



SUBJECT:	Core Science
PAPER NUMBER:	I – Level 1-2-3
DATE:	6 th May 2025
DURATION:	2 hours 5 minutes

Directions to Candidates

- The use of electronic calculators is permitted.
- You are requested to show your working and to write the units where necessary.

Useful information

- Standard temperature and pressure (stp): 0 °C and 1 atm
- The molar volume for gases at stp = 22.4 dm³
- A Periodic Table which includes the symbol, the name, the atomic number and the relative atomic mass of each element, is printed on the back of this booklet.
- When necessary, take *g*, acceleration due to gravity, as 10 m/s².

Useful equations

$\rho = \frac{m}{V}$	$v = f\lambda$	$Q = m c \Delta\theta$	
Speed = $\frac{\text{distance}}{\text{time}}$	Unbalanced force = ma	$W = m g$	momentum = $m v$
$v = u + a t$	$s = u t + \frac{1}{2} a t^2$	$v^2 = u^2 + 2 a s$	$s = (u + v) \frac{t}{2}$
$Q = I t$	$V = I R$	$P = I V$	$E = P t$
$R_{\text{total}} = R_1 + R_2$	$\frac{1}{R_{\text{total}}} = \frac{1}{R_1} + \frac{1}{R_2}$	Efficiency = $\frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$	
Area of a triangle = $\frac{1}{2} b h$	Area of a trapezium = $\frac{1}{2} (a + b) h$	Area of a circle = πr^2	

List of polyatomic ions and their charges	
Name	Formula
Ammonium	NH ₄ ⁺
Nitrate	NO ₃ ⁻
Sulfate	SO ₄ ²⁻
Carbonate	CO ₃ ²⁻
Hydrogencarbonate	HCO ₃ ⁻
Hydroxide	OH ⁻

Answer ALL questions

1. This question is about waves.

a. Underline the correct statement about waves. (1)

- Waves are caused by electricity and transfer energy as they travel.
- Waves are caused by vibrations and transfer energy as they travel.
- Waves are caused by wind and transfer matter as they travel.
- Waves are caused by vibrations and transfer matter as they travel.

b. Give the definition and the unit of the following quantities.

Amplitude: _____
 _____ Unit: _____ (1)

Frequency: _____
 _____ Unit: _____ (1)

Wavelength: _____
 _____ Unit: _____ (1)

c. Describe the relationship between speed and wavelength of a wave of a known constant frequency.

 _____ (1)

d. State **ONE** difference between a transverse wave and a longitudinal wave.

_____ (1)

e. The following setup is used to investigate reflection in a plane mirror.

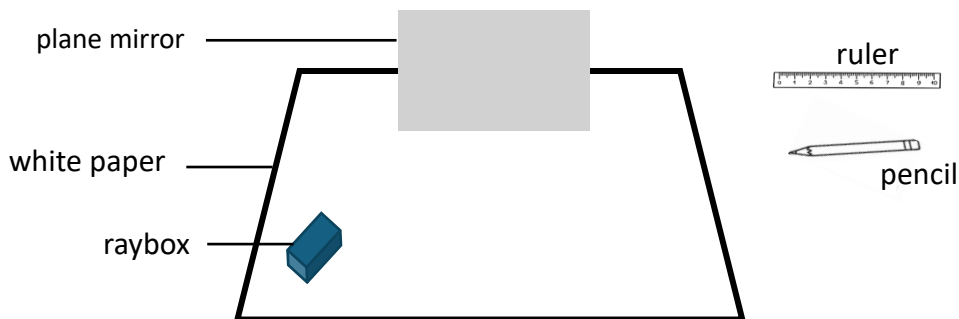


Figure 1

i. Name **ONE** more piece of apparatus required to carry out this investigation.

_____ (1)

ii. Outline the steps to be followed during the investigation.

(3)

iii. Complete the following:

Light is a _____ wave. The angle of _____ is _____ to the angle of _____.

(2)

(Total: 12 marks)

2. This question is about motion.

a. Speed is an example of a scalar quantity while velocity is a vector quantity. State the meaning of:

Scalar quantity: _____

_____ (1)

Vector quantity: _____

_____ (1)

b. An athlete spends some time training. She runs a distance of 1400 m in 15 minutes, then rests for 5 minutes and runs another 600 m in 5 minutes.

i. Sketch a distance-time graph to represent the above scenario. (3)

ii. Calculate the athlete's speed during the first part of her training.

(2)

This question continues on next page.

c. The athlete then went cycling and the following graph represents her journey.

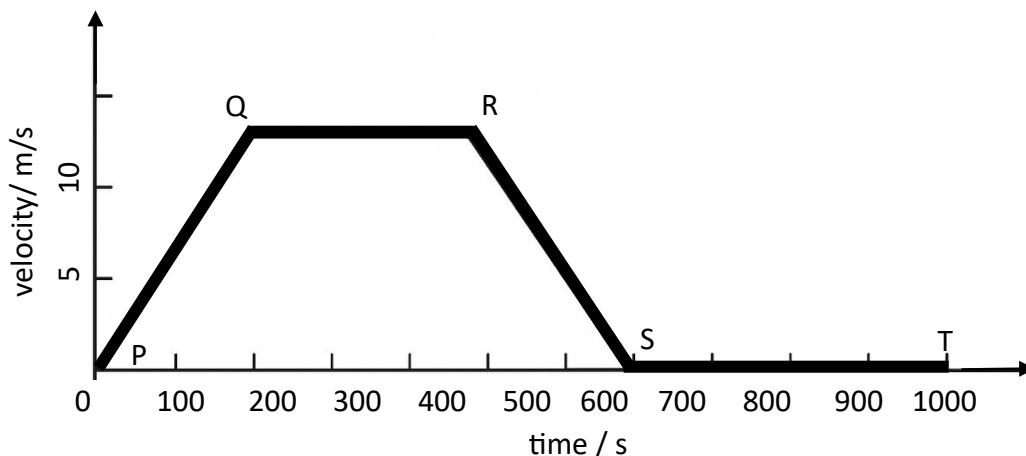


Figure 2

i. State which part of the graph represents the cyclist while:

- moving at constant velocity: _____ (1)
- at rest: _____ (1)
- decelerating: _____ (1)

ii. Calculate the acceleration of the cyclist during the first 200 s.

_____ (2)

(Total: 12 marks)

3. Two students were discussing electricity with their teacher in the Science laboratory.

a. Outline **TWO** sustainable forms of electricity generation used in Malta.

_____ (2)

b. During the lesson, the students were given some resistors of the same resistance and the following circuits were constructed.

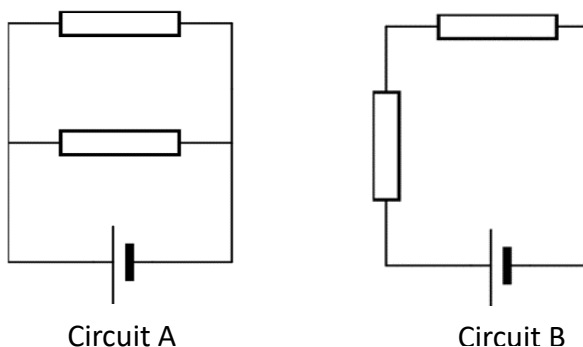


Figure 3

i. In which of the above circuits are the resistors connected in:

Series - _____ Parallel - _____ (1)

ii. Define current.

_____ (1)

iii. For both circuits A and B, draw an arrow to represent the flow of conventional current.

_____ (1)

iv. The students would like to add a switch in the circuit. Draw the symbol of a switch. (1)

v. Explain how the total resistance for circuit A is different from that of circuit B.

_____ (2)

c. In another session in the lab, the students were given the following components to investigate Ohm's Law.

Power supply Variable resistor Resistor Switch

i. Name **TWO** other pieces of apparatus required in this investigation.

_____ (1)

ii. Outline the steps which the students have to follow during this investigation. The first one has been done for you.

The components were connected properly.

_____ (2)

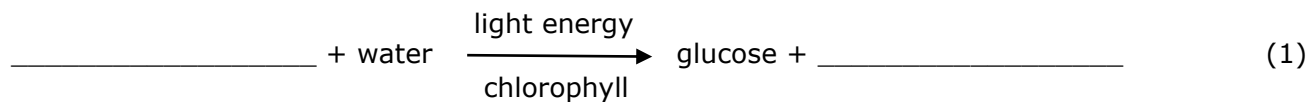
(Total: 11 marks)

4. Green plants perform the process of photosynthesis.

a. State the importance of photosynthesis to plants.

