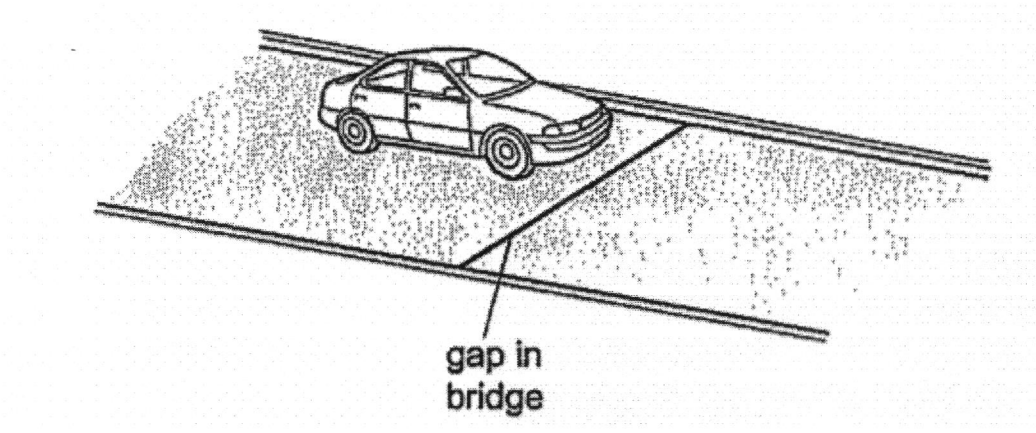
C



D



16 A gap is left between the two metal halves of a bridge. The gap contains air.



A The gap becomes larger because the air expands.

B The gap becomes larger because the metal contracts.

C The gap becomes smaller because the air contracts.

D The gap becomes smaller because the metal expands.

17 If a fizzy drink is mixed with powdered mint sweets, a lot of carbon dioxide is produced.

For this reaction to occur, what must the substances contain?

	Fizzy drink	Mint sweets
A	acid	alkali
B	acid	carbonate
C	alkali	base
D	alkali	carbonate

18 Many people suffer from 'acid indigestion' caused by too much hydrochloric acid in the stomach.

The problem can be cured by using an 'antacid', which is weakly alkaline.

What is the best pH for an antacid?

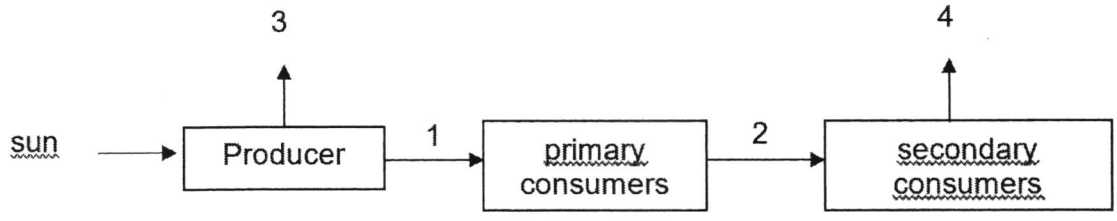
A 3

B 6

C 9

D 14

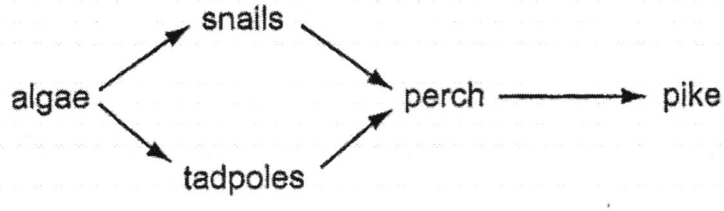
19 The diagram shows the flow of energy in the ecosystem.



Which of the numbered arrows represent the smallest amount of energy transferred between organisms, and the largest amount of energy lost to the ecosystem?

	smallest amount of energy transferred	largest amount of energy lost
	1	3
B	1	4
C	2	3
D	2	4

20 The food web shows feeding relationships in a lake.



All the perch are killed by water pollution.

How will this affect the food web?

A The population of algae will increase

B The population of snails will increase

C The population of pike will increase

D The population of tadpoles will decrease

Section B [40 marks]

Answer **all** the questions in the spaces provided.

1 As Singapore entered peak season for the disease, there was a rise in dengue cases in the warmer days of 2019.

Fig. 1.1 shows the concentration of dengue fever virus antibodies in one of the victims' body over a period of 40 days.

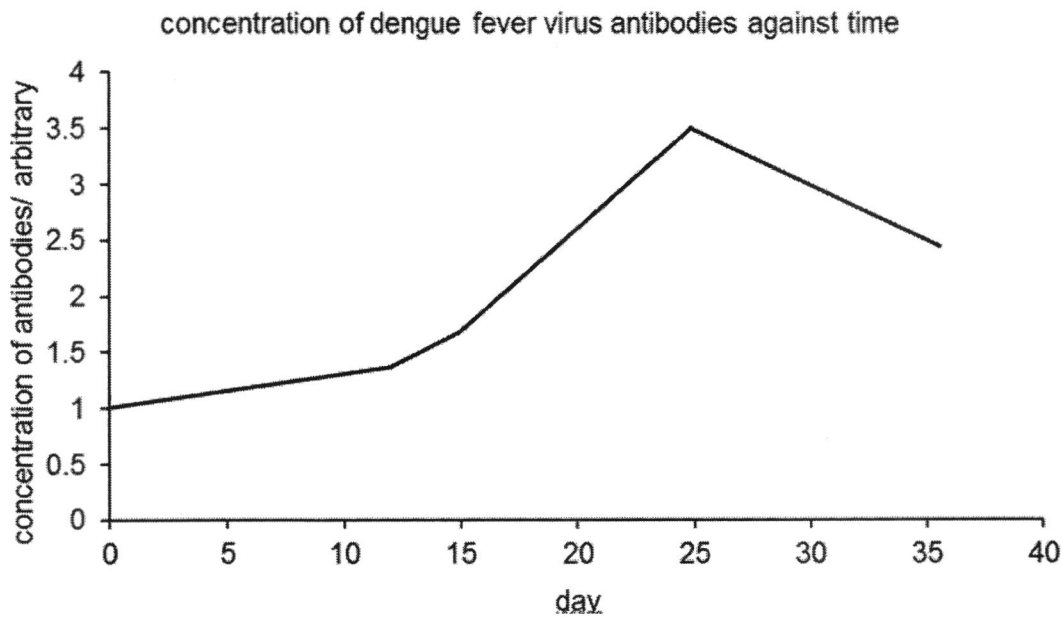


Fig 1.1

In order to determine whether one has been infected, the doctor will refer to the results for the concentration of dengue fever antibodies as shown in the table below.

	concentration of dengue fever antibodies / arbitrary units
normal	≤1.80
unconfirmed	1.81 – 2.49
infected	≥2.50

(a) With reference to the graph, suggest the day where the victim was diagnosed with the dengue fever virus.

.....

[1]

(b) How do the antibodies protect the victim against the dengue fever virus?

.....

[1]

(c) With reference to the graph, suggest which day did the victim begins to recover from dengue fever.

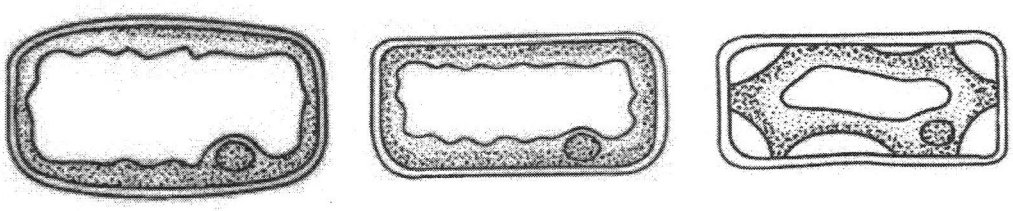
..... [1]

(d) When the victim was cut accidentally by a piece of paper, she realised that her wound did not stop bleeding after some time. Suggest the blood component that is impaired and how it affects her.

