HILLGROVE SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2022
SECONDARY 2 EXPRESS

CANDIDATE NAME	( )	CLASS	-
CENTRE NUMBER	S	INDEX NUMBER	

SCIENCE

Section A

Additional Materials: OAS

6 October 2022
1 hour 45 min
08.10 AM to 09.55 AM
(With Sections B and C)

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in 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.

SECTION A

Answer **all** questions.
Use a **2B** pencil to shade the most correct answer on the OAS provided.

Setter: Mr Tam KK

This document consists of **11** printed pages

Section A
Multiple Choice Questions [30 marks]

Answer **all** the questions in this section on the OAS provided.

1 When a force is applied to a body, several effects are possible.

Which effect cannot occur?

A The body moves faster.

B The body slows down.

C The mass of the body increases.

D The shape of the body is changed.

2 A rock on the Mars has a mass of 243 g. It is brought to Earth where the gravitational field is stronger.

What will happen to the mass and weight of the rock when it is on Earth?

A The rock will have less mass and less weight on Earth.

B The rock will have less mass and the same weight on Earth.

C The rock will have the same mass and more weight on Earth.

D The rock will have the same mass and the same weight on Earth.

3 A force was applied to hammer a nail into a wall. The sharp end of the nail has a cross sectional area of 0.0005 m^2.

If the pressure exerted at the sharp end of the nail is 300,000 Pa, what was the force applied to hammer the nail?

A 0.15 N

B 60 N

C 150 N

D 6,000,000 N

4 The work done on an object does not depend on

A the direction in which the force is applied.

B the size of the force applied.

C the size of the object.

D whether the object moves.

5 Which option best describes the term 'biofuel'?

A an energy source derived from animal and/or plant matter

B an energy source formed from the remains of dead plants and animals over millions of years

C an energy source that enables animals to maintain their body temperature

D a type of fuel derived from the heat produced by the bodies of warm-blooded animals

6 Which statement is correct?

A Convection is the only way through which the earth receives energy from the sun.

B Heat is transferred from a cold object to a hot object.

C Radiation of heat occurs with or without a medium.

D The conduction of heat in a metal is mainly due to the free movement of the atoms in the metal.

7 Which of the following heat transfers is/are due to the change in the density of a material?

A convection and conduction

B conduction only

C convection only

D radiation only

8 A silver spoon and a plastic spoon are placed on a table in a room.

The silver spoon is colder to the touch because silver is a better

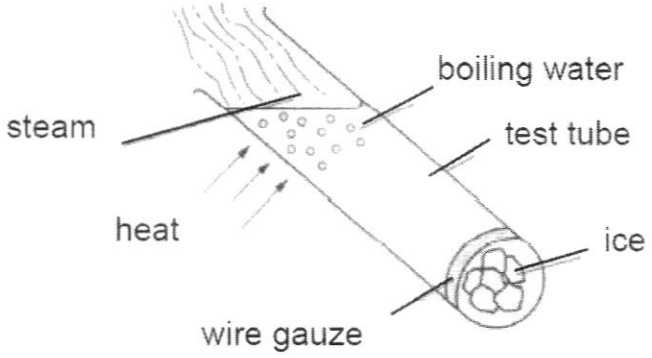
A conductor of heat than plastic.

B insulator of heat than plastic.

C radiator of heat than plastic.

D reflector of heat than plastic.

9 Boiling water and ice can exist at the same time in a test tube.



What does this experiment show?

A Convection occurs in water.

B Water does not conduct heat well.

C Wire gauze has a higher density than water.

D Wire gauze is a good reflector of heat.

10 An aqueous solution of the organic compound methylamine has a pH greater than 7.

Which statement about methylamine is correct?

A It neutralises an aqueous solution of sodium hydroxide.

B It reacts with copper(II) carbonate to give carbon dioxide gas.

C It reacts with dilute acid to form salt.

D It turns blue litmus paper red.

11 Some substances are heated in air and the observations made are recorded in the table.

Which substance is most likely to have undergone a physical change?

	before heating	during heating	after heating
A	green solid	black solid	black solid
B	grey solid	light given off	white solid
C	silvery grey solid	silvery grey liquid	silvery grey solid
D	silvery grey liquid	white liquid	white solid

12 The table gives information about two indicators.

indicator	colour in acidic solution	pH at which colour changes	colour in alkaline solution
methyl orange	red	5	yellow
phenolphthalein	colourless	10	pink

Which colours would be observed when each indicator was added separately to pure water?

	methyl orange	phenolphthalein
A	red	colourless
B	yellow	colourless
C	red	pink
D	yellow	pink

13 Bubbles form in a solution due to various reasons.

Which situation will cause bubbles to form as a result of a chemical change?

A blowing into a cup of water with a straw

B boiling milk in a saucepan

C opening a can of soft drink

D placing a strip of magnesium ribbon into dilute acid

14 Which statement describes a positive test to show that an acid has reacted with a metal in a test-tube?

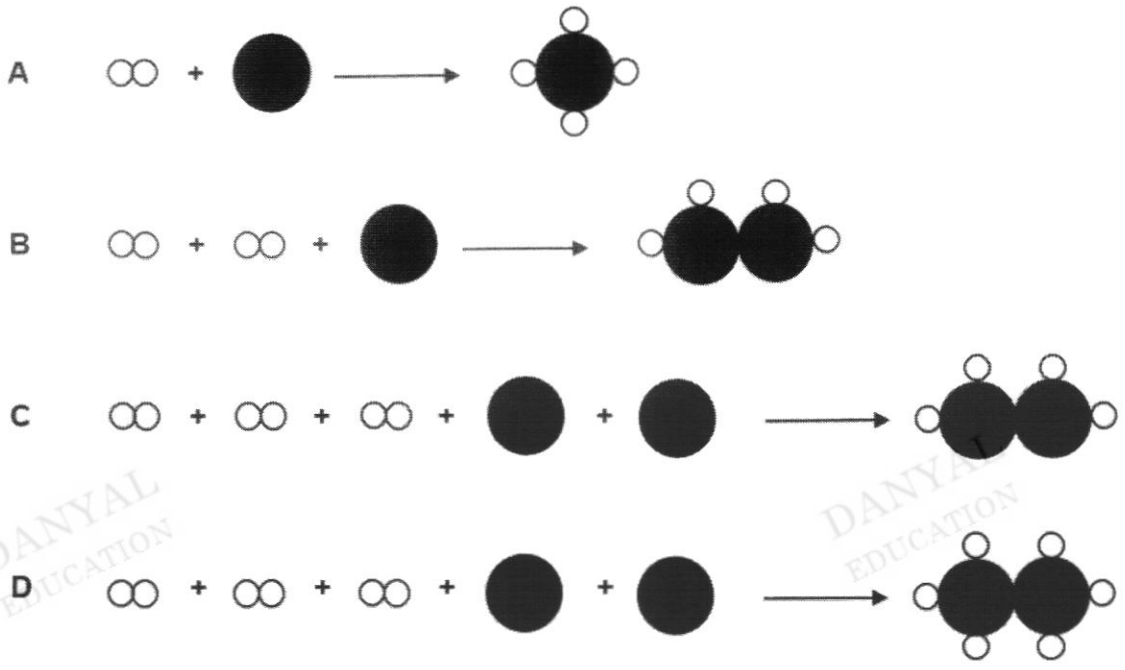
A a blue solution is obtained when the gas evolved is passed into Universal Indicator solution