_____ (1)

b. Complete the word equation to explain what happens during photosynthesis.



c. An experiment that investigates factors that affect photosynthesis was performed as shown in Figure 4. A water plant was placed in a test-tube with water. The test-tube was put at different distances from an LED light source. The rate of photosynthesis was measured by counting the number of gas bubbles coming out of the plant.

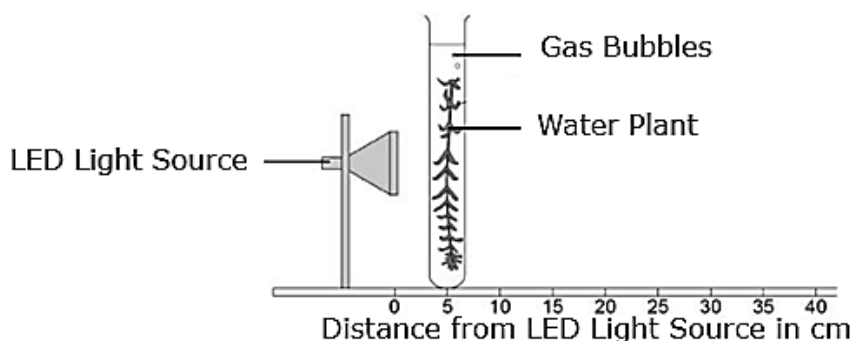


Figure 4

i. Identify the factor that is being investigated in this experiment.

_____ (1)

ii. The LED light source does **not** get hot. Explain the importance of this.

 _____ (2)

iii. All the gas bubbles produced by the water plant, were collected. Describe a test to prove what the gas produced is.

 _____ (2)

d. This experiment was performed at a temperature of 15 °C and a temperature of 25 °C. The graph in Figure 5 shows the results obtained.

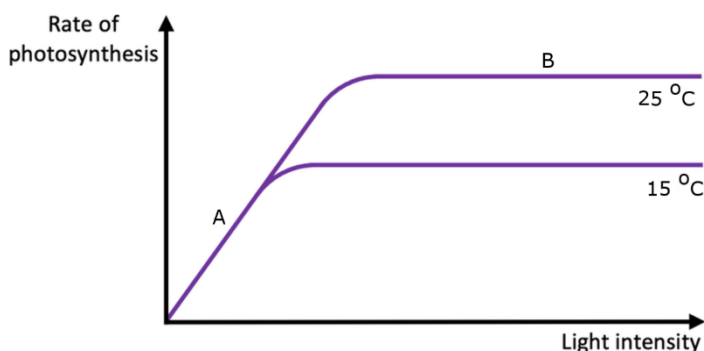


Figure 5

i. Explain the trend observed on the graph at point A.

(1)

ii. Explain what is happening at point B.

(2)

(Total: 10 marks)

5. a. Write the term that best describes the statements below.

Statement	Term
i. The place where an organism lives.	
ii. All the individuals of the same species that live within an area.	
iii. All the interactions between organisms and the abiotic factors in an area.	
iv. A species that is at risk of becoming extinct.	
v. Areas in Malta where development is restricted or highly regulated to protect the natural landscape, heritage and environment.	

(5)

This question continues on next page.

- b. Some students want to estimate the number of plants present in a garigue habitat. They use the sampling equipment shown in Figure 6.



Figure 6

This equipment which has an area of 1 m² is thrown four times. The number of plants found in each of the four throws is as shown in Table 1.

Table 1

Throw Number	Number of plants
1	14
2	5
3	9
4	12

The whole garigue habitat measures 26,000 m². Use the information in Table 1 to estimate the total number of plants present in this habitat. Show your working.

(3)

(Total: 8 marks)

6. a. Identify **ONE** negative effect of the lifestyle choices shown in the pictures below that may affect our health.

i.



Figure 7

(Source: <https://www.spatzmedical.com/blog/bad-eating-habits-to-avoid/>)

(1)

ii.



Figure 8

(Source: <https://www.pathofast.com/>)

(1)

b. The chef at the 2024 Paris Olympics was responsible for the diet of athletes. Each athlete had a special diet that corresponded with the sport they practice. Unfortunately, the waiter mixed up their food. Food tests were performed.

i. Explain why solid food should be crushed before testing.

(1)

ii. Describe the test for starch.

(1)

This question continues on next page.

iii. Give the possible observations and conclusions of the test in part (b)(ii).

(2)

iv. To test the food for glucose, Benedict’s solution was added to a sample of food. No change was observed. A friend suggested that an important step has been missed. Give this important step.

(1)

v. If the test for glucose were positive, the original blue colour changes. Identify a colour that may be obtained.

(1)

vi. Sasha Gatt is a Maltese Olympic swimmer. Swimming is a high energy sport where athletes must swim at a fast pace. Suggest which food component is necessary to give her this burst of energy.

(1)

c. Figure 9 shows the plot of the changes in heartbeat of a Maltese Olympian.

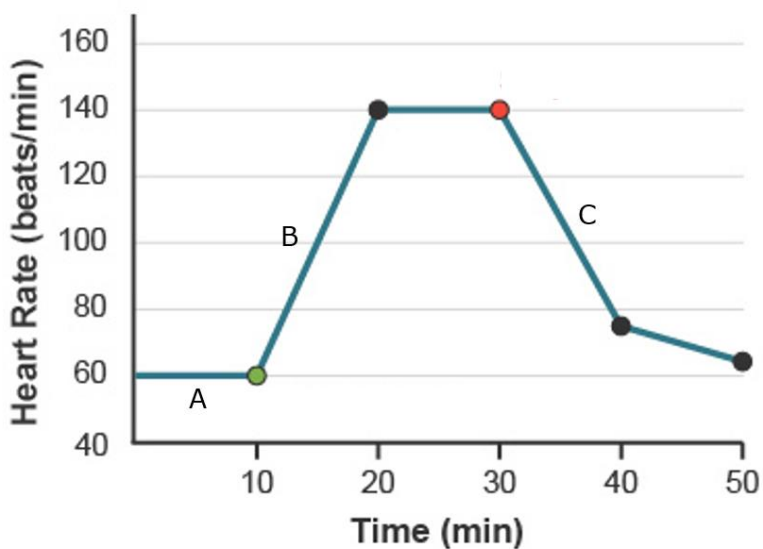


Figure 9

(Source: <https://brainly.com/question/526168>)

i. Suggest what the Olympian was doing at point A.

(1)

ii. Suggest what the Olympian was doing at point B. (1)

(1)

-
- d. Changes in heart rate are accompanied by changes in breathing rate.
i. Describe the volume and frequency of the breathing rate at point A and at point B.

(4)

- ii. The diaphragm plays an important role in breathing. Explain the role of the diaphragm during inhalation to bring about these changes.

(2)

(Total: 17 marks)

7. Forensic scientists were called in to investigate the disappearance of a painting from a Fine Arts museum. The evidence found at the crime scene included three fingerprints and some drops of blood.

- a. Identify **TWO** procedures that need to be done to preserve data once forensic scientists arrive at the crime scene.

(2)

- b. Figure 10 shows three fingerprints that were lifted from the crime scene. Describe a technique used by forensic scientists to obtain fingerprints.

(2)

- c. Detectives suspect that the robbery was done by a museum employee. The blood was found to be blood type A positive (A+). Three staff members have an A+ blood type. Explain how knowing blood type can determine who is **not** the thief, however, it cannot tell us who the thief is.

(2)

d. Figure 10 shows the three fingerprints found in the crime scene.