..... [2]

2 A student places some hydrilla in three salt solutions of different concentrations. After 5 minutes, a leaf was taken from each solution and viewed under a microscope.

Fig. 4.1 shows how the cells taken from each salt solution looks like.



Cell A Cell B Cell C

Fig. 2.1

(a) Complete Table 4.1 to match each cell with the salt solution it was immersed in. [1]

Concentration of salt solution/ mol dm^{-3}	Cell
0.1	
0.3	
0.6	

Table 2.1

(b) Explain the observation in cell C.

.....

.....

..... [2]

3 After a meal rich in carbohydrates, the concentration of glucose in the small intestine changes.

The table below shows the concentration of glucose at different distances along the small intestine.

Distance along the small intestine in cm	Concentration of glucose in mol/dm^3
100	50
300	500
500	250
700	0

Table 3.1

(a) At what distance along the small intestine is the glucose concentration highest?

..... [1]

(b) Use the data in Table 3.1 to plot a bar chart on the graph Fig 3.1 below.
Label the y-axis.
Choose a suitable scale. [4]

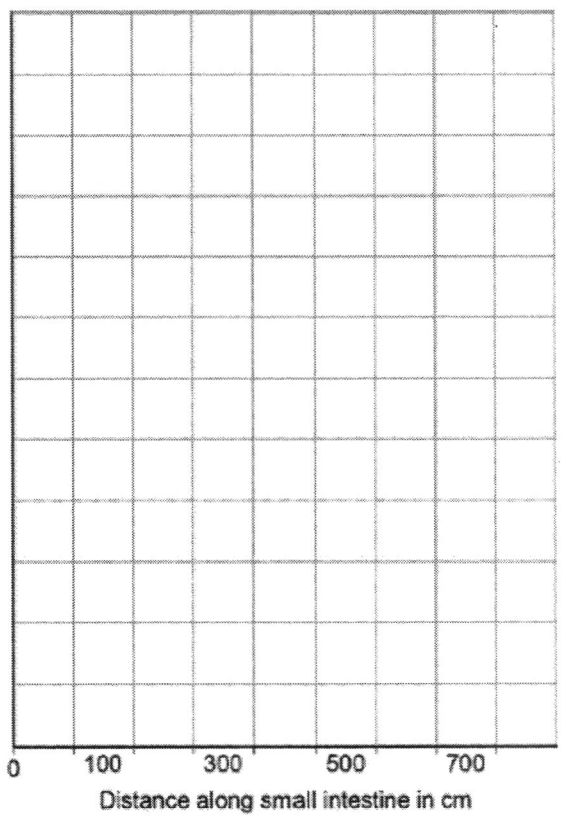


Fig 3.1

(c) Refer to the graph Fig 3.1 above.

Describe how the concentration of glucose changes as distance increases along the small intestine.

.....

.....

..... [2]

(d) Explain why the concentration of glucose in the small intestine changes between 100cm and 300cm.

.....

.....

..... [2]

4 Fig 4.1 represents part of a protein molecule.

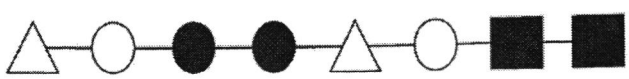
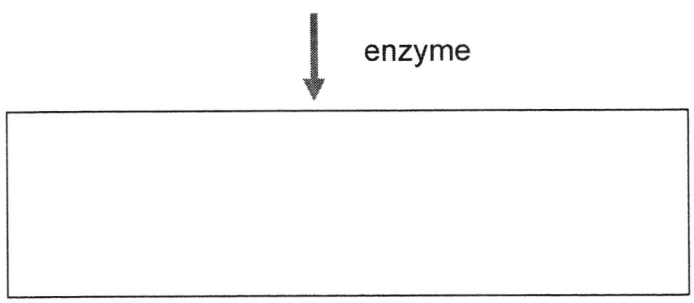


Fig 4.1



(a) Draw on the box to show all the molecules present after the complete digestion of this part of the protein. [2]

(b) Name the type of enzyme which digests the proteins.

.....

.... [1]

5 The diagram below shows the lighting circuit of a house.

(a) State the circuit arrangement of the lighting of house in Fig 5.1.

..... [1]

(b) State if this circuit arrangement of the lighting is suitable. Give two reasons to support your answer.

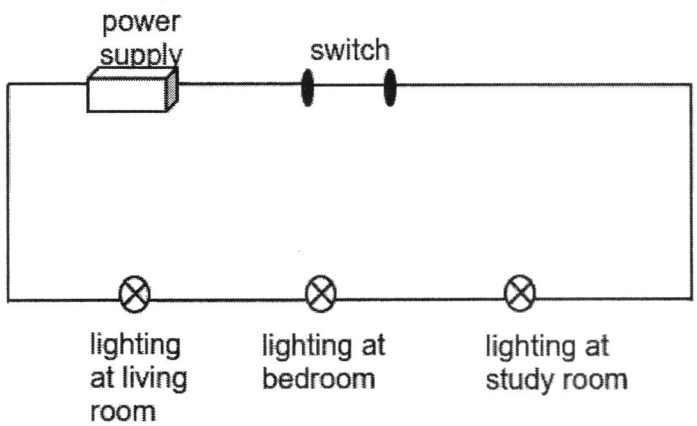


Fig 5.1

1 .....

2 ..... [2]

(c) How will the brightness of the lighting be affected if the owner of the house added more lighting at the study room?

.....

[1]

6 Fig 6.1 below shows a pair of shoes (not drawn to scale).

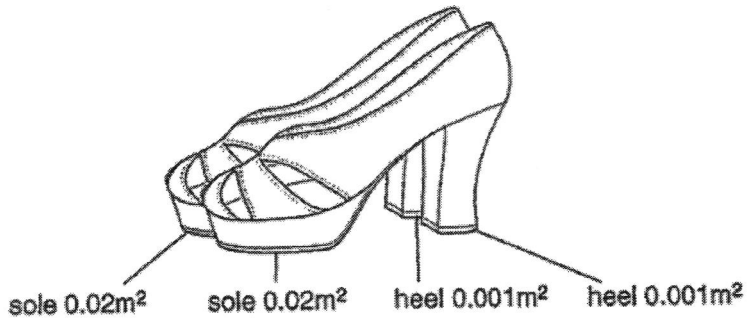


Fig 6.1

(a) What is the total area of the pair of shoes in contact with the ground?

[1]

(b) The person wearing these shoes weighs 840N.

Use the equation $P = \frac{F}{A}$

to calculate the total pressure under the shoes.

[1]

7 The power consumption of some common household appliances is shown in Fig. 7.1.

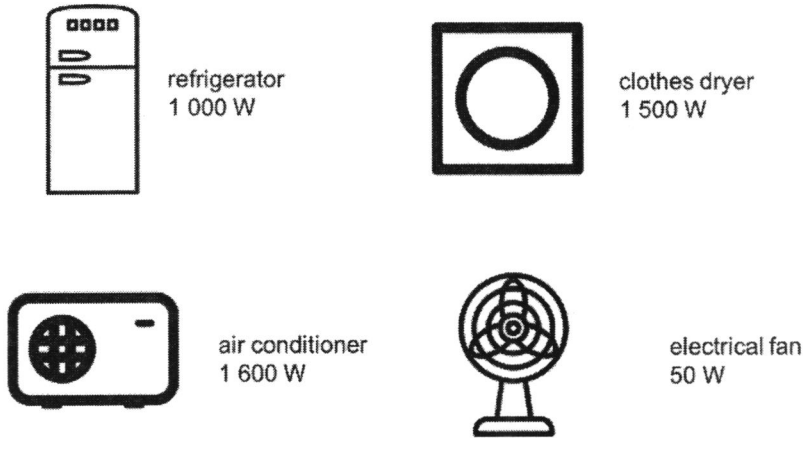


Fig 7.1

(a) Calculate the total electrical energy used by the four appliances in a week if each was used for the durations stated in Table 7.1.

