



**BEATTY SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2025
SECONDARY TWO G3**

CANDIDATE
NAME

CLASS

REGISTER
NUMBER

LOWER SECONDARY SCIENCE

6 October 2025

Setter: Ms Ain

Sections A, B and C: 2 hours

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

This Lower Secondary Science Paper consists of 3 sections – Sections A, B and C.

SECTION B (40 MARKS)

You are advised to spend no more than **90 minutes** on **Sections B and C**.

Write your name, class and register number on all the work you hand in.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, 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.

Answer **all** questions in the spaces provided on the question paper.
A copy of the Periodic Table is printed on page 12.

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

For Examiner's Use	
B	40

Section B

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

- 1** Methane (CH_4) is a gas produced when cows release waste gases. Methane reacts with oxygen (O_2) to form carbon dioxide (CO_2) and water (H_2O).

- (a) State the type of chemical reaction that takes place when methane reacts with oxygen.

..... [1]

- (b) The molecules of methane and oxygen are given in Fig. 1.1.

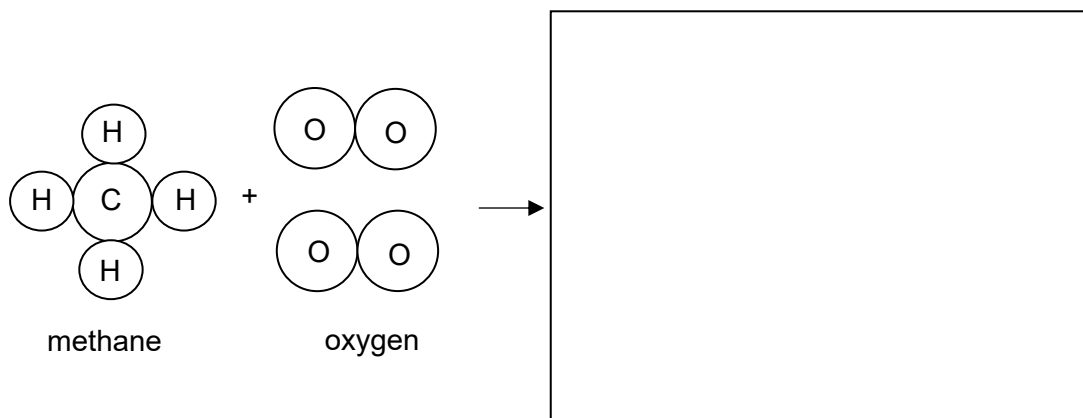


Fig. 1.1

Based on the principle of conservation of mass, draw the products of the reaction between one methane molecule and two oxygen molecules in the box provided in Fig. 1.1. [2]

- (c) Explain the difference in the composition between an element and a compound. Include an example of an element and a compound from the named reaction in (a).

.....

 [1]

[Total: 4]

- 2 A drop of blood is viewed under a microscope. Fig. 2.1 shows some red and white blood cells.

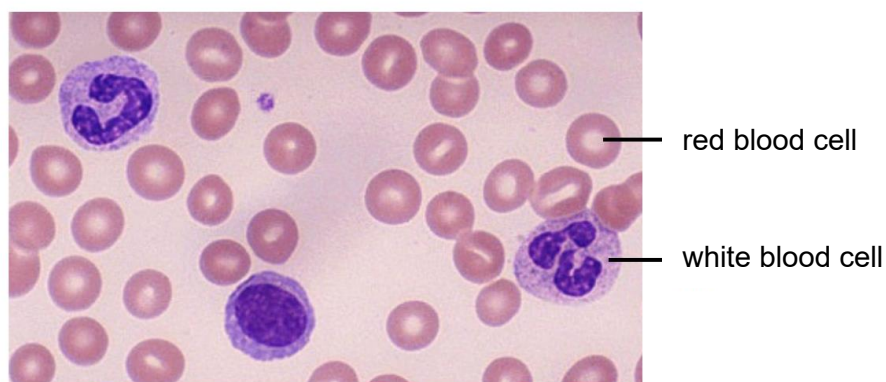


Fig. 2.1

- (a) Other than size and number of cells, compare the two types of cells by stating **one** visible similarity and **one** visible difference.

similarity

.....

difference

..... [2]

- (b) Using Fig. 2.1, explain why blood is considered a tissue.