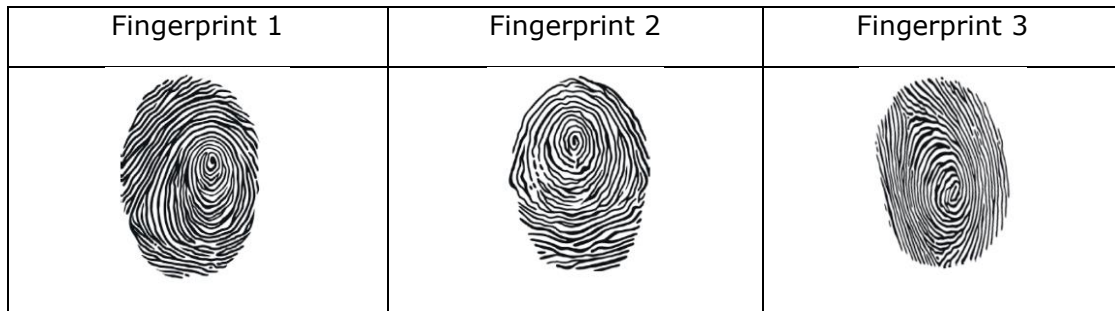


Figure 10

The fingerprints of the three staff members with A+ blood were obtained. These are shown in Figure 11.

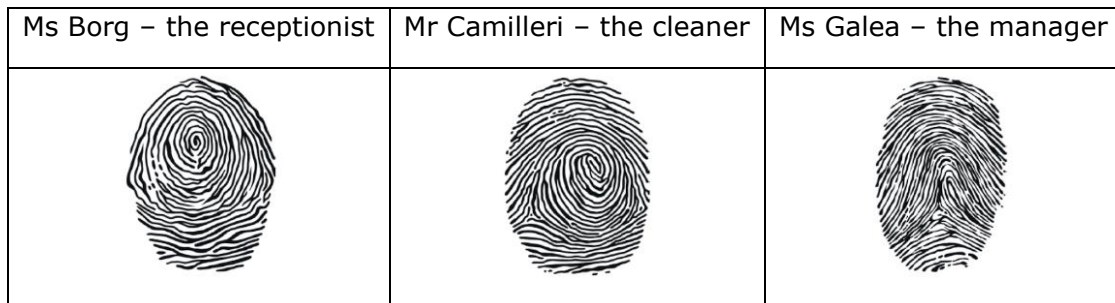


Figure 11

i. Explain why it is more reliable to use fingerprints than it is to use blood type to determine who the thief is.

_____ (1)

ii. Compare the fingerprints from Figure 10 with those of Figure 11 and determine who the thief may be.

_____ (1)

(Total: 8 marks)

8. a. Hydrogen undergoes combustion in a sufficient amount of air to give water.

i. Write a word equation for the chemical reaction taking place.

_____ (1)

ii. Write a balanced chemical equation, including state symbols, for the chemical reaction taking place. Assume that the reactants and products are at room temperature and pressure.

_____ (3)

iii. Find the relative molecular mass of water. Consult the Periodic Table (Page 16) for the required relative atomic masses. Show your working.

_____ (2)

iv. The mass of water is 22.5 g. Calculate the number of moles of water present.

_____ (2)

v. The volume of the mass of water in part (iv) is 22.5 cm³. Calculate the density of water.

_____ (2)

b. Water is a molecule, where the elements are bonded together by covalent bonds.

i. State the valency of each element in water.

_____ (2)

ii. Draw the dot-and-cross diagram – including outer shell electrons only – for the water molecule.

(2)

This question continues on next page.

c. Nina was investigating the pH of a number of liquids that are found at home. The results are reported in Table 2. Indicate in the third column of Table 2 whether they are acidic, alkaline or neutral.

Table 2

Solution	pH	Acidic, alkaline or neutral
Vinegar	2.7	
Bleach	12.5	
Milk	6.8	
Lime water	10.5	

(2)

(Total: 16 marks)

9. a. Identify a technique to separate components in the mixtures in Table 3.

Table 3

Mixture	Separation technique
A mixture of sand and water	
Common salt from sea water	

(2)

b. Several factors affect solubility. Mention **TWO** such factors.

_____ (2)

c. Explain how salt is produced in salt pans.

_____ (2)

(Total: 6 marks)

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PERIODIC TABLE OF THE ELEMENTS

1	2	3	4	5	6	7	0												
7 Li Lithium 3	9 Be Beryllium 4	11 Na Sodium 11	12 Mg Magnesium 12	13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulfur 16	17 Cl Chlorine 17	18 Ar Argon 18										
19 K Potassium 19	20 Ca Calcium 20	21 Sc Scandium 21	22 Ti Titanium 22	23 V Vanadium 23	24 Cr Chromium 24	25 Mn Manganese 25	26 Fe Iron 26	27 Co Cobalt 27	28 Ni Nickel 28	29 Cu Copper 29	30 Zn Zinc 30	31 Ga Gallium 31	32 Ge Germanium 32	33 As Arsenic 33	34 Se Selenium 34	35 Br Bromine 35	36 Kr Krypton 36		
37 Rb Rubidium 37	38 Sr Strontium 38	39 Y Yttrium 39	40 Zr Zirconium 40	41 Nb Niobium 41	42 Mo Molybdenum 42	43 Tc Technetium 43	44 Ru Ruthenium 44	45 Rh Rhodium 45	46 Pd Palladium 46	47 Ag Silver 47	48 Cd Cadmium 48	49 In Indium 49	50 Sn Tin 50	51 Sb Antimony 51	52 Te Tellurium 52	53 I Iodine 53	54 Xe Xenon 54		
55 Cs Caesium 55	56 Ba Barium 56	57 La Lanthanum 57	72 Hf Hafnium 72	73 Ta Tantalum 73	74 W Tungsten 74	75 Re Rhenium 75	76 Os Osmium 76	77 Ir Iridium 77	78 Pt Platinum 78	79 Au Gold 79	80 Hg Mercury 80	81 Tl Thallium 81	82 Pb Lead 82	83 Bi Bismuth 83	84 Po Polonium 84	85 At Astatine 85	86 Rn Radon 86		
																		20 Ne Neon 10	40 He Helium 2

1	H	1
	Hydrogen	

a	X	b
	Y	

relative atomic mass
SYMBOL
Name
atomic number

Key:



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Useful equations

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Speed = $\frac{\text{distance}}{\text{time}}$	Unbalanced force = ma	W = m g	momentum = m v
$v = u + a t$	$s = u t + \frac{1}{2} a t^2$	$v^2 = u^2 + 2 a s$	$s = (u + v) \frac{t}{2}$
Q = I t	V = I R	P = I V	E = P t
$R_{\text{total}} = R_1 + R_2$	$\frac{1}{R_{\text{total}}} = \frac{1}{R_1} + \frac{1}{R_2}$	Efficiency = $\frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$	
Area of a triangle = $\frac{1}{2} b h$	Area of a trapezium = $\frac{1}{2} (a + b) h$	Area of a circle = πr^2	

List of polyatomic ions and their charges	
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Nitrate	NO ₃ ⁻
Sulfate	SO ₄ ²⁻
Carbonate	CO ₃ ²⁻
Hydrogencarbonate	HCO ₃ ⁻
Hydroxide	OH ⁻

Answer ALL questions in ALL sections.

SECTION A: This section carries 40 marks.

- Goalkeepers need good reaction times if they are to stop the ball from entering the net. To practice, a reaction time trainer is used. The circular bulbs light up and the goalkeeper hits it as many times as possible in one minute. The reaction time is recorded by the trainer.

The flashing light is the stimulus and the goalkeeper responds by hitting the bulb.

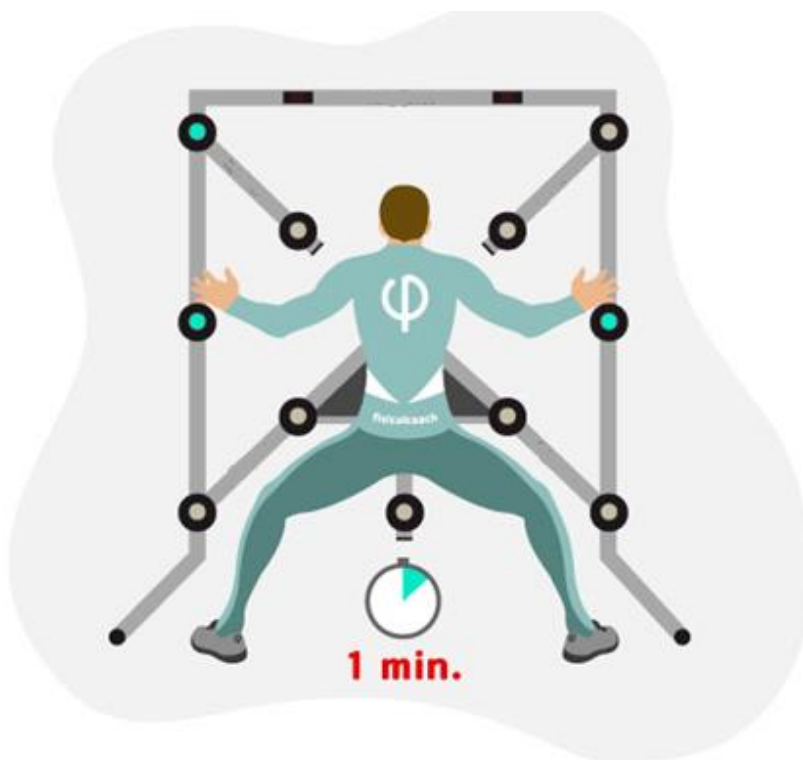


Figure 1. A reaction time trainer

(Source: <https://fiscalcoach.com>)

- State the nervous pathway followed to bring about the response described by filling in the spaces.