Table 7.1

Household appliances	Usage (hour per day)
Refrigerator	24
Clothes dryer	2
Air conditioner	8
Electric fan	5

[3]

(b) If electricity costs 25 cents per kWh, how much would a family have to pay for the electrical usage calculated in part **(bi)**?

..... [1]

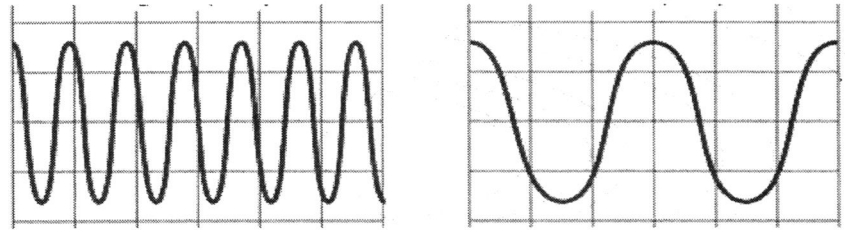
(c) Suggest a way for this family to conserve energy.

.....

.....

..... [1]

8 Fig 8.1 below shows two sound waves.



sound wave 1 sound wave 2

Fig.8.1

(a) Which sound wave has a lower pitch? Explain your answer.

.....

.....

..... [2]

(b) Do you expect any difference in the volumes of the two sound waves? Explain your answer.

.....

.....

..... [2]

9 Singapore, a garden city, is trying to promote biodiversity conservation through the many initiatives and programmes of National Parks.

(a) What is biodiversity?

Tick **one** box.

The different habitats in an ecosystem	☐
The interaction of living and non-living factors in a habitat	☐
The interdependence of organisms on Earth	☐
The total number of organisms in an ecosystem	☐
The variety of different species on Earth	☐

[1]

(b) Protecting and preserving the environment is part of conservation. Conservation reduces global warming and disruption of natural cycles.
As the human beings in the world experience increasing effect of global warming, there is more awareness to try to achieve better standard of living without harming the environment through sustainable living.

(i) List two human activities that can harm the environment.

.....

.....

.....

..... [2]

(ii) State two ways where you can make an active contribution to sustainable living.

.....

.....

.....

.....

..... [2]

Section C [20 Marks]

Answer any **two** questions in the spaces provided.

C1 Fig C1.1 shows a diagram of the human female reproductive system.

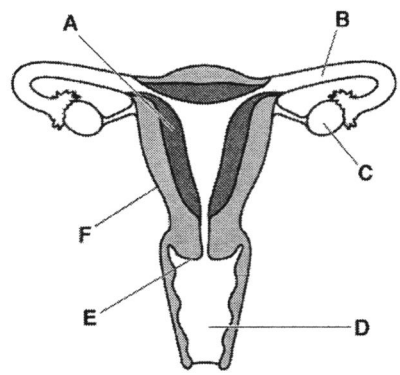


Figure C1.1

(a) Using letters A-F, identify the parts of the human female reproductive system in Fig C1.1 :

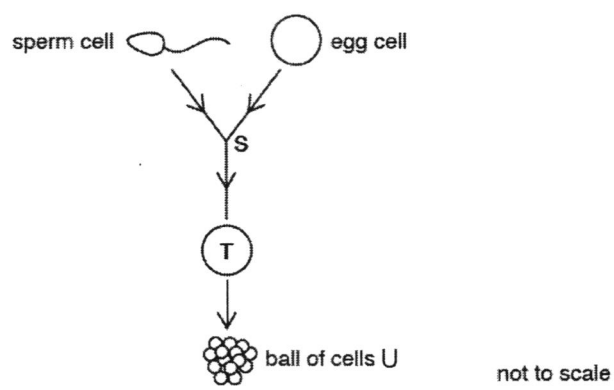


Figure C1.2

(i) where process S in Figure Y occurs .....

(ii) where ball of cells U implants itself ..... [1]

(b) During a woman's menstrual cycle, the thickness of the uterine lining changes.

Mdm Lee is a newly-wed woman. Fig 6.1 below shows the changes in the thickness of Mdm Lee's uterine lining in a particular month.

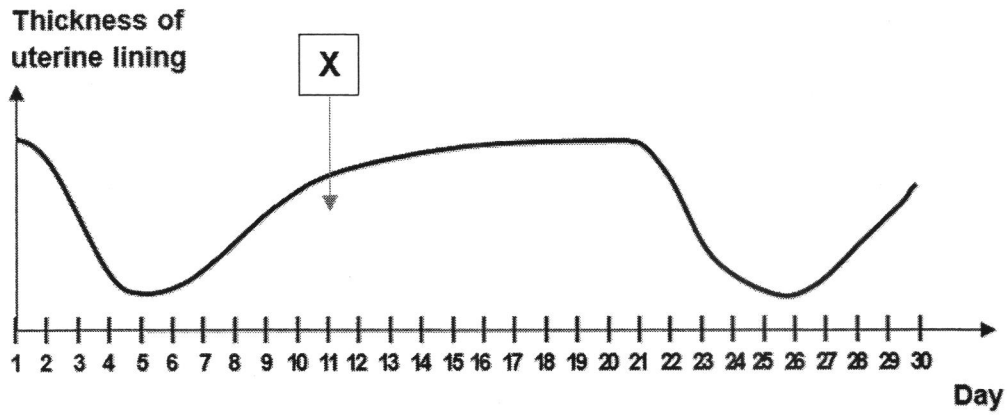


Fig C1.3

(i) With reference to Fig C1.3, estimate the duration of Mdm Lee's menstrual cycle.

..... [1]

(ii) With reference to Fig C1.3, state the **two** days in the month when Mdm Lee's menstruation started.

..... [1]

(iii) With reference to Fig C1.3, suggest what may have happened at point X where Mdm Lee noticed a slight increase in her body temperature in the early morning.

..... [1]

(iv) Suggest why pregnancy may occur if sexual intercourse takes place several days before point X.

..... [1]

(v) Name the method of birth control that makes use of the information in a chart like this. Explain how this method of birth control is used to prevent pregnancy.

Name of method .....

Explanation .....

(c) Fig C1.4. below shows the changes in the thickness of Mdm Lee's uterine lining in one of the months in the following year.

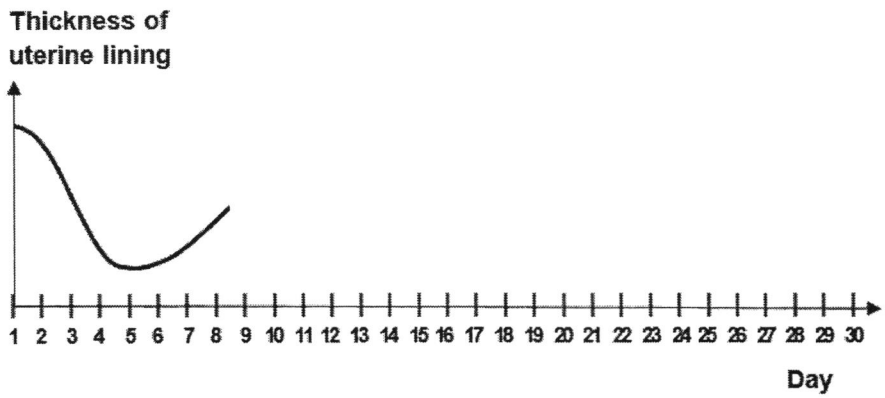


Fig C1.4

Complete the diagram to show the thickness of uterine lining changes if Mdm Lee has successfully conceived. [1]

(d) Human immune-deficiency virus (HIV) is a sexually transmitted virus. State two precautions that can be used to prevent the spread of this virus.

.....

..... [2]

C2 **(a)** Ali wants to investigate heat transfer in the laboratory. He filled an electric kettle with water as shown in Fig C2.1.

