This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

Lebanon Evangelical School
for Boys and Girls
Loueizeh - Baabda

Stage Exam 06

20JUN, 21JUN2022

Do NOT write in this box. Your MARK will be placed here.

Subject :	Physics
Class :	9A
Teacher :	Dr Ruth Brett
Duration :	1 hour

All work should be written in this answer booklet in black pen. You may use pencil for drawings and rough work. You must show your working. Give your answers to two or three significant figures. Use g=10m/s^2 for the acceleration of free fall.

Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

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- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

You may find these equations useful:

$$frequency = \frac{1}{time\ period} \qquad f = \frac{1}{T}$$

$$power = \frac{energy\ transferred}{time\ taken} \qquad P = \frac{W}{t}$$

$$(final\ speed)^2 = (initial\ speed)^2 + (2 \times acceleration \times distance) \qquad v^2 = u^2 + (2 \times a \times s)$$

Where necessary, assume the acceleration of free fall, g = 10 m/s^2

FORCES

1. Define friction. (1)

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2. Define thinking distance. (1)

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3. State Hooke's law. (1)

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4. Define plastic behaviour. (1)

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5. Describe a distance-time graph for a stationary object. (1)

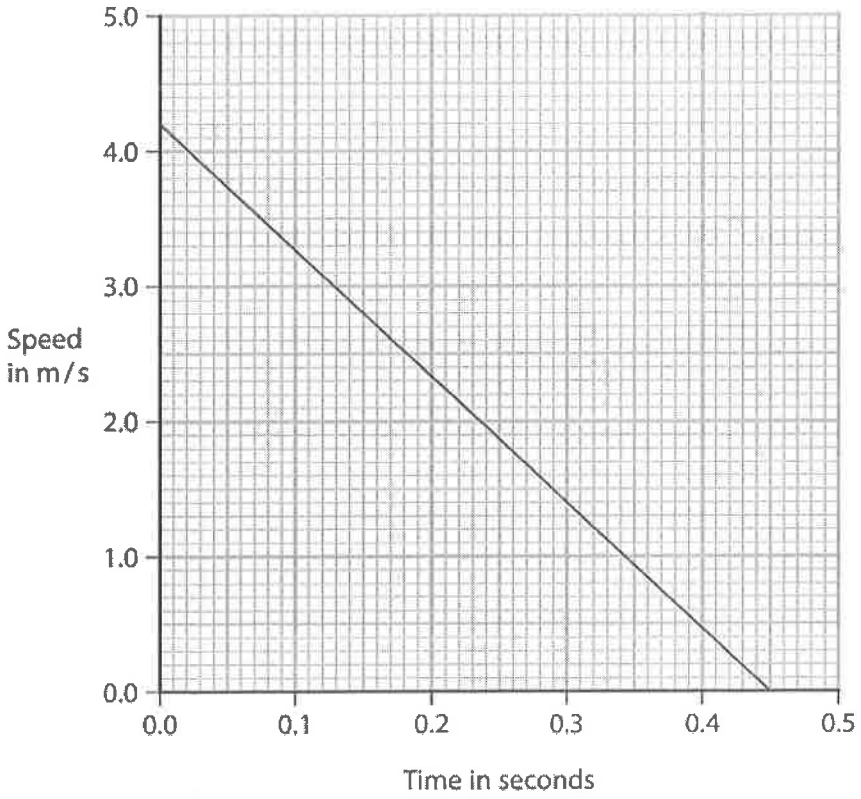
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6 (a) A person throws an object vertically upwards.

The speed-time graph shows how the speed of the object varies from the time it is thrown until reaching its maximum height.



(i) Calculate the acceleration of the object.

(3)

acceleration = ... m/s^2

(ii) Calculate the distance the object travels to reach its maximum height.

(3)

distance = ... m

Total for Question = 6 marks

7. The photograph shows a whale jumping out of the surface of the sea.



(Source: © Alexander Baumann/Shutterstock)

(a) At the top of the jump, the whale's velocity is 0 m/s.

The whale falls 2.2 m from the top of the jump to the surface of the sea.

Calculate the velocity of the whale when it hits the surface of the sea.

(4)

velocity = ... m/s

(b) A resultant force causes the whale to slow down when it hits the surface of the sea.

(i) Draw an arrow to show this resultant force.

