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**HILLGROVE SECONDARY SCHOOL  
END-OF-YEAR EXAMINATION 2019  
SECONDARY TWO (EXPRESS)**

CANDIDATE NAME  ( ) CLASS  -

CENTRE NUMBER 

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 INDEX NUMBER 

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**SCIENCE**

**07 October 2019**

Candidates answer on the Question Paper.

**1 hour 45 minutes**

Additional materials required: OTAS

**08.00 AM to 09.45 AM**

**READ THESE INSTRUCTIONS FIRST**

Write your class, index number and name on 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.

**Section A**

Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D**.  
Use a 2B pencil to shade the correct answer on the OTAS provided.

**Section B**

Answer **all** questions in the space provided on the question paper.

**Section C**

Answer **three** questions. Question 11 is in the form of an **Either/Or** question. Only one part should be answered. Write your answers in the spaces provided on the question paper.

At the end of the examination, fasten all your work securely together.  
The number of marks is given in brackets [ ] at the end of each question or part question.

A copy of the Periodic Table is given on page 32.

For Examiner's Use	
Section	Marks
A	
B	
C	
<b>TOTAL</b>	

Parent's/ Guardian's Signature: \_\_\_\_\_

Setter: Teo Wee Sze

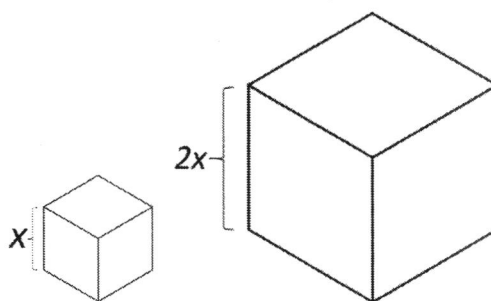
### Section A

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

- 1 A rock on the moon has a mass of 0.50 kg. 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.
- 2 When a force is applied to a body, which effect would not occur?
- A The body rotates.
- B The body speeds up.
- C The mass of the body decreases.
- D The pressure on the body increases.
- 3 The diagram shows two cubes, made of the same material, on a table. The larger cube weighs  $8W$  and has sides that are twice as long as the smaller cube which weighs  $W$ .



What is the pressure exerted by the larger cube on the table?

- A half the pressure exerted by the smaller cube on the table
- B same as the pressure exerted by the smaller cube on the table
- C twice the pressure exerted by the smaller cube on the table
- D triple the pressure exerted by the smaller cube on the table

4 Sally leaves home at 9.15 am and drives at a speed of 60 km/h to work. She reaches her workplace at 10 am. How far is Sally's workplace from her home?

- A 36 km
- B 45 km
- C 80 km
- D 2700 km

5 Which source of energy is non-renewable?

- A biofuels
- B fossil fuels
- C geothermal energy
- D hydroelectric energy


6 I, II, III and IV are a man's actions while hanging a picture in his room.

- I picking up the picture from the floor
- II driving a nail into the wall using a hammer
- III holding the picture against the wall and slotting the hook onto the nail
- IV standing stationary in front of the picture to check the alignment

Which actions involve the man doing work?

- A I and II
- B II and IV
- C I, II and III
- D I, II, III and IV

- 7 Which row shows the correct order for the speed of sound in air, steel and water?

	slowest		fastest
<b>A</b>	air	steel	water
<b>B</b>	air	water	steel
<b>C</b>	water	air	steel
<b>D</b>	water	steel	air

- 8 Where do vibrations in the ear start?

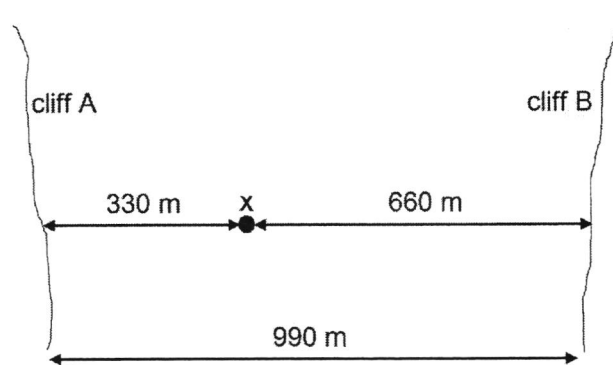
- A ear bones
- B ear canal
- C ear drum
- D external ear

- 9 A violin produces a note of frequency 256 Hz.

Which statement about the violin string is correct?

- A It has a thickness of 2.56 mm.
- B It is 256 cm long.
- C It produces sound waves travelling at 256 m/s.
- D It vibrates 256 times each second.

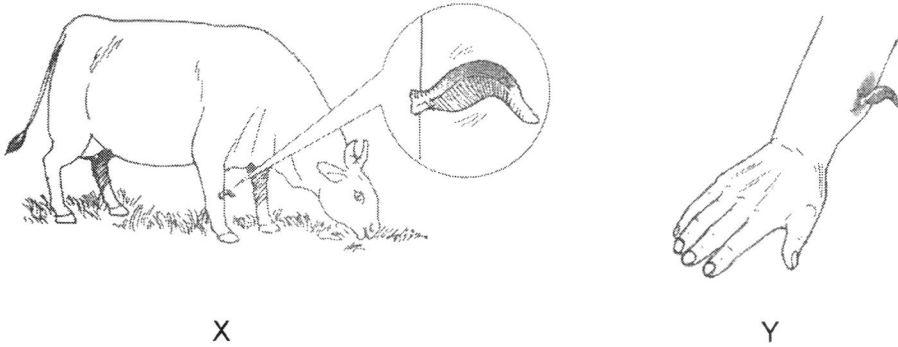
- 10 The diagram shows a man standing at point X which is 330 m from cliff A and 660 m from cliff B. Cliffs A and B are 990 m apart from each other. The man fires a pistol and hears 2 echoes.



Assuming the speed of sound in air is 330 m/s, what is the time interval between the first and second echoes?

- A 1.0 s
  - B 2.0 s
  - C 3.0 s
  - D 6.0 s
- 11 Which frequency of sound cannot be detected by human ears?
- A 10 Hz
  - B 25 Hz
  - C 1200 Hz
  - D 18 000 Hz

- 12 The diagram shows leeches attaching to different organisms. In X, leeches attach to a cow to feed on its blood while in Y, a doctor used leeches to attach onto the swollen hand of a patient to prevent accumulation of blood.



What is the relationship between the organisms in X and Y?

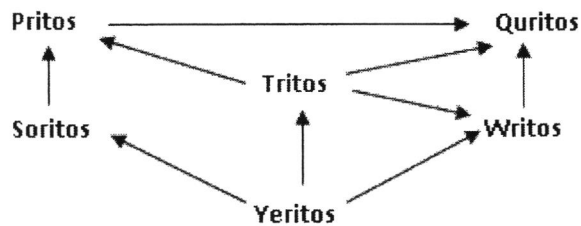
	X	Y
<b>A</b>	both organisms are harmed	one organism benefits while the other is harmed
<b>B</b>	both organisms benefit from each other	one organism benefits while the other is harmed
<b>C</b>	one organism benefits while the other is harmed	both organisms are harmed
<b>D</b>	one organism benefits while the other is harmed	both organisms benefit from each other

- 13 The table lists information about the trophic levels P, Q, R and S of a food chain.

trophic level	number of organism	energy in the trophic level
P	1000	1000 000
Q	10	20 000
R	1	10 000 000
S	500	200 000

Which correctly describes the food chain?