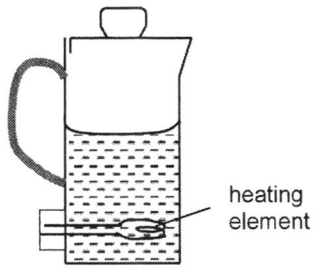


Fig C2.1

(i) Explain why the heating element is positioned near the bottom.

.....

.....

..... [2]

(ii) Fig C2.2 below shows a temperature-time graph of water being heated in the kettle when the heating element is positioned at the bottom as shown in Fig C2.1.

On Fig C2. 2, draw another graph showing the change of temperature with time when the heating element is positioned at the top of the water. [1]

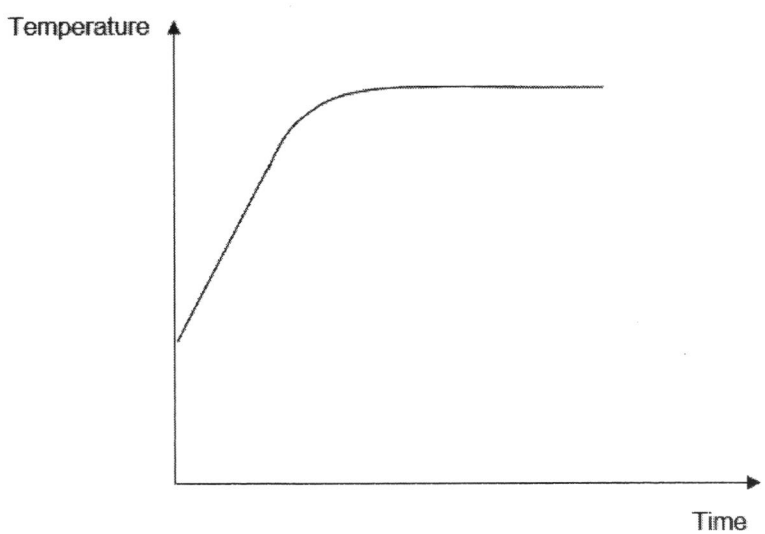


Fig C2.2

(b) The hot water is then transferred to two metal cans as shown below after one period. Both cans are placed the same distance from an electric heater. The initial temperature of the water in teach can is the same.

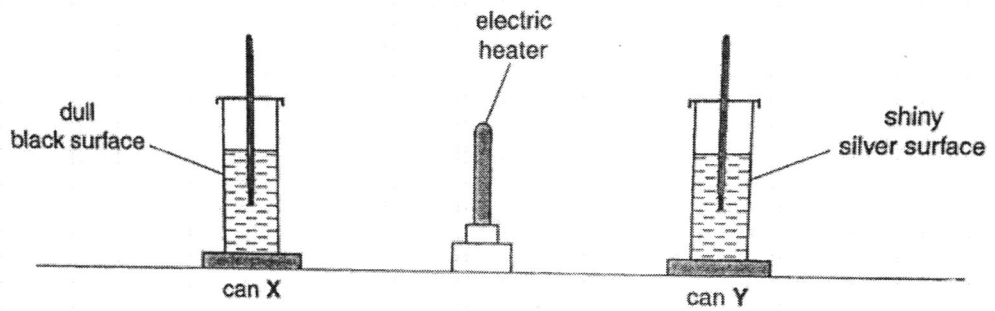


Fig C2.3

(i) Name the process by which energy from the electric heater reaches the cans.

..... [1]

(ii) The temperature of the water in both cans rises. In which can, X or Y, will the temperature rise more quickly? Explain your answer.

.....

.....

..... [2]

(iii) If the lids are not placed on the cans, the mass of water in each can decreases, even before the water reaches its boiling point.
Explain what happens to the water to cause this decrease in mass.

.....

.....

..... [1]

(c) Ali then decided to use a vacuum flask, as shown in Fig C2.4 for his grandma's daily use as it is capable of keeping hot water for a long time without continuous heating.

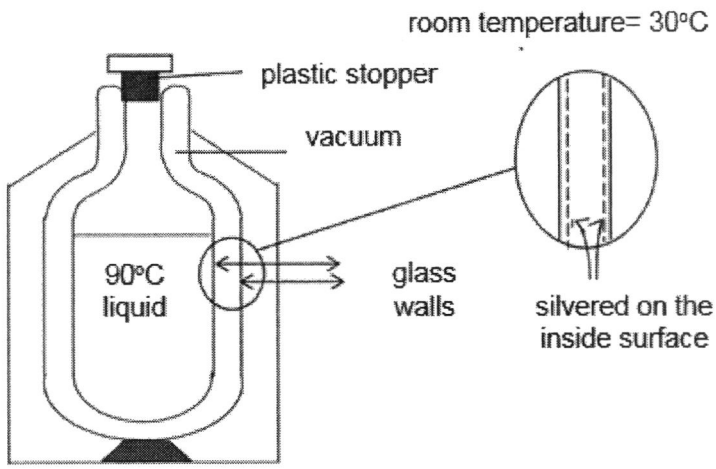


Fig C2.4

(i) Explain how the silvered wall help to keep the hot water hot for a long time.

.....

.....

..... [1]

(ii) Explain how the vacuum between glass walls help to keep the hot water hot for a long time.

.....

.....

..... [2]

C3 **(a)** An experiment was carried out to investigate the speed at which copper(II) carbonate reacts in hydrochloric acid as shown in Fig. C3.1. A conical flask containing the copper(II) carbonate crystals and excess hydrochloric acid was placed on top of an electronic mass balance. Mass was lost as bubbles of gas were formed and the gas escaped from the mixture. The mass of the flask and the contents were recorded in Table C3.1.

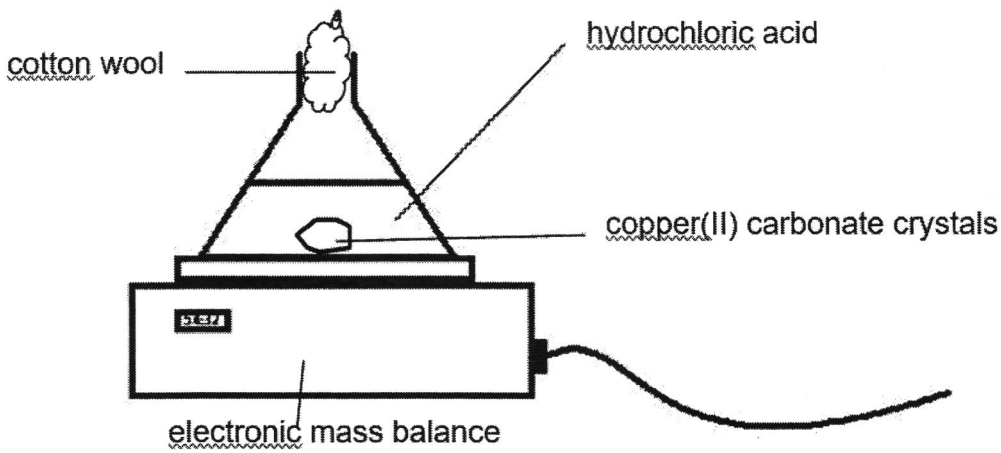


Fig C3.1

ime/ min	0	1	2	3	4	5	6	7
mass of flask & contents/ g	90.4	89.3	88.5	88.0	87.8	87.8	87.8	87.8
total loss in mass/ g	0	1.1						

Table C3.1

(i) Suggest why excess hydrochloric acid is added into the conical flask.

..... [1]

(ii) Complete the missing information in Table C3.1. [1]

(iii) At which minute did the chemical reaction stop?

..... [1]

(iv) Describe a suitable method to test the type of gas present in the conical flask after the chemical reaction has stopped.

Test:

.....

.....

Observation:

.....

..... [2]

(v) Write down a word equation for the reaction between the copper(II) carbonate and hydrochloric acid.

..... [2]

(b) Two drops of Universal Indicator are added to different 10 cm^3 alkaline samples. All the samples are colourless. Dilute hydrochloric acid is added dropwise into each sample until the solution is no longer acidic or alkaline. The number of drops of acid required for each sample is shown in Table C3.2.