Stimulus → _____ → _____ → _____ → Response (3)

- Identify the type of neuron that brings about this response.

_____ (1)

- Give **ONE** other example of stimulus, besides light.

_____ (1)

(Total: 5 marks)

Please turn the page.

2. a. Friction is useful when holding objects.

i. Define friction.

(1)

ii. Give **TWO** other examples where friction is useful.

(2)

b. Air resistance affects ball movement in sports such as tennis.

i. Define air resistance.

(1)

ii. Give **ONE** other example where air resistance is useful.

(1)

(Total: 5 marks)

3. The carbon footprint is one of a number of ways in which our lifestyle has an impact on the environment and we should aim to reduce it.

a. Underline the correct words in the following definition of carbon footprint. (2)

Carbon footprint is a measure of the amount of (oxygen / carbon dioxide / carbon) released into the (sea / earth's crust / atmosphere) as a result of the activities of a particular person, organization, or community.

b. List **THREE** ways of reducing the carbon footprint.

(3)

(Total: 5 marks)

Please turn the page.

4. a. Name the organ system that the heart is part of.

_____ (1)

b. Identify the vessels below in (i) Figure 2 and (ii) Figure 3, and describe their function.

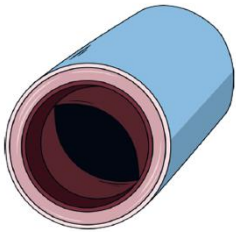


Figure 2

i. Name: _____ (1)

Function: _____

_____ (1)



Figure 3

ii. Name: _____ (1)

Function: _____

_____ (1)

(Total: 5 marks)

5. Sounds coming from band marches and fireworks play an important role in our village feasts.

a. State whether the following statements about sound are True or False.

	Statement	True / False
i	The frequency range which can be heard by an average person is 200 Hz – 20,000 Hz.	
ii	Sounds of more than 140 dB are not harmful to the ear.	
iii	Sound waves are example of transverse waves.	

(3)

b. List **TWO** ways in which the ears can be protected from damage.

_____ (2)

(Total: 5 marks)

6. Figure 4 shows the human digestive system.

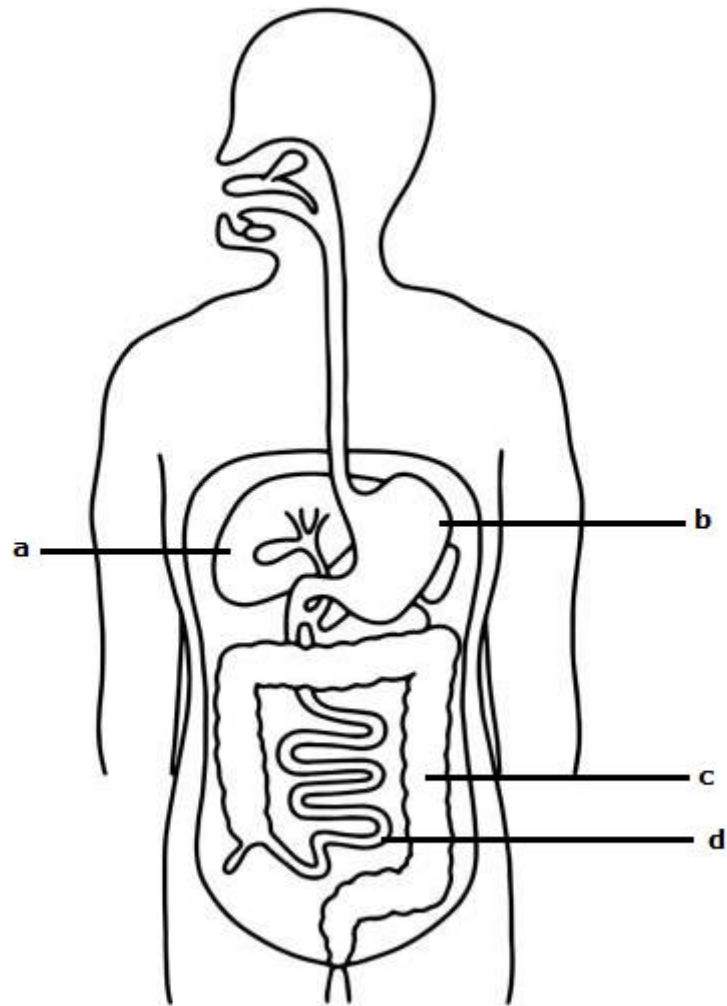


Figure 4

(Adapted from: <https://www.istockphoto.com>)

a. Name structures **a** and **b**.

Structure **a**: _____ (1)

Structure **b**: _____ (1)

b. Describe **ONE** main function of **c**.

_____ (1)

c. Describe **ONE** main function of **d**.

_____ (1)

d. On the diagram label the oesophagus with an **X**.

(1)

(Total: 5 marks)

7. Some students investigated the distribution of Mediterranean thyme (*Thymbra capitata*) in a section of Wied Babu. They noticed that the thyme grew in patches.

a. Describe how the students should decide where to place the quadrats to investigate the distribution of the Mediterranean thyme.

(2)

b. The diagram shows one of the quadrats that the students used.

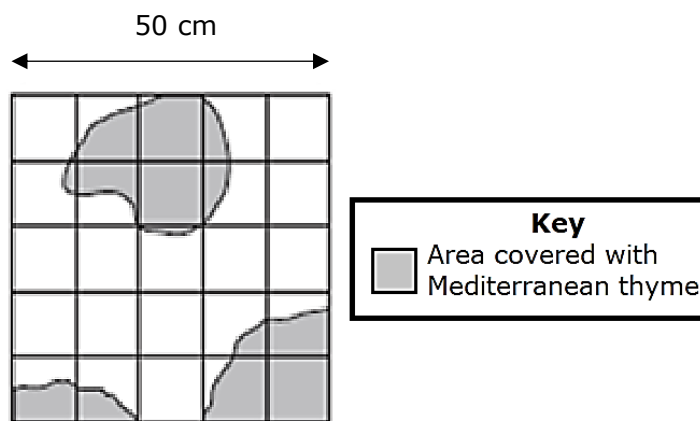


Figure 5

i. Count the number of squares of the quadrat covered with Mediterranean thyme. Consider only those that are more than 50% covered.

Number of squares = _____ (1)

ii. Some bees were observed feeding on the flowers of the Mediterranean thyme. Explain why quadrat sampling is **not** a suitable method to estimate the bee population.

(1)

c. State **ONE** negative human impact due to the presence of students in Wied Babu.