B a burning splint is extinguished with a 'pop' sound by the gas evolved

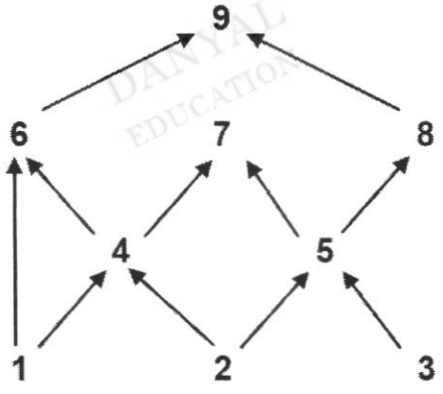
C a white precipitate is obtained when the gas evolved is bubbled through lime water

D lime water remains colourless when the gas evolved is bubbled through lime water

15 Which model shows a correct chemical reaction?



16 The diagram shows nine organisms forming a food web.



Which group of organisms are primary consumers?

A 1, 2 and 3

B 4, 5 and 6

C 6, 7 and 8

D 7, 8 and 9

17 Which process removes carbon dioxide from the atmosphere?

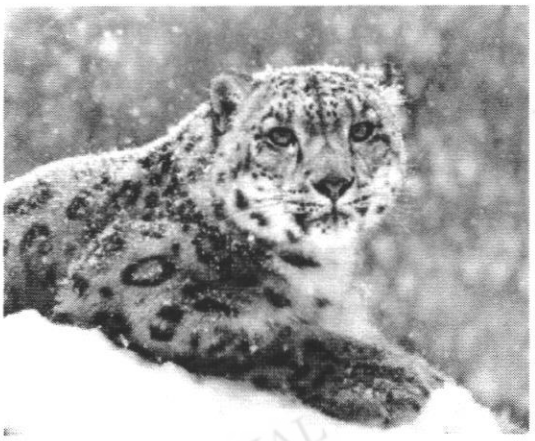
A combustion of fossil fuels

B decomposition by bacteria

C photosynthesis by green plants

D respiration by living organisms

18 The diagram shows a snow leopard, *Panthera uncia*. The habitat of the snow leopard is the high mountains of Central Asia.



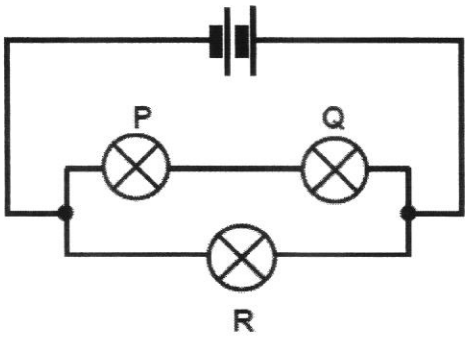
Snow leopards usually live and hunt alone. Their main prey is grazing herbivores, such as wild sheep and wild goats. They also hunt domesticated animals and livestock.

The number of snow leopards has decreased dramatically in the last 40 years.

Which row correctly describes the consequences to the ecosystem if the number of snow leopards continues to decrease?

	number of herbivores	number of plants	competition for plants	biodiversity
A	decrease	decrease	increase	increase
B	decrease	increase	decrease	increase
C	increase	decrease	increase	decrease
D	increase	increase	decrease	decrease

19 Three identical light bulbs are connected in a circuit.



Which statement correctly ranks the bulbs according to their brightness?

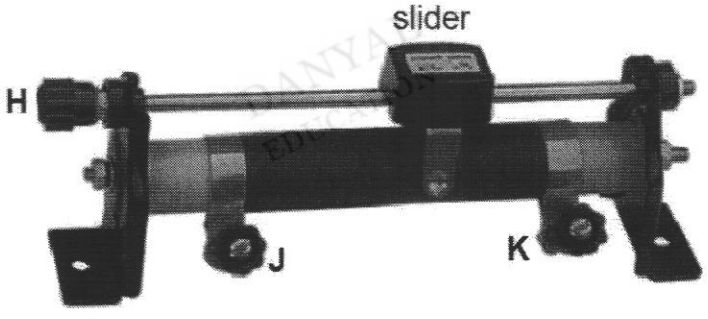
A All the bulbs are equally bright.

B P and Q are equally bright, and R is brighter than P and Q.

C P and Q are equally bright, and R is dimmer than P and Q.

D R is the brightest, and Q is brighter than P.

20 The diagram shows a rheostat. The three terminals are labelled H, J and K.



Which connections and slider position would give the lowest resistance?

	connection	slider position
A	H and J	nearer to J
B	H and K	nearer to J
C	H and J	nearer to K
D	J and K	nearer to K

21 Which pair of items are safety devices designed to cut off electric current?

A fuse and circuit breaker

B rheostat and fuse

C variable resistor and circuit breaker

D voltmeter and switch

22 What is the electric power of an appliance?

A It refers to how fast energy is moving the appliance.

B It refers to how much voltage is needed by the appliance.

C It refers to how strong the appliance is.

D It refers to the amount of energy converted into other forms per second.

23 Which statement is correct?

A Both starch and protein molecules can pass through cell membranes.

B Both starch and protein molecules cannot pass through cell membranes.

C Only protein molecules can pass through cell membranes.

D Only starch molecules can pass through cell membranes.

24 Which statement best describes the diet of an Eskimo living in the cold Arctic region as compared to a Singaporean living in a tropical country?

A An Eskimo consumes more food which are high in fats.

B An Eskimo consumes more food which are high in proteins.

C An Eskimo consumes more fruits.

D An Eskimo drinks more water.

25 Which group of food nutrients is the main source of energy?

A carbohydrates

B fats

C proteins

D vitamins

26 When faeces stay in the rectum for a long time, they become very hard.

Which statement correctly explains this?

A Bacteria present in the large intestine use large amounts of water.

B Digestion of mineral salts cause the faeces to become hard.

C Only evaporation takes place when faeces stay longer in the rectum.

D Too much water is absorbed from the contents in the large intestine.