Table C3.2

sample	number of drops of dilute hydrochloric acid required
bleach	13
drain cleaner	16
liquid hand soap	3
mouthwash	4

(i) Which sample is the most alkaline?

..... [1]

(ii) Name the type of reaction between the samples and acid.

..... [1]

(iii) How can you tell that the reaction mixture is no longer acidic or alkaline?

..... [1]

Section A [20 Marks]

1	A	6	D	11	D	16	D
2	D	7	D	12	C	17	B
3	B	8	A	13	A	18	C
4	A	9	A	14	D	19	C
5	B	10	A	15	D	20	B

Answer **all** the questions in the spaces provided.

1 As Singapore entered peak season for the disease, there was a rise in dengue cases in the warmer days of 2019.

Fig. 1.1 shows the concentration of dengue fever virus antibodies in one of the victims' body over a period of 40 days.

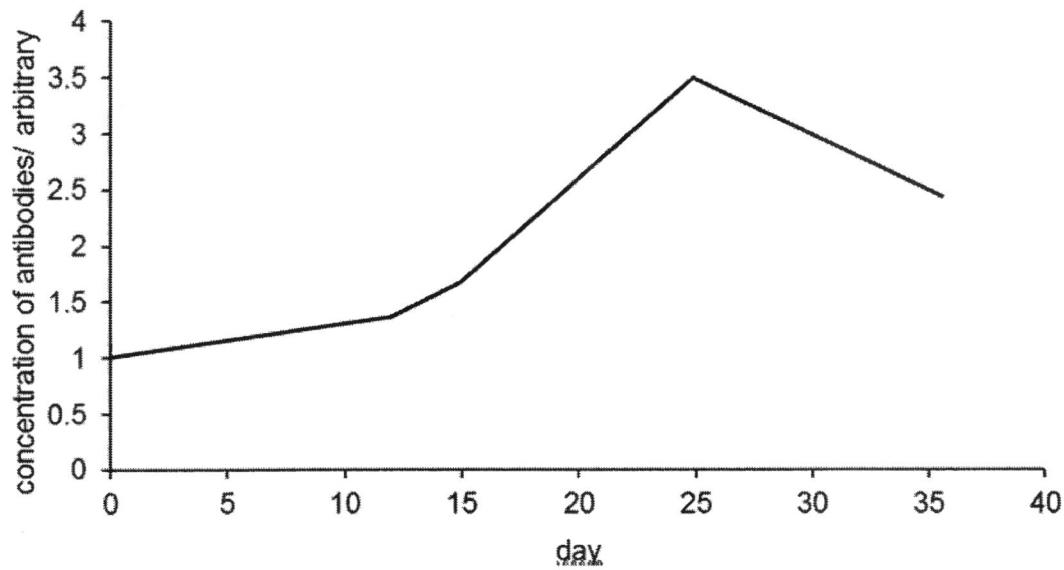


Fig 1.1

In order to determine whether one has been infected, the doctor will refer to the results for the concentration of dengue fever antibodies as shown in the table below.

	concentration of dengue fever antibodies / arbitrary units
normal	≤1.80
unconfirmed	1.81 – 2.49
infected	≥2.50

(a) With reference to the graph, suggest the day where the victim was diagnosed with the dengue fever virus.

Day 19 (accept day 18 and day 20) [1]

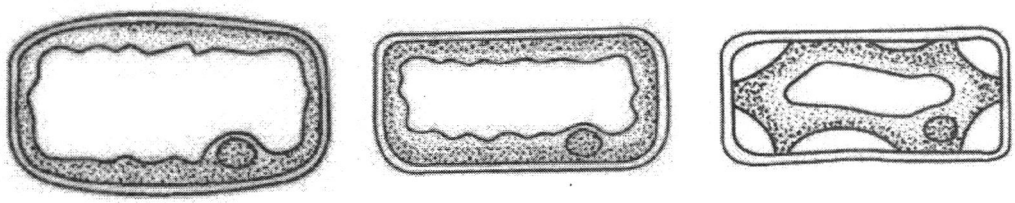
(b) How do the antibodies protect the victim against the dengue fever virus?

The antibodies neutralize the dengue fever virus (accept destroy) [1]

	(c)	With reference to the graph, suggest which day did the victim begins to recover from dengue fever.	
		Day 25	[1]
	(d)	When the victim was cut accidentally by a piece of paper, she realised that her wound did not stop bleeding after some time. Suggest the blood component that is impaired and how it affects her.	
		She has low counts of platelets, thus not able to clot the blood when there is a cut. **This may lead to excessive loss of blood, and coma.**	[2]

2 A student places some hydrilla in three salt solutions of different concentrations. After 5 minutes, a leaf was taken from each solution and viewed under a microscope.

Fig. 4.1 shows how the cells taken from each salt solution looks like.



Cell A **Cell B** **Cell C**

Fig. 2.1

(a) Complete Table 4.1 to match each cell with the salt solution it was immersed in. [1]

Concentration of salt solution/ mol dm^{-3}	**Cell**
0.1	A
0.3	B
0.6	C

Table 2.1

(b) Explain the observation in cell C.

Cell C shrinks in size
There is a net movement of water molecules out of cell C
As there is a higher water potential in cell C than in the concentrated salt solution, water moves out of cell C through the partially permeable membrane by osmosis. [2]

3 After a meal rich in carbohydrates, the concentration of glucose in the small intestine changes.

The table below shows the concentration of glucose at different distances along the small intestine.

Distance along the small intestine in cm	Concentration of glucose in mol/dm^3
100	50
300	500
500	250
700	0

Table 3.1

(a) At what distance along the small intestine is the glucose concentration highest?

300 cm [1]

(b) Use the data in Table 3.1 to plot a bar chart on the graph Fig 3.1 below.

Label the y-axis.

Choose a suitable scale. [4]

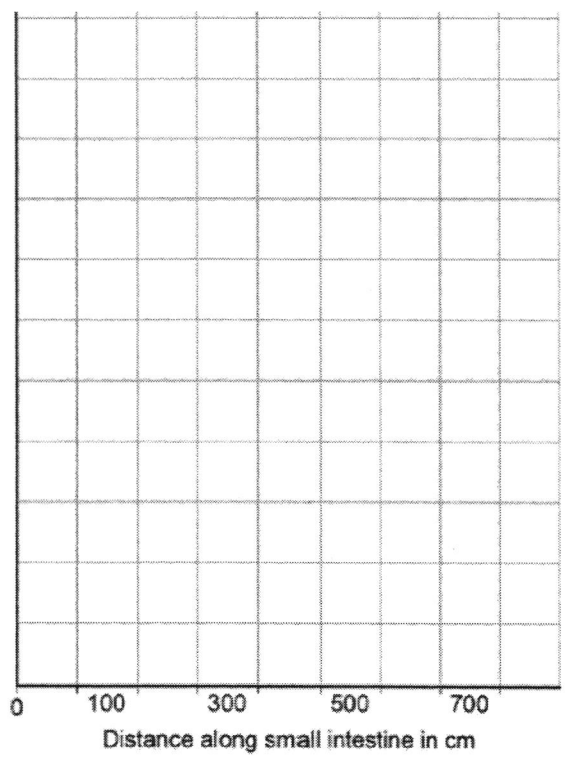
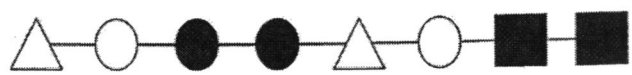
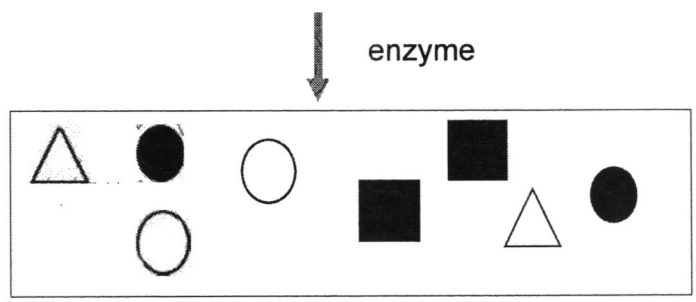
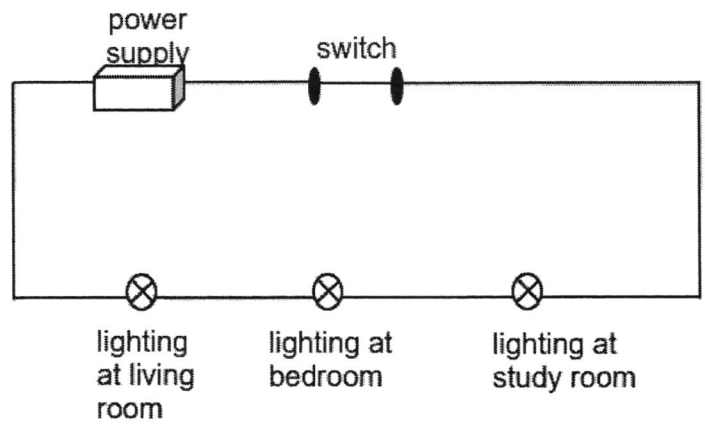


