2025.S26

2025J057C1EL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Cycle Final Examination 2025

Science

Common Level

Monday 9 June Morning 9:30 – 11:30

360 marks

Examination Number

Date of Birth DD/MM/YY

For example, 3rd February 2005 is entered as 03 02 05

Centre Stamp

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Science 2025

Model answers based on the SEC marking scheme.
Not an official SEC completed paper.

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Instructions

There are two sections in this examination paper.

Section A	150 marks	10 questions
Section B	210 marks	4 questions

Answer all parts of all questions.

You may ask the superintendent for a copy of the Formulae and Tables booklet. You must return it at the end of the examination. You are not allowed to bring your own copy into the examination.

Not all the questions carry equal marks. The number of marks for each question is stated at the top of the question.

Write your answers in the spaces provided in this booklet. You are not required to use all of the space provided. There is extra space at the end of Section A and at the back of the booklet. Label any extra work clearly with the question number and part.

This examination booklet will be scanned and your work will be presented to an examiner on screen. Anything that you write outside of the answer areas may not be seen by the examiner.

Write your answers in blue or black pen. You may use pencil for graphs and diagrams only.

Section A — 150 marks

Question 1 **(15 marks)**

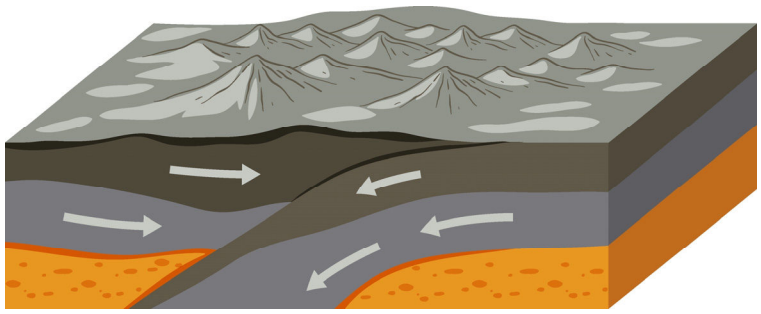
Many factors can influence the Earth's climate. These factors can be natural (i.e. not caused by humans) *or* mainly due to human activity.

Some examples of these factors are listed in the table below.

Decide if each of the factors are **natural** *or* **mainly due to human activity** by putting a tick (✓) in the correct column.

Factor	Natural	Mainly due to human activity
Ocean currents	✓	
Volcanic eruptions	✓	
Cutting down trees		✓
Movement of tectonic plates	✓	
Burning of fossil fuels		✓




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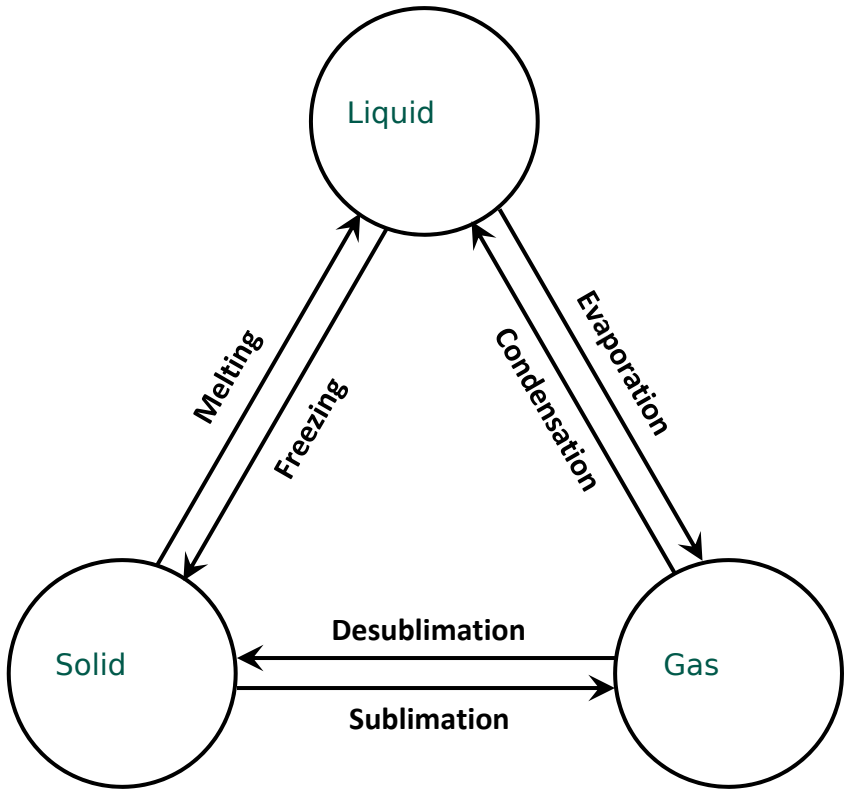
WHY / HOW

Natural processes and human activities can both affect climate.

Question 2 **(15 marks)**

The diagram below shows the processes involved in the changes of state of matter.
The diagram is incomplete.

(a) Write the words **Solid**, **Liquid** and **Gas** into the correct circles to complete the diagram.



(b) Are the processes shown in the diagram examples of physical *or* chemical changes?
Put a tick (✓) in the correct box.

Physical	☑
Chemical	☐

Justify your answer.

No new substance is formed. The substance remains chemically the same.

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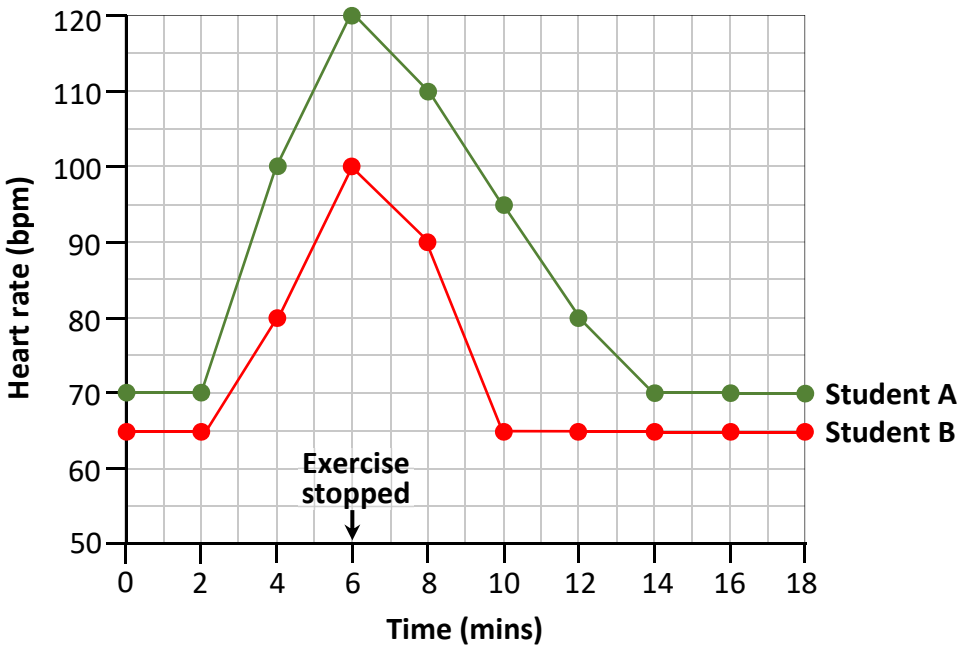
WHY / HOW

A change of state is physical: particles rearrange but remain the same substance.