(1)



(Source: © Eugenia Petrovskaya/Shutterstock)

(ii) The resultant force acting on the whale is 18 000 N.

The mass of the whale is 4100 kg.

Calculate the acceleration of the whale.

(3)

acceleration = ... m/s^2

Total for Question = 8 marks

ELECTRICITY

8. How does a fuse work? (1)

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9. Define alternating current. (1)

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10. How should a voltmeter be connected? (1)

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11. Describe how current changes with voltage for a wire or resistor. (1)

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12. What is the relationship between light intensity and the resistance of a light-dependent resistor. (1)

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13. Diagram 1 below shows a machine used for demonstrating electrostatics.

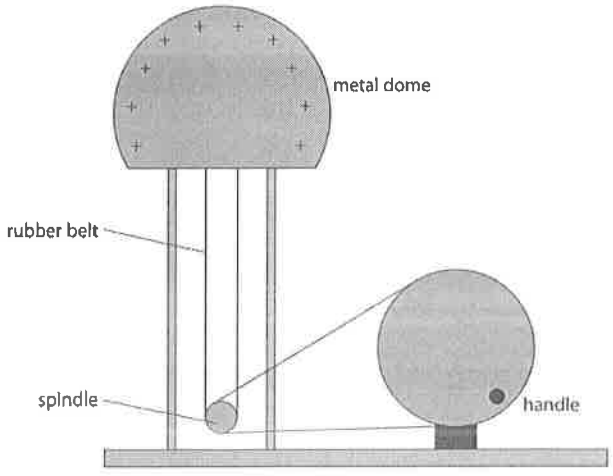


Diagram 1

(a) When the handle is turned, the dome becomes positively charged.

(i) In terms of electron movement, give a reason why the metal dome becomes positively charged.

(1)

(b) The metal dome is discharged.

A thin metal case is then placed on top of the metal dome, as shown in Diagram 2.

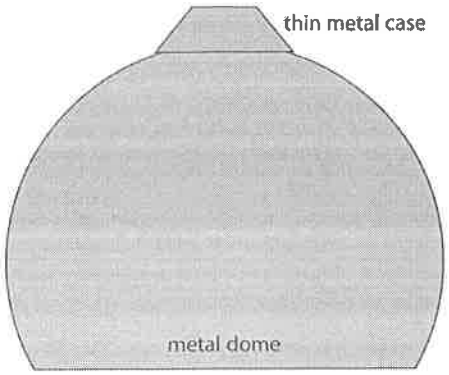


Diagram 2

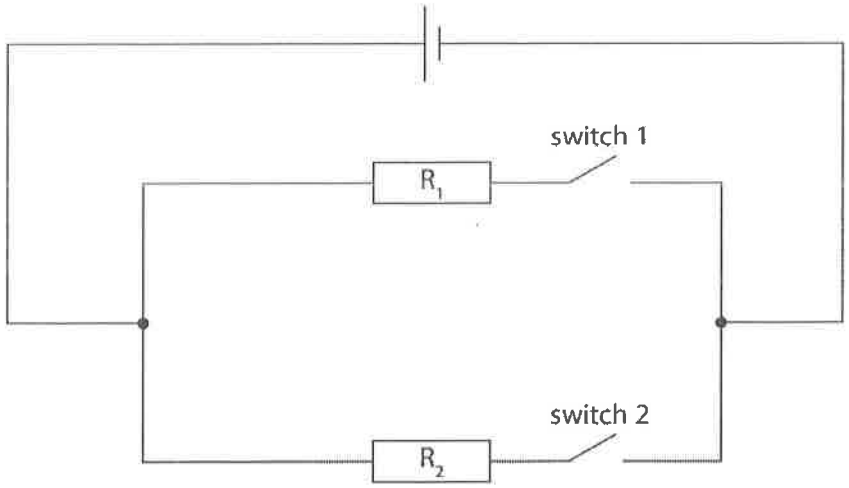
(i) When the handle is turned, the thin metal case moves upwards away from the dome.

Explain why the thin metal case starts to move upwards.

(3)

Total for question = 4 marks

14. The diagram shows a circuit containing a cell, two switches and two resistors, R_1 and R_2.



a) Both switches are closed.
The voltage across the cell is 4.5 V. Explain how the voltage across R2 comapres with the voltage across the cell. (2)

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b) Switch 1 is now opened while switch 2 remains closed.

