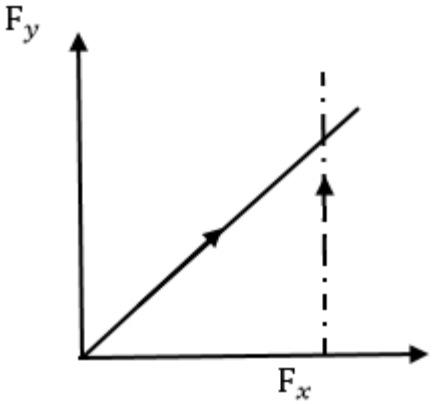
MATIGO EXAMINATIONS BOARD

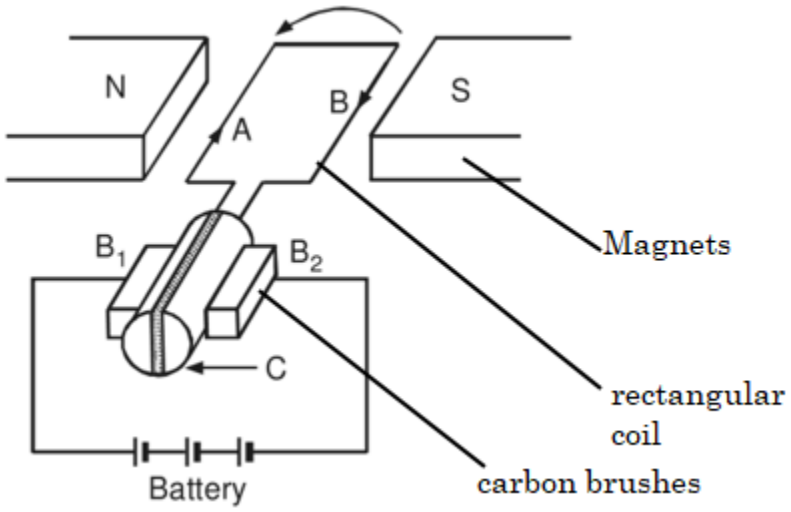
535/2
PHYSICS
MARKING GUIDE 2023
PAPER 2

✓ Full mark
✓ Half mark

Qn	Answer	*marks*
1(a)(i)	An equilibrant force is a single force that if applied on a body under a system of forces, the body goes into equilibrium state **OR** It is a single force which is equal in magnitude and opposite in direction to the resultant force on a body. This force makes a body to go into a state of equilibrium.	01
(ii)	• Resultant force of the body should be zero i.e. sum of forces in one direction is equal to the sum of forces in opposite direction. • The sum of clockwise moments about a turning point is equal to the sum of anti-clockwise moments.	02
(b)	Horizontal force; $F_x = 8N$ Vertical force; $F_y = 20 - 5 = 15N$  $F^2 = F_x^2 + F_y^2$ $F = \sqrt{F_x^2 + F_y^2}$ $F = \sqrt{8^2 + 15^2}$ $F = \sqrt{298}$ $F = 17N$	

(c)	1st law • A body remains in its state of rest or uniform motion in a straight line unless acted upon by an external force. 2nd law • It states that the force applied on a material is directly proportional to the applied force and it takes place in the direction of the force. 3rd law • For every action, there is always on equal but opposite reaction force.	03
(d)	Landing on sand makes one to slide, this increases the time of landing, thereby reducing the rate of change of momentum. According to Newton's 2nd law, this in turn reduces the impact force on ground. This reduces the risk of high jumpers hurting themselves.	
(e)	$$m_1u_1 + m_2u_2 = (m_1 + m_2)V$$ $$(300 \times 20) + (600 \times 0) = (3000 + 600) \times V$$ $$60{,}000 + 0 = 3600V$$ $$V = 16.67 ms^{-1}$$ $$s = ut + \frac{1}{2}at^2$$ But $a = \frac{v-u}{t}$ $$= \frac{0 - 16.67}{30}$$ $$a = 0.56 ms^{-2}$$ $$s = 16.67 \times 30 + \frac{1}{2} - 0.56 \times 30^2$$ $$= 248.1\, m$$	
2(a)(i)	A simple d.c motor is a device that converts electrical energy into mechanical energy by creating a magnetic field that is powered by direct current.	