Question 3 **(15 marks)**

Two students, **A** and **B**, investigated the effect of exercise on heart rate (the number of heart beats per minute, bpm).

They monitored their heart rates at rest for 2 minutes. They then monitored their heart rates while exercising and for a number of minutes after exercising had stopped. The results of their investigation are shown in the graph below.



(a) Which student, **A** *or* **B**, had a lower heart rate at the start of the investigation?

Student B

(b) How much higher was the heart rate of student **A** compared to student **B** after 6 minutes?

20 beats per minute

(c) For how many minutes did the students exercise? Put a tick (✓) in the correct box.

2 ☐ 4 ☑ 6 ☐ 8 ☐

(d) In general, heart rate returns to normal more quickly in people who exercise frequently.
Which student, **A** *or* **B**, do you think is likely to exercise more frequently?
Put a tick (✓) in the correct box.

Student **A** ☐ Student **B** ☑

(e) Other than frequent exercise, name a lifestyle factor which contributes to good heart health.

Eat a healthy, balanced diet.

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WHY / HOW

Compare recovery to each student's own resting heart rate. A quicker return suggests better fitness.

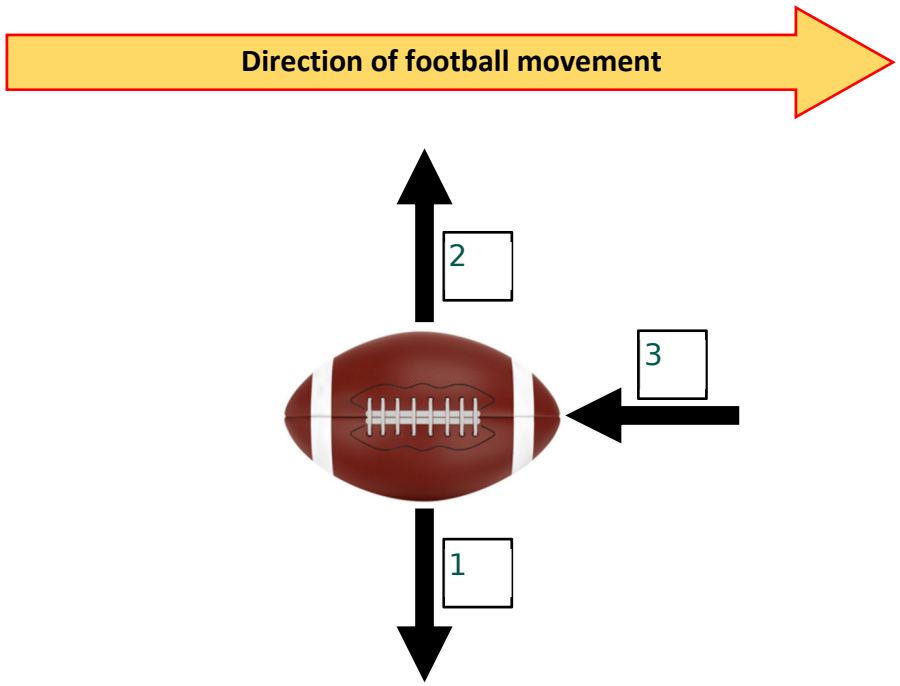
Question 4 **(15 marks)**

The image shows a person throwing a football.
Three forces act on the football as it moves through the air.
These forces are listed and numbered in the table below.

Force acting on the ball	Number
Weight	**1**
Lift	**2**
Friction (air resistance)	**3**



(a) Match each arrow to the type of force acting on the ball as it moves through the air by writing the numbers **1**, **2** and **3** in the correct boxes on the diagram.



(b) The mass of the football was 0.4 kg. Acceleration due to gravity is 9.8 m/s^2.
Calculate the weight of the football. Include the unit for your answer.

Calculation:
Weight = mass × gravitational field strength

W = 0.4 × 9.8

W = 3.92 N

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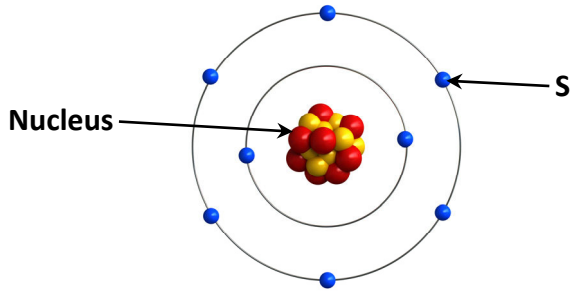
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WHY / HOW

Mass is measured in kg; weight is a force in newtons. Arrows show force direction.

Question 5 **(15 marks)**

Atoms contain subatomic particles. The diagram below represents the structure of the atom proposed by Niels Bohr in 1913.



(a) **(i)** In Bohr's model, subatomic particle **S** orbits the nucleus and has a negative charge. What is the name of this particle? Put a tick (✓) in the correct box.

Electron ☑ Neutron ☐ Proton ☐

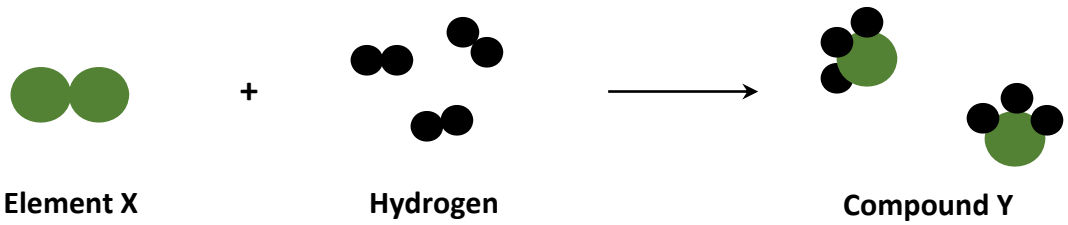
(ii) Which subatomic particle is located in the nucleus of an atom and has no charge? Put a tick (✓) in the correct box.

Electron ☐ Neutron ☑ Proton ☐

(iii) Bohr's model of the atom is often referred to as a 'planetary model'. Suggest a reason for this.

Electrons orbit the nucleus, like planets orbiting the Sun.

(b) Elements consist of atoms. The diagram below represents a chemical reaction between two elements. Element **X** reacts with hydrogen to form compound **Y**.



(i) Identify element **X** by putting a tick (✓) in the correct box below. (You may use page 79 of the *Formulae and Tables* booklet to help you answer this question.)

Lithium ☐ Magnesium ☐ Nitrogen ☑

(ii) Hence, write the chemical formula for compound **Y**.