(i) State the formula linking energy transferred, charge and voltage.

(1)

(ii) The voltage across the cell stays constant at 4.5V.

Calculate the charge transferred through the cell when the cell transfers 4.1 J of energy.

(3)

charge transferred = ... C

Total for Question = 6 marks

15. A toaster is an electrical device used for toasting bread.



© Levent Konuk/Shutterstock

The toaster contains thin metal wires.

These wires get hot when there is a current in them.

(i) State the formula linking power, current and voltage.

(1)

(ii) The power rating of the toaster is 2.8 kW.

Calculate the total current in the toaster.

[mains voltage = 230V]

(3)

current = ... A

(iii) The toaster contains 48 thin metal wires.

Calculate the current in each of the thin metal wires.

(1)

current = ... A

Total for Question = 5 marks

WAVES

16. Define the frequency of a wave. (1)

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17.List the electromagnetic spectrum in order of increasing frequency. (1)

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18. Where ia an image formed in a plane mirror? (1)

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19. What is a longitudinal wave? (1)

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20. Give a danger of microwaves. (1)

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21. Wi-Fi signals are electromagnetic waves that can be transmitted at frequencies of 2.4 GHz and 5.2 GHz.

(a) (i) State a similarity of the Wi-Fi signals at 2.4 GHz and 5.2 GHz.

(1)

.....

(ii) The two Wi-Fi signals have different frequencies.

State another difference between the Wi-Fi signals.

(1)

.....

(b) (i) State the formula linking speed, frequency and wavelength.

(1)

(ii) Calculate the wavelength of Wi-Fi signals transmitted at 5.2×10^9 Hz.

[speed of light = 3.0×10^8 m/s]

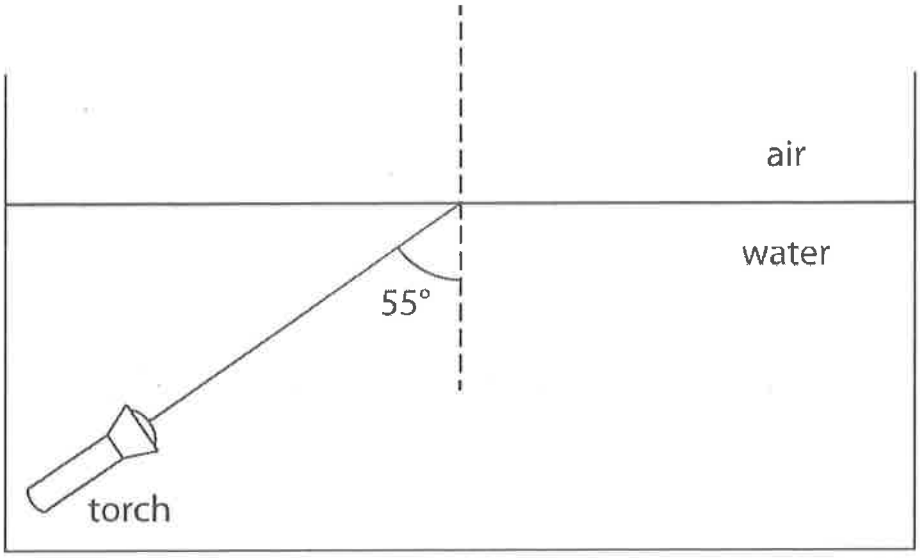
(2)

wavelength = ... m

(c) (i)State the formula linking refractive index, angle of incidence and angle of refraction. (1)

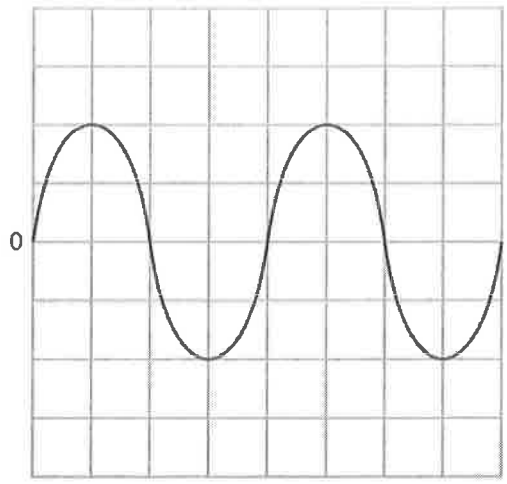
(ii) Calculate the angle of refraction if the refractive index of glass is 1.5 and the angle of incidence is 64°. Give your answer to the nearest degree. (2)

(d) The critical angle for water is 50°. Complete the path of the ray of light approaching a boundary between water and air. (1)



Total for Question = 9 marks

22. The oscilloscope trace in the diagram below shows a sound wave:



Oscilloscope settings:

y direction: 1 square = 0.5 V

x direction: 1 square = 0.5 ms

(i) Determine the period of the sound wave.