27 Which component of blood is responsible for transporting waste products to the kidneys for removal?

A plasma

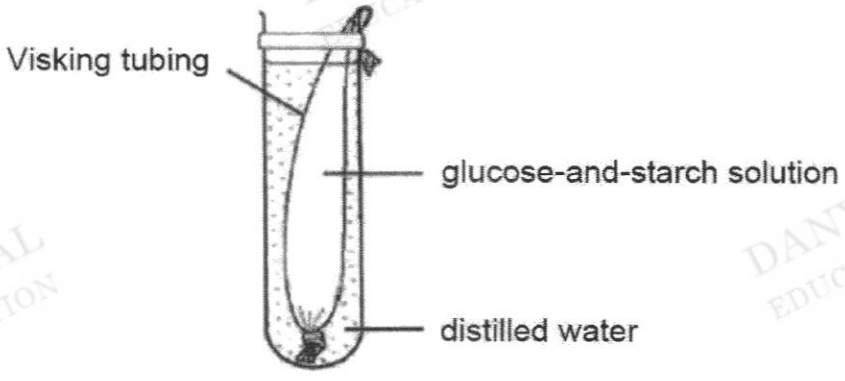
B platelets

C red blood cells

D white blood cells

28 The diagram shows an experiment using a Visking tubing.

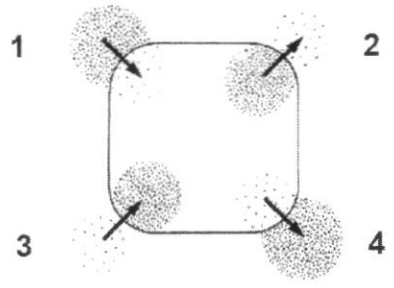
Starch is a large molecule and cannot pass through the Visking tubing while glucose is a small molecule and can pass through the Visking tubing.



Which row correctly shows the change in the number of glucose molecules and starch molecules inside the Visking tubing after 20 minutes?

	number of glucose molecules inside the Visking tubing	number of starch molecules inside the Visking tubing
A	decreased	unchanged
B	increased	unchanged
C	decreased	decreased
D	increased	decreased

29 The diagram shows ways in which molecules, represented by the dots, may move into and out of a cell.

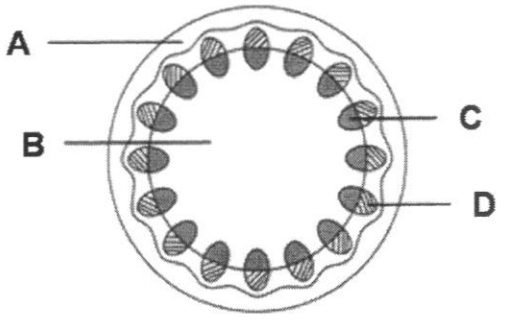


Which row correctly describes the movement of carbon dioxide molecules and oxygen molecules into or out of leaf cells during the day?

	carbon dioxide molecules	oxygen molecules
A	1	2
B	1	4
C	4	3
D	4	1

30 The diagram shows a cross-section of a flowering plant stem.

Which structure is responsible for the transport of food from the leaves to all parts of the plant?



HILLGROVE SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2022
SECONDARY 2 EXPRESS

CANDIDATE NAME ( ) CLASS [ ] - [ ]

CENTRE NUMBER S [ ][ ][ ][ ] INDEX NUMBER [ ][ ][ ][ ]

SCIENCE

Sections B and C

Candidates answer on the Question Paper.

6 October 2022
1 hour 45 min
08.10 AM to 09.55 AM
(With Section A)

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

SECTION B

Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

SECTION C

Answer **three** questions. Question 11 is in the form of an EITHER / OR question. Only one should be answered.
Write your answers in the spaces provided on the Question Paper.

The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section	**Marks**
A	**30**
B	**40**
C	**30**
TOTAL	**100**

Parent's/ Guardian's Signature: _____

Setter: Mr Tam KK

This document consists of **20** printed pages

Section B
Short Structured Questions [40 marks]

Answer **all** questions. Write your answers in the spaces provided.

1 Fig 1.1 Peter is standing on snow in his snowshoes.
Objects sink into snow if the pressure on the snow exceeds 3000 N/m^2.

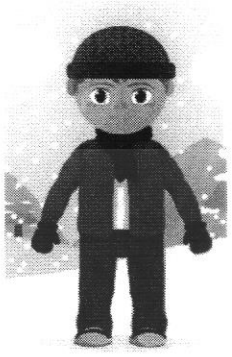


Fig. 1.1

Peter has a weight of 560 N.
Each shoe that he is wearing has a base area of 0.028 m^2.

(a) What is the area of contact between his shoes and the ground?

area of contact = ... m^2 [1]

(b) Calculate the pressure that Peter is exerting on the snow when standing upright.

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

(c) Hence, state whether Peter will sink into the snow.

..... [1]

(d) Fig. 1.2 shows a snowboard that allows Peter to ski on the snow without sinking into it.

Fig 1.2

Explain why Peter does not sink into the snow when standing on the snowboard.

.....

..... [2]

2 Fig. 2.1 shows train tracks buckled due to very hot weather.

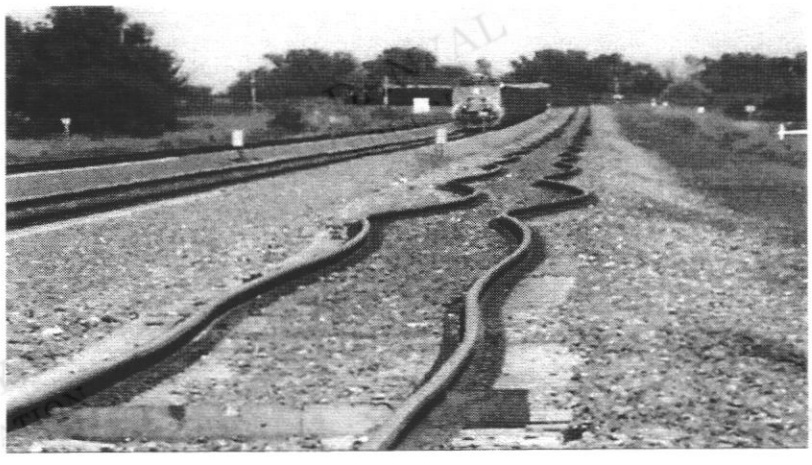


Fig. 2.1

(a) Explain why and how this happened.

.....

..... [2]

(b) State one way to reduce this problem.

.....

..... [1]

3 Fig. 3.1 shows the design of an aluminium heat sink. It is placed over the processor chip of a computer to help it remove heat quickly.