.....

..... [1]

[Total: 3]

- 3 Table 3.1 shows information of three elements, **X**, **Y** and **Z**.

Table 3.1

element	number of protons	number of electrons	number of neutrons
X	9	9	10
Y	19	18	20
Z	10	10	10

- (a) Determine the atomic number and nucleon number for element **X**.

atomic number

nucleon number

[1]

- (b) A student claims that element **Y** is an atom.

Do you support the student's claim? Use data in Table 3.1 to support your explanation.

.....

 [2]

- (c) Using the Periodic Table, name and write the chemical symbol for the element represented by **Z**.

name

chemical symbol [1]

[Total: 4]

- 4 (a) Fig. 4.1 shows a Newton's cradle.

A typical Newton's cradle consists of metal balls suspended in a metal frame so that they just touch each other at rest. When one sphere at the end is lifted and released, it strikes the stationary spheres, transmitting a force through them that pushes the last sphere upward. This sphere then swings back and strikes the other spheres, repeating the effect in the opposite direction.

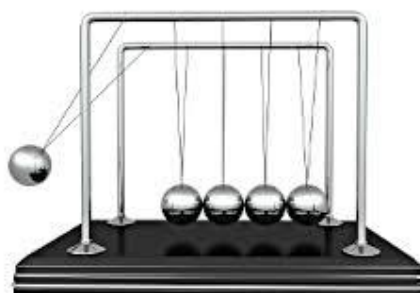


Fig. 4.1

- (i) Explain the scientific principle that causes the spheres to swing back and forth.

.....
 [1]

- (ii) Suggest why the spheres can theoretically go on indefinitely (without end) if the Newton's cradle is placed in a vacuum container.

.....
 [1]

- (b) Fig. 4.2 shows a boy standing on his skateboard at the top of a track. The total weight of the boy and his skateboard is 400 N.

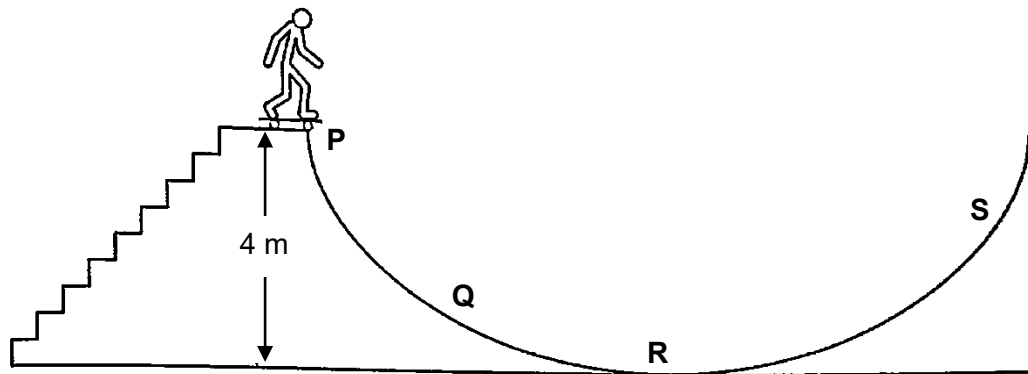


Fig. 4.2

- (i) State and explain whether work is done when the boy carries his skateboard from the bottom to the top of the stairs.

.....
 [1]

- (ii) The boy travels on his skateboard until he reaches point S on the track, where he stops momentarily.

Explain why this point is lower than point P.

.....
 [1]

- (iii) State at which point (P, Q, R or S) would the boy have the **most** kinetic energy.

Explain your answer.

.....
 [1]

[Total: 5]

- 5 Fig. 5.1 shows a food chain with the flow of energy.