(3)

period = ... s

(ii) Calculate the frequency of the sound wave.

(2)

frequency = ... Hz

(iii) Deduce whether humans can hear the sound wave.

(2)

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.....

Total for Question = 7 marks

WORKED SOLUTION

This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

Lighting the fires that burn for eternity

Loueizeh - Baabda

Lebanon Evangelical School

for Boys and Girls — Loueizeh - Baabda

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$power = \frac{energy\ transferred}{time\ taken}$ $\qquad P = \frac{W}{t}$

$(final\ speed)^2 = (initial\ speed)^2 + (2 \times acceleration \times distance)$ $\qquad v^2 = u^2 + (2 \times a \times s)$

Where necessary, assume the acceleration of free fall, g = 10 m/s^2

FORCES

1. Define friction. (1)

Friction is a force that apposes motion (1)

2. Define thinking distance. (1)

The distance travelled between a driver seeing a hazard and putting the brakes on. (1)

3. State Hooke's law. (1)

The force applied is proportional to the extension of a spring / wire (1)

4. Define plastic behaviour. (1)

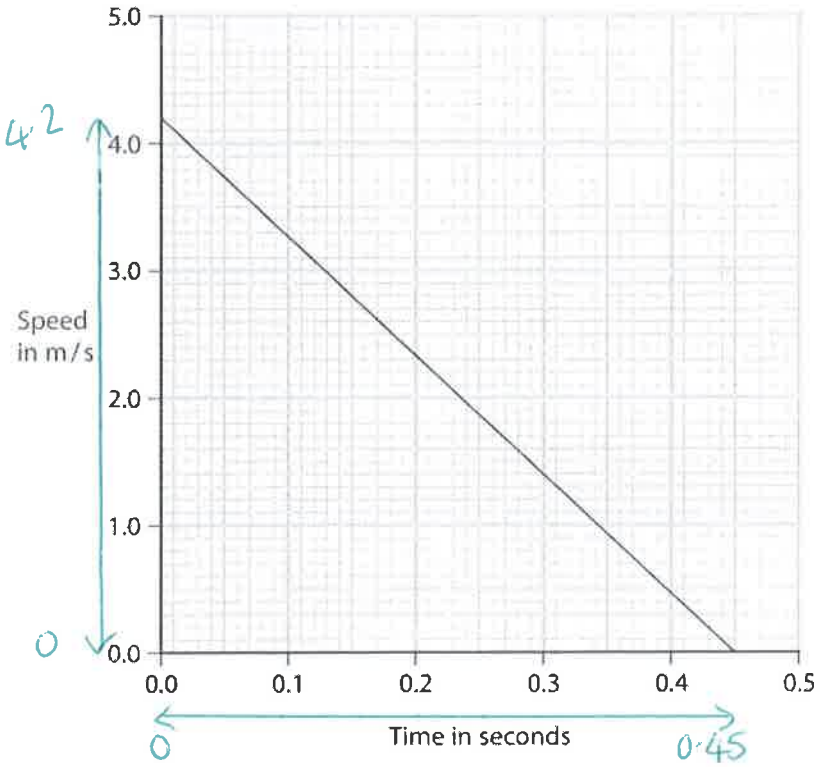
The object doesn't return to its original length when the load is removed. (1)

5. Describe a distance-time graph for a stationary object. (1)

Horizontal straight line. (1)

6 (a) A person throws an object vertically upwards.

The speed-time graph shows how the speed of the object varies from the time it is thrown until reaching its maximum height.



(i) Calculate the acceleration of the object.

(1) for using this fact

$$\text{acceleration} = \text{gradient} = \frac{-4.2}{0.45} = -9.33$$

(1) (1) must be negative

acceleration = -9.3 m/s²

(ii) Calculate the distance the object travels to reach its maximum height.

$$\text{distance} = \text{area (1) under line} = \frac{1}{2} \times 4.2 \times 0.45 \quad (1)$$

$$\text{distance} = 0.945$$

(1)

distance = 0.95 m

Total for Question = 6 marks

7. The photograph shows a whale jumping out of the surface of the sea.



(Source: © Alexander Baumann/Shutterstock)

(a) At the top of the jump, the whale's velocity is 0 m/s.