(1)

(Total: 5 marks)

8. In a seashore ecosystem, the food web shown in Figure 6 may be found.

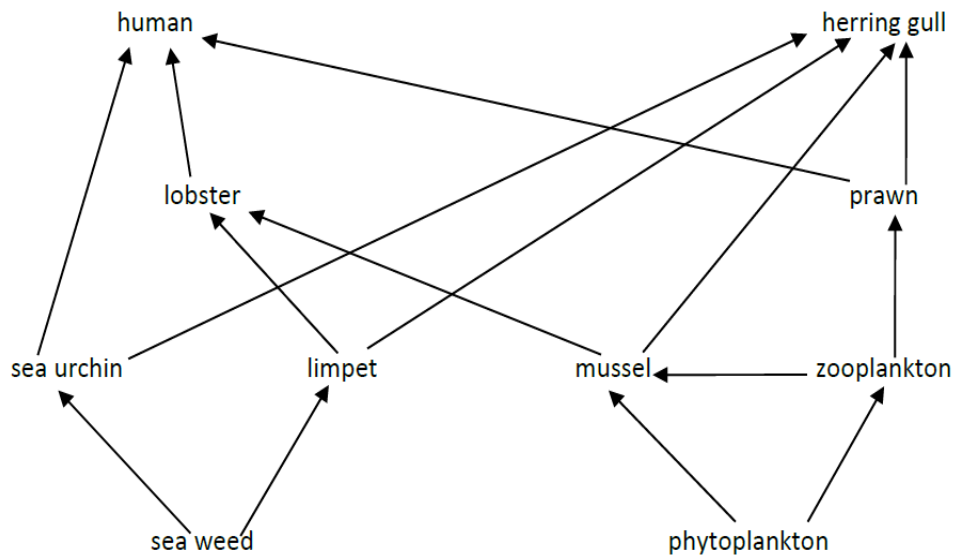


Figure 6: Seashore ecosystem

a. Use the food web in Figure 6 to write a food chain with three trophic levels.

(2)

b. Use the information in the food web shown in Figure 6 to explain why mussels are described as omnivores.

(1)

c. In the space below represent a pyramid of energy for the first three trophic levels of the food web shown in Figure 6.

(2)

(Total: 5 marks)

Please turn the page.

SECTION B: This section carries 15 marks.

9. Read the passage below and answer ALL the questions that follow.

Water is needed by all living organisms on Earth to survive. It is gained and lost through the various activities and processes that organisms do. The correct amount of water in the organisms' cells is maintained by the process of osmosis. Without osmosis, the leaves of plants would wilt, and animals could become dehydrated.

The water reaching our homes often has chlorine added to it. This water is used for various activities in our homes. Amongst other things, water is used to rinse food, wash dishes and clean different surfaces. If the water is hard, we will notice that the soap will not lather well. To fix this, some people use water softeners or detergents. Biological detergents help in removing stains faster.

Another everyday activity that requires water in our home is cooking. During cooking, heat speeds up the cooking process and helps to cook food more quickly.

a. List **TWO** reasons why water is important for living organisms.

Reason 1: _____ (1)

Reason 2: _____ (1)

b. State **ONE** way how animals:

i. gain water in their bodies;

_____ (1)

ii. lose water from their bodies.

_____ (1)

c. Describe the process of osmosis.

_____ (3)

d. Osmosis can be considered as a special type of diffusion. Explain **ONE** factor that affects the rate of osmosis.

_____ (2)

e. Explain why the water reaching our homes often has chlorine added to it.

_____ (1)

f. Distinguish between "hard" and "soft" water.

_____ (1)

g. Explain why hard water makes cleaning difficult.

_____ (1)

h. Explain why biological detergents help in removing stains faster than non-biological ones.

_____ (2)

i. Heat speeds up the cooking process. Identify **ONE** other method that may speed up this process.

_____ (1)

(Total: 15 marks)

SECTION C: This section carries 45 marks.

10. This question is about electricity.

a. State whether the following materials are conductors or insulators of electricity.

Material	Conductor / Insulator
Plastic	
Copper	
Aluminium	
Glass	

(2)

This question continues on next page.

b. Draw a labelled circuit which can be used to test whether the above mentioned materials are electrical conductors or insulators.

(3)

c. Name **ONE** appliance that is double insulated.

(1)

d. The diagram below shows a standard fused three-pin plug. Complete the following table by stating the names of the wires and their respective colour.

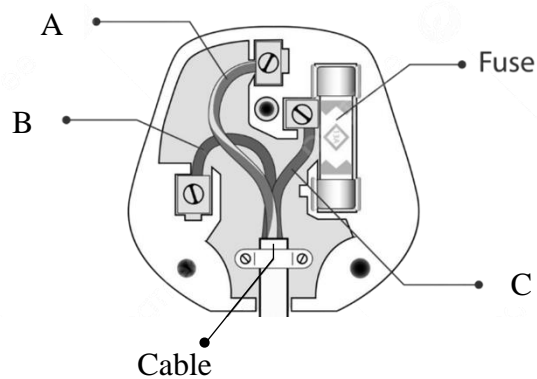


Figure 7

Wire	Name	Colour
A		
B		
C		

(3)

e. Distinguish between direct and alternating current.

(2)

f. The fuse is an important safety feature in the three-pin plug. Explain why fuses may have various ratings.

(1)

g. The following components are used in household circuitry.

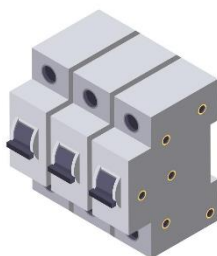


Figure 8

i. State the name of these components: _____ (1)

ii. Explain their function in a household circuit.

(2)

(Total: 15 marks)

11. a. We need to look at the physical and mental wellbeing of people to determine if they have a healthy body. List **TWO** ways of maintaining a healthy body.

(2)

b. Infectious diseases are caused by pathogens. Pathogens can be transmitted in various ways.

i. Complete the following table by naming a disease for **each** type of pathogen and how this is transmitted. The first one has been worked out. (4)

Pathogen Type	Name of disease	Pathogen Transmission
Yeast (Fungus)	Athlete's Foot	Contact with infected person / surface
Virus		
Bacterium		

This question continues on next page.

ii. Figure 9 shows the two types of cells in the breathing system which help it fight infection. Describe how these two types of cells defend the body.

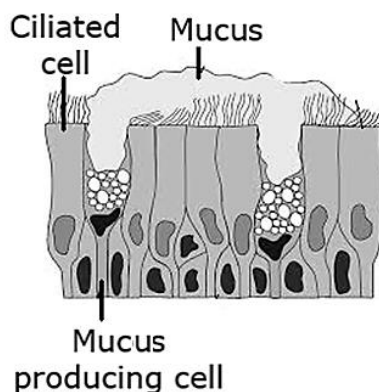


Figure 9

(2)

c. Air is a mixture of gases. We inhale and exhale air during breathing.

i. List the percentages of oxygen and carbon dioxide in inhaled air.

Oxygen: _____ (1)

Carbon dioxide: _____ (1)

ii. State whether the percentages of oxygen and carbon dioxide increase, decrease or stay the same in exhaled air.

Oxygen: _____ (1)

Carbon dioxide: _____ (1)

iii. What is observed when carbon dioxide is bubbled through lime water?

(1)

iv. The valency of carbon is 4, while the valency of oxygen is 2. Describe valency.

(2)

(Total: 15 marks)

12. A bank robbery did not go as smoothly as the thieves hoped. During the robbery, one of the thieves bit a bank employee after he refused to hand over the money. The security guard punched one of the thieves in the nose causing a nosebleed. Then as they left with the money, the dye pack exploded, staining the money with red ink. Forensic scientists were called to the crime scene, and they uncovered the following:

- a few drops of blood on the floor;
- a shoeprint with some dirt;
- a bite mark on the arm of a bank employee.

a. DNA fingerprinting is a method used to identify living things based on samples of their DNA.

i. Describe the structure of DNA.

(2)

ii. DNA is located in the nucleus. Describe how DNA is organised in the nucleus.

(2)

iii. Identify **ONE** example of a mutagen.

(1)

b. The drops of blood were analysed under a microscope. Identify **TWO** types of blood cells shown in the photo in Figure 10.

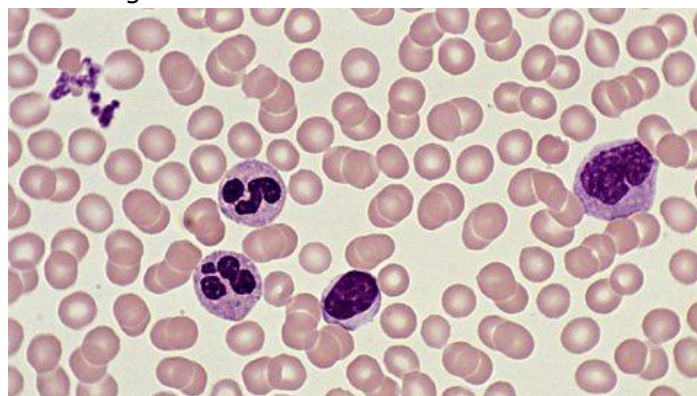


Figure 10

(Source: <https://www.bbc.co.uk/bitesize/guides/z3pjsrd/revision/7>)

(2)

c. Forensic scientists drew an impression of the bite mark that was left on the bank employee’s arm.

