MARKING GUIDE SESEMAT SEMINAR PHYSICS UCE 2023

WAVES AND LIGHT

WAVES

1

(a) (i) Sound is a form of energy produced by a vibrating source.

(ii)

Water waves	Sound waves
Are transvers waves	Are longitudinal waves
Are relatively slower	Are relatively faster
Can travel in a vacuum	Need a material medium to travel or cannot travel through a vacuum

(b) (i) Reverberation is the effect of a prolonged sound heard when an echo merges with the original sound.

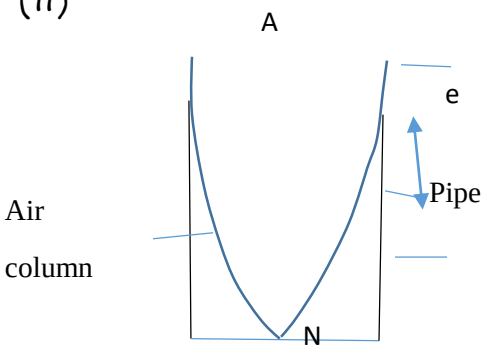
(ii) Reverberation is a result of merging of an echo with the original sound. For an echo to be heard, the time lag between the echo and original sound must be at least 0.1 seconds. In a small room, this time lag is less than 0.1 second, hence an echo cannot be heard.

(iii) The experimenter stands at a known distance d from a tall wall. Sound is made by shouting and the stop clock is started simultaneously with the shouting. When the echo is heard, the stop clock is stopped immediately and the time taken is noted and recorded as t. The velocity V of sound is calculated from $V = \frac{2d}{t}$.

The experiment is repeated using other values of d and the average velocity is the velocity of sound in air.

(c)(i) Resonance is the vibration of a body at its natural frequency due to impulses received from a nearby body vibrating at the same frequency.

(ii)



e =End correction

(iii) $f_o = \frac{V}{2L} = \frac{330}{2X0.75} 220\ Hz$

(d) (i) Frequency is the number of wave cycles made in one second.

(ii) – Length of the string

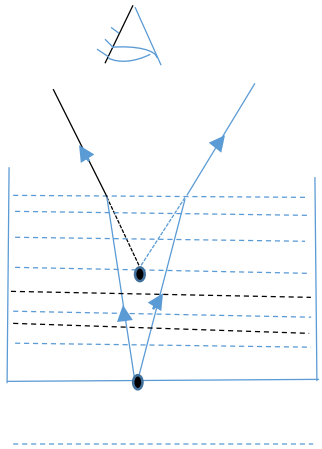
- Tension in the string
- Mass per unit length of the string

LIGHT

(a) (i) Refraction is the bending of a light ray when it passes through two media of different optical densities.

Refraction is caused by change of speed of light in the 2 media of different optical densities. The speed of light in the denser medium is lower than that in less dense medium.

(ii)



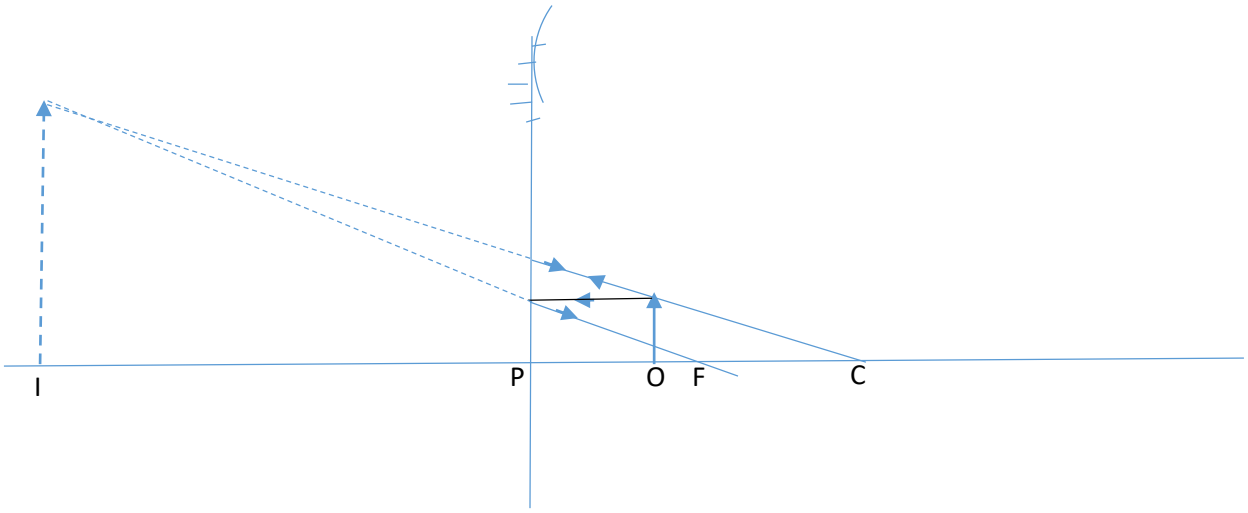
Light rays from an object o (bottom of the pool) are refracted at the water surface towards the observer's eye. To the observer, the refracted rays appear to come from I, the image of the bottom. Hence the swimming pool appears shallower.