NH_3

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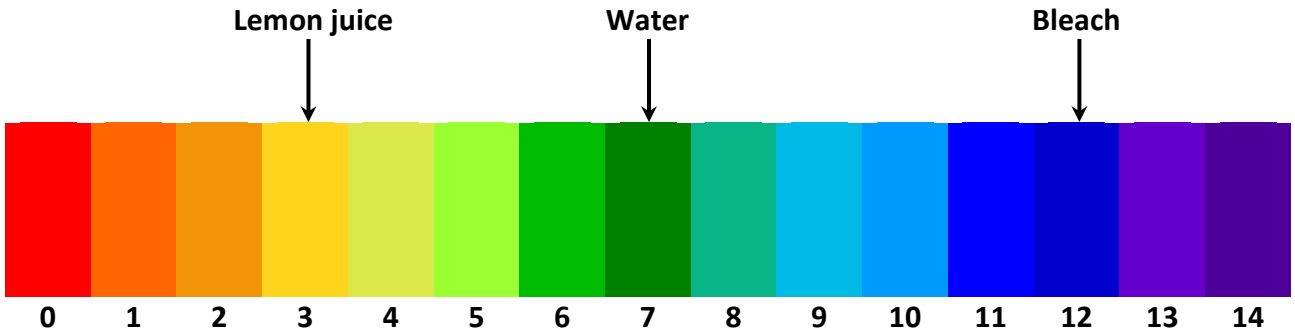
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WHY / HOW

Bohr's planetary analogy is a simplified model. NH_3 means one nitrogen atom to three hydrogen atoms.

Question 6 **(15 marks)**

The diagram below shows the pH of some common household substances.



(a) Classify each of the substances in the diagram as acidic *or* basic *or* neutral.

Substance	Acidic *or* Basic *or* Neutral
Lemon juice	Acidic
Water	Neutral
Bleach	Basic

(b) Some insect stings are acidic and some are basic.

A type of cream can be used to treat (by neutralisation) some insect stings. One of the ingredients in the cream is sodium bicarbonate, which is a base.

Which type of sting (acidic *or* basic) could this cream be used to treat?

Acidic



(c) Identify one product from the list below which is commonly formed when an acid and a base react.

Water **Oxygen** **Hydrogen**

Water

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WHY / HOW

An acid and a base can neutralise each other. The sting example is the simplified exam model.

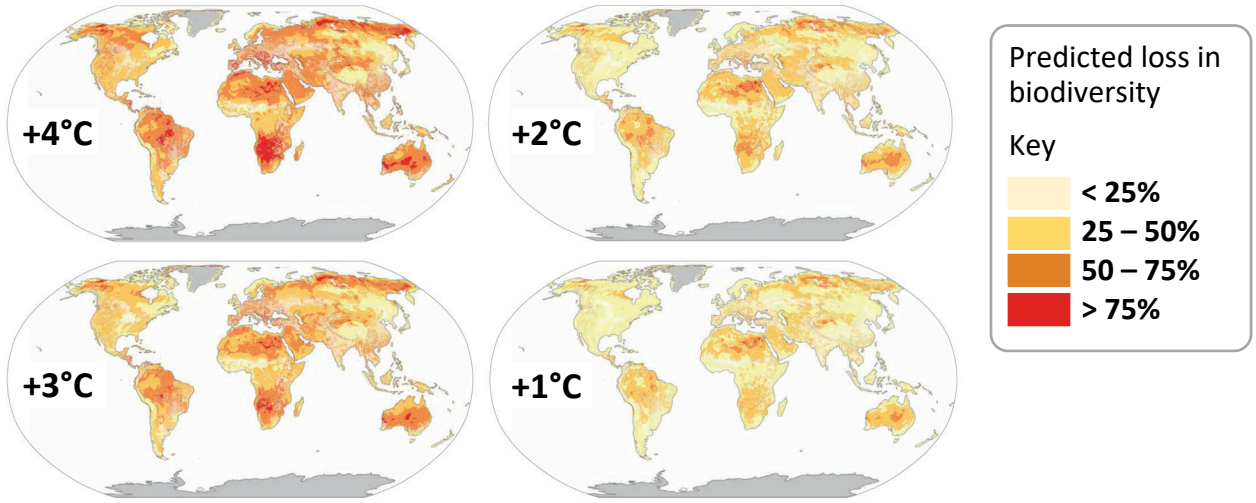
Question 7 **(15 marks)**

Organisms live in ecosystems.

(a) State one way in which humans can benefit from ecosystems.

Ecosystems provide food for humans.

Global warming is threatening biodiversity (variety of life on Earth).



Adapted from *Living Planet Report, 2022*, worldwildlife.org

(b) According to the chart, what is the relationship between global temperatures and the variety of life on Earth?

Greater global temperature increases are associated with greater predicted
biodiversity loss.

(c) Other than reducing our use of fossil fuels, describe two ways in which humans can conserve biodiversity.

1. Protect natural habitats.
2. Reduce pesticide pollution.

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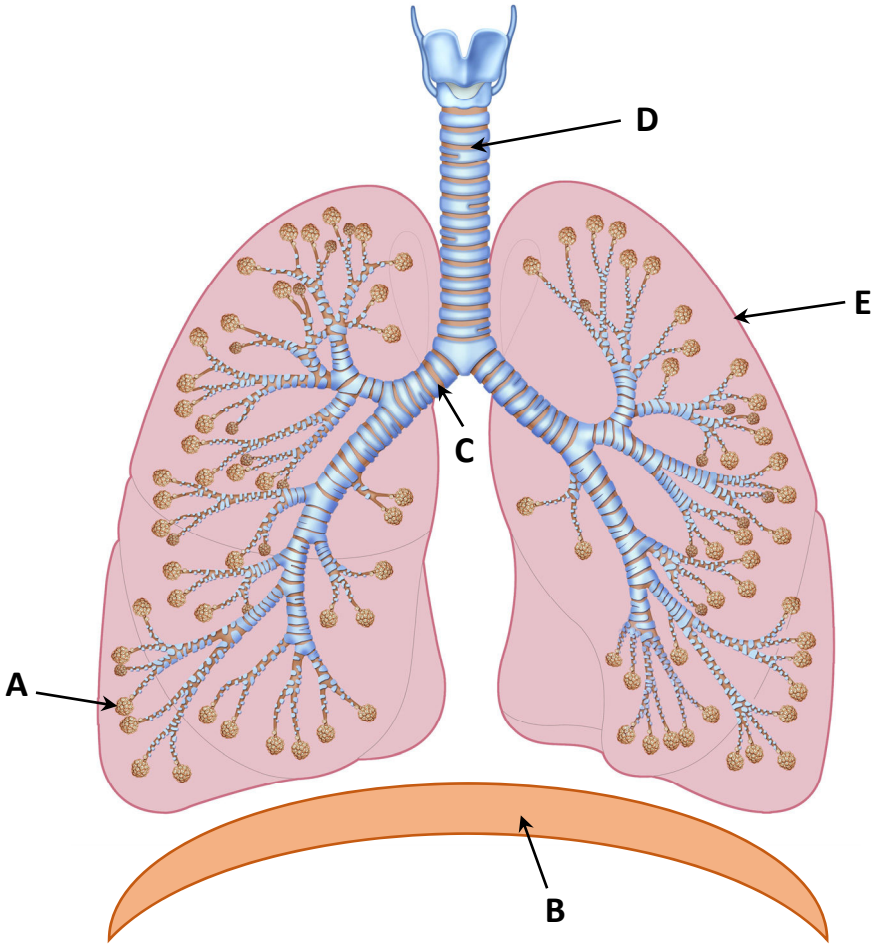
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WHY / HOW

Read the map key: darker colours represent greater predicted loss.