Fig 3.1

	(c)	Refer to the graph Fig 3.1 above. Describe how the concentration of glucose changes as distance increases along the small intestine.	
		As distance increases along the small intestine from 100cm to 300 cm, the concentration of glucose increases from 50 to 500 mol/dm^3 **As distance increases along the small intestine from 300 to 700 cm, the concentration of glucose decrease from 500 to 0 mol/dm^3**	[2]
	(d)	Explain why the concentration of glucose in the small intestine changes between 100cm and 300cm.	
		As the starch molecules are being digested into maltose by pancreatic maltase and the maltose being digested into glucose by intestinal maltase, the concentration of glucose continue to increase from 100 cm to 300 cm in the small intestine.	[2]
4	Fig 4.1 represents part of a protein molecule.		
	 **Fig 4.1**  		
	(a)	Draw on the box to show all the molecules present after the complete digestion of this part of the protein.	[2]
		(must have the correct shape, size and number of amino acids)	
	(b)	Name the type of enzyme which digests the proteins.	
		protease	[1]

5	The diagram below shows the lighting circuit of a house.		
	(a)	State the circuit arrangement of the lighting of house in Fig 5.1.	
		Series circuit	[1]
	(b)	State if this circuit arrangement of the lighting is suitable. Give two reasons to support your answer.	
		 **Fig 5.1**	
		It is not suitable **There is only one switch for all the lightings in the living room, bedroom and study room. It is not able to only switch on or off any one of the lightings at one time** **When there is one faulty light bulb, all bulbs cannot light up.**	[2]
	(c)	How will the brightness of the lighting be affected if the owner of the house added more lighting at the study room? **The lightings will all be dimmer**	[1]

6 Fig 6.1 below shows a pair of shoes (not drawn to scale).

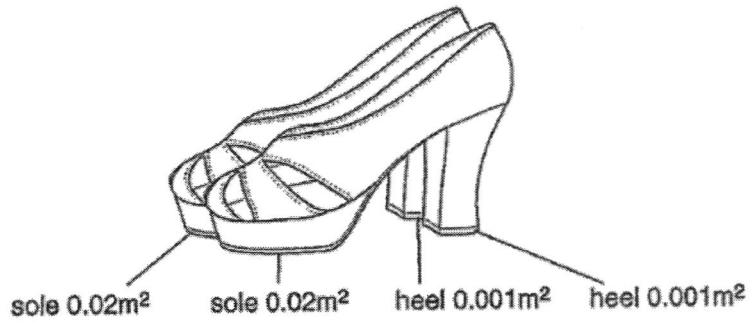


Fig 6.1

(a) What is the total area of the pair of shoes in contact with the ground?

Total area of the pair of shoes in contact with the ground

= (0.02 + 0.02 +0.001 + 0.001) m

= 0.042 m^2

[1]

(b) The person wearing these shoes weighs 840N.

Use the equation $P = \frac{F}{A}$

to calculate the total pressure under the shoes.

$$P = \frac{F}{A}$$

$$= \frac{840\ N}{0.042\ m^2}$$

$$= 20\ 000\ Nm^{-2}$$

[1]

7 The power consumption of some common household appliances is shown in Fig. 7.1.

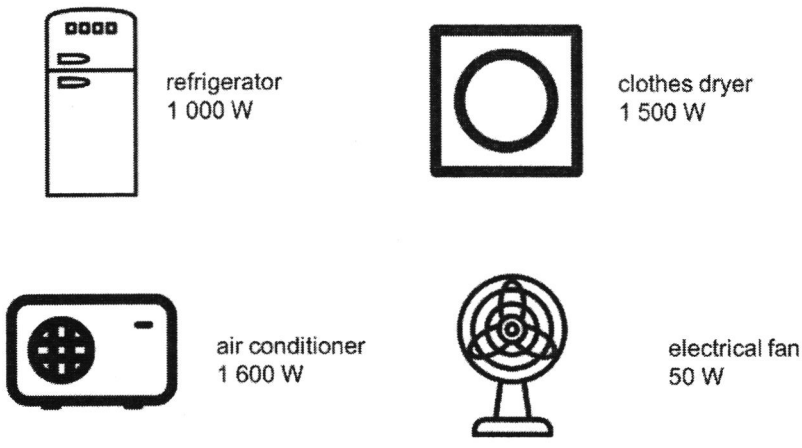


Fig 7.1

(a) Calculate the total electrical energy used by the four appliances in a week if each was used for the durations stated in Table 7.1.

Household appliances	Usage (hour per day)
Refrigerator	24
Clothes dryer	2
Air conditioner	8
Electric fan	5

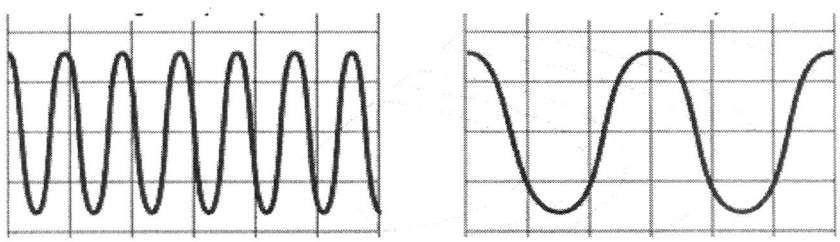
Electrical energy used by refrigerator in a week
= 1 kW x 24h x 7days
= 168 kWh

Electrical energy used by clothes dryer in a week
= 1.5kW x 2h x 7days
= 21 kWh

Electrical energy used by air conditioner in a week
= 1.6kW x 8h x 7days
= 89.6 kWh

Electrical energy used by electric fan in a week
= 0.05kWh x 5h x 7 days
= 1.75kWh

[3]

		Total electrical energy used by the four appliances in a week **= (168 + 21 + 89.6 + 1.75) kWh** **= 280.35 kWh**	
	(b)	If electricity costs 25 cents per kWh, how much would a family have to pay for the electrical usage calculated in part **(bi)**?	
		The total bill for the week will be **= 280.35kWh x $0.25** **= $70.08**	[1]
	(c)	Suggest a way for this family to conserve energy.	
		Use the fan instead of the air conditioner **OR** **Dry the clothes under the sun instead of using the clothes dryer**	[1]
8	Fig 8.1 below shows two sound waves.  sound wave 1 sound wave 2 **Fig.8.1**		
	(a)	Which sound wave has a lower pitch? Explain your answer.	
		Sound wave 2 has a lower pitch. It has a lower frequency.	[2]
	(b)	Do you expect any difference in the volumes of the two sound waves? Explain your answer.	
		The volume of the two sound waves will be the same as both have the same amplitude.	[2]

9	Singapore, a garden city, is trying to promote biodiversity conservation through the many initiatives and programmes of National Parks.			
	(a)	What is biodiversity? Tick **one** box.		
		The different habitats in an ecosystem ☐ The interaction of living and non-living factors in a habitat ☐ The interdependence of organisms on Earth ☐ The total number of organisms in an ecosystem ☐ The variety of different species on Earth √		[1]
	(b)	Protecting and preserving the environment is part of conservation. Conservation reduces global warming and disruption of natural cycles. As the human beings in the world experience increasing effect of global warming, there is more awareness to try to achieve better standard of living without harming the environment through sustainable living.		
		(i)	List two human activities that can harm the environment.	
			Deforestation / clearing land for housing, agricultural purposes **Disposing plastic into the sea / empty parcel of lands** **Large scale burning of fossil fuels such as burning fuel in transport system, clearing land through burning, produces large amount of carbon dioxide.** **(accept correct answers)**	[2]
		(ii)	State two ways where you can make an active contribution to sustainable living.	
			Reduce impulse purchases and possess excess clothes and materials **Recycle materials that can be reused, avoid one time use and throw** **Etc.**	[2]

Section C [20 Marks]

Answer any **two** questions in the spaces provided.