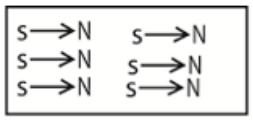
(ii)



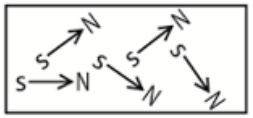
It consists of a rectangle coil of wire placed between pieces of strong magnets. The ends of the rectangular coil are connected to split rings (commutators, C)

- When current is passed through the coil, equal but opposite forces are exerted on the side of the coil. These constitute a couple causing it to rotate.
- When the coil reaches the vertical position, the commutator rings loose contact with the carbon brushes, current is cut off but inertia of the coil makes it go past the vertical position gaining the contact again.
- Since the commutator rings exchange contacts when current in coil is reversed, the coil keeps in rotating in the same direction.

(b)(i)

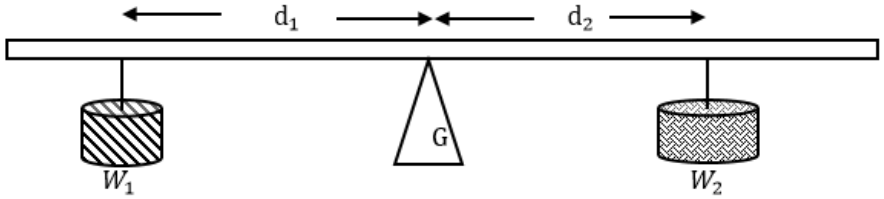


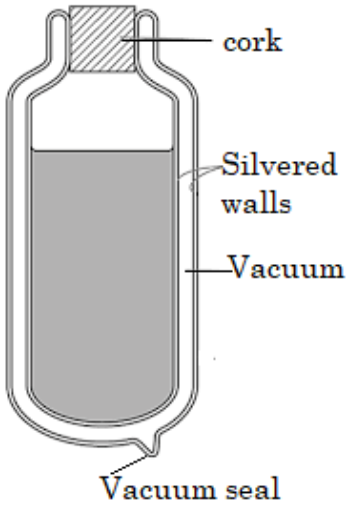
Magnetized Material

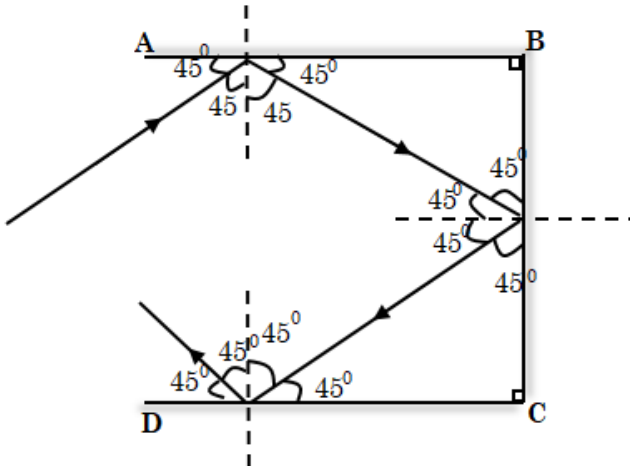


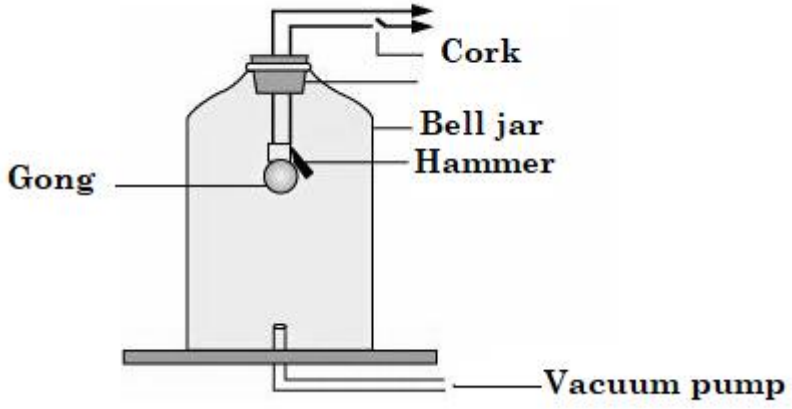
Un magnetized Material

	• When a steel bar gets magnetized using any method, the dipoles keep aligning themselves in a particular direction and the steel bar is said to be fully magnetized when all the dipoles are aligned in a particular direction (it reaches saturation point) • When a steel bar is demagnetized, the arrangement of the dipoles is disorganized, the alignment is disorganized until all the dipoles are disorganized, and the steel bar will then have completely lost its magnetism.	
(d)(i)	Like poles repel while unlike poles attract.	
(ii)	Magnetic shielding helps in operation of • Energy metres • Safety devices • Protects TV screens • Aerospace, medical devices	
3(i)	Polarization is the collection of hydrogen bubbles around the copper anode partially insulates it from the electrolyte.	
(ii)	Local Action is the gradual wearing of the zinc electrode due to impurities on it reacting with the electrolyte.	
(c)	Cost of electricity $= P \times T \times C$ $\frac{200}{100} \times \frac{40}{60} \times 120$ $= 160Shs$	
(d)	• Accumulators provide a large amount of current unlike dry cells. • Accumulators produce current by reversible processes hence can be recharged when they run down unlike dry cells which cannot be recharged when they run down.	
4(a)	Moment of force is the product of force and the perpendicular distance of its line of action from the pivot.	

(b)	 • A metre role is balanced on a knife edge and the point, G where it balances is noted. • Keeping the knife edge at point G, known weights W_1 and W_2 are placed on either sides of the metre role. • The weights are adjusted until the metre role balances again. The distance d_1 from W_1 to pivot and the distance d_2 from pivot to W_2 are measured and recorded. • It is found out that, $W_1 \times d_1 = W_2 \times d_2$ • This verifies the principle of moments.	
(c)(i)	$Clockwise\ moments = Anti-clockwise\ moment$ $20 \times 40 = F \times 5$ $\frac{800}{5} = \frac{5F}{5}$ $F = 160N$	
(ii)	To increase on their base area. This increases the stability of the racing cars.	
d(i)	Stable equilibrium is a state of equilibrium, in which a body rests on its biggest area and slight displacement of the body makes it return to its original/initial position when the force is removed.	
(ii)	• Lowering the base area • Raising the position of the centre of gravity of a body.	
5(a)	Temperature is the number that express the degree of hotness or coldness of a body. S.I unit is kelvin (K)	
(b)	Temp. $\theta = \frac{x}{y}$ 100℃ but $x = 0 - 7 = -7cm$ $= \frac{-7}{20} \times 100℃$ $= -35℃$	

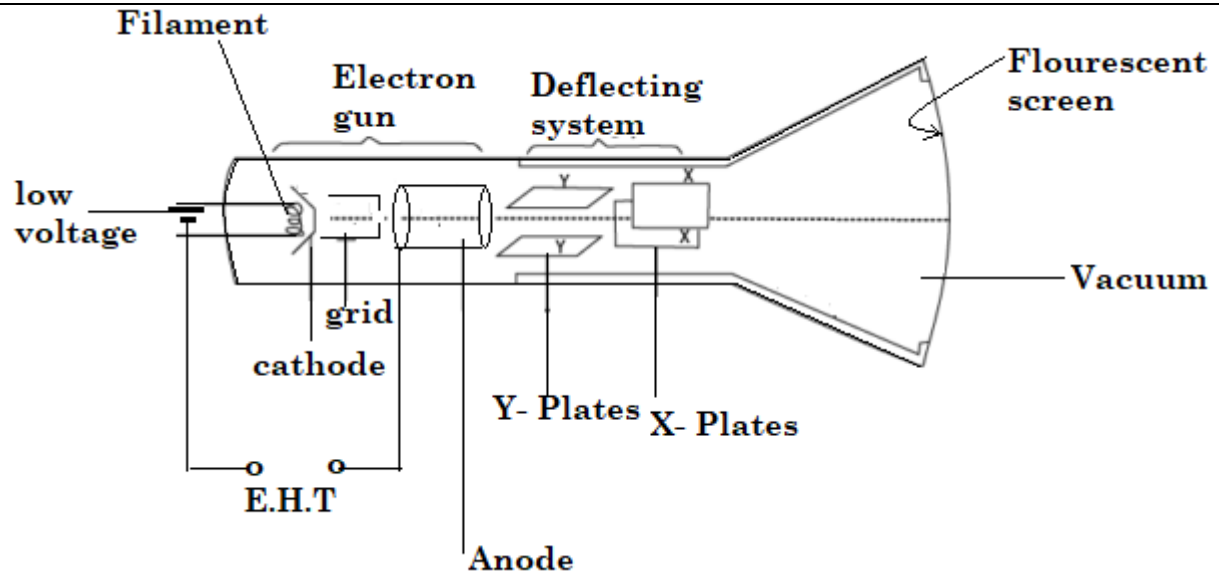
(c)	• It should opaque to easily be seen • It should have a very high boiling point • It should have a very low freezing point • It should not wet glass walls • It should be a very good conductor	
	 • Cork minimizes heat transfer by conduction since it's a poor conductor of heat. • Double silvered walls minimize heat transfer by radiation, they reflect heat back to the liquid. • The vacuum minimizes heat transfer by both conduction and convection since both require materials medium for their transmission.	
(e)(i)	It states that the pressure of a fixed mass of a gas is inversely proportional to its volume provided the absolute temperature remains constant.	
(ii)	$P_1V_1 = P_2V_2$ $1.2\ x\ 12 = 3.6 \times V_2$ $V_2 = 4.0\ litres$	
6(a)	• The incident ray, the normal and the reflected ray at the point of incidence all lie in the same plane. • The angle of incidence is equal to the angle of reflection.	
(b)(i)	• Laterally inverted. • Virtual. • Same size as object.	

	• Same distance behind the mirror as the object in front of the mirror.	
(ii)		
(iii)	Number of images = $\frac{360}{\theta} - 1$ ` $\frac{360}{60} - 1$ $= 6 - 1$ $= 5\ images$	
(c)	$Real\ dust \qquad Scale$ $(1:5unit)$ $f = 10cm$ $m = 2$ $u = 15cm$ $v = ??$ $h_0 = ??$ $h_i = ??$ $But\ m = \frac{v}{u}$ $\frac{2}{1} = \frac{v}{15} = v = 15 \times 2$ $= 30cm$ Distance on scale $f = \frac{1}{5} \times 10 = 2cm$	

	$u = \frac{1}{5} \times 15 = 3cm$ $v = \frac{1}{5} \times 30 = 6cm$	
(d)	• used in telescopes • used in lens cameras • slide projectors • correction of long sightedness	
7(a)	Transverse waves in which particles of the mediator vibrate perpendicular to the direction of propagation of the waves whereas longitudinal waves are waves in which particles of the medium vibrate parallel to the direction of propagation of the waves. ***Transverse waves*** ***Longitudinal waves*** - *water waves* – *sound waves* - *electromagnetic waves* – *waves in slinky springs*	
(b)	The distance between the incident sound and the echo (reflected sound) is too small making the original sound and reflected not distinguishable by ear.	
(c)(i)	Ultrasonic sound is sound of very high frequency not detected by the human ear. These sounds are only visible to bats, dolphins, whales etc.	
(ii)	Sound Q is of higher amplitude than sound P.	
d(i)	An echo is the reflected sound.	
(ii)	 • An electric bell is enclosed in a tall jar whose bottom is connected to a vacuum pump.	

	• The electric bell is switched on, the hammer hits the gong and sound is heard. • The vacuum pump is then switched on, so that air is withdrawn from the bell jar. • The sound produced begins to fade until it is heard no more, yet the hammer is seen hitting the gang. • The air is again allowed back into the bell jar by switching off the vacuum pump, the sound is heard again. • This shows that sound is a mechanical wave and therefore it requires a material medium for its transmission.	
8(a)(i)	Activity refers to the number of atoms decaying per second.	01
(ii)	Radioactivity is the spontaneous dis-integration of heavy unstable nucleus to form a stable nucleus accompanied with release of alpha particles, beta particle and gamma rays.	01
(iii)	Half-life is the time taken by a radioactive substance to decay half of its original mass.	01
(b)	$\%\ of\ mass\ decayed\ =\ 93.75\%$ $Remaining\ =\ 100 - 93.75$ $= 6.25\%$ $100\% \xrightarrow{t_{\frac{1}{2}}} 50\% \xrightarrow{t_{\frac{1}{2}}} 25\% \xrightarrow{t_{\frac{1}{2}}} 12.5\% \xrightarrow{t_{\frac{1}{2}}} 6.25\%$ $nt_{\frac{1}{2}}\ = total\ time, where\ n = number\ of\ decays$ $4t_{\frac{1}{2}} = 50$ $t_{\frac{1}{2}} = 12.5hours$	
(c)(i)	Nuclear fission is the splitting of a heavy unstable nucleus into two lighter nuclei accompanied with release of energy. Nuclear fusion is the union of two lighter nuclei to form one stable nucleus accompanied with release of energy.	02
(ii)	It requires very high temperature, almost those approaching the temperature of the sun and this had to maintain it for a long time. The atomic nuclei of hydrogen isotopes are positively charged so to bring them close requires high pressures and confinement.	

8(d)



Structure

- ACRO consists of three main parts, the electron gun, deflecting system and the florescent screen. The election gun has a cathode, control grid and anode, the deflecting system has x-plates and Y-plates.

Action

- The cathode is heated using a low voltage supply and it emits electrons by thermionic emission.
- The electrons move through the control grid to anode.
- The anode accelerates and focuses the electrons through the deflecting system to the florescent screen.
- In the deflecting system, x-plates deflect the electron beam horizontally and the y-plates vertically.
- The fluorescent screen displays the electron spot.