Question 8 **(15 marks)**

The diagram shows the human breathing system.



Complete the table by matching the words in the list below to the letters in the diagram.

Diaphragm **Trachea** **Bronchus** **Lung** **Alveolus**

Letter	Part of breathing system
A	Alveolus
B	Diaphragm
C	Bronchus
D	Trachea
E	Lung

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WHY / HOW

Gas exchange happens in alveoli. The diaphragm helps change chest volume.

Question 9 (15 marks)

Time, mass, temperature and density are fundamental properties of the physical world.

The passage below describes these properties.

The following words are missing from the passage:

Density Temperature Mass Acceleration Time

Write the missing words in the spaces provided.

Mass _____ is a measure of the amount of matter in an object and affects an object's resistance to acceleration _____.

Density _____ is a measure of the mass per unit volume of an object and is related to the ability of a substance to float in a liquid.

Time _____ is a dimension in which events unfold continuously, forming the basis for understanding change and motion.

Temperature _____ is directly proportional to kinetic energy of the particles within a substance and affects the physical state and behaviour of a substance.

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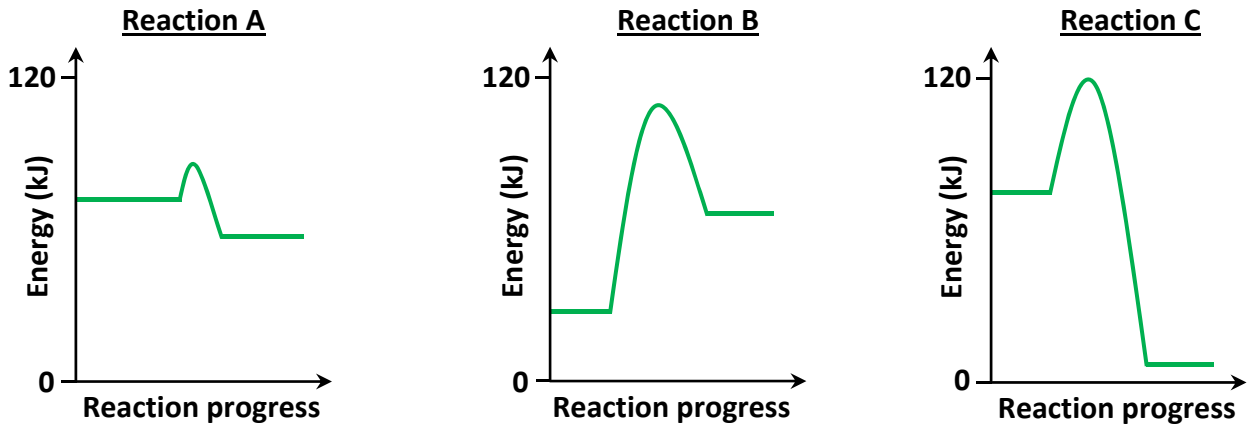
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WHY / HOW

Density = mass / volume. Temperature relates to the mean kinetic energy of particles.

Question 10 **(15 marks)**

Energy profile diagrams for three different chemical reactions, **A**, **B** and **C** are shown below.



(a) In which reaction, **A** *or* **B** *or* **C**, do the reactants have the lowest energy?

B

(b) Which reaction, **A** *or* **B** *or* **C**, gives out the most heat?

C

(c) Which reaction, **A** *or* **B** *or* **C**, has the lowest activation energy (requires the least amount of energy to get started)?

A

(d) Which of the following statements about activation energy is true?
Put a tick (✓) in the correct box.

A low activation energy results in a reaction which will be fast.	☑
A low activation energy results in a reaction which will be slow.	☐

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WHY / HOW

Activation energy is the rise from the reactants to the peak. Lower barriers usually mean faster reactions when other factors are comparable.

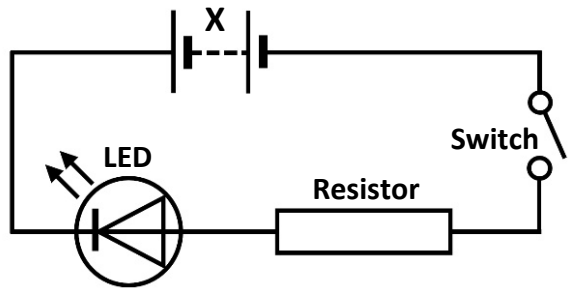
Additional writing space for Section A
Label all work clearly with the question number and part.

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Section B — 210 marks

Question 11 **(30 marks)**

A student set up the circuit shown to investigate the operation of a light emitting diode (LED).



(a) Identify component **X** in the circuit. You may use the symbols on pages 72 – 78 of the *Formulae and Tables* booklet to help you answer this question.

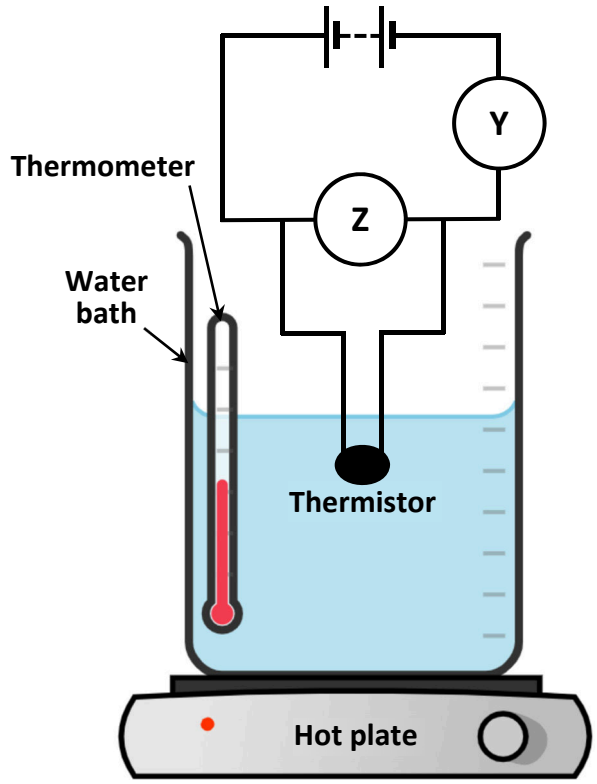
Battery

(b) The student made the following statements about the circuit above.
Indicate if each statement is true or false by putting a tick (✓) in the correct column.

Statement	True	False
The resistor is connected in series with the LED.	✓	
When the switch is closed, the LED will emit light.		✓
The resistor increases the current flowing in the LED.		✓

A thermistor is a type of resistor.

The apparatus shown was used to collect the data needed to calculate the resistance of a thermistor at different temperatures.



(c) **(i)** Identify instrument **Y** which was used to measure the current in the circuit.