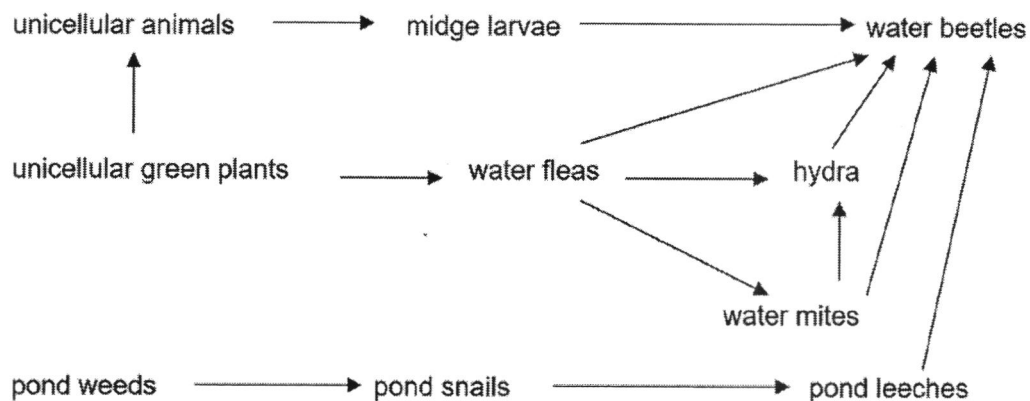
- A  $P \rightarrow S \rightarrow Q \rightarrow R$   
 B  $Q \rightarrow S \rightarrow P \rightarrow R$   
 C  $R \rightarrow P \rightarrow S \rightarrow Q$   
 D  $R \rightarrow Q \rightarrow S \rightarrow P$
- 14 The diagram shows a food web.



Which organism in the food web is the producer?

- A Pritos  
 B Quritos  
 C Yeritos  
 D The Sun

- 15 The diagram shows a food web in a fresh water pond.



Which organism in the food web is both a secondary and a tertiary consumer?

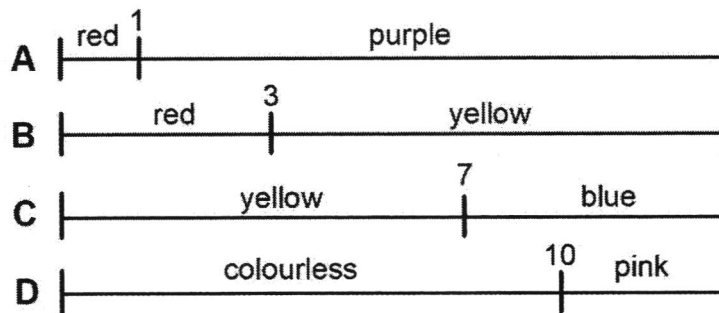
- A midge larvae
  - B pond leeches
  - C water beetles
  - D water fleas
- 16 Aluminium reacts with oxygen to form aluminium oxide.
- Which type of chemical reaction has taken place?
- A both combustion and oxidation
  - B both decomposition and oxidation
  - C combustion only
  - D oxidation only
- 17 Electricity is passed through a solution and hydrogen gas and oxygen gas are produced.
- Which statement correctly describes the process?
- A Electroplating is taking place.
  - B Electrolysis is taking place.
  - C Oxidation is taking place.
  - D Thermal decomposition is taking place.

- 18 Four beakers contain solutions I, II, III and IV on a table. When a piece of blue litmus paper was dipped into one of the solutions, the blue litmus paper remained blue.

- I detergent
- II liquid soap
- III orange juice
- IV pure water

Which solutions could have resulted in this observation?

- A I and II
  - B III and IV
  - C I, II and III
  - D I, II and IV
- 19 The diagram shows four indicators A, B, C and D and their colours in different pH.



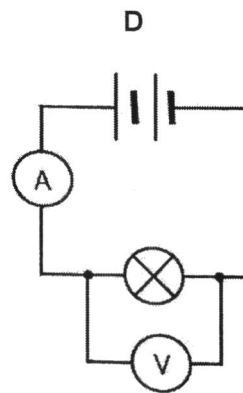
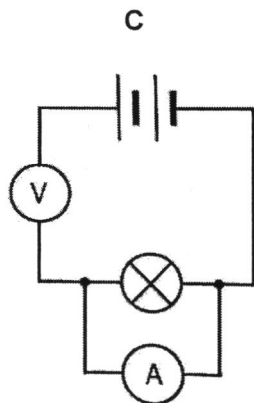
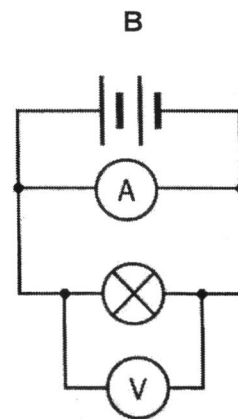
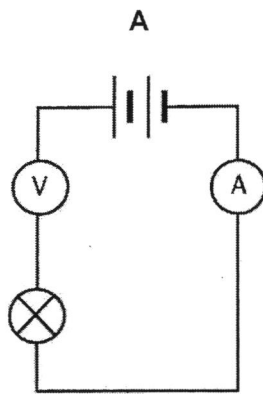
Which indicator can be used to differentiate between a solution of pH 2 and a solution of pH 6?

- 20 Which equation is not balanced?
- A  $4Al + 3O_2 \rightarrow 2Al_2O_3$
  - B  $2Fe + 3H_2SO_4 \rightarrow Fe_2(SO_4)_3 + 3H_2$
  - C  $MgCO_3 + 2HNO_3 \rightarrow Mg(NO_3)_2 + 2H_2O + CO_2$
  - D  $NaOH + HCl \rightarrow NaCl + H_2O$

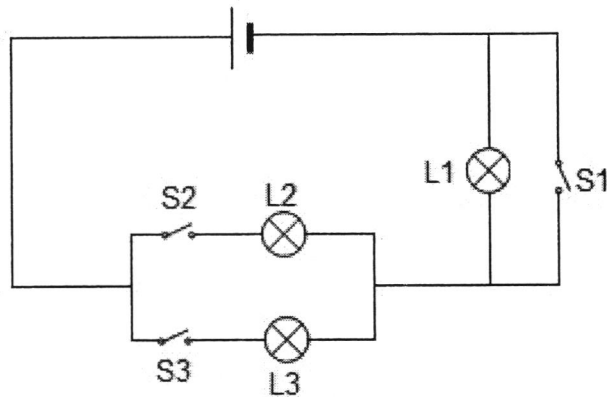
21 What are the factors affecting the resistance of a wire?

- A length of wire, cross-sectional area of wire, curvature of wire
- B length of wire, cross-sectional area of wire, material of wire
- C texture of wire, colour of wire, material of wire
- D texture of wire, colour of wire, curvature of wire

22 Which circuit can be used to find the resistance of the lamp?

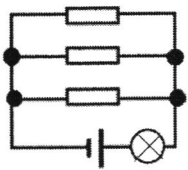


- 23 The diagram shows a circuit with 3 switches, S1, S2 and S3, and 3 identical light bulbs, L1, L2 and L3.

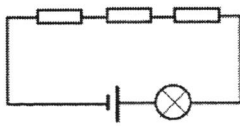


Which switches must be closed such that all 3 light bulbs will light up?

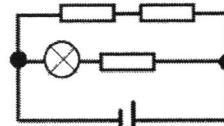
- A S1 and S2  
 B S1 and S3  
 C S2 and S3  
 D S1, S2 and S3
- 24 I, II, III and IV show 4 different combinations of a light bulb and 3 resistors, each with a resistance of  $2\ \Omega$ .