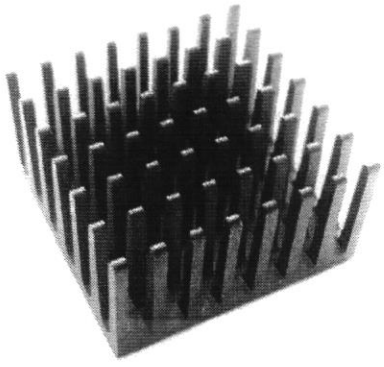


Fig. 3.1

(a) Explain how this heat sink helps to remove heat from the processor quickly by the following methods of heat transfer.

conduction .....

.....

radiation .....

.....

[2]

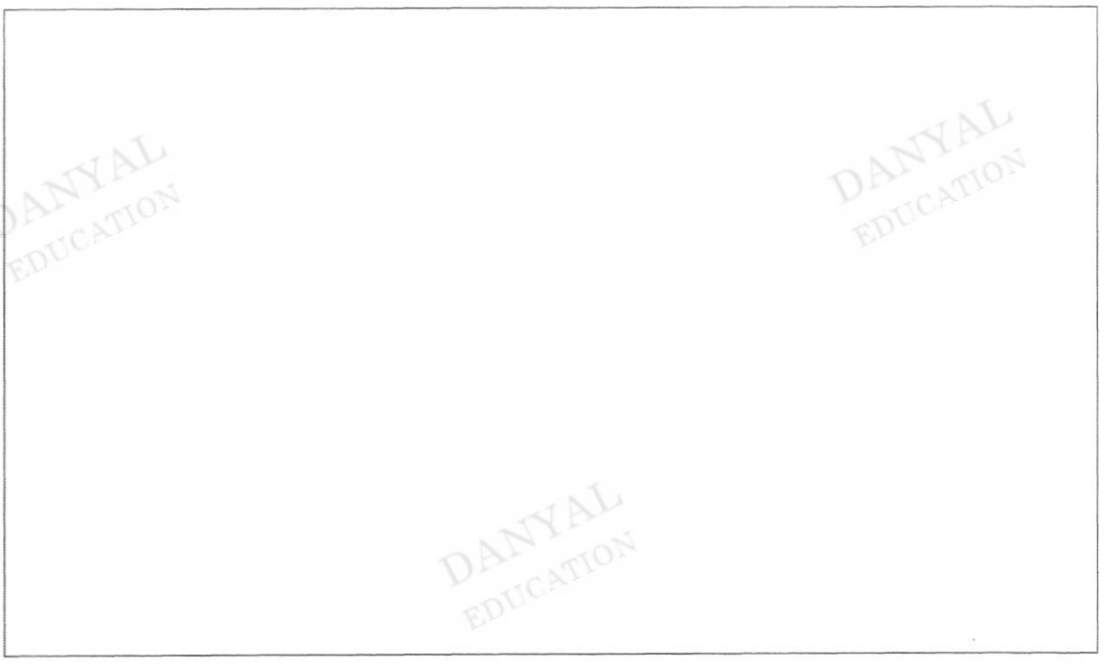
(b) State and explain one way this design can be improved further.

.....

..... [2]

4 In the box below, draw the circuit connecting the following components:

- two cells in series,
- some connecting wires,
- two light bulbs arranged in parallel,
- a voltmeter to measure the voltage of the cells,
- an ammeter to measure the current through one light bulb.



[4]

5 Fig. 5.1 shows the soft drink that contains sodium benzoate and vitamin C.

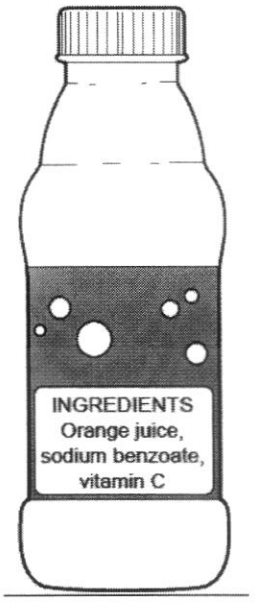


Fig. 5.1

Sodium benzoate can be formed via a neutralisation reaction of benzoic acid with sodium hydroxide. Sodium benzoate is a soluble salt.

(a) Write the word equation for the reaction between benzoic acid and sodium hydroxide.

..... [1]

(b) Benzoic acid also reacts with sodium carbonate to form sodium benzoate, water and a gas.

(i) State the identity of the gas formed.

..... [1]

(ii) Describe a test that can be carried out to identify the gas and state the expected observation.

test .....

.....

observation .....

.....

[2]

6 Fig. 6.1 shows the presence of large, complex nutrients in a food sample as the food passes along the alimentary canal.

The width of the dark strip shows the amount of large complex nutrients present in the respective organs.

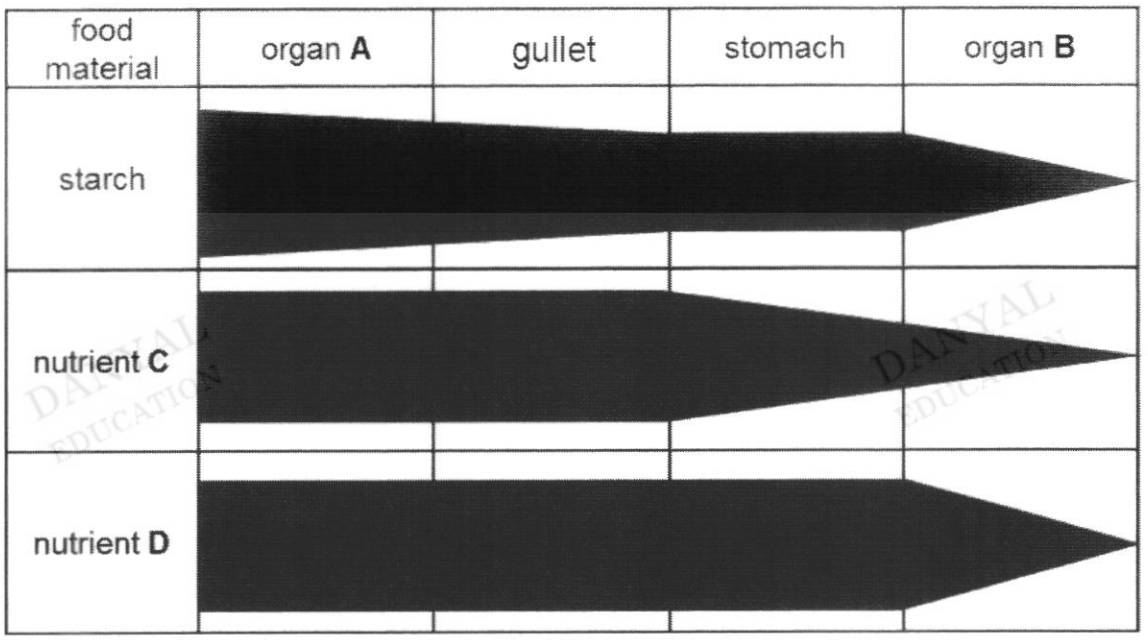


Fig. 6.1

(a) Identify organs **A** and **B**. [2]

organ **A** .....

organ **B** .....