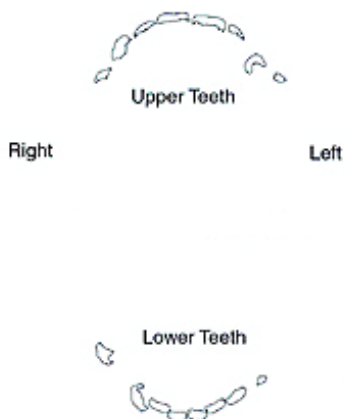


Figure 11
(Source: <https://www.forensic.to/webhome/bitemarks/>)

i. Analyse the bite mark impression. List **TWO** observations that can be made.

(2)

ii. There are different types of teeth. On Figure 11, label an incisor. (1)

d. As indicated in the introduction, when the robbers “left with the money, the dye pack exploded, staining the money with red ink.”

i. Indicate a technique that the forensic scientists can use to test that the red ink contains the same components as the original red ink from the bank.

(1)

ii. The red ink from the bank contains barium metal ions. The forensic scientists carried out a flame test to verify the presence of Ba²⁺ ions. Describe the procedure to perform a flame test.

(3)

iii. State the observed flame colour for the presence of Ba²⁺ ions.

(1)

(Total: 15 marks)

Blank Page

PERIODIC TABLE OF THE ELEMENTS

1	2	3	4	5	6	7	0	
7 Li Lithium 3	9 Be Beryllium 4	11 Na Sodium 11	12 C Carbon 6	13 Al Aluminium 13	14 N Nitrogen 7	15 O Oxygen 8	16 F Fluorine 9	17 Ne Neon 10
19 K Potassium 19	20 Ca Calcium 20	23 Sc Scandium 21	24 Ti Titanium 22	25 V Vanadium 23	26 Cr Chromium 24	27 Mn Manganese 25	28 Fe Iron 26	29 Ni Nickel 28
37 Rb Rubidium 37	38 Sr Strontium 38	39 Y Yttrium 39	40 Zr Zirconium 40	41 Nb Niobium 41	42 Mo Molybdenum 42	43 Tc Technetium 43	44 Ru Ruthenium 44	45 Rh Rhodium 45
85 Pb Lead 82	86 Bi Bismuth 83	87 Po Polonium 84	88 At Astatine 85	89 Rn Radon 86	90 Fr Francium 87	91 Ra Radium 88	92 Ac Actinium 89	93 Th Thorium 90
101 Ag Silver 108	102 Cd Cadmium 112	103 In Indium 115	104 Sn Tin 119	105 Sb Antimony 122	106 Te Tellurium 128	107 I Iodine 127	108 Xe Xenon 131	109 Kr Krypton 36
117 Lu Lanthanum 57	118 Hf Hafnium 72	119 Ta Tantalum 73	120 W Tungsten 74	121 Re Rhenium 75	122 Os Osmium 76	123 Ir Iridium 77	124 Pt Platinum 78	125 Au Gold 79
133 Cs Caesium 55	134 Ba Barium 56	135 La Lanthanum 57	136 Ce Cerium 58	137 Pr Praseodymium 59	138 Nd Neodymium 60	139 Pm Promethium 61	140 Sm Samarium 62	141 Eu Europium 63
151 Fr Francium 87	152 Ra Radium 88	153 Ac Actinium 89	154 Th Thorium 90	155 Pa Protactinium 91	156 U Uranium 92	157 Np Neptunium 93	158 Pu Plutonium 94	159 Am Americium 95
167 Uu Ununseptium 117	168 Uu Ununseptium 118	169 Uu Ununseptium 119	170 Uu Ununseptium 120	171 Uu Ununseptium 121	172 Uu Ununseptium 122	173 Uu Ununseptium 123	174 Uu Ununseptium 124	175 Uu Ununseptium 125

1
H
Hydrogen
1

Key:

a	X	y	b
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relative atomic mass
SYMBOL
Name
atomic number



SUBJECT:	Core Science
PAPER NUMBER:	II – Level 2-3
DATE:	6 th May 2025
DURATION:	2 hours 5 minutes

Directions to Candidates

- The use of electronic calculators is permitted.
- You are requested to show your working and to write the units where necessary.

Useful information

- Standard temperature and pressure (stp): 0 °C and 1 atm
- The molar volume for gases at stp = 22.4 dm³
- A Periodic Table which includes the symbol, the name, the atomic number and the relative atomic mass of each element, is printed on the back of this booklet.
- When necessary, take *g*, acceleration due to gravity, as 10 m/s².

Useful equations

$\rho = \frac{m}{V}$	$v = f\lambda$	$Q = m c \Delta\theta$	
Speed = $\frac{\text{distance}}{\text{time}}$	Unbalanced force = ma	$W = m g$	momentum = $m v$
$v = u + a t$	$s = u t + \frac{1}{2} a t^2$	$v^2 = u^2 + 2 a s$	$s = (u + v) \frac{t}{2}$
$Q = I t$	$V = I R$	$P = I V$	$E = P t$
$R_{\text{total}} = R_1 + R_2$	$\frac{1}{R_{\text{total}}} = \frac{1}{R_1} + \frac{1}{R_2}$	Efficiency = $\frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$	
Area of a triangle = $\frac{1}{2} b h$	Area of a trapezium = $\frac{1}{2} (a + b) h$	Area of a circle = πr^2	

List of polyatomic ions and their charges	
Name	Formula
Ammonium	NH ₄ ⁺
Nitrate	NO ₃ ⁻
Sulfate	SO ₄ ²⁻
Carbonate	CO ₃ ²⁻
Hydrogencarbonate	HCO ₃ ⁻
Hydroxide	OH ⁻

Answer ALL questions in ALL sections.

SECTION A: This section carries 40 marks.

- Goalkeepers need good reaction times if they are to stop the ball from entering the net. To practice, a reaction time trainer is used. The circular bulbs light up and the goalkeeper hits it as many times as possible in one minute. The reaction time is recorded by the trainer. The flashing light is the stimulus and the goalkeeper responds by hitting the bulb.

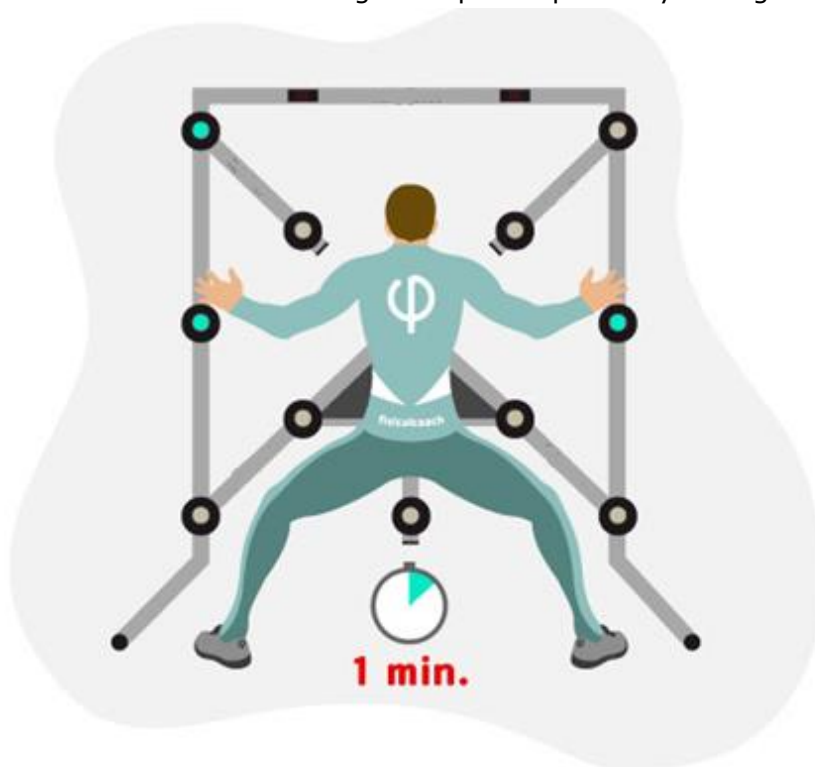


Figure 1

(Source: <https://fiscalcoach.com>)

a. Define the term stimulus.