(iii) when angle of incidence is greater than the critical angle than the critical angle.

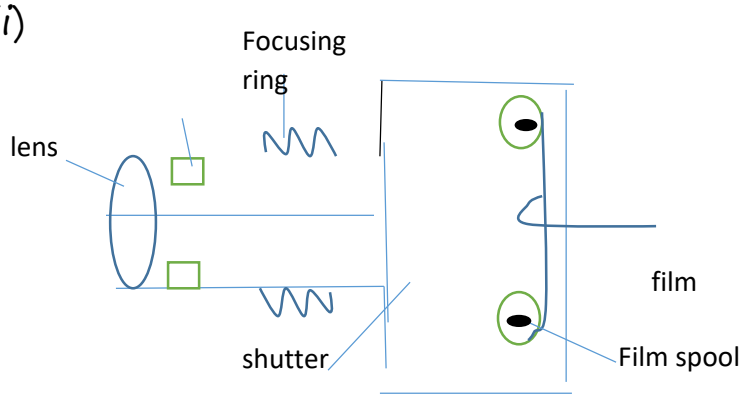
When a ray is travelling from a denser to a less dense medium.

(b) (i) Radius of curvature is the distance between Centre of curvature and the pole of the mirror.

(ii)



(c)(i)

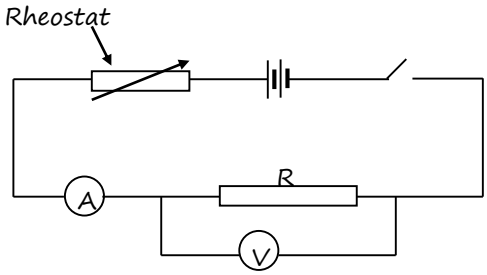
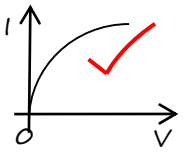
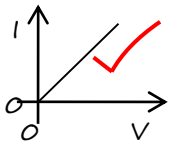


The lens receives light rays from the object and focuses the rays to the film. The diaphragm then controls the amount of light reaching the film. The shutter controls the exposure time for the image formed as well as amount of light reaching the film. The film is coated with a light sensitive substance and is where the image is formed.

(ii)

Human eye	camera
The distance between the lens and retina is fixed	The distance between the lens and the film is variable
The lens of the eye has a variable focal length	The lens of the camera is fixed
The lens of the eye is biological	The lens of the camera is artificial

6.

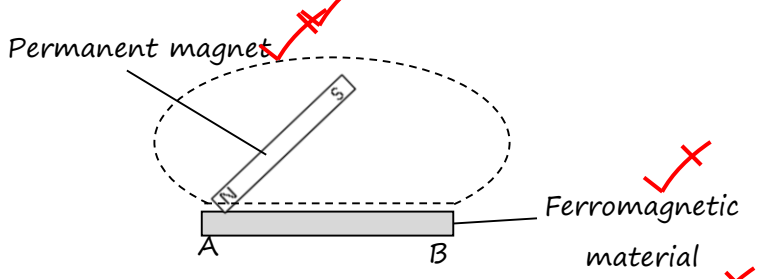
No	SCORING POINTS	REMARKS
7(c)(i)	At constant temperature, the current flowing through a metallic conductor is directly proportional to the potential difference across it. ✓	
(ii)	– The circuit is connected with a voltmeter across the resistor, R as shown in the diagram below  Correct circuit ✓	
	– The switch is closed and the rheostat adjusted to give a suitable reading, I on the ammeter. ✓ – The corresponding voltmeter reading, V is noted. ✓ – The procedure is repeated by adjusting the rheostat to obtain different values of current, I and the corresponding values of p.d, V are recorded. ✓ – When a graph of current, I against potential difference, V is plotted, a straight-line graph through the origin is obtained. ✓ – This shows that current is directly proportional to p.d hence verifying Ohm's law ✓	$I = \frac{}{\Phi} \times 2 = \underline{1.33A}$ ✓
(b)	 Filament bulb ✓  Metal wire ✓	
(c)(i)	From V = IR 8 = I x 4 ⇒ I = <u>2A</u> ✓	
(ii)	P.d across parallel resistors = 12 – 8 = 4V ✓ From V = IR ⇒ 4 = 2 x R ⇒ R = <u>2Ω</u> ✓ From R = ~~Product~~ Sum ⇒ $\frac{6X}{6+X}$ = 2 ✓ 2(6 + X) = 6X 12 + 2X = 6X ⇒ X = <u>3Ω</u> ✓	