(b) Using the information given in Fig. 6.1, identify nutrients **C** and **D**. [2]

nutrient **C** .....

nutrient **D** .....

(c) Suggest why the amount of starch (carbohydrate) decreases in the gullet even though no enzymes are produced there.

.....

.....

..... [2]

7 Fig. 7.1 shows the human transport system, which carries blood throughout the body.

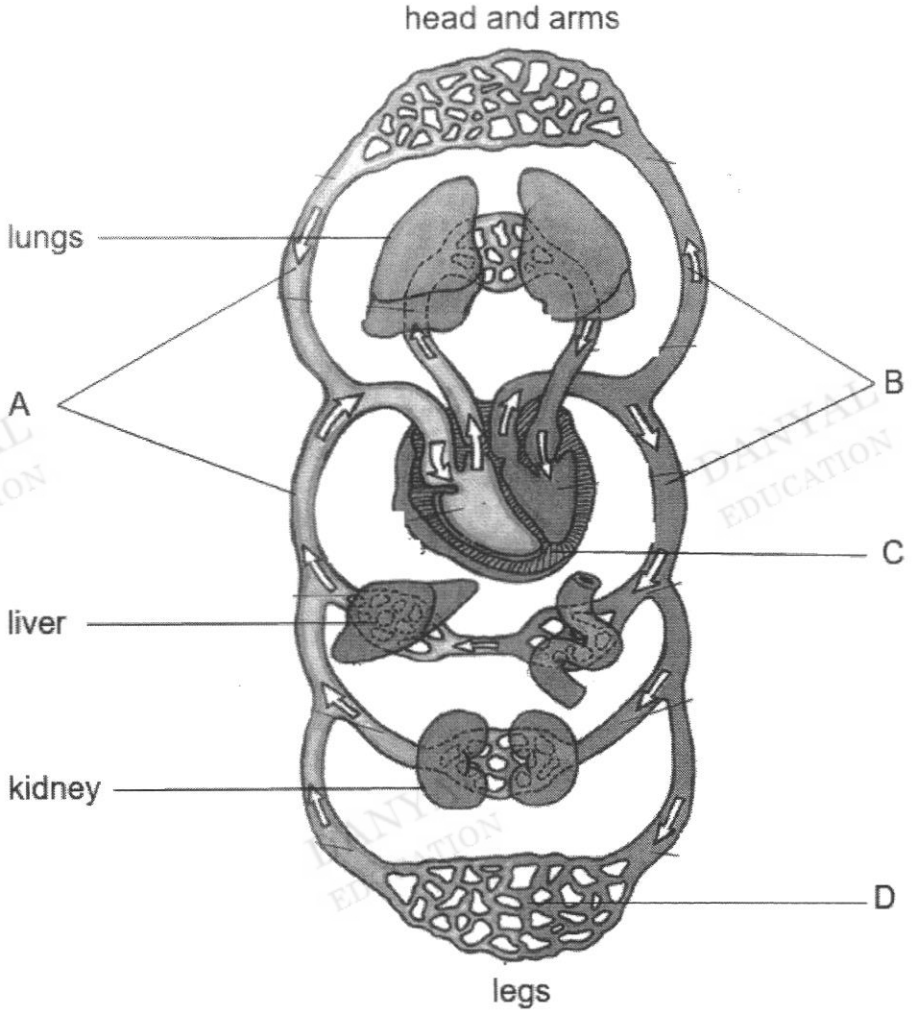


Fig. 7.1

(a) Label the parts **A** to **D**. [4]

A .....

B .....

C .....

D .....

(b) State one difference in the functions of **A** and **B**.

.....

.....

..... [1]

(c) **(i)** Name the gas that is transported by red blood cells from the lungs to the body cells.

..... [1]

(ii) Identify and explain the process that allows the gas in **(c)(i)** to leave the red blood cells and enter other cells in the body.

.....

.....

..... [2]

8 Fig. 8.1 shows apparatus at the start of an experiment to investigate the digestion of fat droplets by enzyme **X**.

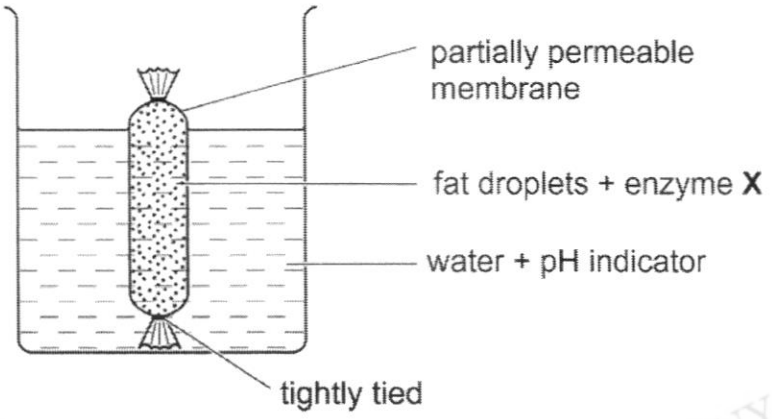


Fig. 8.1

The pH indicator is green in a pH of 7, blue when the pH is above 7 and red when it is below 7.

The apparatus is kept at 37 °C for 20 minutes, during which time the indicator changes colour.

(a) State the identity of enzyme **X**.

..... [1]

(b) Complete the word equation for the digestion of fat droplets by enzyme **X** by giving the names of the products.

fats → ..... + ... [1]

(c) State the colour change of the indicator after 20 minutes. Explain your answer.

colour changes from ..... to ..... [1]

explanation .....

..... [2]

Section C
Long Structured Questions [30 marks]
Answer **all** the questions in this section.
Answer only one of the two alternative questions in **Question 11**.