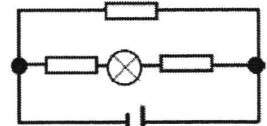
I



II



III

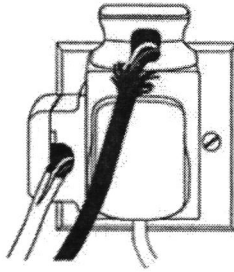


IV

Which row shows the circuits arranged in increasing brightness of the light bulb?

- A I  $\rightarrow$  III  $\rightarrow$  IV  $\rightarrow$  II  
 B I  $\rightarrow$  IV  $\rightarrow$  III  $\rightarrow$  II  
 C II  $\rightarrow$  III  $\rightarrow$  IV  $\rightarrow$  I  
 D II  $\rightarrow$  IV  $\rightarrow$  III  $\rightarrow$  I

- 25 The diagram shows some plugs connected to a socket.

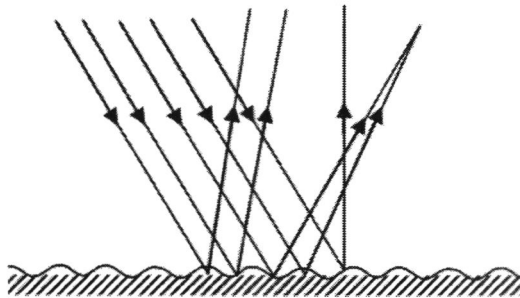


I, II and III are some electrical hazards.

- I damaged insulation of wires
- II damp conditions
- III overloading of socket

Which hazard(s) is / are shown in the diagram?

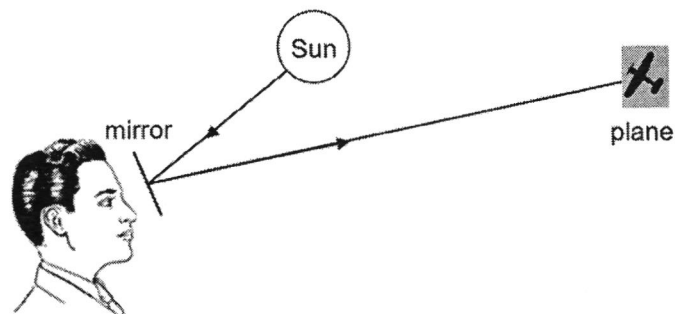
- A III only
  - B I and II only
  - C I and III only
  - D I, II and III
- 26 The diagram shows a beam of light reflecting off a surface.



Which statement about the reflection is correct?

- A The angles of incidence for all the rays are equal to each other.
- B The angle of incidence for each ray is equal to its angle of reflection.
- C The angles of reflection for all the rays are equal to each other.
- D The reflection is an example of regular reflection.

- 27 The diagram shows a man using a mirror to send signals to a search plane by reflecting light from the Sun to the plane.

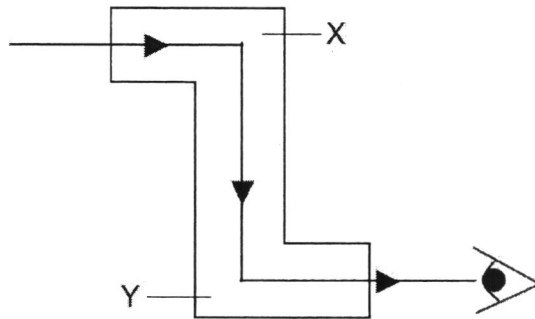


Given that the angle between the incident ray and reflected ray is  $28^\circ$ , what is the angle of incidence?

- A  $14^\circ$   
 B  $28^\circ$   
 C  $62^\circ$   
 D  $76^\circ$
- 28 Which statement does not describe the image formed by a plane mirror?
- A Its distance from the mirror equals the distance of the object from the mirror.  
 B It is inverted.  
 C It is upright.  
 D It is the same size as the object.
- 29 What are the properties of the images formed by concave and convex mirrors?

	concave mirror	convex mirror
A	diminished	magnified
B	magnified	diminished
C	magnified	distorted
D	virtual	magnified

30 The diagram shows an optical instrument.



What kinds of mirror are placed at positions X and Y inside the optical instrument?

	X	Y
<b>A</b>	concave mirror	plane mirror
<b>B</b>	convex mirror	concave mirror
<b>C</b>	plane mirror	convex mirror
<b>D</b>	plane mirror	plane mirror

## Section B

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

- 1 Fig. 1.1 shows a weightlifter, who weighs 700 N, lifting 3800 N of weights up a vertical distance of 2.05 m.

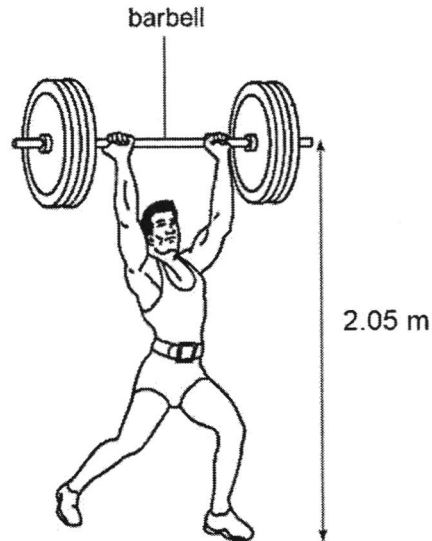


Fig. 1.1

- (a) Calculate the work done by the weightlifter in lifting the weights from ground to the position shown in Fig. 1.1.

work done = \_\_\_\_\_ [2]

- (b) (i) Given that the total surface area of the weightlifter that is in contact with the ground is  $0.02 \text{ m}^2$ , calculate the pressure he is exerting on the ground.

pressure = \_\_\_\_\_ [2]

- (ii) Suggest a way the weightlifter can reduce the pressure exerted on the ground.

\_\_\_\_\_ [1]  
\_\_\_\_\_

[total: 5 marks]

- 2 Fig. 2.1 shows a stationary ball with a gravitational potential energy of 120 J at point **A**. It is released from point **A** then it hits the ground at point **B** before rising to a new highest point, **C**.

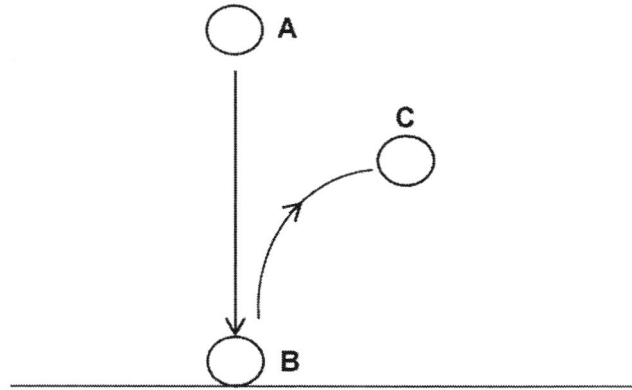


Fig. 2.1

- (a) As the ball falls from point **A** to point **B**, it does 20 J of work against air resistance. Determine the gravitational potential energy and kinetic energy of the ball just before it hits the ground at point **B**.

Gravitational potential energy = \_\_\_\_\_ [1]

Kinetic energy = \_\_\_\_\_ [1]

- (b) (i) When the ball hits the ground at point **B**, 30 J of energy is converted to other forms of energy. The ball then does another 5 J of work against air resistance as it rises from point **B** to point **C**. Determine the gravitational potential energy and kinetic energy of the ball at point **C**.