The whale falls 2.2 m from the top of the jump to the surface of the sea.

Calculate the velocity of the whale when it hits the surface of the sea.

(4)

$u = 0 \quad v = ? \quad s = 2.2\text{m} \quad a = 10\text{m/s}^2$

$v^2 = u^2 + (2 \times a \times s)$ (1) [using this]

$v^2 = 0 + (2 \times 10 \times 2.2) = 44$ (1)

$v = \sqrt{44} = 6.63$ (1)

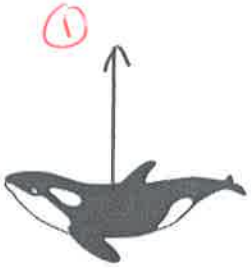
(1)

velocity = 6.6 m/s

(b) A resultant force causes the whale to slow down when it hits the surface of the sea.

(i) Draw an arrow to show this resultant force.

(1)



(1)

Explanation

↓ Whale moving this way so force must be ↑ to make it slow down

(Source: © Eugenia Petrovskaya/Shutterstock)

(ii) The resultant force acting on the whale is 18 000 N.

The mass of the whale is 4100 kg.

Calculate the acceleration of the whale.

(3)

$F = m \times a$

$18\,000 = 4100 \times a$ (1)

$a = \frac{18\,000}{4100} = 4.39 \text{ m/s}^2$ (1)

(1)

acceleration = 4.4 m/s²

Total for Question = 8 marks

ELECTRICITY

8. How does a fuse work? (1)

If the current is too high, the fuse melts, breaking the circuit. (1)

9. Define alternating current. (1)

The current changes direction continually. (1)

10. How should a voltmeter be connected? (1)

In parallel with the device that you want to measure the voltage across. (1)

11. Describe how current changes with voltage for a wire or resistor. (1)

The current is proportional to the voltage. (1)

12. What is the relationship between light intensity and the resistance of a light-dependent resistor. (1)

As the light intensity increases, the resistance of a light dependent resistor decreases (1)

13. Diagram 1 below shows a machine used for demonstrating electrostatics.

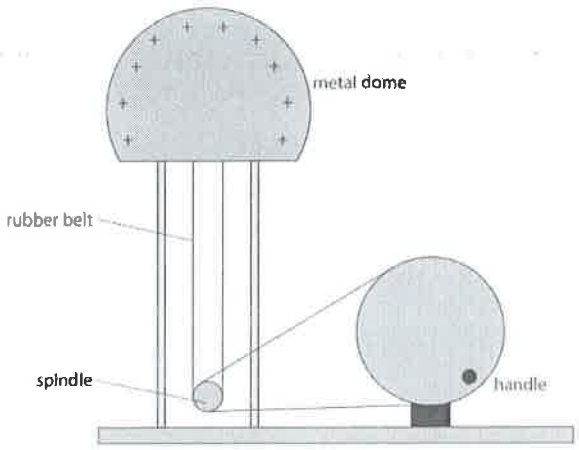


Diagram 1

(a) When the handle is turned, the dome becomes positively charged.

(i) In terms of electron movement, give a reason why the metal dome becomes positively charged.

(1)

The dome loses electrons which are negatively charged. (1)

(b) The metal dome is discharged.

A thin metal case is then placed on top of the metal dome, as shown in Diagram 2.

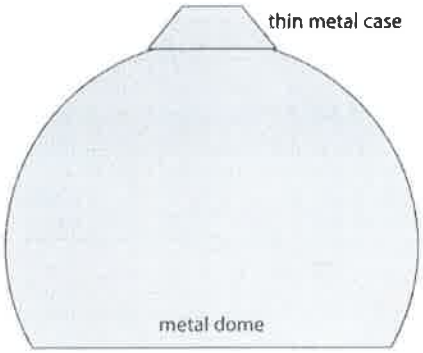


Diagram 2

(i) When the handle is turned, the thin metal case moves upwards away from the dome.