C1 Fig C1.1 shows a diagram of the human female reproductive system.

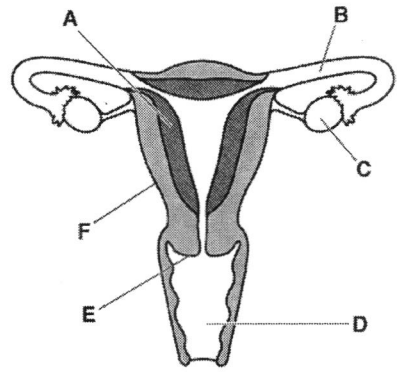


Figure C1.1

(a) Using letters A-F, identify the parts of the **human** female reproductive system in Fig C1.1 :

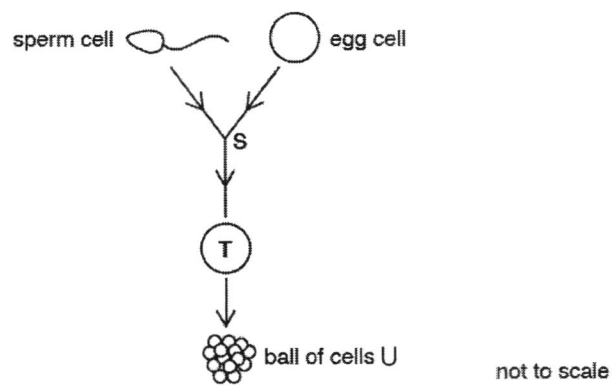


Figure C1.2

(i) where process S in Figure Y occurs B

(ii) where ball of cells U implants itself A [1]

(b) During a woman's menstrual cycle, the thickness of the uterine lining changes.

Mdm Lee is a newly-wed woman. Fig 6.1 below shows the changes in the thickness of Mdm Lee's uterine lining in a particular month.

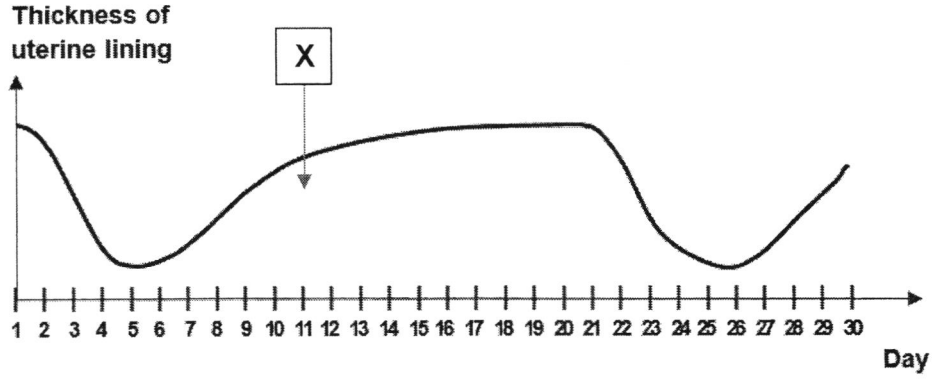


Fig C1.3

(i) With reference to Fig C1.3, estimate the duration of Mdm Lee's menstrual cycle.

21 days (accept 20 days) [1]

(ii) With reference to Fig C1.3, state the **two** days in the month when Mdm Lee's menstruation started.

Day 1 and Day 21 [1]

(iii) With reference to Fig C1.3, suggest what may have happened at point X where Mdm Lee noticed a slight increase in her body temperature in the early morning.

Ovulation day [1]

(iv) Suggest why pregnancy may occur if sexual intercourse takes place several days before point X.

The sperms can survive for a few days in the female reproductive system [1]

(v) Name the method of birth control that makes use of the information in a chart like this. Explain how this method of birth control is used to prevent pregnancy.

Name of method **natural rhythm**

Explanation **By tracking ovulation day and avoid sexual intercourse during fertile period.**

..... [2]

(c) Fig C1.4. below shows the changes in the thickness of Mdm Lee's uterine lining in one of the months in the following year.

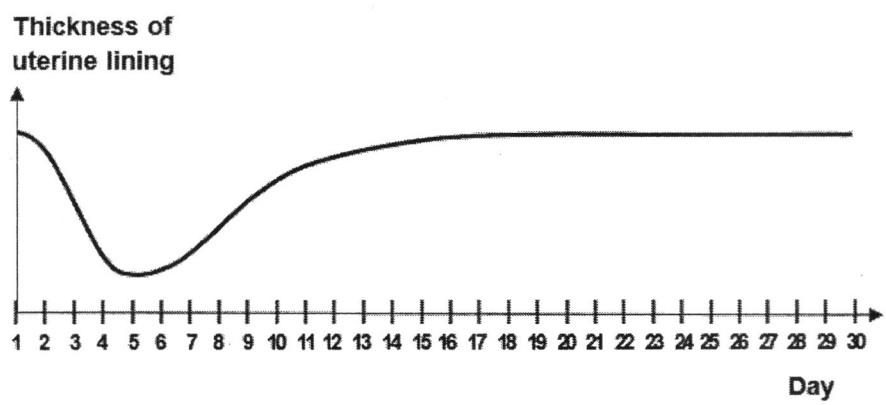


Fig C1.4

Complete the diagram to show the thickness of uterine lining changes if Mdm Lee has successfully conceived. [1]

(d) Human immune-deficiency virus (HIV) is a sexually transmitted virus. State two precautions that can be used to prevent the spread of this virus.

Keep to one sexual partner

Avoid sharing needles for injection, ear piercing etc

[2]

C2 **(a)** Ali wants to investigate heat transfer in the laboratory. He filled an electric kettle with water as shown in Fig C2.1.

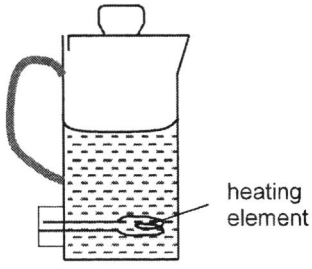


Fig C2.1

(i) Explain why the heating element is positioned near the bottom.

Heating element is near the bottom so that
hot water heated up can rise up and cold water sink
to generate convection current [2]
for faster heating up of the water in the whole kettle.

(ii) Fig C2.2 below shows a temperature-time graph of water being heated in the kettle when the heating element is positioned at the bottom as shown in Fig C2.1.