9 Fig. 9.1 shows part of the food web for the coral reef ecosystem.

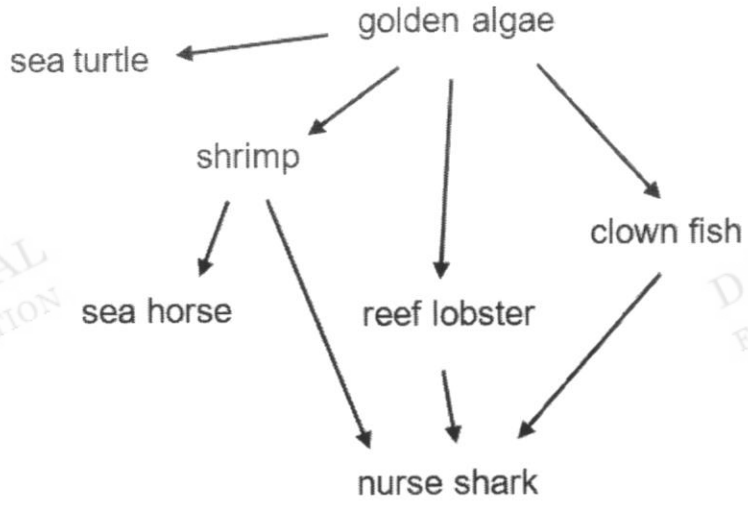


Fig. 9.1

(a) **(i)** With reference to Fig. 9.1, identify a producer and a secondary consumer in the Table 9.2. [2]

Table 9.2

type of consumer	organism
producer	
secondary consumer	

(ii) Based on Fig. 9.1, write down the most energy-efficient food chain.

..... [1]

(b) The following information was obtained from a poster describing coral reef ecosystems:

"The relationship between sea corals and golden algae can be described as mutualism. In the coral reef ecosystem, the sea corals consume a herbivore known as zooplankton. However, sea corals is also a source of food for butterfly fish. The nurse shark is a predator of butterfly fish."

(i) Based on the information, complete the food web in Fig. 9.1 to include the relationships between the organisms listed in the poster. [1]

(ii) Define *mutualism*.

.....

..... [1]

(iii) Explain how sea corals and algae can share a mutualistic relationship by identifying the substances produced by each organism.

.....

.....

..... [1]

(c) Stingrays that consume sea horses were suddenly introduced into the coral reef ecosystem.

Explain how the population of shrimps could be affected.

.....

.....

..... [2]

(d) Fig. 9.3 shows part of a poster that discusses the threats faced by coral reef ecosystems.

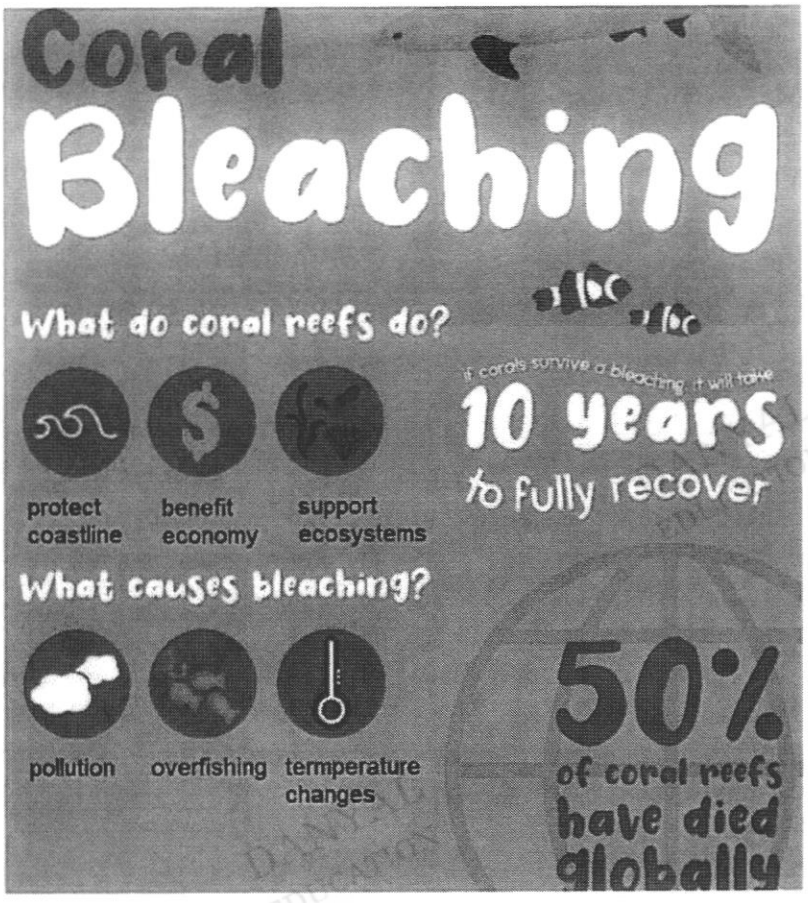


Fig. 9.3

One method to protect the coral reef ecosystem is to implement laws to prevent overfishing so that the balance in the ecosystem is maintained.

State two other steps that we can take to conserve the diversity in coral reef ecosystem.

1 .....

.....

2 .....

.....

[2]

10 Fig. 10.1 shows the ingredients list from a bottle of fruit juice, listing its chemical contents.

Ingredients:
carbonated water
sugar
citric acid
apple flavour
sodium benzoate

Fig. 10.1

(a) Identify one of these chemicals that has a sour taste.

..... [1]

(b) Suggest the pH value of this fruit juice.

..... [1]

(c) Citric acid can react with other compounds to bring about a chemical change.

Describe the term 'chemical change'.

.....

..... [1]

(d) Citric acid can react with carbonates. An example of a common carbonate used in food is sodium carbonate.

(i) Complete the general word equation in the space below. [1]

acid + carbonate ⟶ .....

(ii) Describe what is observed when citric acid reacts completely with an exact portion of sodium carbonate in a test-tube.

..... [1]

(iii) The reaction is tested with both blue litmus paper and red litmus paper before and after the reaction has occurred.

Complete the table to indicate the colour before and after the reaction in **(d)(ii)**. [2]

	before	after
blue litmus paper		
red litmus paper		

(iv) Describe the mass of the products when compared to the mass of the reactants for the reaction in **(d)(ii)**.

..... [1]

(e) The formation of acid rain is another example of an acid reacting with other compounds to bring about a chemical change.

(i) Name a substance that dissolves in rainwater to form 'acid rain'.

..... [1]

(ii) Name an effect of acid rain.

.....

..... [1]

11 EITHER

Fig. 11.1 shows an electric kettle used to boil water for drinking.