(1)

b. Explain the nervous pathway followed to bring about the response described by filling in the spaces.

Stimulus → _____ → _____ → _____ → Response (3)

c. Identify the type of neuron that brings about this response.

(1)

(Total: 5 marks)

2. Traditional Maltese houses used to be built using double walls and with an insulator material in between the walls. Nowadays, most modern houses are encouraged to use double glazing in windows.

a. Describe in terms of energy transfers, how these **TWO** techniques make buildings more energy efficient.

(4)

b. Explain **ONE** other way of reducing the carbon footprint.

(1)

(Total: 5 marks)

3. a. Explain the difference between scalar and vector quantities.

(2)

b. Weight is considered to be a vector quantity. Briefly explain 'weight'.

(1)

c. Sketch a velocity-time graph to represent the journey of a car accelerating uniformly from rest to 5 m/s in 2 s, travelling at a constant velocity for a further 8 s, and decreasing the velocity uniformly, coming to a complete stop in the next 3 s. (2)

(Total: 5 marks)

4. a. Outline in terms of particles, why sound waves cannot travel in a vacuum.

_____ (1)

b. Briefly explain why sound waves travel faster in liquids than in gases.

_____ (2)

c. A person standing 340 m away from a smooth cliff hears an echo 2 s after shouting. Calculate the speed of sound in air.

_____ (2)

(Total: 5 marks)

5. a. Describe the function of: a vein (in Figure 2), and an artery (in Figure 3).

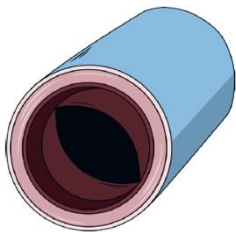


Figure 2

Function: _____

_____ (1)



Figure 3

Function: _____

_____ (1)

b. Explain why the circulatory system is often described as a 'double circulatory system'.

_____ (2)

c. Cardiovascular disease accounted for 1,230 deaths in Malta in 2021.

(Source: UM researchers paving way for prevention & treatment against heart disease in major EU project TargetMI).

Discuss **ONE** way how a sedentary lifestyle may lead to heart disease.

_____ (1)

(Total: 5 marks)

6. a. The diagrams in Figure 4 show two food components that are composed of building blocks.



Figure 4

Identify the type of food components **A** and **B**.

Component A: _____ (1)

Component B: _____ (1)

b. Name **ONE** element that is present in both food components.

_____ (1)

c. Food component **A** is a macromolecule. Mention **TWO** differences between the properties of **A** and its building blocks.

_____ (2)

(Total: 5 marks)

Please turn the page.

7. Wied Babu is in Żurrieq and home to various rare and endemic plant species such as carob trees, the Italian orchid and the Maltese rock centaury. Locals and tourists alike enjoy hiking through the valley while enjoying nature.

Explain **ONE** way how the following may impact the biotic factors in the area.

a. Introduction of new species

_____ (1)

b. Overtourism

_____ (1)

c. Overuse of pesticides in neighbouring fields

_____ (1)

d. Very long dry summers

_____ (1)

e. Urbanisation

_____ (1)

(Total: 5 marks)

8. In a seashore ecosystem, the food web shown in Figure 5 may be found.

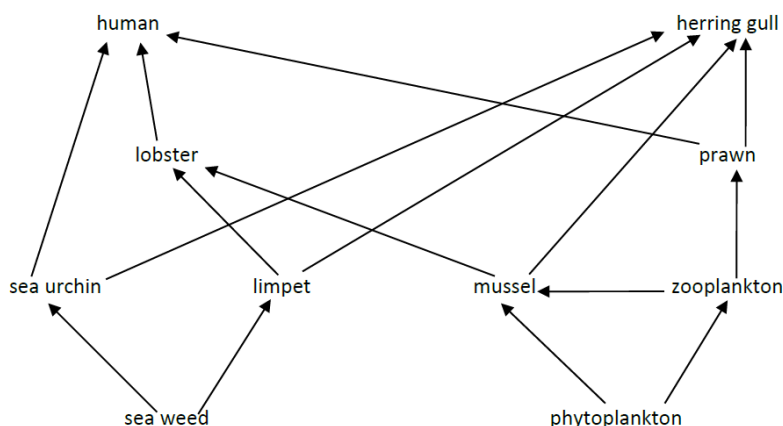


Figure 5: Seashore ecosystem

a. From the food web shown in Figure 5, identify **ONE** secondary consumer.

_____ (1)

b. Herring gulls are being hunted by a new predator in this ecosystem.

i. Predict what will happen to the number of prawns in this ecosystem.

_____ (1)

ii. Explain your answer to part b(i).

_____ (1)

c. A pyramid of energy for food web above is shown in Figure 6 below.

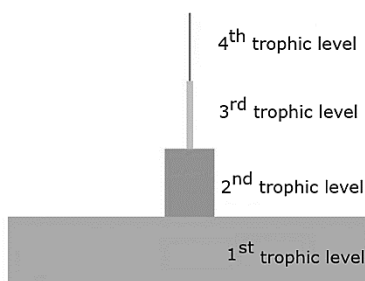


Figure 6

List **TWO** reasons that explain why energy is lost between the different trophic levels.

Reason 1: _____ (1)

Reason 2: _____ (1)

(Total: 5 marks)

SECTION B: This section carries 15 marks.

9. Read the passage below and answer ALL the questions that follow.

Water is needed by all living organisms on Earth to survive. It is gained and lost through the various activities and processes that organisms do. The correct amount of water in the organisms' cells is maintained by the process of osmosis. Without osmosis, the leaves of plants would wilt, and animals could become dehydrated.

The water reaching our homes often has chlorine added to it. This water is used for various activities in our homes. Amongst other things, water is used to rinse food, wash dishes and clean different surfaces. If the water is hard, we will notice that the soap will not lather well. To fix this, some people use water softeners or detergents. Biological detergents help in removing stains faster.

Another everyday activity that requires water in our home is cooking. During cooking, heat speeds up the cooking process and helps to cook food more quickly.

This question continues on next page.

a. List **TWO** reasons why water is important for living organisms.

Reason 1: _____ (1)

Reason 2: _____ (1)

b. State **ONE** way how animals:

i. gain water in their bodies;

_____ (1)

ii. lose water from their bodies.

_____ (1)

c. Describe the process of osmosis.

_____ (3)

d. Osmosis can be considered as a special type of diffusion. Explain **ONE** factor that affects the rate of osmosis.

_____ (2)

e. Explain why the water reaching our homes often has chlorine added to it.

_____ (1)

f. Distinguish between "hard" and "soft" water.

_____ (1)

g. Explain why hard water makes cleaning difficult.

_____ (1)

h. Explain why biological detergents help in removing stains faster than non-biological ones.

_____ (2)

i. Heat speeds up the cooking process. Identify **ONE** other method that may speed up this process.

_____ (1)

(Total: 15 marks)

SECTION C: This section carries 45 marks.

10. A student is investigating Ohm’s Law, using the circuit shown below.

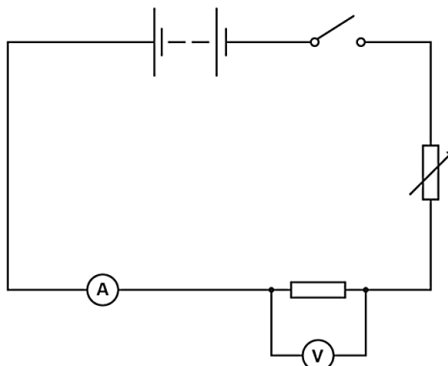


Figure 7

Unless the batteries are connected, and the switch is closed, both the ammeter and the voltmeter show no reading.

a. Explain that for charge to flow, a source of potential difference and a closed circuit are needed.

(2)

b. During the experiment, the student realised that the ammeter reads the same reading when placed in different points along the circuit. Explain.

(2)

c. Explain why an ideal ammeter has negligible resistance.

(2)

d. Explain why an ideal voltmeter has an infinitely high resistance.