Gravitational potential energy = \_\_\_\_\_ [1]

Kinetic energy = \_\_\_\_\_ [1]

- (ii) State the energy conversion when the ball hits the ground at point **B**.

\_\_\_\_\_ [1]

[total: 5 marks]

- 3 (a) Fig. 3.1 shows a springy metal strip and a rotating block. Sound is produced when the springy metal strip is hit by the rotating block.

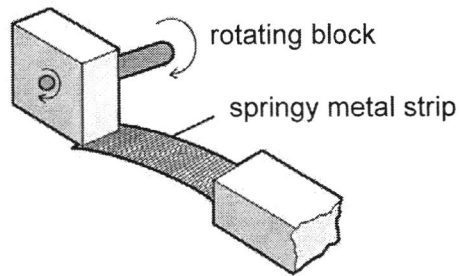


Fig. 3.1

State and explain how the sound produced will change when

- (i) the rotating block is rotated faster,

\_\_\_\_\_ [1]

- (ii) a larger force is used by the rotating block to hit the springy metal strip,

\_\_\_\_\_ [1]

- (iii) the experiment is conducted in a vacuum.

\_\_\_\_\_ [1]

- (b) Fig. 3.2 shows a typical hearing aid for people with damaged cochlea.

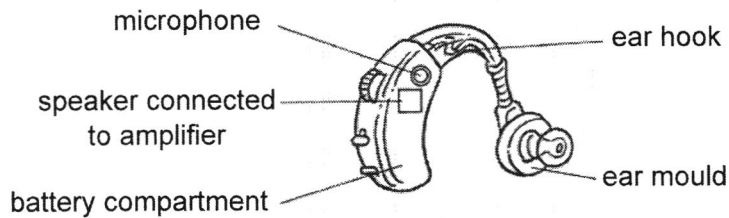


Fig. 3.2

- (i) Describe the function of the cochlea in the human ear.

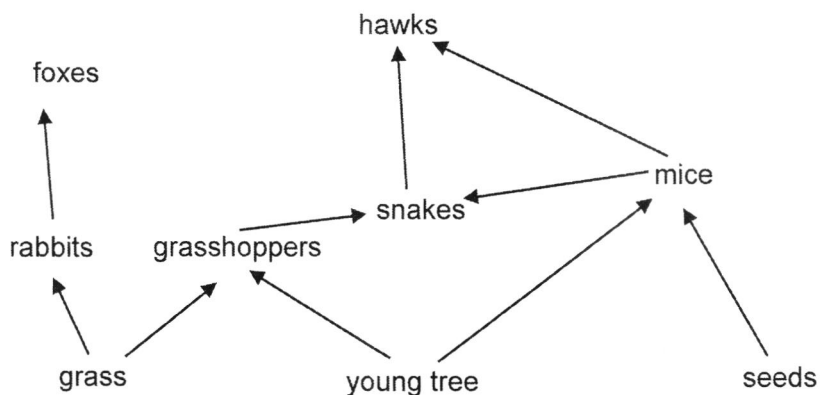
\_\_\_\_\_  
\_\_\_\_\_ [1]

- (ii) State the use of the amplifier in the hearing aid.

\_\_\_\_\_ [1]

[total: 5 marks]

- 4 Fig. 4.1 shows a food web within a certain community near a volcano.



**Fig. 4.1**

- (a) Name the primary consumers in the food web.

\_\_\_\_\_ [1]

- (b) Predict and explain the effects on the food web if there was a disease outbreak within the fox population.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

\_\_\_\_\_ [2]

- (c) At one time, the volcano erupted and the sky was covered with dark ashes for half a year and no light was able to shine through the sky.

State and explain how the population of hawks will change.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

\_\_\_\_\_ [2]

[total: 5 marks]

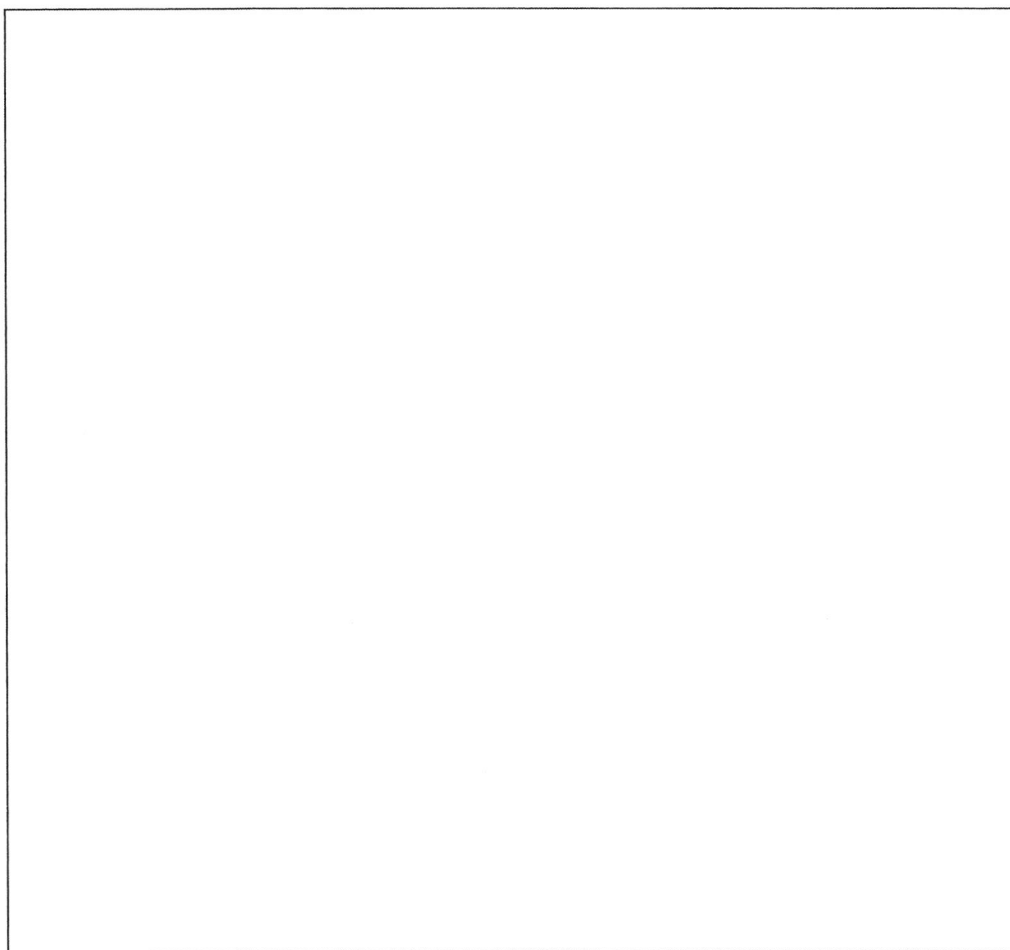
- 5 Draw an electric circuit that uses the following electrical components to meet the given conditions. Label all components in the circuit.

Electrical components:

- two cells
- an ammeter
- a voltmeter
- a variable resistor
- three light bulbs, **P**, **Q** and **R**
- two switches, **S<sub>1</sub>** and **S<sub>2</sub>**

Given conditions:

- light bulb **P** is parallel with light bulb **Q** and both light bulbs **P** and **Q** are in series with light bulb **R** [1]
- switch **S<sub>1</sub>** controls all three light bulbs **P**, **Q** and **R** while switch **S<sub>2</sub>** controls only light bulb **Q** [1]
- the ammeter measures the total current flowing in the circuit [1]
- the voltmeter measures the potential difference across light bulb **P** [1]
- the variable resistor is used to control the brightness of light bulb **P** [1]



[total: 5 marks]

- 6 (a) An electric iron is plugged to the main switch, but it did not work. Fig. 6.1 shows the plug of the electric iron with its cover removed.