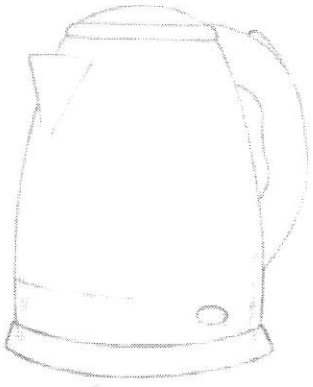


Fig. 11.1

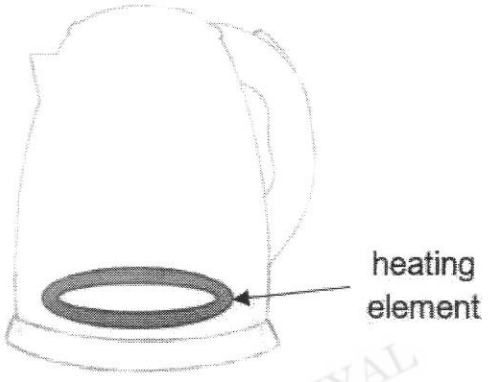


Fig. 11.2

(a) (i) The heating element is placed at the bottom of the kettle.

Describe how the water in the kettle is heated up.

.....

.....

.....

.....

..... [3]

(ii) On Fig. 11.2, draw arrows to show the movement of water in the kettle when it is being heated. [1]

(iii) The body of the kettle is made of a shiny metal.

State how this helps the water in the kettle remain hot for a longer period.

.....

..... [1]

(b) Hot water from the kettle is used to brew a small cup of coffee. The cup used is a double-glass wall cup shown in Fig 11.3. Air is trapped between the glass walls.

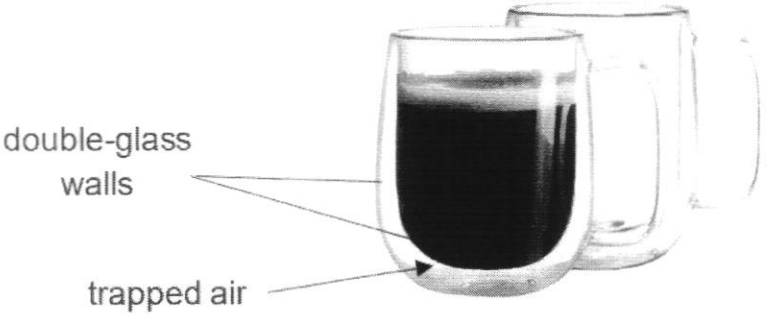


Fig. 11.3

(i) State why the trapped air helps to keep the drink warm for a longer time.

.....

..... [1]

(ii) State what can replace the trapped air which can reduce the transfer of heat even more.

..... [1]

(c) The kettle has a power rating of 2100 W. It takes 6 mins to boil water and is used twice a day.

(i) Calculate the amount of energy in kWh used by the kettle in one week.

energy used = ... kWh [2]

(ii) The cost of electricity is 30.17 cents per kWh. Find the total cost of using the kettle for one week.

cost = $ ..... [1]

11 OR

Fig. 11.1 shows the solar panels that are being installed on the roof of most HDB blocks in Singapore.

Fig. 11.1

(a) (i) State the principle of conservation of energy.

.....

..... [1]

(ii) Describe the energy conversion that takes place in the solar panel.

..... [1]

(iii) State an advantage of using solar panels to generate electricity.

.....

..... [1]

(iv) State a disadvantage of using solar panels to generate electricity.

.....

..... [1]

(b) Fig.11.2 shows an electric fan powered by the electricity generated by the solar panels.

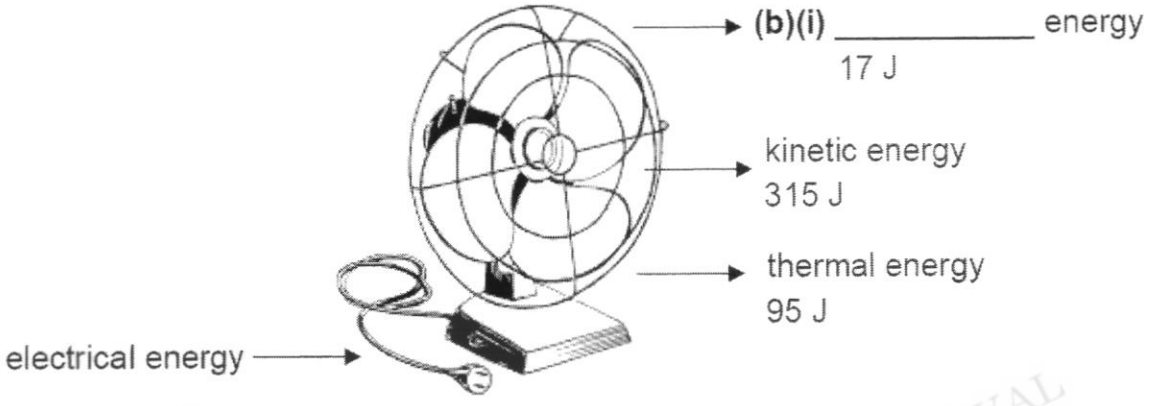


Fig. 11.2

(i) In Fig. 11.2, complete the blank for the energy converted by the fan. [1]

(ii) Calculate the elertrical energy supplied to the fan.

electrical energy = ... J [1]

(iii) Suggest two **different** ways to conserve electricity at home.

1. .....
.....
2. .....
.....

[2]

(c) Fig. 11.3 shows a switch being turned on.

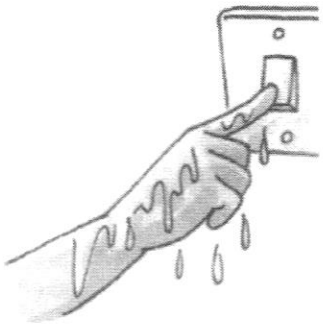


Fig. 11.3

(i) Identify the electrical hazard shown in Fig. 11.3.

..... [1]

(ii) Suggest a precaution that could be taken to prevent the electrical hazard identified in **(c)(i)**.

..... [1]

END OF PAPER

SA2 2022 MARK SCHEME

Subject : Lower Secondary Science
Level : Sec 2E

Section A: Multiple Choice Questions [30 marks]

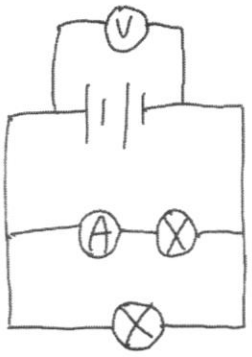
1	2	3	4	5	6	7	8	9	10
C	C	C	C	A	C	C	A	B	C
11	12	13	14	15	16	17	18	19	20
C	B	D	B	D	B	C	C	B	A
21	22	23	24	25	26	27	28	29	30
A	D	B	A	A	D	A	A	A	D

Section B: Short Structured Questions [40 marks]

1	(a)	$0.028 \times 2 = 0.056$	1
	(b)	$P = F / A$ $= 560 / 0.056$ $= 10,000$	1 1
	(c)	Peter will sink into the snow. (> 3,000 N/m^2)	1
	(d)	His weight/downward force is spread over a larger contact area. Hence, pressure exerted on the snow is lesser	1 1
		Total	6