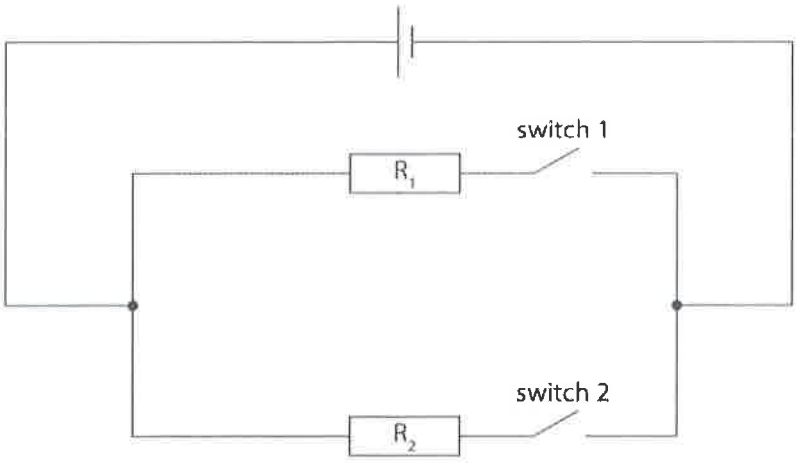
Explain why the thin metal case starts to move upwards.

(3)

The metal case also loses electrons (1) and becomes positively charged. The metal case and the dome now have the same charge (1), so they repel each other. (1)

Total for question = 4 marks

14. The diagram shows a circuit containing a cell, two switches and two resistors, R_1 and R_2.



a) Both switches are closed.
The voltage across the cell is 4.5 V. Explain how the voltage across R2 comapres with the voltage across the cell. (2)

(1)
The voltage across R_2 is also 4.5V because it is in parallel with the cell.
(1)

b) Switch 1 is now opened while switch 2 remains closed.

(i) State the formula linking energy transferred, charge and voltage.

(1)
Energy = charge x voltage or voltage = $\frac{\text{energy}}{\text{charge}}$ (1)

(ii) The voltage across the cell stays constant at 4.5 V.

Calculate the charge transferred through the cell when the cell transfers 4.1 J of energy.

(3)
$V = \frac{E}{Q}$ $\quad 4.5 = \frac{4.1}{Q}$ (1)

$Q = \frac{4.1}{4.5} = 0.911$
(1)

(1)
charge transferred = 0.91 C

Total for Question = 6 marks

15. A toaster is an electrical device used for toasting bread.



© Levent Konuk/Shutterstock

The toaster contains thin metal wires.

These wires get hot when there is a current in them.

(i) State the formula linking power, current and voltage.

(1)

power = current × voltage (1)

(ii) The power rating of the toaster is 2.8 kW.

Calculate the total current in the toaster.

[mains voltage = 230 V]

(3)

2·8kW = 2800W

2800 = I × 230 (1)

$I = \frac{2800}{230} = 12.17$ (1)

(1)

current = 12·2 A

(iii) The toaster contains 48 thin metal wires.

Calculate the current in each of the thin metal wires.

(1)

The current splits equally between the wires

$\frac{12}{48} = 0.25$

current = 0·25 (1) A

If using your answer from (ii) → $\frac{12.2}{48} = 0.254$

Total for Question = 5 marks

WAVES

16. Define the frequency of a wave. (1)

The number of (complete) waves in one second (1)

17. List the electromagnetic spectrum in order of increasing frequency. (1)

increasing wavelength →
GXULIMR
← increasing frequency

radio waves, microwaves, infrared, visible light, ultra-violet, x-rays, gamma rays (1)

18. Where ia an image formed in a plane mirror? (1)

Behind the mirror (1) (the same distance from the mirror as the object)

19. What is a longitudinal wave? (1)

The oscillations are parallel to the direction of travel of the wave. (1)

20. Give a danger of microwaves. (1)

Internal heating of body tissue (1)

21. Wi-Fi signals are electromagnetic waves that can be transmitted at frequencies of 2.4 GHz and 5.2 GHz.

(a) (i) State a similarity of the Wi-Fi signals at 2.4 GHz and 5.2 GHz.

(1)

They travel at the same speed (1) (or both transverse waves)

(ii) The two Wi-Fi signals have different frequencies.

State another difference between the Wi-Fi signals.

(1)

They have different wavelengths (1)

(b) (i) State the formula linking speed, frequency and wavelength.