(2)

The experiment was done with a fixed $20\ \Omega$ resistor, and with a filament bulb. The batteries used in both experiments had a total of 24 V. The results obtained were plotted on the same graph.

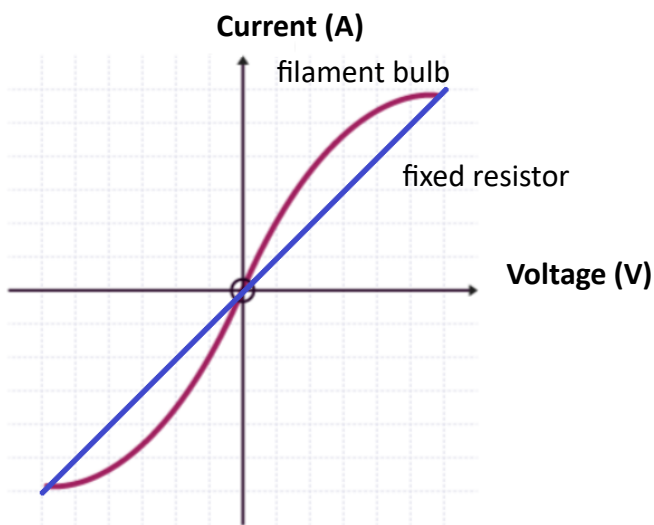


Figure 8

e. Interpret the two different graphs obtained.

(4)

f. Define Ohm's Law.

(1)

g. Calculate the ammeter reading when the experiment was done using the fixed resistor.

(2)

(Total: 15 marks)

11. a. We need to look at the physical and mental wellbeing of people to determine if they have a healthy body. List **TWO** ways of maintaining a healthy body.

(2)

b. The breathing system has specialised cells that help it fight infection. Figure 9 shows two of these cells. Describe how these two types of cells defend the body.

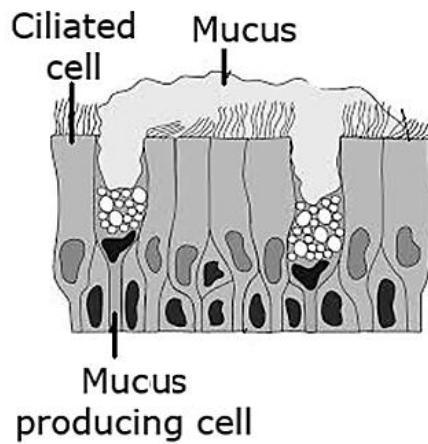


Figure 9

(2)

c. Smoking affects the health of a person. Describe the effect of nicotine, tar and carbon monoxide in cigarette smoke on health.

(3)

d. Carbohydrates, such as those found in pasta, are a vital part of our diet. They serve as the body's main and most efficient sources of energy, fuelling our muscles and brain. When preparing a plate of pasta, as part of the cooking process, we always add common salt and boil the water.

i. In this case, identify:

The solvent: _____ (1/2)

The solute: _____ (1/2)

This question continues on next page.

ii. Explain the term saturated solution.

(2)

iii. Common salt is obtained from sea water. Explain.

(1)

iv. There are mixtures that can be separated by simple distillation and others by fractional distillation. Explain when we can use the method and give a suitable example in each case.

Simple distillation: _____

(1)

Example: _____

(1)

Fractional distillation: _____

(1)

Example: _____

(1)

(Total: 15 marks)

12. A bank robbery did not go as planned. During the robbery a thief bit a bank employee after he refused to hand over the money. The security guard punched one of the thieves in the nose causing a nosebleed. As they left with the money the dye pack exploded staining the money with red ink. The forensic scientists were called to the crime scene, and they uncovered the following:

- a few drops of blood on the floor;
- a bite mark on the arm of a bank employee.

a. DNA fingerprinting is a method used to identify living things based on samples of their DNA.

i. Describe the structure of DNA.

(2)

ii. DNA is located in the nucleus. Describe how DNA is organised in the nucleus.

(2)

iii. Identify **ONE** example of a mutagen.

(1)

b. Describe **TWO** pieces of information, other than DNA, that can be obtained from analysing the drops of blood found on the floor.

(2)

c. Forensic scientists drew an impression of the bite mark that was left on the bank employee's arm, as shown in Figure 10.

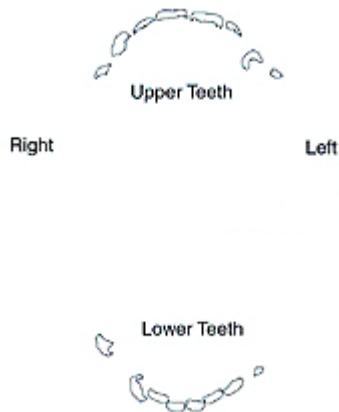


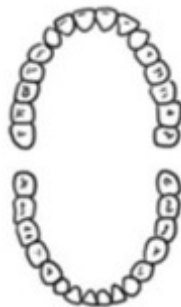
Figure 10
(Source: <https://www.forensic.to/webhome/bitemarks/>)

i. Analyse the bite mark impression. List **TWO** observations that can be made from the bite mark.

(2)

This question continues on next page.

- ii. A few weeks after the robbery a suspect was brought into custody. Figure 11 shows the analysis of his teeth by the forensic scientists.



(Source: <https://csidds.com/2016/12/02/american-academy-of-forensic-sciences-asks-public-for-bitemark-validation-studies/>)

Figure 11

Is he the person that bit the bank employee?

_____ (1)

- d. As indicated in the introduction, when the robbers “left with the money, the dye pack exploded, staining the money with red ink.” The red ink was investigated by paper chromatography, and it separated into two distinct spots: spot A at 3 cm and spot B at 7 cm.
 - i. What does the presence of the two spots indicate about the red ink?

_____ (1)

- ii. What can one conclude about the solubilities (in the solvent used) of the component of spot A and the component of spot B.

_____ (1)

- iii. The red ink from the bank contains metal ions. The forensic scientists carried out flame tests on spot A and spot B. The presence of barium ions was identified in spot A. State the colour of the flame.

_____ (1)

- iv. Considering that barium has an atomic number of 56, how many electrons does the Ba^{2+} ion have? Show your reasoning.

_____ (2)

(Total: 15 marks)

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PERIODIC TABLE OF THE ELEMENTS

1	2	3	4	5	6	7	0	
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37 Rb Rubidium 37	38 Sr Strontium 38	39 Y Yttrium 39	40 Zr Zirconium 40	41 Nb Niobium 41	42 Mo Molybdenum 42	43 Tc Technetium 43	44 Ru Ruthenium 44	45 Rh Rhodium 45
55 Cs Caesium 55	56 Ba Barium 56	57 La Lanthanum 57	72 Hf Hafnium 72	73 Ta Tantalum 73	74 W Tungsten 74	75 Re Rhenium 75	76 Os Osmium 76	77 Ir Iridium 77
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77
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101 Ag Silver 47	106 Pd Palladium 46	108 Cd Cadmium 48	112 Hg Mercury 80	115 In Indium 49	119 Tl Thallium 81	120 Pb Lead 82	122 Bi Bismuth 83	123 Po Polonium 84
63.5 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36	86 Xe Xenon 54
59 Ni Nickel 28	59 Co Cobalt 27	59 Ni Nickel 28	59 Ni Nickel 28	59 Ni Nickel 28	59 Ni Nickel 28	59 Ni Nickel 28	59 Ni Nickel 28	59 Ni Nickel 28
115 In Indium 49	119 Tl Thallium 81	120 Pb Lead 82	122 Bi Bismuth 83	123 Po Polonium 84	124 At Astatine 85	125 Rn Radon 86	126 Fr Francium 87	127 Ra Radium 88
27 Al Aluminium 13	28 Si Silicon 14	29 P Phosphorus 15	31 S Sulfur 16	32 Cl Chlorine 17	35.5 Ar Argon 18	40 K Potassium 19	40 Ca Calcium 20	40 Sc Scandium 21
11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10	27 Al Aluminium 13	28 Si Silicon 14	29 P Phosphorus 15
1 H Hydrogen 1	2 He Helium 2	3 Li Lithium 3	4 Be Beryllium 4	5 B Boron 5	6 C Carbon 6	7 N Nitrogen 7	8 O Oxygen 8	9 F Fluorine 9

Key:

a	X	y	b
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relative atomic mass
SYMBOL
Name
atomic number