Ammeter

(ii) Identify instrument **Z** which was used to measure the voltage across the thermistor.

Voltmeter

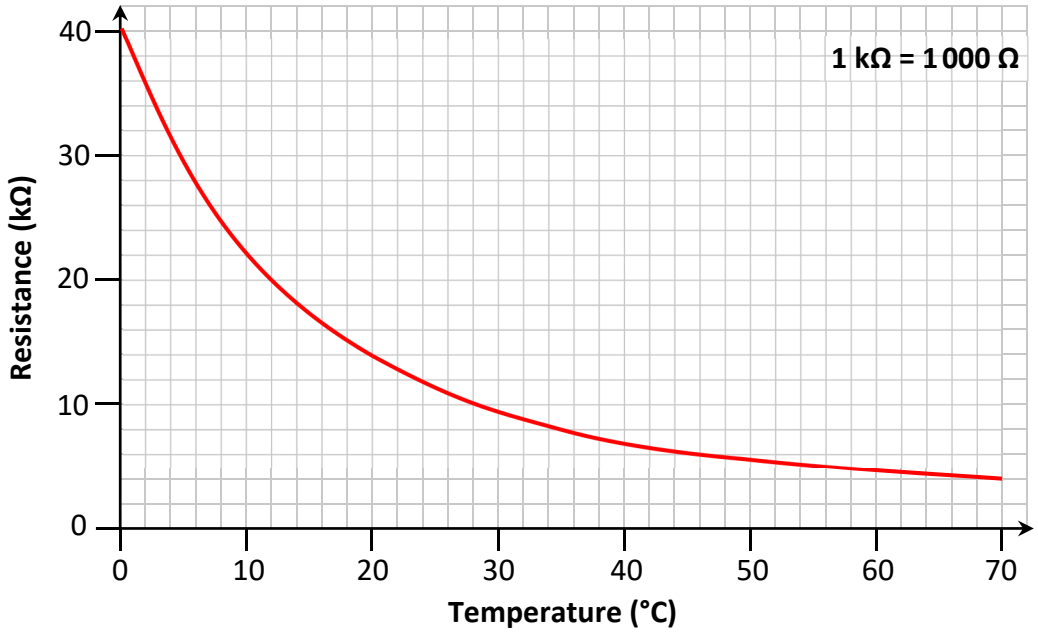
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WHY / HOW

An LED conducts in one direction. An ammeter goes in series; a voltmeter goes in parallel.

The resistance of the thermistor was calculated using measurements for voltage and current taken at various temperatures. The graph below shows how the resistance varied with temperature.



(d) **(i)** Put a tick (✓) in the box beside the statement which correctly finishes the following sentence:

When the thermistor was heated from 0 °C to 20 °C,

its resistance increased by 14 kΩ ☐

its resistance decreased by 14 kΩ ☐

its resistance decreased by 26 kΩ ☑

its resistance decreased by 36 kΩ ☐

(ii) At one stage of the investigation, the current in the thermistor was 0.0004 A and the voltage across it was 8 V. Using this data, calculate the **resistance** of the thermistor at this stage. You may use page 61 of the *Formulae and Tables* booklet to help you answer this question.
Hence, use the graph above to determine the **temperature** of the thermistor when these readings were taken.

Calculation:
R = V / I

R = 8 / 0.0004 = 20 000 Ω = 20 kΩ

From the graph: temperature ≈ 12 °C.

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WHY / HOW

Use amperes in V = IR. Find 20 kΩ on the vertical axis, then read the matching temperature.

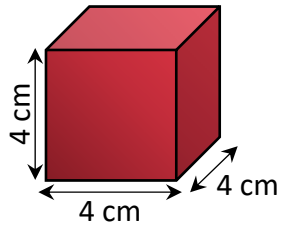
Question 12 **(60 marks)**

Objects can have the same volume but different surface areas.

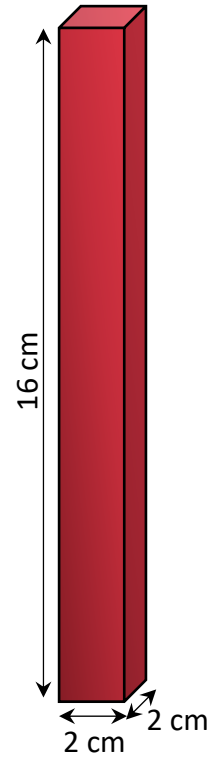
The diagram shows two solid objects, **A** and **B**.
Both objects have a volume of 64 cm^3.

(a) **(i)** Explain how the volume of either of these objects could be calculated.

Volume = length × width × height



Object A



Object B

(ii) The total surface area of object **A** is 96 cm^2.
Calculate the total surface area of object **B**.

Calculation:
Two ends: 2 × (2 × 2) = 8 cm^2

Four long faces: 4 × (16 × 2) = 128 cm^2

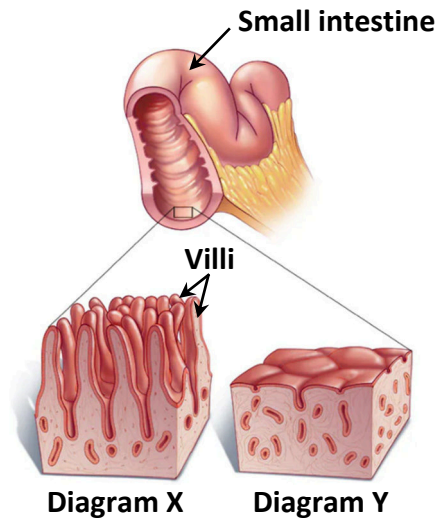
Total surface area = 136 cm^2

The diagram shows part of the small intestine.
One of the functions of the small intestine is to absorb digested nutrients into the blood.

Diagram **X** shows a healthy small intestine.
Diagram **Y** shows the small intestine of a person with a digestive disorder.

(b) Using your knowledge of surface area, explain why people who have this disorder may be under-nourished.

Damaged villi have a smaller surface area.
Fewer digested nutrients can be absorbed
into the blood, so the person may be
under-nourished.



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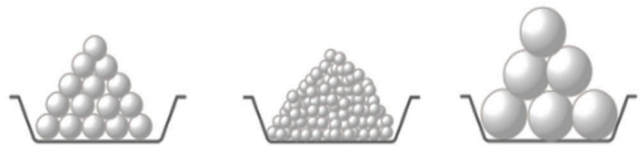
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WHY / HOW

Surface area affects exchange. Villi provide a large area for absorption.

The rate of chemical reactions is influenced by surface area.

The diagram shows three dishes, **1**, **2** and **3**. Each dish contains 2 g of marble chips.



(c) **(i)** Name an instrument that could be used to measure 2 g of marble chips.