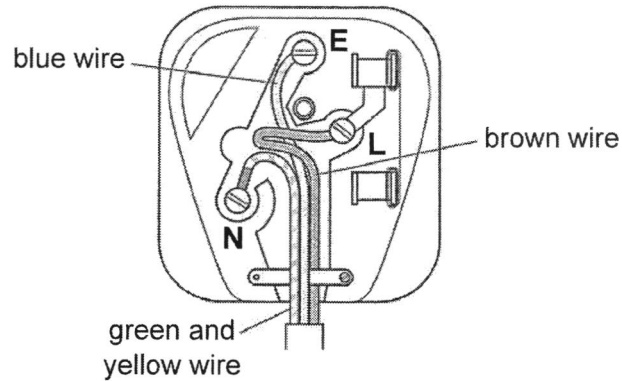


Fig. 6.1

State two mistakes in the connections within the plug.

- 1 \_\_\_\_\_ [1]
- 2 \_\_\_\_\_ [1]

- (b) Fig. 6.2 shows the other end of the electric iron.

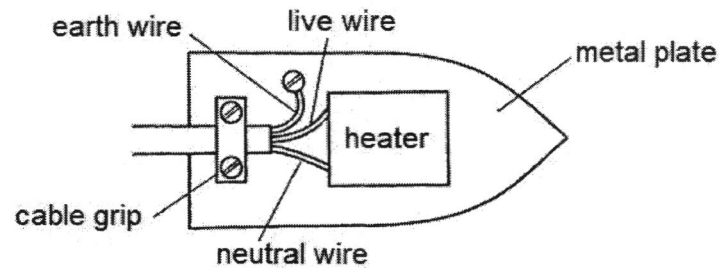


Fig. 6.2

Explain why the earth wire is connected to the metal plate of the electric iron.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_ [3]

[total: 5 marks]

- 7 Table 7.1 shows the electrical appliances that can be found in a typical household, their usage time per day and their power rating.

**Table 7.1**

electrical appliance	usage time	power rating
air-conditioner	7 hours	1.5 kW
ceiling fan	4 hours	100 W
lighting	4 hours	180 W
television	180 minutes	220 W

- (a) The cost of using all the electrical appliances for a day is \$6.14. Calculate the cost of each unit of electricity.

unit cost = \_\_\_\_\_ [2]

- (b) (i) From Table 7.1, state the electrical appliance which would have the greatest impact on global warming.

\_\_\_\_\_ [1]

- (ii) Suggest two ways to conserve energy at home.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ [2]

[total: 5 marks]

- 8 (a) Fig. 8.1 shows an object placed in front of a plane mirror. A spot 'X' is marked at the top of the object.

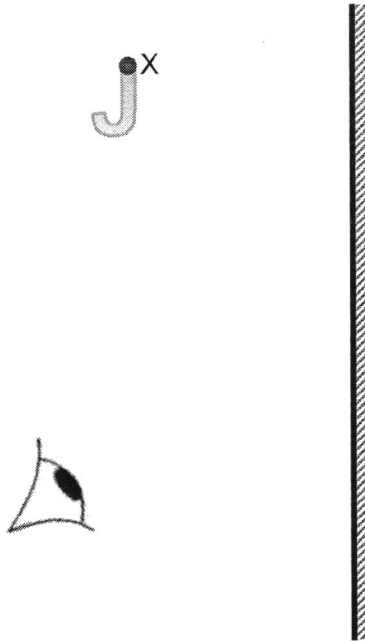
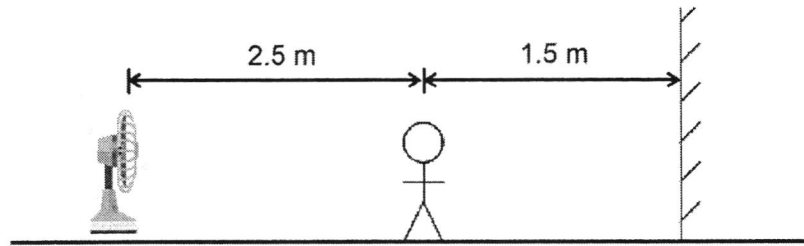


Fig. 8.1

On Fig. 8.1, draw the

- (i) image of the object [1]
- (ii) path of two rays of light leaving point X on the object then reflecting at the mirror before entering the eye [2]

(b) Fig. 8.2 shows a man and a fan in front of a plane mirror.



**Fig. 8.2**

The man walks 0.5 m towards the mirror. Calculate the new distance between the fan and the man's image in the mirror.

distance = \_\_\_\_\_ [2]

[total: 5 marks]

### Section C

Answer **all** the questions in this section in the spaces provided. Question **11** is in the form of an **Either / Or** question. Only one part should be answered.

- 9 Table 9.1 shows the pH value of four colourless solutions and the colour change when Universal indicator is added to them.

**Table 9.1**

solution	pH	colour after adding Universal indicator
P	1	red
Q	5	
R	7	green
S	13	

- (a) State the colour after adding Universal indicator to solution Q and solution S.

solution Q \_\_\_\_\_

solution S \_\_\_\_\_ [1]

- (b) A gas is produced when a piece of magnesium ribbon is added into a sample of one of the solutions. Another gas is produced when a carbonate is added into another sample of the same solution.

Student A suggested that the solution is solution Q while student B suggested that the solution is solution S.

- (i) State and explain which student is correct.

student \_\_\_\_\_

explanation \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [1]

- (ii) Describe a test to identify the gas produced when magnesium is added.

test \_\_\_\_\_ [1]  
\_\_\_\_\_

observation \_\_\_\_\_ [1]  
\_\_\_\_\_

- (iii) Describe a test to identify the gas produced when carbonate is added.

test \_\_\_\_\_ [1]  
\_\_\_\_\_

observation \_\_\_\_\_ [1]  
\_\_\_\_\_

- (c) State and explain the final colour observed when solution P and solution R are mixed then added with Universal indicator.

final colour \_\_\_\_\_

explanation \_\_\_\_\_ [1]

- (d) Solution S is found to be a metal hydroxide solution and reacts with solution P to produce sodium sulfate.

(i) Name the type of reaction when solution P reacts with solution S.  
\_\_\_\_\_ [1]

- (ii) Suggest the chemical names of solution P and solution S.

solution P \_\_\_\_\_

solution S \_\_\_\_\_ [1]

- (iii) Hence, write a word equation for the reaction between solution P and solution S.

\_\_\_\_\_ [1]

[total: 10 marks]

- 10 Fig. 10.1 shows a man observing a shark which is looking at a tank containing a toy fish, in the seawater. The tank is made of a transparent material Y and the toy fish is enclosed within liquid X. Of the 3 optical media, material Y has the highest optical density, followed by seawater then liquid X.