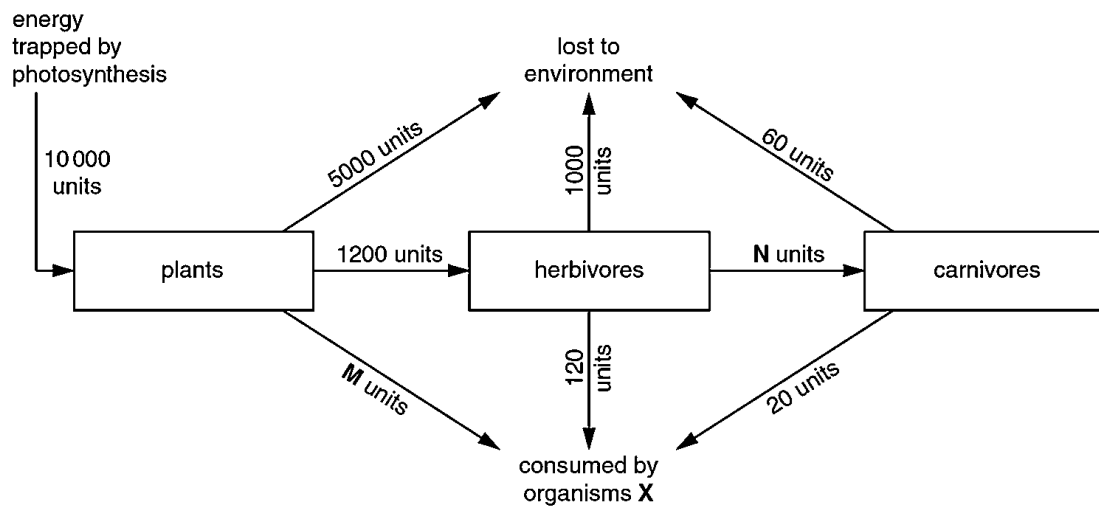


Fig. 5.1

- (a) Calculate the energy values of **M** and **N**.

energy value of **M** = ... units

energy value of **N** = ... units [1]

- (b) Suggest a process that might account for the loss of energy from organisms to the environment.

..... [1]

- (c) Suggest why the movement of energy in the food chain is described as a flow (one-directional) and **not** a cycle.

.....
 [1]

- (d) Explain how organism **X** contributes to the flow of nutrients in the food chain.

.....
 [1]

[Total: 4]

- 6 Fig. 6.1 shows a pool filled with water. A woman was walking around the pool and she spotted a ring at the bottom of the pool.

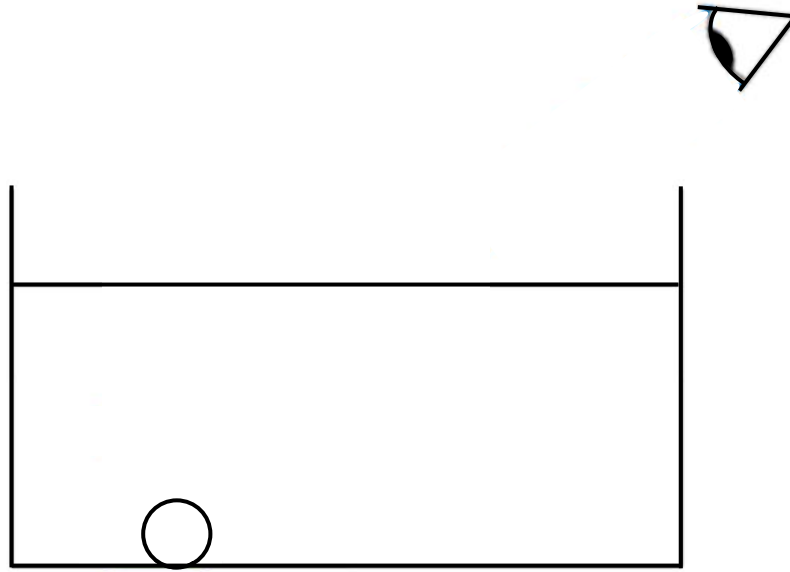


Fig. 6.1

- (a) On Fig. 6.1, draw the apparent position of the ring's image as seen by the woman's eye. [1]
- (b) (i) On Fig. 6.1, draw two rays to locate the image to the woman's eye. [1]
- (ii) On Fig. 6.1, draw two rays from the ring to the eye to show that the rays are refracted. [1]
- (c) Explain why the eye sees the apparent position of the ring as drawn in (a).