	From V = IR 4 = I x 3 I = 4/3 = **1.33A**	

7

Soft magnetic material is one used for making temporary magnets.

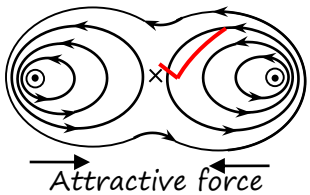
Example: Soft iron

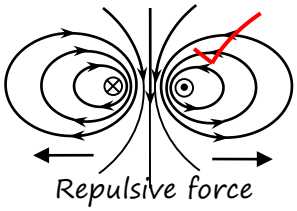


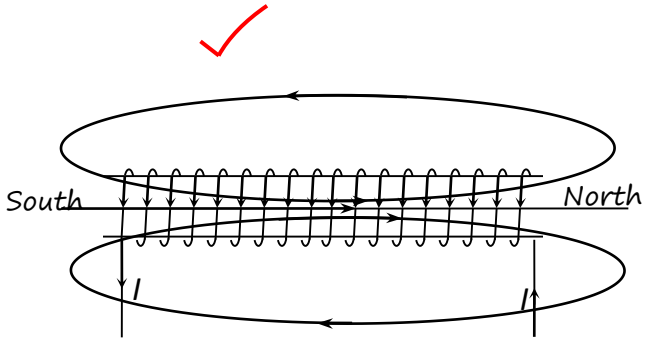
- One pole of a permanent magnet is placed in contact with one end of a ferromagnetic material and dragged up to the other end.
- The magnet is then lifted up and the process is repeated using the same pole.
- This will cause the dipoles in the domains to align themselves making end B **(in this case)** to become a south pole.

A magnetic material consists of dipoles (molecular magnets) in different domains which are oriented in different directions. When the dipoles are aligned to face one direction, then they create a force due to the field that can make it have potential energy to affect ferromagnetic materials.

Current carrying conductors have magnetic field around them. When they are carrying current in the same direction, the field interact creating attractive force.

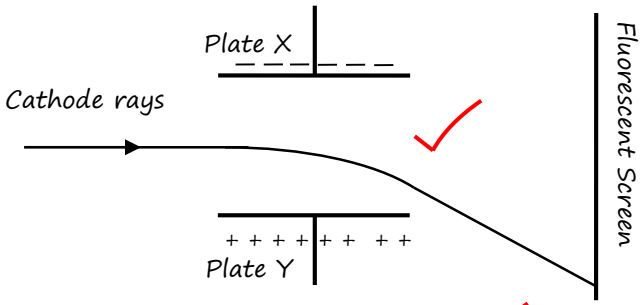




For conductors carrying current in opposite directions, the magnetic fields interact creating repulsive force between them.  	

8.

No	SCORING POINTS	REMARKS
8(a)	Radioactivity is the spontaneous and continuous disintegration of a heavy unstable nuclei to give out radiations.	
(b)(i)	The statement means that it takes 16 hours for the activity of a sample of the radioactive material to reduce to half their original value.	
(ii)	$1 \longrightarrow \frac{1}{2} \longrightarrow \frac{1}{4} \longrightarrow \frac{1}{8}$ = 3 half lives $3t_{½}$ = 24 years $t_{½} = \frac{24}{3}$ = 8 years	
(c)(i)	– Treatment of cancer – Sterilisation of medical equipment	Any other correct med use
(ii)	– Heating the metal (Thermionic emission) – Irradiating the metal surface using electromagnetic radiation (Photoelectric emission)	

(d)	– The beam would be deflected downwards and forms a bright spot on the screen.  – Cathode rays are negatively charged. – They are attracted towards the positive plte, Y and repelled by the negative plate, X. – X – rays carry no charge. – They will therefore move in a straight line. – A bright spot will be formed in the middle of the screen.	Correct path of rays.

END