2	(a)	The metal tracks gained heat and expanded under hot weather. There is no room for expansion, so the tracks bent/warped/buckled.	1 1
	(b)	introduce expansion gaps between railway tracks to provide space for expansion	1
		Total	3

3	(a)	aluminium is a good conductor of heat which allows heat to be conducted away quickly large surface area allows heat to be radiated away quickly/higher rate of radiation	1 1
	(b)	paint the heat sink black black is a good/better emitter of radiation *OR* place a fan over the heat sink blow hot air away from the heat sink quickly	1 1
		Total	4

4		• 2 cells in series • 2 bulbs arranged in parallel • 1 voltmeter parallel/across to 2 cells • 1 ammeter in series with 1 light bulb	1 1 1 1
		Total	4

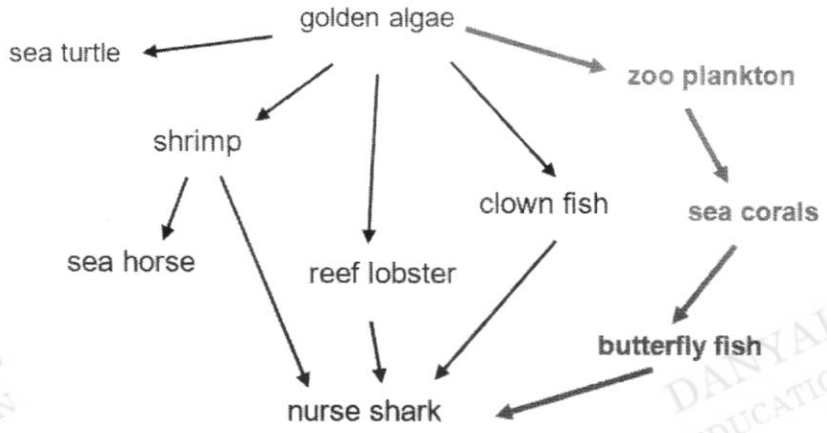
5	(a)	benzoic acid + sodium hydroxide → sodium benzoate + water	1
	(b) (i)	carbon dioxide	1
	(ii)	bubble the gas into limewater/aqueous calcium hydroxide White precipitate formed in limewater	1 1
		Total	4

6	(a)	A: mouth B: small intestine	1 1
	(b)	C: proteins D: fats / lipids	1 1
	(c)	carbohydrase / amylase from the mouth continues to digest/break down the starch in the food/bolus as it travels to the stomach	1 1
		Total	6

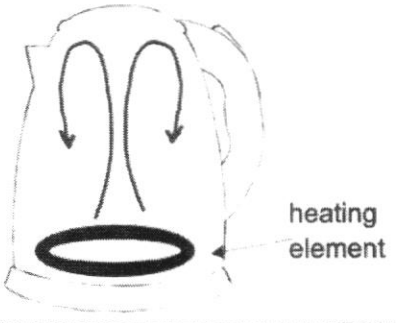
7	(a)	A: veins B: arteries C: heart D: capillaries	1 1 1 1
	(b)	• A transport blood towards the heart while B transport blood away from the heart. • A transport deoxygenated blood while B transport oxygenated blood.	1 (any 1)
	(c) (i)	oxygen	1
	(ii)	diffusion because there is a higher concentration of oxygen in the red blood cells than in the body cells	1 1
		Total	8

8	(a)	lipase	1
	(b)	glycerol + fatty acids	1
	(c)	green to red fatty acids (acidic) are small enough to diffuse/move out of the partially permeable membrane by diffusion causing the indicator to change colour	1 1 1
		Total	5

Section C: Long Structured Questions [30 marks]

9	(a)	(i)	golden algae sea horse / nurse shark	1 1
		(ii)	golden algae → sea turtle	1
	(b)	(i)		1
		(ii)	the relationship between two organisms in which both organisms benefit from each other	1
		(iii)	Sea corals give out carbon dioxide during respiration which algae needs for photosynthesis. + Algae gives out oxygen during photosynthesis which sea corals need for respiration.	1
	(c)		The population of shrimps will increase. When stingrays consume sea horses, the population of sea horses decreases/less sea horses//less predators to feed on shrimps.	1 1
	(d)		• introduce/implement laws to prevent/deter pollution of sea waters with coral reef • reduce carbon emission/greenhouse gases emissions to reduce effects of global warming	1 1
			Total	10

10	(a)		citric acid	1
	(b)		any values between 2 to 6 (i.e., 2, 3, 4, 5, 6)	1
	(c)		• formation of new product(s) • irreversible • heat may be gained or lost	1 (any 1)
	(d)	(i)	salt + water + carbon dioxide	1
		(ii)	effervescence / bubbling in the solution	1
		(iii)	red / blue red / red	1 1
		(iv)	same	1
	(e)	(i)	sulfur dioxide / oxides of nitrogen	1
		(ii)	kills plants and fishes / harms aquatic life / damages/corrodes buildings and statues	1
			Total	10

11 E	(a)	(i)	water at the bottom is heated, expands, becomes less dense and rises. cooler denser water at the top sinks the process repeats forming a convection current	1 1 1
		(ii)	 reasonable diagram showing convection current	1
		(iii)	shiny silvery surface is a poor emitter of radiation	1
	(b)	(i)	air is a poor conductor of heat	1
		(ii)	vacuum *(to prevent heat lost by conduction and convection)*	1
	(c)	(i)	E = P × t = (2100/1000) kW × (6/60) h × 2 × 7 = 2.94 kWh *(3 s.f.)*	 1 1
		(ii)	total cost = E × unit cost = 2.94 ~~kWh~~ × \$(30.17/100) / ~~kWh~~ = \$0.89 *(2 d.p.)*	 1
			Total	10

11 O	(a)	(i)	energy cannot be created or destroyed + can only be converted from one form to another/transferred from one object to another	1
		(ii)	light/solar energy → electrical energy	1
		(iii)	does not release air pollutants/harmful gases/greenhouse gases	1
		(iv)	electricity can only be generated when there is sufficient sunlight/supply depends on weather conditions and the season	1
	(b)	(i)	sound	1
		(ii)	17 + 315 + 95 = 427 ~~J~~	1
		(iii)	• Buy electrical appliances that have energy labels with ≥ 3 ticks. • Switch off the air conditioner after a short while and then switch to a fan. • Switch off the water heater after use. • Use a vacuum flask instead of an electric hot water dispenser. • Switch off the power socket lo reduce standby power.	2 any 2
	(c)	(i)	damp conditions/touching a switch with wet hands	1
		(ii)	do not touch the switch with wet hands/ dry the hands before turning on the switch	1
	Total			10