.....

.....

.....

..... [2]

[Total: 5]

- 7 Four identical potato strips are placed in four different solutions J, K, L and M. The solutions are of different concentrations.

The solutions are:

- 0.1 g/cm³ sugar solution
- 0.3 g/cm³ sugar solution
- 0.6 g/cm³ sugar solution
- distilled water

The length of each potato strip is recorded after ten minutes. Fig. 7.1 shows the results.

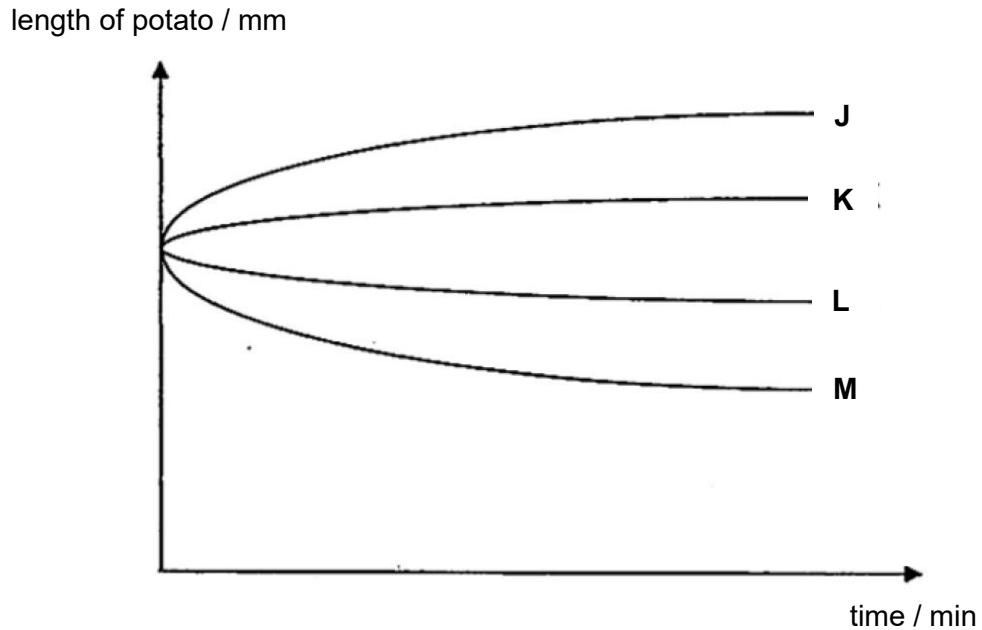


Fig. 7.1

- (a) Using evidence from Fig. 7.1, deduce and explain which solution is distilled water.

.....

 [3]

- (b) Estimate the sugar concentration of the potato strip before it is immersed into the solutions.

..... g/cm³ [1]

- (c) Sketch on Fig. 7.1, how the length of a potato strip will change over time if it is placed in a solution with the same sugar concentration in (b). [1]

[Total: 5]

- 8 Distillation is a widely used method for obtaining scent compounds, particularly in the fragrance and essential oils industries. Fragrances and essential oils are volatile, which means they evaporate easily at normal room temperature. Steam distillation is a specialised type of distillation used primarily for extracting volatile essential oils from aromatic plants such as lavender, peppermint, rosemary, and citrus fruits.

Fig. 8.1 shows a diagram of a steam distillation set-up for extracting lemongrass oil from lemongrass. The arrows in Fig. 8.1 indicate the path of the vapour in the set-up.