Balance

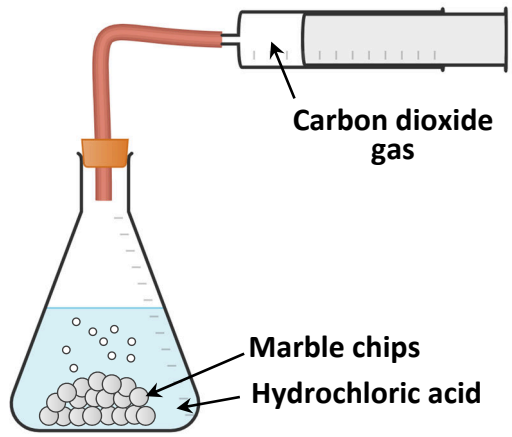
(ii) Which dish contains marble chips with the largest total surface area?
Put a tick (✓) in the correct box.

Dish **1** ☐ Dish **2** ☑ Dish **3** ☐

Marble chips react with hydrochloric acid to produce carbon dioxide gas.

A group of students was asked to investigate the effect of marble chip size on the rate of this reaction.

They used the apparatus shown on the right.



Some of the variables that might change *or* be kept constant during this investigation are listed below.

The concentration of hydrochloric acid	**The size of the marble chips**
The volume of gas produced each minute	**The loudness of the noise in the room**
The temperature of the acid	**The total mass of the marble chips**

(d) **(i)** From the list, identify three variables which the students should have kept constant during the investigation.

1. Concentration of hydrochloric acid
2. Temperature of acid
3. Total mass of marble chips

(ii) From the list, identify one relevant variable which changed during the investigation.

Size of marble chips

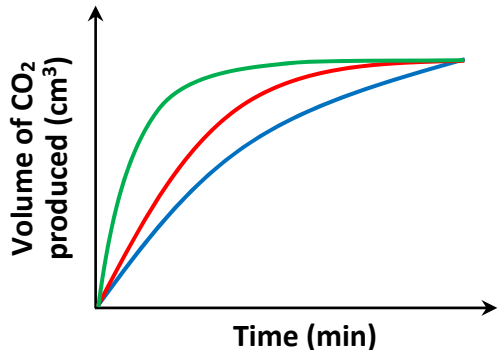
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WHY / HOW

Change chip size and keep the other relevant conditions constant for a fair test.

(e) The graph below shows the results obtained by the students.



(i) Which of the curves (green *or* red *or* blue) on the graph corresponds to the reaction with the slowest rate? Justify your answer.

Blue: its initial gradient is smallest, so gas is produced most slowly.

(ii) Which of the curves (green *or* red *or* blue) on the graph corresponds to the reaction which finished first? Justify your answer.

Green: it reaches its plateau first.

(f) The students collected carbon dioxide gas in this investigation.
Describe how you would produce another common gas in the laboratory, including how you would test the gas to confirm its identity.

Gas: oxygen.
Add manganese dioxide catalyst to hydrogen peroxide
in a flask. Fit a bung and delivery tube. Collect the gas
in a gas syringe (or over water).
Test with a glowing splint: oxygen relights it.

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WHY / HOW

Gradient shows rate. A plateau means no more gas is being produced.

Question 13 **(60 marks)**

The table below shows data comparing four of the planets in our solar system – Venus, Mercury, Mars and Earth.

Property	Venus	Mercury	Mars	Earth
Acceleration due to gravity (m/s^2)	8.9	3.7	3.7	9.8
Time taken to rotate on its own axis (Earth days)	243	59	1	1
Time taken to orbit the Sun (Earth days)	225	88	687	365
Mass ($\times 10^{24}$ kg)	4.87	0.330	0.642	5.97
Diameter (km)	12 104	4879	6792	12 756
Volume ($\times 10^{10}$ km^3)	92.84	6.08	16.31	108.32
Density (kg/m^3)	5243	5429	3934	5513
Mean surface temperature (°C)	464	167	– 65	15
Distance from the Sun ($\times 10^6$ km)	108.2	57.9	227.9	149.6
Number of moons	0	0	2	1

(a) Based only on the data above, indicate if each statement below is true *or* false by putting a tick (✓) in the correct column.

Statement	True	False
Acceleration due to gravity is the same on Mars and Mercury.	✓	
The planet with the smallest density has the largest volume.		✓
The number of moons orbiting the planets decreases the further the planets are from the Sun.		✓
Mars has the lowest mean surface temperature and is furthest from the Sun.	✓	
The planet with the smallest mass is the planet furthest from the Sun.		✓
The planet with the largest diameter is the planet which takes the longest to orbit the Sun.		✓
Venus takes longer to rotate on its own axis compared to the time it takes to orbit the Sun.	✓	
An eclipse can occur on Mercury.		✓

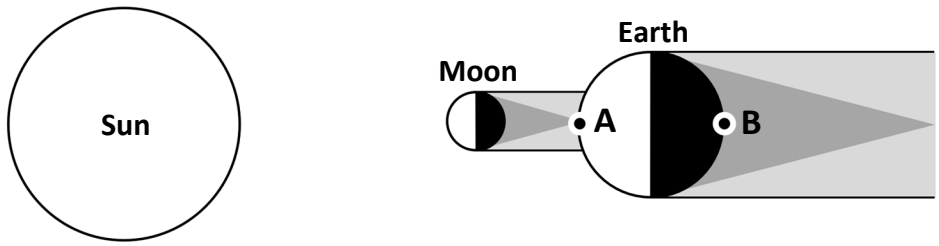
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WHY / HOW

Use the supplied data, even where a general rule seems tempting.

The diagram below shows the positions of the Sun, the Moon and Earth when an eclipse was observed from Earth (size and distance are not to scale).
Positions **A** and **B** are locations on Earth's surface.



(b) Which statement correctly describes the type of eclipse that was occurring and the position on Earth where this eclipse was observed? Put a tick (✓) in the correct box.

A lunar eclipse was observed from position **A**. ☐

A lunar eclipse was observed from position **B**. ☐

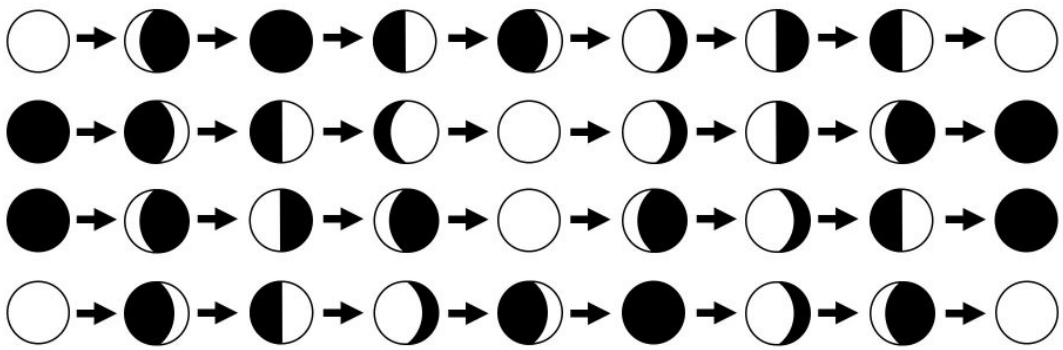
A solar eclipse was observed from position **A**. ☑

A solar eclipse was observed from position **B**. ☐

(c) Name the phase of the Moon visible from Earth at position **A**.

New Moon

(d) Which diagram sequence below shows the correct order of lunar phases as viewed from Earth for a period of one lunar cycle? Put a tick (✓) in the correct box.



☐

☑

☐

☐

(e) How many complete revolutions does the Moon make around the Earth each month?

One complete revolution

(f) Explain why total eclipses do not occur every time the Moon revolves around the Earth.

The Moon's tilted orbit prevents alignment every month.

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WHY / HOW

A solar eclipse occurs when the Moon blocks sunlight. The Moon's tilted orbit explains why this is not monthly.

Space agencies are working together to set up a lunar time zone using atomic clocks.

(g) Atomic clocks measure time using the vibration of atoms.
Discuss another technological application of physics. In your answer, you should refer to the impact your example has on science, society and the environment.

Name of technological application:
Earth-observing satellites
Impact on science:
Provide observations and data for climate research.
Impact on society:
Improve weather forecasts and warnings, helping people prepare for storms.
Impact on the environment:
Monitor deforestation and other environmental changes. Launches and space
debris can also have environmental impacts.

(h) Discuss, using three examples, the future role of space exploration in society.

1. Research can increase our knowledge of the universe and the origins of
planets.
2. Satellite technologies can improve worldwide communication and
navigation.
3. International space missions can encourage cooperation and shared
scientific progress.

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WHY / HOW

Explain consequences, rather than only naming technologies.

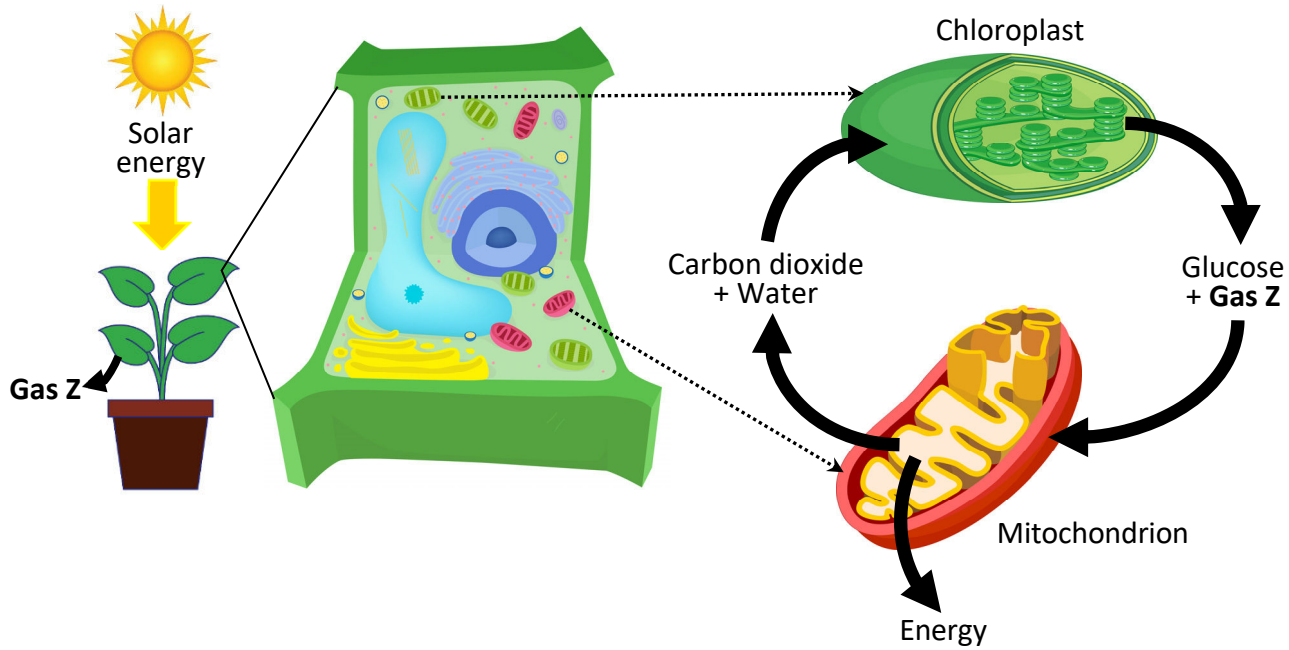
Question 14 **(60 marks)**

Photosynthesis and respiration are biological processes.

(a) What is meant by the term *biological*?

Relating to living things.

The diagram below shows the relationship between photosynthesis and respiration in a plant cell.



(b) **(i)** Name the part of the cell where photosynthesis takes place.

Chloroplast

(ii) Name the part of the cell where respiration takes place.

Mitochondrion

(iii) Glucose reacts with gas **Z** in the mitochondrion. Identify gas **Z**.

Oxygen

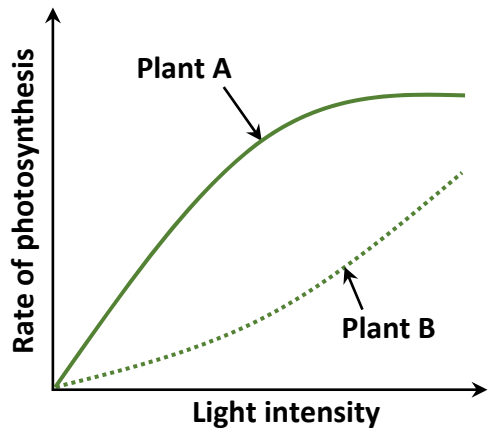
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WHY / HOW

Photosynthesis stores energy in glucose; respiration releases usable energy from glucose.

(c) The graph on the right shows the relationship between light intensity and the rate of photosynthesis for two different plants, **A** and **B**.



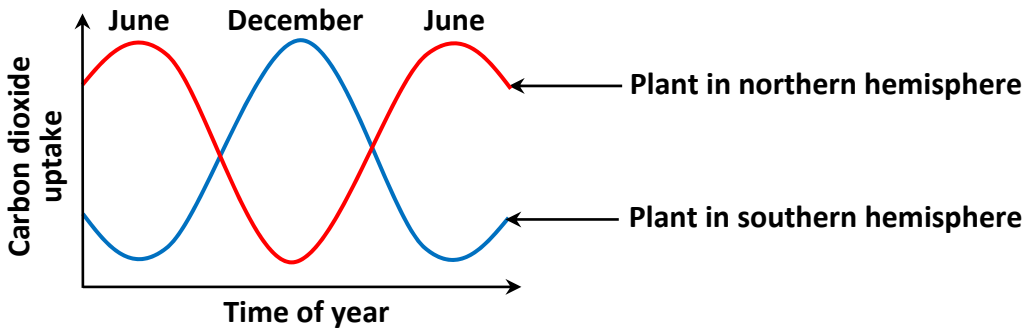
(i) Explain the relationship between light intensity and the rate of photosynthesis for plant **B**.

The rate of photosynthesis increases as
light intensity increases over the range
shown.

(ii) Which plant, **A** *or* **B**, is better adapted to a habitat where there is low light intensity? Justify your answer.

Plant A: it has a higher rate of photosynthesis at low light intensity.

(d) The graph below shows how carbon dioxide uptake by two plants of the same species varied as the seasons changed.