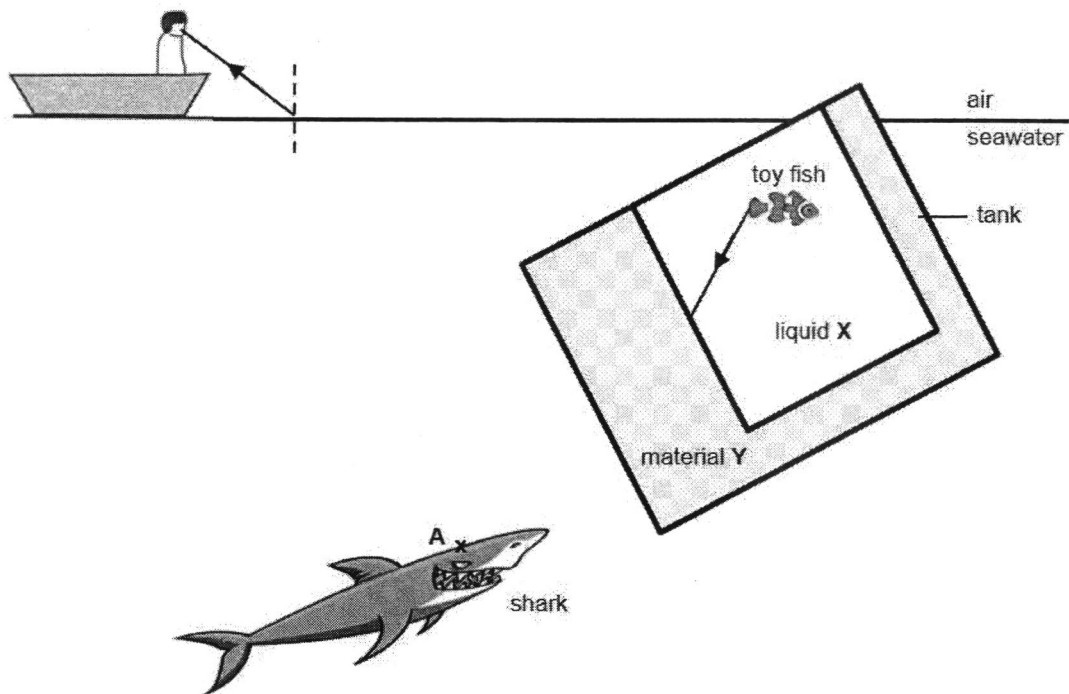


Fig. 10.1

- (a) Describe and explain how the light ray from the toy fish in Fig. 10.1 travels when it goes from liquid X into material Y.

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[3]

(b) On Fig. 10.1,

- (i) complete the path of the light ray from the toy fish as it travels from liquid **X** through material **Y** and seawater to reach the eye of the shark.

Indicate the normal at the boundary between liquid **X** and material **Y** and between material **Y** and the seawater. [2]

- (ii) label the angle of incidence '*i*' and the angle of refraction '*r*' at the boundary between liquid **X** and material **Y**. [1]

(c) In Fig. 10.1, the man is observing Point **A** which is at the top of the shark.

- (i) On Fig. 10.1, complete the path of the ray entering the man's eyes and mark the apparent position of point **A** as '**B**'. [2]

- (ii) Hence, state and explain which medium, air or seawater, is optically less dense.

medium \_\_\_\_\_ [1]

explanation \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ [1]

[total: 10 marks]

## 11 Either

Fig. 11.1 shows a kitchen circuit. The microwave oven draws a current of 10 A while the toaster draws a current of 6 A.

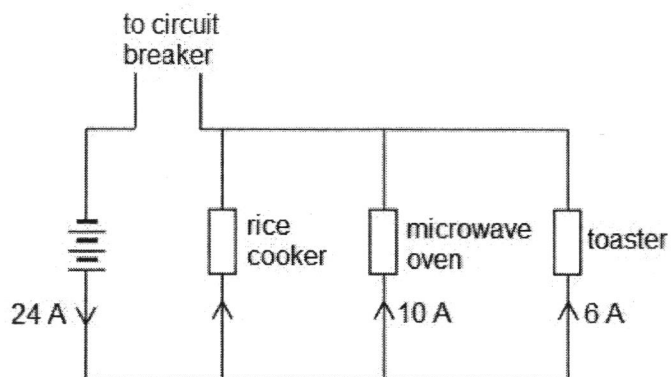


Fig. 11.1

- (a) Describe the function of the circuit breaker.

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[1]

- (b) (i) Given that the microwave oven has a resistance of  $12\ \Omega$ , calculate the potential difference across the microwave oven.

potential difference = \_\_\_\_\_ [1]

- (ii) Determine the potential difference across the toaster.

potential difference = \_\_\_\_\_ [1]

- (iii) Hence, calculate the resistance of the toaster.

resistance = \_\_\_\_\_ [1]

(iv) Calculate the effective resistance of the kitchen circuit.

effective resistance = \_\_\_\_\_ [1]

(c) (i) Determine the current drawn by the rice cooker.

current = \_\_\_\_\_ [1]

(ii) Suggest a suitable fuse rating for the rice cooker.

\_\_\_\_\_  
 \_\_\_\_\_ [1]

(iii) Describe how the fuse can be used to protect the rice cooker.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ [2]

(d) In Fig. 11.1, draw two light bulbs that are in series with each other and connected in parallel to the toaster. [1]

[total: 10 marks]

11 Or

- (a) Fig. 11.2 shows a circuit with a  $3\ \Omega$  resistor, a  $6\ \Omega$  resistor and a rheostat with resistance ranging from  $2\ \Omega$  to  $6\ \Omega$ .

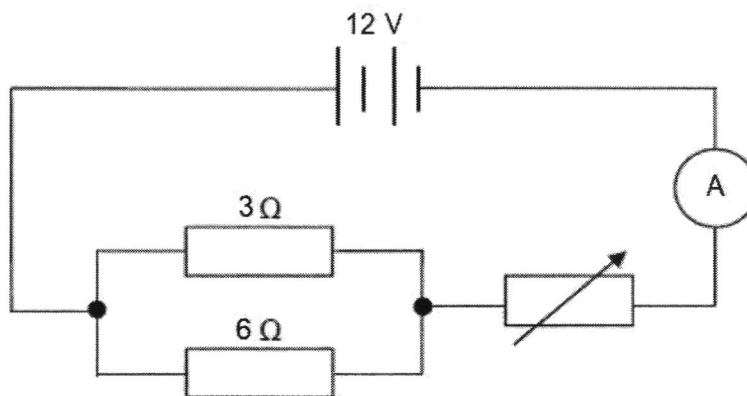


Fig. 11.2

- (i) Calculate the effective resistance of the  $3\ \Omega$  and  $6\ \Omega$  resistors.

effective resistance = \_\_\_\_\_ [1]

- (ii) Determine the maximum current that can flow through the circuit.

maximum current = \_\_\_\_\_ [2]

- (iii) Calculate the resistance of the rheostat when the current is  $1.5\ \text{A}$ .

resistance = \_\_\_\_\_ [2]

- (b) Fig. 11.3 shows a lighting circuit of a typical room with 2 lamps connected to a 240 V mains supply.

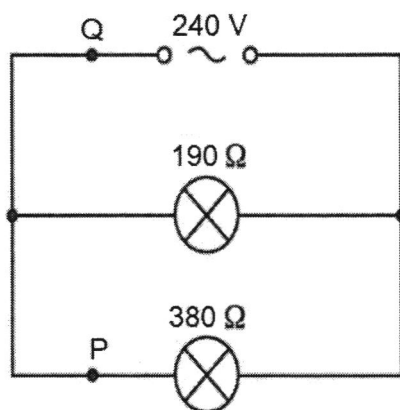


Fig. 11.3

- (i) Calculate the current at point P.

current = \_\_\_\_\_ [1]

- (ii) Calculate the current at point Q.

current = \_\_\_\_\_ [2]

- (iii) Suggest two reasons for arranging the lamps in the manner shown in Fig. 11.3.