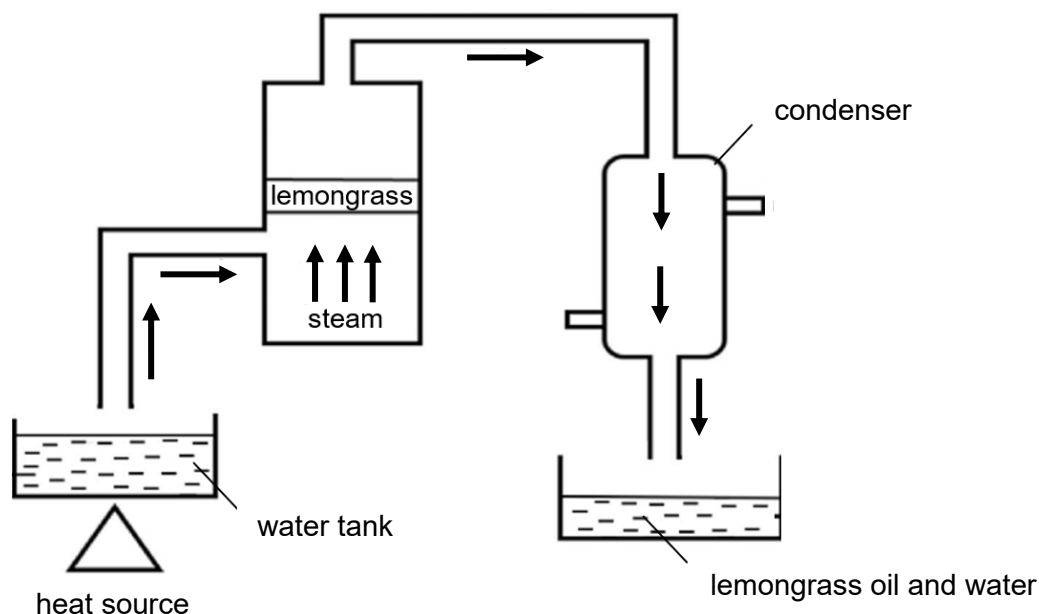


Fig. 8.1

There are four processes involved in steam distillation.

- 1 Steam is generated by heating water in the water tank.
- 2 The steam is passed through a chamber containing the plant material, causing the volatile oils to evaporate.
- 3 The steam containing the volatile oils is then cooled and condensed back into liquid form in a separate container.
- 4 Essential oils are immiscible with water, so they float on the surface of the condensed water and can be separated easily.

- (a) Using the particulate nature of matter, explain how changes in energy result in the physical change that occurs in the water tank during steam distillation.

.....

.....

.....

.....

..... [3]

- (b) On Fig. 8.1, draw arrows to indicate the direction of water flowing in and out of the condenser. Label the arrows 'water in' and 'water out'. [1]

- (c) The efficiency of the distillation method used to obtain essential oils can be inferred from the percentage yield. A higher percentage yield indicates that more essential oils are extracted.

Percentage yield can be calculated by the following formula:

$$\text{Percentage yield} = \left(\frac{\text{actual mass of essential oil collected (g)}}{\text{theoretical mass of essential oil present (g)}} \right) \times 100 \%$$

Theoretical mass refers to the maximum mass of product that can be obtained, while actual mass refers to the mass of product obtained from the extraction.

- (i) The East Indian lemongrass has an essential oil content of 1.5 %.

Calculate the theoretical mass of essential oil extracted from 2.5 kg of East Indian lemongrass. Show your working clearly and express your final answer in grams.

theoretical mass = ... g [2]

- (ii) Aromatics Distillery extracted 20.0 g of essential oil from 2.5 kg of East Indian lemongrass.

Calculate the percentage yield of lemongrass oil extracted by Aromatics Distillery. Show your working clearly and leave your final answer to 3 significant figures.

percentage yield = ... % [1]

(d) Aromatics Distillery aims to conduct an experiment to compare the percentage yield of essential oil collected from the East and West Indian lemongrass.

(i) State **one** variable that should be kept constant in the experiment.

..... [1]

(ii) State the independent variable in the experiment.

..... [1]

(iii) State **one** evidence to suggest that the distillate is a mixture.

.....
..... [1]

[Total: 10]

End of Section B

The Periodic Table of Elements

Group																						
1	2	1 H hydrogen 1										13	14	15	16	17	18					
		Key																				
		proton (atomic) number atomic symbol name relative atomic mass																				
3 Li lithium 7	4 Be beryllium 9																					
11 Na sodium 23	12 Mg magnesium 24	3	4	5	6	7	8	9	10	11	12						5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84					
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131					
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids		72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —				
87 Fr francium —	88 Ra radium —	89–103 actinoids		104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	114 Fl flerovium —		116 Lv livermorium —							

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
	89 Ac actinium	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —