

UGANDA NATIONAL EXAMINATIONS BOARD

DRAFT

Subject: PHYSICS PAPER 2

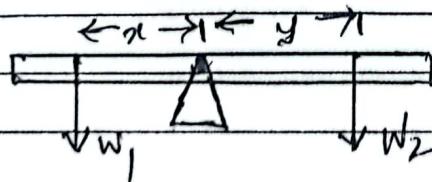
Paper code: 53S/2

V.T

Level: PLE UCE UACE

Year: 2023

Question	Scoring Points	Notes	marks
Q1 a(i)	It is the point of application of the resultant force due to the earth's attraction on the body; ✓	The position through which the wt of the body appear/seem to act	1
(ii) Widening the base;	- Lowering the centre of gravity with respect to the size of the base; ✓	- engine as low as possible - chassis as low as possible upper parts made light material	2
b(ii)	It is formed by two equal and opposite parallel forces; ✓	- Luggage compartment at the bottom - Active suspension	1
(iii)	The sum of the forces in one direction is equal to the sum of forces in the opposite direction; ✓ The sum of the anticlockwise moments about a point is equal to the sum of clockwise moments about the same point; ✓	- Resultant of forces is zero - Resultant of moment of the same point is zero	2



A metre rule is supported on a knife edge so that it balances in the horizontal position. A known weight W_1 is placed at a known distance x from the knife edge. Another known

Unfrom not a must



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mark

weight w_2 is placed on the other side of the metre rule and moved to a position so that the metre rule again balances. The distance y of w_2 from the knife edge is measured. The clockwise moments w_2y and the anticlockwise moments w_1x are determined and compared. If they are equal, the principle is verified.

It is found that $w_1x = w_2y$

found that $w_1x = w_2y$

$$(i) \text{ Speed} = \frac{\text{distance}}{\text{time}} = \frac{(u+v)}{2} t = \frac{(0+v)^2}{2} = 10 \text{ ms}^{-1}$$

$$\begin{array}{c} s=vt \\ s=at^2 \\ \frac{1}{2}at^2=vt \\ at=2v \\ a=\frac{2v}{t} \end{array}$$

$$(ii) s = ut + \frac{1}{2}at^2$$

$$v = u + at$$

$$w = u + \frac{1}{2}ax^2$$

$$10 = 0 + 2a$$

$$a = 5 \text{ ms}^{-2}$$

$$a = 5 \text{ ms}^{-2}$$

(iii) Applied force = P = net force + frictional force

$$P = ma + F$$

$$P - F = ma$$

$$P = 0.5 \times 5 + 2$$

$$P = 2.5 + 2$$

$$P = 4.5 \text{ N}$$

Total

16



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Scoring Points	Notes	marks
(i) Parallax is the apparent movement of an object relative to another due to the movement of the observer; ✓	Relative motion of object or observer due to motion of observer	
- Virtual image is one formed by the apparent intersection of light rays; ✓	Image cannot be formed on a screen	2
(ii) An optical pin on a stand is placed in front of a plane mirror and its image is viewed inside the mirror; ✓	A line AB is drawn on a sheet of paper fixed on a soft board.	
A search pin is placed behind the mirror so that its top part appears to be in line with the image; ✓	- A plane mirror is placed vertically on AB	
mirrors. The head is moved to the sides to view the image again; ✓	- A pin P is fixed vertically in front of the mirror. Looking through the mirror on	
The position of the search pin is adjusted until a point is formed where the image and the search pin is adjusted until a point is formed where the image and the search	the other side pins P ₁ and P ₂ are fixed so that they are in	
pin move together as the observer moves head to the sides; ✓	a straight line with the image of P ₁	
The position of the search pin is now the position of the image; ✓	The position of the eye is changed and 5	
Mirrors tarnish with time while two other prisms P ₃ and P ₄ are fixed	prisms are durable	1



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Mirrors produce multiple images which prisms do not.

- Images in prisms are brighter than images in plane mirrors.

- No loss of energy in prisms and loss of energy in plane mirrors

in straight line ✓
P₁, P₂, P₃

The mirror, P₁, P₂, P₃
and P₄ are removed

A line is drawn

through the marks of
P₁ and P₂ ✓ Another

line is drawn through

the marks of P₃ and
P₄ ✓ The lines are

produced to meet at P
which is the position

of the image. ✓

(c) Critical angle is the angle of incidence in the dense medium for which the angle of refraction in the less ^{dense} medium is 90° .

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

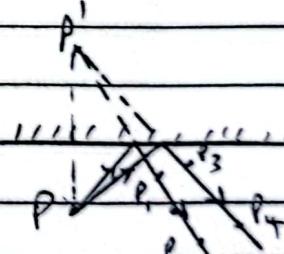
$$\sin i = 1.43 \sin 38^\circ$$

$$\sin i = 0.8804 \Rightarrow i = 61.7^\circ$$

$$ii) \sin c = \frac{1}{n}$$

$$c = \sin^{-1}\left(\frac{1}{1.43}\right)$$

$$c = 44.4^\circ$$



$$nsini = \text{constant.}$$

$$nsini = n \sin i$$

$$1.43 \sin 38^\circ = 1 \times \sin i$$

$$i = \sin^{-1}(1.43 \sin 38^\circ)$$

$$i = 61.7^\circ$$

$$iii) n = \frac{\sin i}{\sin r}$$

$$\frac{1}{1.43} = \frac{\sin i}{\sin r}$$

$$1.43 = \frac{\sin 38^\circ}{\sin r}$$

$$r = 44.4^\circ$$



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Mark	Scoring Points	Notes	Mark
1	(i) Momentum is the product of mass and velocity of a body ; ✓ (ii) Potential energy is the energy possessed by a body by virtue of its position or state ; ✓		2
1	(b) Momentum = kgms^{-1} , ✗ Potential energy = J , ✓	Kilogram metre per second. ✓ Joule joule. ✗	1 ✗
1	(c) When the stone falls, its potential energy is converted to k.e ; On impact, the momentum imparted is used to crush the orange ; when coming from a small height the momentum imparted and unable to crush the orange ; on impact.	Small height \Rightarrow low velocity \Rightarrow low momentum ; low rate of change of momentum \Rightarrow small force ; no crushing	
3	When coming from a greater height the momentum on impact is greater and is sufficient to crush the orange on impact	High velocity \rightarrow high momentum \rightarrow large force ; crushing ;	5
1	Initial Velocity = $\frac{72 \times 1000}{3600} = 20 \text{ ms}^{-1}$	When the stone falls k.e is converted to k.e	
1	Initial momentum = mv $mv = 900 \times 20$ $= 18,000 \text{ kgms}^{-1}$	On impact the k.e does work to crush the orange ; when comming from short height the k.e is	3
1	Retarding force = $\frac{u^2 - v^2}{2as}$	small and work done	3
1	$F = mg$ $= 900 \times 20$ $= 18,000 \text{ N}$	$= \frac{400 - 0}{2 \times 80} = 25 \text{ ms}^{-2}$	



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notes

$$(i) \text{Initial } k.e = \frac{1}{2}mv^2 = \frac{1}{2} \times 900 \times 20 \times 20$$

is unable to crash

$$k.e = 180,000 J$$

the orange. When

NB 3 diis

$$v^2 = u^2 + 2as \Rightarrow 0 = 20^2 + 2a \times 80$$

coming from a greater

$$\therefore 2a = -\frac{400}{80} = -2.5 \text{ ms}^{-2}$$

height the k.e is

$$\therefore F = ma = 900 \times 2.5 = -2250 \text{ N}$$

greater and the

$$\text{Retarding force} = 2250 \text{ N.} \checkmark$$

Work done on the

orange is sufficient

to crash the orange.

Total

(a) Substances in which electrons are bound to their atoms; ✓

- do not conduct electric charge

(ii) Substances in which electrons can move freely from atom to atom; ✓

- do not allow heat to pass

(b) When bodies are rubbed on each other heat is generated. Electrons are released from the surface of

- can conduct electric charge.

one body. The surface with strong attraction gain electrons and becomes negatively charged. The

- Allow heat to pass

surface that lost electrons becomes positively charged.

- Fixed it

- electrons release it weakly from it

- Strong attachment

- negative it

- positive it

(c) Like charges repel unlike charges attract;

(d) i) The leaf will diverge further;

- Electrons will be repelled to the metal plate and the leaf;

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Paper code: S35/2

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Year: 2023

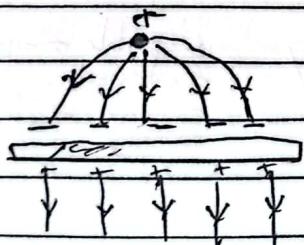
leaf is repelled further due to increased repulsion between it and the metal plate;

1

- (ii) The stream will be bent towards the rod; positive charge is induced in stream on the side near the rod; while the negative charges (electrons) are displaced to the ~~extreme end~~ ~~earth~~ on the extreme end of the stream. Thus the attraction of the stream towards the rod.

2

(e)



Field pattern; ✓ charge flow; charged plate; ✓ direction; ✓

3

(f)

- electrostatic crop sprayer ✓
- electrostatic paint sprayer ✓
- electrostatic precipitators ✓
- electrostatic air filters ✓ X
- Photo copiers - Electrostatic
- Van de Graaf generators
- lightning conductors

2

(any four)

Total

16



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Subject: PHYSICS

Paper code: 53513

Level: PLE UCE UACE

Year: 2023

SCORING POINTS	NOTES
5(a)(ii) Conduction is the flow of heat through matter from places of higher temperature one of lower temperature without the movement of matter as a whole; ✓	
(ii) Convection is the method of heat transfer which involves movement of particles of the medium from hot to cold areas; ✓	
(b) The flask has a lid made of insulating material. This prevents heat loss by convection and conduction. The double walls of the flask are separated by vacuum which prevents heat loss by convection and conduction. ✓	- lid is insulator; ✓ - stops convection at curved - Double walls of flask are separated by vacuum - Since both parts are in contact - vacuum medium for heat loss
(c) Cold water is heated in the boiler and rises by convection to hot water storage tank. Cooler water in the storage tank flows down to the boiler to replace the hot water. In this way, supply of hot water collects in the storage tank; When hot water is drained out through the tap, cold water from the header tank replaces it; ✓	- cold water heats - rises by convection - flows to boiler - refrigerates cold water in storage tank



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Subject: PHYSICS

Paper code: 53512

Level: PLE UCE UACE

Year: 2023

SCORING POINTS	NOTES	MA
<p>(i) Amount of hot water delivered = 20kg Amount of cold water delivered = 40kg Let θ be the final temperature Then Heat gained = heat lost $40 \times c_w \times (\theta - 20) = 20 \times C_w \times (80 - \theta)$ $2\theta + \theta = 80 + 40$ $3\theta = 120$ $\theta = 40^\circ\text{C}$</p>		2
<p>(ii) Heat lost = $60 \times c_w \times (40 - 32)$ $= 60 \times 4200 \times 8$ $= 2,016,000\text{J}$</p> <p>Heat gained = $m_l + mc\theta$ $= m (340,000 + 4200 \times 32)$ $= 474,400\text{m}$ $\therefore 474,400\text{m} = 2,016,000$ $m = 4.25\text{ kg}$</p>		4
TOTAL		1
<p>(iii) Radioactivity is the spontaneous disintegration of unstable radioactive nuclide with emission of radiations ;</p> <p>(iv) Half life is the time taken for half of the original sample of atoms to decay ;</p> <p>v) $n = \frac{t}{T_h} \Rightarrow n = \frac{120}{24} = 5\text{g}$</p>	<p>Radioactivity is the spontaneous disintegration of the nucleus.</p> <p>activity, mass</p> <p>5 half lives</p>	1



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Subject: PHYSICS

Paper code: 5352

Level: PLE UCE UACE

Year: 2023

SCORING POINTS

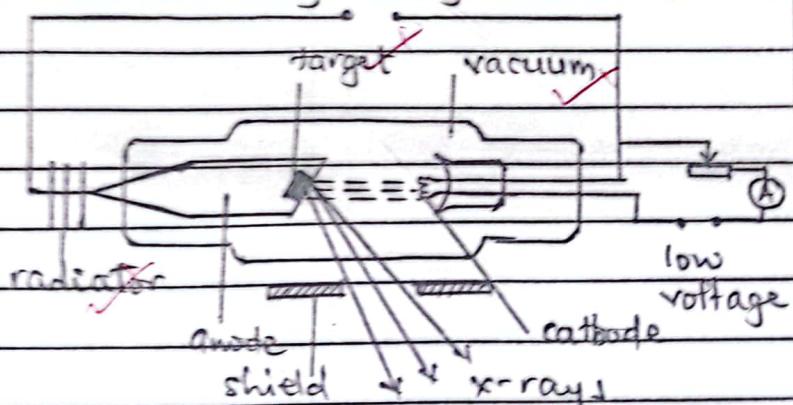
$$64 \rightarrow 32 \rightarrow 16 \rightarrow 8 \rightarrow 4 \rightarrow 2 ;$$

$t_{1/2}$ $t_{1/2}$ $t_{1/2}$ $t_{1/2}$ $t_{1/2}$

mass remaining = $2g ;$

(v) (i) Cathode rays are fast moving electrons ;

(ii) high voltage



NOTES

$$t = 0, 24, 48, 72, 96, 120 ;$$

m 64 32 16 8 4 2

mass left = $2g ;$

$$M_R = M_0 \left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}} ;$$

$$= 64 \left(\frac{1}{2}\right)^{\frac{120}{24}} ;$$

$$= 64 \left(\frac{1}{2}\right)^5$$

$$= \frac{64}{32} = 2g ;$$

any four correctly labeled parts $\pm @$

2

The cathode is heated by low voltage supply ; electrons are emitted thermionically from the cathode ; The electrons are accelerated by high voltage across the tube towards the target ; On striking the metal target, x-rays are produced ;

(iii)	Cathode rays	x-rays
- charged particles	carry no charge ;	
- speed varies	travel at constant	
	speed of light ;	
- low penetrating power	high penetrating power ;	

4

SCORING POINTS

NOTES

Cathode rays

X-rays

- has mass ✓ - has no mass

- deflected by both electric and magnetic fields ✓ - not deflected by electric and magnetic fields

- fast moving ✓ electromagnetic radiations

} can stop
} Irreflexively

TOTAL

(first four : @)

(a) (i) Compressions are places of high pressure ; ✓ particles close to each other density ✓
Rarefactions are places of low density ✓ particles far from each other density ✓

$$(ii) f = 620 \text{ Hz} \quad v = 320 \text{ ms}^{-1}$$

$$v = f\lambda ; \Rightarrow \lambda = \frac{v}{f} = \frac{320}{620} ;$$

$$= 0.53 \text{ m} ;$$

(b) (i) One person stands in front of a tall wall about 50m away and another person holds a stop watch to record the time interval ; The first person claps every time the echo is heard. This is done for several number of claps and the time taken recorded. If the distance from the clapper to the wall is $s \text{ m}$ and the time interval is t_s for successive claps then

Two people stand at a known distance, away from a tall wall ; One claps and the other starts a stop watch at the same time ; He stops the stop watch when he hears the echo and records the time ; The

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SCORING POINTS	NOTES
$\text{Speed} = \frac{\text{distance travelled}}{\text{time taken}}$ $v = \frac{25}{t}$	experiment is repeated to find the average time t . $\text{speed} = \frac{25}{t}$
(ii) Precautions taken to reduce errors in the experiment. <ul style="list-style-type: none"> - The experimenter should stand more than 50m away from the wall. - several claps must be used - ensure the claps coincide with the echo - time accurately (properly). 	A vibrating tuning fork of known frequency f is held near the open end of a resonance tube filled with water.
(c) The longer the length, the lower the frequency f ; and the shorter the length, the higher the frequency. or frequency is inversely proportional to length.	The water level is gradually lowered by opening the tube until a loud sound is heard; The tap is closed and the length
(d) velocity of waves = frequency \times wavelength $= 50,000 \times 0.1$ $= 5,000 \text{ ms}^{-1}$, depth = velocity \times time $2h = 5000 \times 20$, $h = \frac{1}{2} \times 5000 \times 20$ $= 50,000 \text{ m}$	l_1 of the air column is measured; The tube is again opened to gradually reduce the water level until the second loud sound is heard. The length l_2 of the air column is measured; then

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SCORING POINTS	NOTES
	$V = \frac{1}{2} f(l_2 - l_1)$, Precautions: - accurate measurement - account for end correction by not breaking - Coiling rising to be - Coiling strong force
TOTAL	
8 (a) A neutral point is a point or region in a magnetic field where the magnetic flux is zero. ✓	- magnetic flux is zero
(b)	x neutral points direction → pattern → • Field due to magnet <input checked="" type="checkbox"/> • Earth <input checked="" type="checkbox"/> • Iron <input checked="" type="checkbox"/> • Neutral points <input checked="" type="checkbox"/> Pattern of earth sea when Diving is interacting
(c)(i) Magnetic saturation is said to occur when all dipoles in the domains of the material of the magnet have been aligned in the direction of the magnetic field; and the strength of the magnet cannot be increased any further. ✓	

Harmonic causes voltage as follows
Causes them to generate and settle in
smooth direction
- This is called rotation



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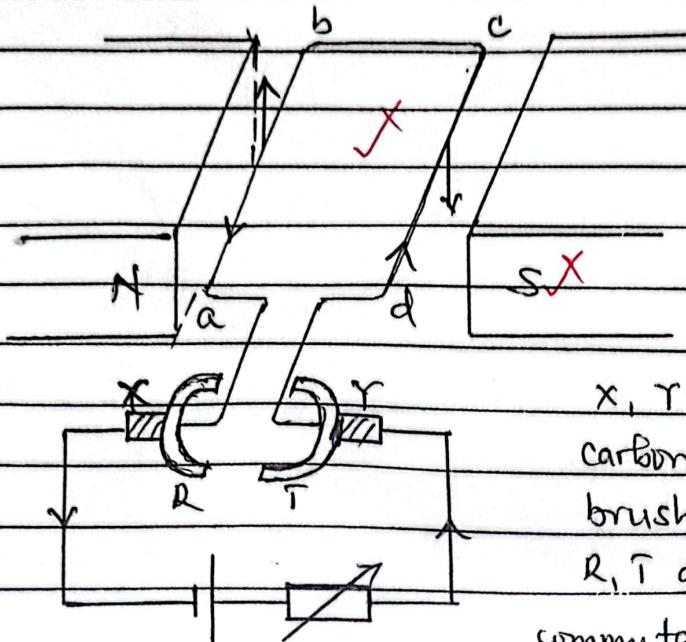
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SCORING POINTS

NOTES



Get score when connected to an

X, Y are carbon brushes
R, T are commutator halves

any four correctly labeled parts ;@

abcd - rectangular coil of wire
When current flows into the coil in the direction shown, side ab moves up while side cd moves down, hence the coil rotates. After 90° rotation there is no force on the coil since the carbon brushes will be facing gaps between the commutators but its inertia takes it past this position. Contact between the carbon brushes and the commutators is remade but with the commutators making contact with opposite brushes,



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SCORING POINTS	NOTES	MAP
so that current and force directions are reversed; side ab which was moving up now moves down and side dc which was moving down now moves up. In this way, the coil rotates continuously. ✓		4
(e) -The permanent magnets are replaced with field coils to produce electromagnets ; -Increase the number of turns of the rotating coil ; -Wind the coils on a soft iron armature ; -Increase the number of segments of the commutators so that each coil has its own pair of segments ; -Increase the area of segments in the magnetic field -Increase the area of the coil in the magnetic field	list two (any 3)	16
TOTAL		2