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[2]

[total: 10 marks]

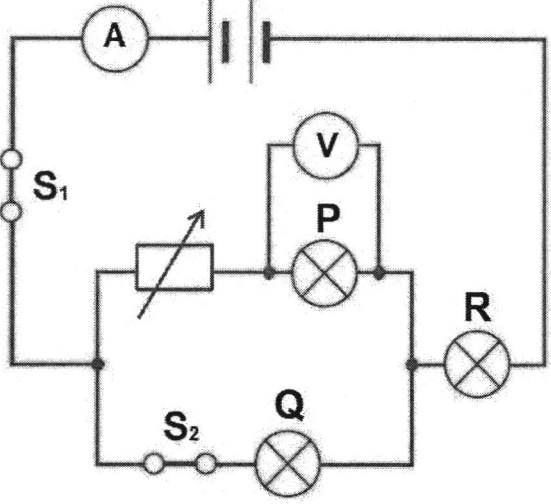
End of Paper

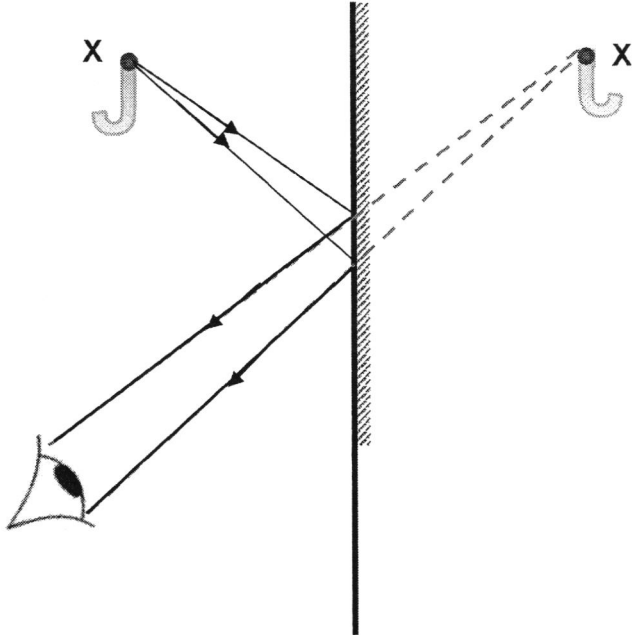
Q1. C Q2. C Q3. C Q4.  
B Q5. B Q6. C Q7. B Q8.  
C Q9. D Q10. B Q11.  
A Q12. D Q13. C Q14.  
C Q15. C

Q16. D Q17. B Q18.  
D Q19. B Q20. C Q21.  
B Q22. D Q23. C Q24.  
D Q25. C Q26. B Q27.  
A Q28. B Q29. C Q30. D

**Section B: Short Structured Questions [40 marks]**

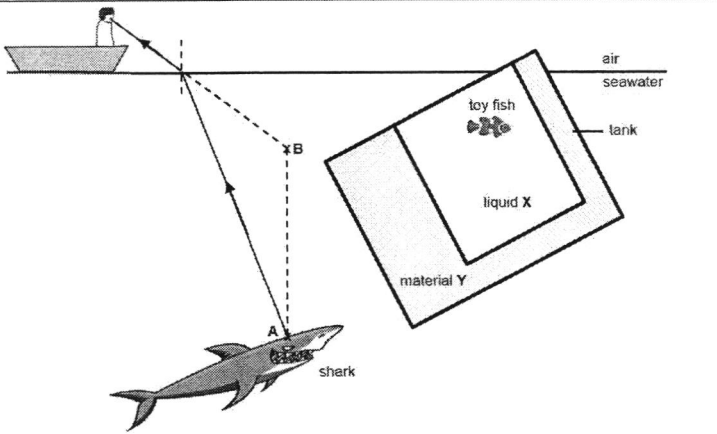
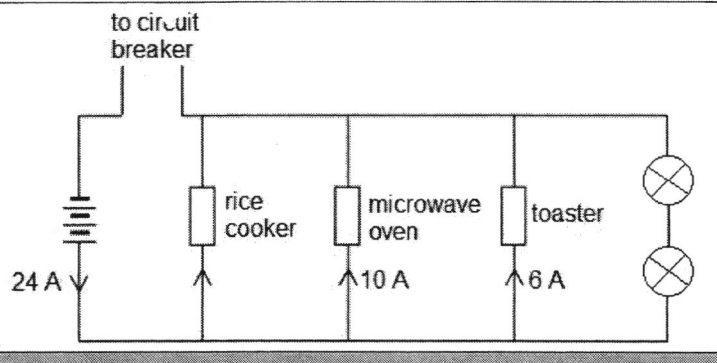
Qn	Answers	Marks	Remarks
1a	$WD = Fd$ $= 3800 \times 2.05$ $= 7790 \text{ J}$	C1 A1	Minus 1 mark for whole Qn if no / wrong units
1bi	$\text{Total } F = 3800 + 700$ $= 4500 \text{ N}$  $P = F / A$ $= 4500 / 0.02$ $= 225\,000 \text{ Pa or } 225\,000 \text{ N/m}^2$	C1 A1	
1bii	<ul style="list-style-type: none"> <li>- <u>Decrease force</u> exerted by reducing his weight / the weights lifted</li> <li>- <u>Increase surface area</u> in contact with the ground by placing both feet flat on the ground</li> </ul>	B1	Any 1  A: wear larger shoes
2a	$GPE = 0 \text{ J}$  $KE = 120 - 20 = 100 \text{ J}$	A1 A1	Minus 1 mark for whole Qn if no / wrong units
2bi	$GPE = 100 - (30 + 5) = 65 \text{ J}$  $KE = 0 \text{ J}$	A1 A1	
2bii	Kinetic energy    thermal energy + sound energy + elastic potential energy	B1	A: heat instead of thermal energy
3ai	<u>Higher pitch</u> as its <u>frequency</u> is increased.	B1	
3aii	<u>Louder</u> as the <u>vibration</u> of sound is larger.	B1	
3aiii	<u>No sound</u> is heard because <u>sound needs a medium / matter to transmit its vibrations / energy</u> but vacuum is absence of matter.	B1	
3bi	The cochlea in the human ear <u>vibrates according to the different frequencies of sound</u> and <u>converts them into electrical signals</u> .	B1	
3bii	To <u>increase the volume</u> of sound	B1	A: To increase <u>amplitude</u> of sound waves  R: To hear clearer / To amplify <u>frequency</u>
4a	rabbits, grasshoppers & mice	B1	
4b	Since the disease affects the foxes, the population of <u>foxes will decrease</u> . As <u>foxes are predators of rabbits</u> , with a decrease in the population of foxes, the <u>population of rabbits will increase</u> .	B1 B1	
4c	The population of hawks will <u>decrease</u> . When there is no light, <u>no energy will be provided for the producers or the producers / plants will not be able to photosynthesize</u> , hence decreasing the food supply for the primary consumers and subsequently all organisms in the food web. This will cause a <u>decrease in population for all organisms in the food web</u> .	B1 B1	