(1)

Speed = frequency × wavelength (1)

(ii) Calculate the wavelength of Wi-Fi signals transmitted at 5.2×10^9 Hz.

[speed of light = 3.0×10^8 m/s]

(2)

$3 \times 10^8 = 5.2 \times 10^9 \times \lambda$ (1)

$\lambda = \frac{3 \times 10^8}{5.2 \times 10^9} = 0.05769$

(1)

wavelength = 0.058 m

(c) (i) State the formula linking refractive index, angle of incidence and angle of refraction. (1)

$n = \frac{\sin i}{\sin r}$ (1)

(ii) Calculate the angle of refraction if the refractive index of glass is 1.5 and the angle of incidence is 64°. Give your answer to the nearest degree. (2)

$1.5 = \frac{\sin 64}{\sin r}$ (1)

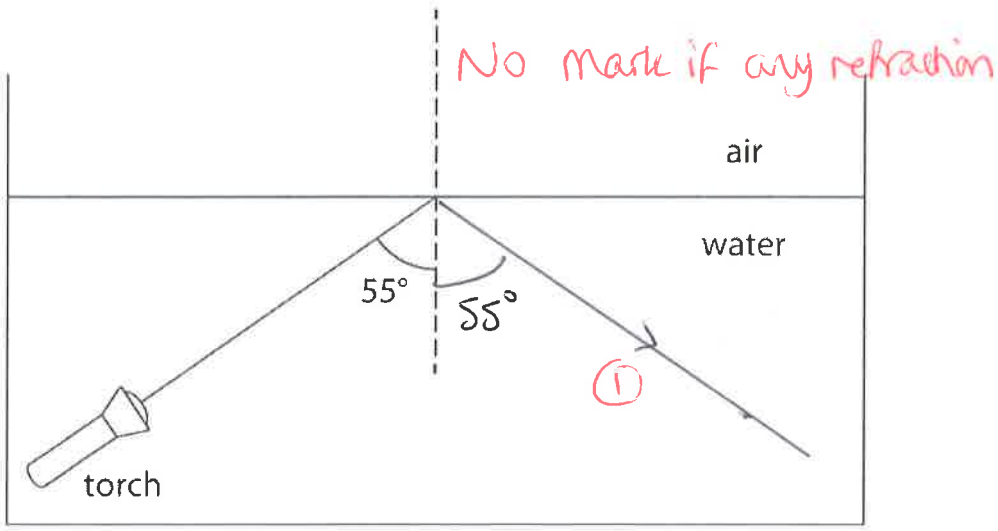
$\sin r = \frac{\sin 64}{1.5} = \frac{0.899}{1.5} = 0.599$

$r = \sin^{-1}(0.599) = 36.8$

$r = 37°$ (1) (to nearest degree)

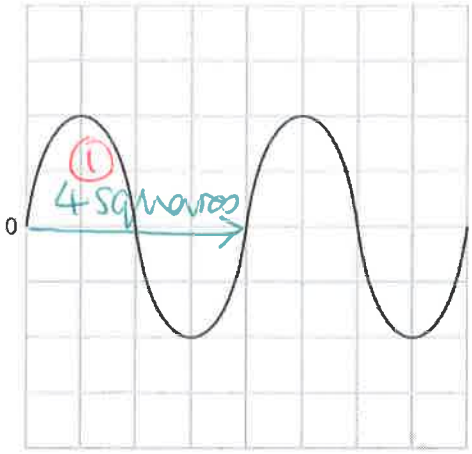
(d) The critical angle for water is 50°. Complete the path of the ray of light approaching a boundary between water and air. (1)

55° > critical angle ⇒ T.I.R.



Total for Question = 9 marks

22. The oscilloscope trace in the diagram below shows a sound wave:



Oscilloscope settings:

y direction: 1 square = 0.5 V

x direction: 1 square = 0.5 ms

Scale

(i) Determine the period of the sound wave.

(3)

$T = 4 \times 0.5\,ms = 2\,ms$

period = 0.002 s

(ii) Calculate the frequency of the sound wave.

(2)

$f = \frac{1}{T} = \frac{1}{0.002} = 500\,Hz$

frequency = 500 Hz

(iii) Deduce whether humans can hear the sound wave.

(2)

Humans can hear sounds between 20Hz and 20000Hz, so they can hear this sound as $25 < 500 < 20000$

Total for Question = 7 marks