On Fig C2. 2, draw another graph showing the change of temperature with time when the heating element is positioned at the top of the water. [1]

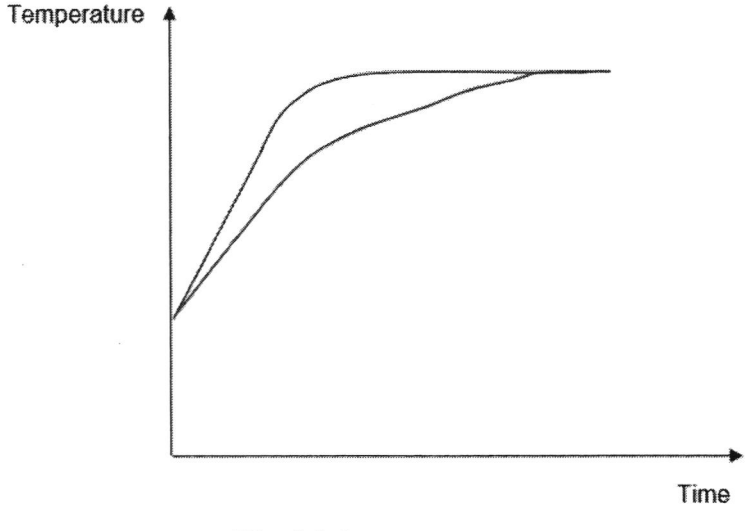


Fig C2.2

(b) The hot water is then transferred to two metal cans as shown below after one period. Both cans are placed the same distance from an electric heater. The initial temperature of the water in teach can is the same.

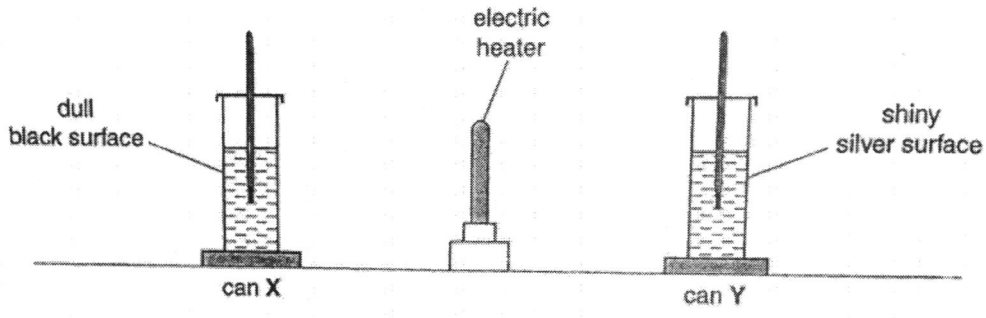


Fig C2.3

(i) Name the process by which energy from the electric heater reaches the cans.

Radiation [1]

(ii) The temperature of the water in both cans rises. In which can, X or Y, will the temperature rise more quickly? Explain your answer.

Temperature in can X will rise more quickly
Dull and black surface is a better absorber of heat.

[2]

(iii) If the lids are not placed on the cans, the mass of water in each can decreases, even before the water reaches its boiling point.
Explain what happens to the water to cause this decrease in mass.

Water being heated up will boil and water vapour escape from the can resulting in a decrease in mass

[1]

(c) Ali then decided to use a vacuum flask, as shown in Fig C2.4 for his grandma's daily use as it is capable of keeping hot water for a long time without continuous heating.

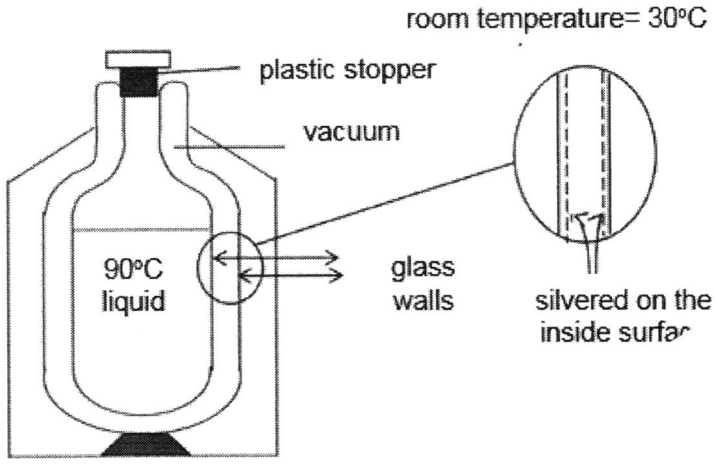


Fig C2.4

(i) Explain how the silvered wall help to keep the hot water hot for a long time.

Silvered wall are poor radiator of heat, thus reducing the heat transfer from the hot water out to the flask.

[1]

(ii) Explain how the vacuum between glass walls help to keep the hot water hot for a long time.

The vacuum between glass walls help to keep the hot water hot for a long time as heat transfer cannot occur via conduction and convection in the vacuum. [2]

C3 **(a)** An experiment was carried out to investigate the speed at which copper(II) carbonate reacts in hydrochloric acid as shown in Fig. C3.1. A conical flask containing the copper(II) carbonate crystals and excess hydrochloric acid was placed on top of an electronic mass balance. Mass was lost as bubbles of gas were formed and the gas escaped from the mixture. The mass of the flask and the contents were recorded in Table C3.1.

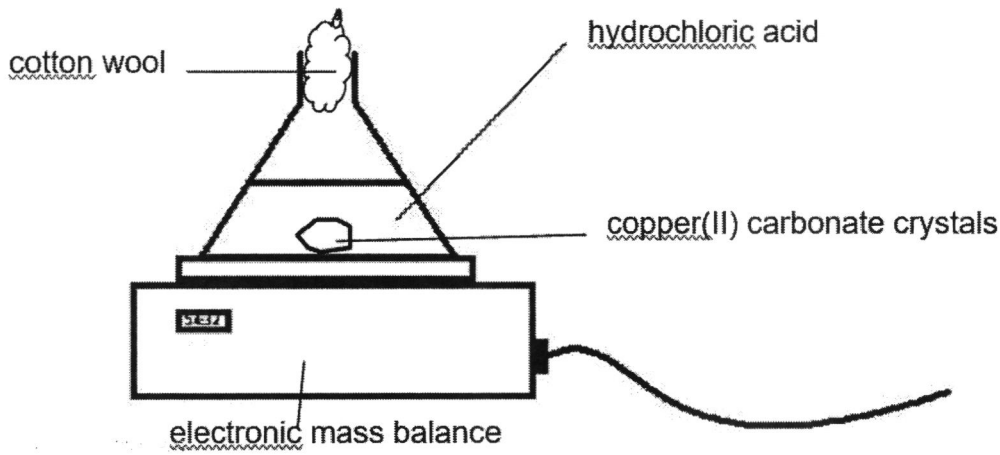


Fig C3.1

Table C3.1

time/ min	0	1	2	3	4	5	6	7
mass of flask & contents/ g	90.4	89.3	88.5	88.0	87.8	87.8	87.8	87.8
total loss in mass/ g	0	1.1	**1.9**	**2.4**	**2.6**	**2.6**	**2.6**	**2.6**

(i) Suggest why excess hydrochloric acid is added into the conical flask.

To use up the copper (II) carbonate crsytals. [1]

(ii) Complete the missing information in Table C3.1. [1]

(iii) At which minute did the chemical reaction stop?

The chemical reaction stops at 4th minute. [1]

(iv) Describe a suitable method to test the type of gas present in the conical flask after the chemical reaction has stopped.

Test:

Bubble the gas produced into limewater

Observation:

If white precipitate is formed in limewater, carbon dioxide gas is present. [2]

(v) Write down a word equation for the reaction between the copper(II) carbonate and hydrochloric acid.

hydrochloric acid + copper(II) carbonate ⟶ copper(II) chloride + water + carbon dioxide [2]

(b) Two drops of Universal Indicator are added to different 10 cm^3 alkaline samples. All the samples are colourless. Dilute hydrochloric acid is added dropwise into each sample until the solution is no longer acidic or alkaline. The number of drops of acid required for each sample is shown in Table C3.2.

Table C3.2

sample	number of drops of dilute hydrochloric acid required
bleach	13
drain cleaner	16
liquid hand soap	3
mouthwash	4

(i) Which sample is the most alkaline?

Drain cleaner [1]

(ii) Name the type of reaction between the samples and acid.

Neutralisation [1]

(iii) How can you tell that the reaction mixture is no longer acidic or alkaline?

When the mixture added with Universal indicator changes to green [1]