5		<p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>Minus 1</p> <p>Minus 1</p>	<p>Light bulbs P, Q &amp; R</p> <p><math>S_1</math> and <math>S_2</math> (circles CANNOT be shaded)</p> <p>Ammeter Voltmeter Variable resistor</p> <p>All components MUST be labelled &amp; CANNOT be at corners</p> <p>Wrong drawing of cells</p> <p>Wires should be relatively straight &amp; NOT curved</p>
6a	<ol style="list-style-type: none"> <li>1. <u>Neutral</u> / blue wire should be connected to the N pin</li> <li>2. <u>Earth</u> / green AND yellow wire should be connected to the E pin</li> <li>3. A <u>fuse is missing</u> and not connected to the live wire.</li> </ol>	B1 x 2	<p>Any 2</p> <p>Must specify type of wire that's wrongly connected</p> <p>R: wrong <u>colour</u> of wire (Qn is about CONNECTIONS)</p>
6b	<p>In case of a <u>fault</u> where the live wire touches the metal casing, the <u>metal casing will become live</u>. The earth wire will then <u>direct the large excessive current directly to ground</u>, thus <u>protecting the user from getting an electric shock</u> should he / she accidentally touch the metal casing.</p>	<p>B1</p> <p>B1</p> <p>B1</p>	
7a	<p>Total energy  <math>= (1.5 \times 7) + (0.1 \times 4) + (0.18 \times 4) + (0.22 \times 180/60)</math>  <math>= 12.28 \text{ kWh}</math></p> <p>Total cost = 12.28 kWh x unit cost  <math>\\$6.14 = 12.28 \text{ kWh} \times \text{unit cost}</math>  unit cost = \$0.50</p>	<p>C1</p> <p>A1</p>	<p>Minus 1 mark for whole Qn if no / wrong units</p>
7bi	air-conditioner	B1	
7bii	<ul style="list-style-type: none"> <li>- Use energy efficient appliances</li> <li>- Switch off electrical appliances when not in use</li> </ul>	B1 x 2	<p>A:</p> <ul style="list-style-type: none"> <li>- use appliances with low power rating</li> <li>- reduce usage time of appliances</li> <li>- use fan instead of air-conditioner</li> </ul> <p>R: use appliances with many ticks</p>

8a		B1  B1  B1	<p>image must be</p> <ul style="list-style-type: none"> <li>- Dotted (virtual)</li> <li>- Laterally inverted</li> <li>- Same distance</li> </ul> <p>Incident rays</p> <ul style="list-style-type: none"> <li>- both MUST be from point X</li> </ul> <p>Reflected rays</p> <ul style="list-style-type: none"> <li>- rays behind mirror MUST be dotted</li> <li>- rays should go to edge of eye</li> </ul> <p>All rays MUST have correct direction of arrows</p>
8b	<p>Final distance of man's image from mirror  <math>= 1.5 - 0.5</math>  <math>= 1 \text{ m}</math></p> <p>New distance between fan and man's image  <math>= 2.5 + 1.5 + 1</math>  <math>= 5 \text{ m}</math></p>	C1  A1	<p>Minus 1 mark for whole Qn if no / wrong units</p>

**Section C: Data / Long Structured / Either Or Questions [30 marks]**

Qn	Answers	Marks	Remarks
9a	Solution Q – yellow / orange Solution S – violet / purple	B1	Both correct
9bi	Student: A  Explanation: Solution Q has a pH of 5, thus it is <u>acidic while</u> solution S has a pH of 13, thus it is <u>alkaline</u> . Only <u>acids and not alkalis react with metals</u> such as magnesium, to produce hydrogen gas <u>and react with carbonates</u> to produce carbon dioxide gas.	B1	
9bii	Test: Insert a <u>lighted splint</u> into the test tube containing the hydrogen gas.  Observation: The lighted splint will be <u>extinguished with a 'pop' sound</u> .	B1 B1	
9biii	Test: Bubble the carbon dioxide gas through aqueous calcium hydroxide / <u>limewater</u> .  Observation: White precipitate will be formed / <u>limewater turned chalky / cloudy</u> .	B1 B1	
9c	Final colour: <u>Red</u>  Explanation: Overall solution <u>remains acidic</u> / there is no reaction between an acidic and neutral solution.	B1	
9di	Neutralisation	B1	
9dii	Solution P: sulfuric acid Solution S: sodium hydroxide	B1	Both correct
9diii	Sulfuric acid + sodium hydroxide → sodium sulfate + water	B1	
10a	Since material Y is <u>optically denser</u> than liquid X, the light ray will <u>slow down in material Y</u> and <u>bend towards the normal</u> .	B1 B1 B1	
10b	<p>The diagram shows a light ray originating from a point 'A' on a shark's head. The ray passes through material Y, then liquid X, then seawater, and finally air. A toy fish is visible in the liquid X. A vertical dashed line represents the normal. The ray bends towards the normal at the interface between material Y and liquid X, and away from the normal at the interface between liquid X and seawater. The ray is labeled 'i' at the air-seawater interface and 'r' at the seawater-liquid X interface.</p>	B1 B1 B1 B1 Minus 1 Minus 1	Refracted ray (MUST be closest to normal)  Emergent ray (MUST bend away from normal MORE than refracted ray BUT LESS than incident ray)  Both i & r correct  Missing / wrong normal  Missing / wrong direction of arrows

10ci		B1 B1 Minus 1	Apparent position, labelled B Incident ray from A Missing / wrong direction of arrows
10cii	<p>Medium: Air</p> <p>Explanation: The light ray <u>bends away from the normal</u> as it travels from seawater to air since it gains speed as it emerges from seawater into air.</p>	B1 B1	
11Ea	When there is <u>overcurrent</u> / excessive current, the circuit breaker will <u>trip and open the circuit</u> , thus <u>cutting the current supply</u> .	B1	
11Ebi	$V = RI$ $= 12 (10)$ $= 120 \text{ V}$	A1	Minus 1 mark for whole Qn if no / wrong units
11Ebii	120 V	A1	
11Ebiii	$V = RI$ $120 = R (6)$ $R = 20 \Omega$	A1	
11Ebiv	$V = RI$ $120 = R (24)$ $R = 5 \Omega$	A1	
11Eci	$I = 24 - (10 + 6)$ $= 8 \text{ A}$	A1	
11Ecii	9 A	B1	A: 10 A
11Eciiii	When there is <u>overcurrent</u> / <u>current larger than the fuse rating</u> , the thin wire in the fuse will melt, causing the <u>fuse to blow</u> . This will result in an <u>open circuit</u> which will stop the current flowing to the rice cooker, hence protecting it from the overcurrent.	B1 B1	
11Ed		B1	

11Oai	$R = 1 \div (1/3 + 1/6)$ $= 2 \Omega$	A1	Minus 1 mark for whole Qn if no / wrong units
11Oaii	$R_T = 2 + 2 = 4 \Omega$  $V = RI$ $12 = 4 (I)$ $I = 3 \text{ A}$	C1 A1	
11Oaiii	$V = RI$ $12 = R_T (1.5)$ $R_T = 8 \Omega$  $R = 8 - 2 = 6 \Omega$	C1 A1	
11Obi	$V = RI$ $240 = 380 (I)$ $I = 0.632 \text{ A (to 3 s.f)}$	A1	
11Obii	$V = RI$ $240 = 190 (I)$ $I = 1.26 \text{ A (to 3 s.f)}$  $I_q = 0.632 + 1.26$ $= 1.89 \text{ A (to 3 s.f)}$	C1 A1	
11Obiii	<ul style="list-style-type: none"> <li>- If one of the lamps blows, the other lamp will still work normally.</li> <li>- The bulbs can be <u>controlled individually</u> by using switches.</li> </ul>	B1 B1	