Explain the pattern observed for *either* plant during this time frame.
You should refer to the tilt of the Earth in your answer.

In June, the northern hemisphere is tilted towards the Sun. Longer days and
more light allow more photosynthesis and carbon dioxide uptake. In
December it is tilted away, so uptake is lower. The southern hemisphere has
the opposite pattern.

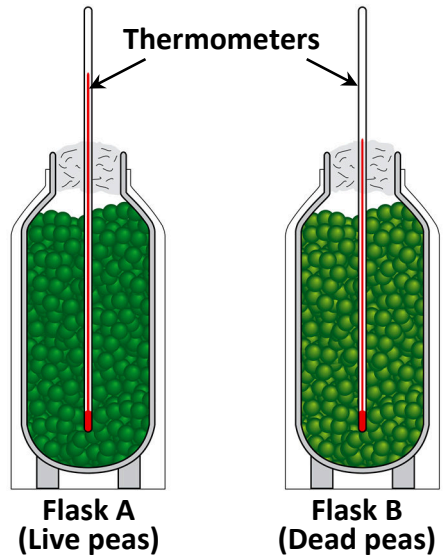
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WHY / HOW

Light provides energy for photosynthesis. The two hemispheres have opposite seasons.

(e) A student carried out an experiment to investigate the process of respiration in peas. They used the apparatus shown in the diagram.

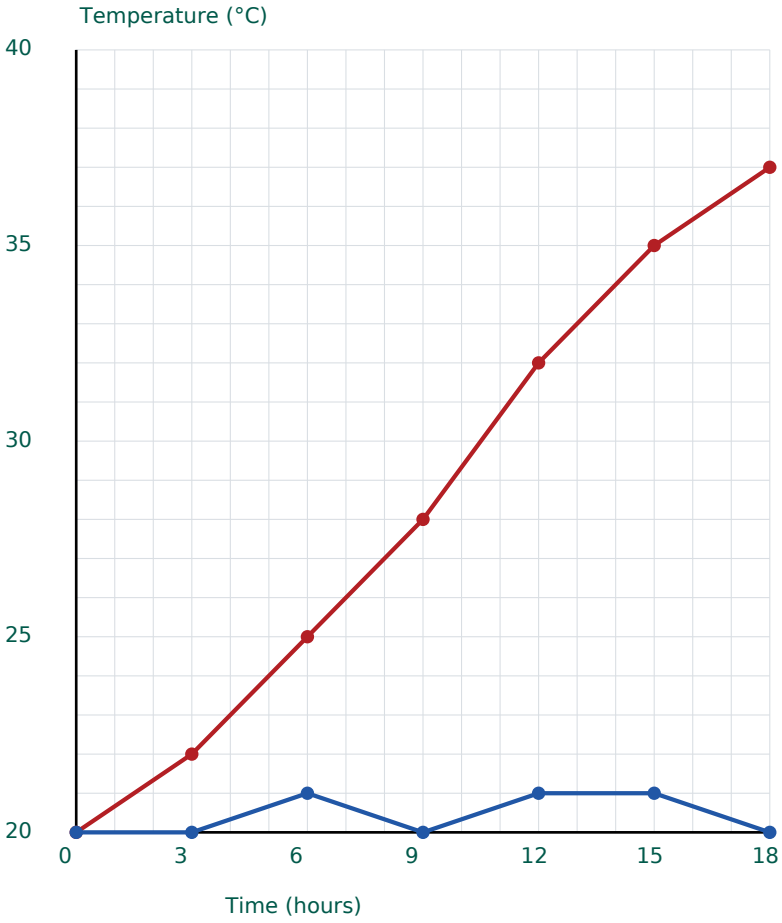


(i) Why is it important that the flasks do not allow heat in or out?

To prevent heat exchange with the surroundings.

The temperature in each flask was monitored over a period of 18 hours. The student recorded the results, as shown in the table below.

(ii) In the space below, draw line graphs for both sets of results.



Time (hours)	Temperature (°C)	
	Flask A	Flask B
0	20	20
3	22	20
6	25	21
9	28	20
12	32	21
15	35	21
18	37	20

(iii) What should the student conclude from the results?

Live peas respire and release heat, causing the temperature to rise. Dead
peas do not respire.

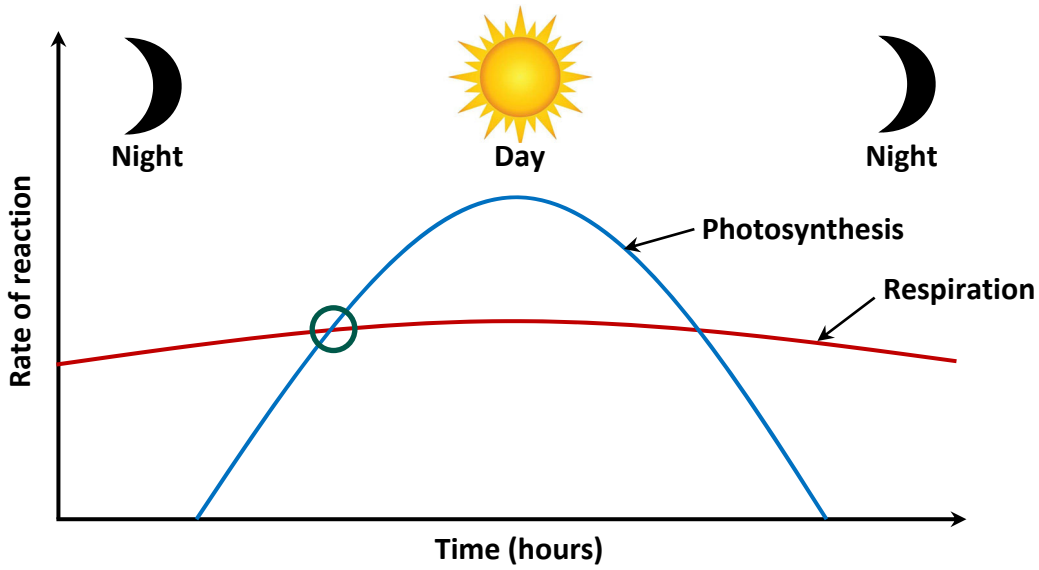
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WHY / HOW

The printed y-axis spacing is inconsistent. This completed graph uses a corrected, uniform temperature scale. Red = live peas A; blue = dead peas B.

(f) The graph below shows how the rates of photosynthesis and respiration for a plant varied over a period of 24 hours.



(i) On the graph above, draw a circle around a point where the rate of respiration equals the rate of photosynthesis.

(ii) What causes the day-night cycle on Earth?

The Earth rotates on its axis.

(iii) Explain why the rate of respiration remains relatively constant over 24 hours, compared to the rate of photosynthesis.

Respiration continues in both light and darkness. Photosynthesis needs light,
so its rate falls at night.

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WHY / HOW

At the intersection, the two rates are equal. Respiration continues day and night.

Additional writing space for Section B
Label all work clearly with the question number and part.

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Junior Cycle Final Examination – Common Level

Science

Monday 9 June

Morning 9:30 – 11:30