(1)

BOARD OF INTERMEDIATE EDUCATION, KARACHI

SECTION " A"Solution of MCQ's

Annual Examination 2024

Subject **PHYSICS** Part **I (New Course)**

Marks **17** Group **Pre- Engg/ Pre Medical**

Sr.No		Sr.No	
i.	**1**	x.	**Work**
ii.	**Zero**	xi.	**Volume**
iii.	**Increase**	xii.	**4 times**
iv.	**Modulation**	xiii.	**Remains same**
v.	**Thermistor**	xiv.	**Dercrease**
vi.	**(a),(c) and (d)**	xv.	**Exponential law**
vii.	**45°**	xvi	**Energy**
viii.	**Force**	xvii	$V_m > V_h > V_a$
ix.	$\left(\frac{\pi}{180}\right)$ **radians**		

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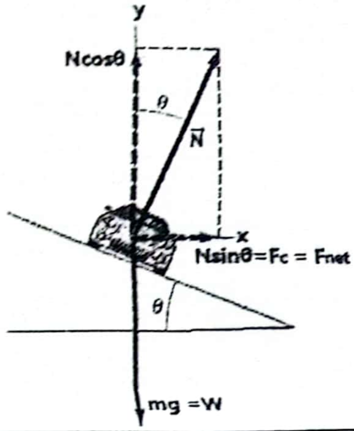
BOARD OF INTERMEDIATE EDUCATION, KARACHI

Solution and Instruction of Sections "B" & "C"

Annual Examination 2024

Subject **PHYSICS** Part **I (New Course)**

Marks **36 (Section B)** Group **Pre- Engg/ Pre Medical**

Q.No.2	Solution and Instructions
i)	• Free body diagram, **(01) mark** • Explanation of the components of normal force $\vec{N}$ acting on the body **(01) mark** • Derivation of formula $\theta = \tan^{-1}\left(\frac{v^2}{rg}\right)$ with necessary mathematical steps **(02) marks** 
ii)	**Data:** **(01) mark** $m = 1.67 \times 10^{-27}$ kg $q_1 = q_2 = 1.6 \times 10^{-19}$ C $r = ?$ Solution: Coulomb's electrostatic force = Weight of proton $\frac{Kq_1q_2}{r^2} = mg$ since, $q_1 = q_2$ **(01) mark** $r^2 = \frac{Kq^2}{mg} = \frac{9 \times 10^9}{1.67 \times 10^{-27} \times 9.8} \times (1.6 \times 10^{-19})^2 = 0.014078$ **(01) mark** $r = \sqrt{0.014078} = 0.1186 = 0.119 = 0.12$ m **(01) mark**

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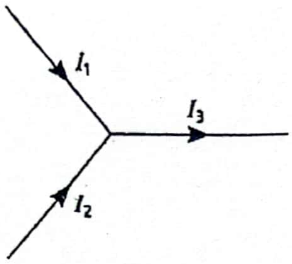
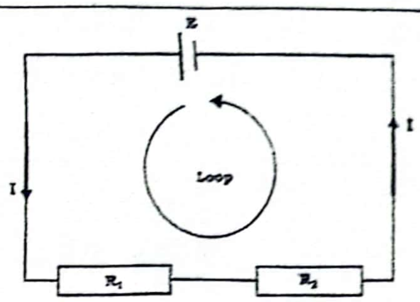
iii)	  Diagram Kirchoff's first law **(01) mark** Diagram Kirchoff's second law **(01) mark** Kirchoff's (**I[st] Law**) Junction rule or current law "the total of the currents that flows into a junction is equal to the sum of currents flows outside the junction in a circuit". $\sum I_{in} = \sum I_{out}$ or $I_1 + I_2 = I_3$ or $\sum I = 0$ **(01) mark** Kirchoff's (**2[nd] Law**) Loop rule or voltage law "sum of electromotive forces in a loop equals the sum of the potential drops in the loop" $\sum E = \sum V$ **(01) mark**
iv)	**Data:** **(01) mark** $R = 500$ m $v = 90\ ms^{-1}$ $\theta = ?$ Solution: $R = \frac{v^2 \sin 2\theta}{g} \Rightarrow \sin 2\theta = \frac{Rg}{v^2}$ **(01) mark** $2\theta = \sin^{-1}(\frac{Rg}{v^2}) = \sin^{-1}(\frac{500 \times 9.8}{90^2}) = 37.22°$ $\theta = 18.61°$ **(01) mark** for launch angle; $\alpha = 90° - 18.61° = \mathbf{71.39°}$. **(01) mark**
v)	Charging of a capacitor always involves some expenditure of energy from the voltage source. This energy is stored up in the electrostatic field set up in the dielectric medium (between the two conductors). When the capacitor is connected to some external circuit (discharging) the stored energy is used in moving the chrages. **(1.5) marks** Derive $U = \frac{1}{2}CV^2$ with necessary steps and brief description, where U is the stored energy. **(2.5) marks**

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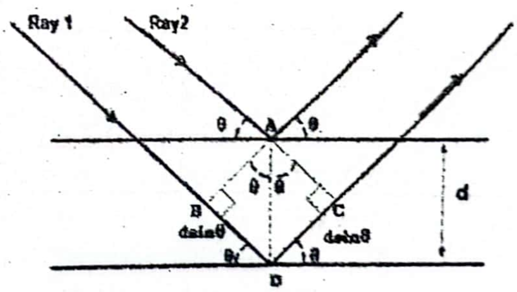
Q.No.2	Solution and Instructions
vi)	Definition of escape velocity. **(01) mark** Derivation of equation $v_{es} = \sqrt{2gR}$ with necessary mathematical steps. **(03) marks**
vii)	**Data:** **(01) mark** $A_1 = 10\ cm^2 = 0.001 m^2$ $F_1 = 50\ N$ $A_2 = ?$ $F_2 = 4800\ N$ Solution: $\frac{F_2}{F_1} = \frac{A_2}{A_1} \Rightarrow A_2 = \frac{F_2}{F_1} \times A_1$ **(01) mark** $A_2 = \frac{4800}{50} \times 0.001 = 0.096\ m^2 = \mathbf{960\ cm^2}$ **(02) marks**
viii)	**Data:** **(01) mark** $f = 3\ Hz$ $\mu = 0.72$ $x_o = ?$ Solution: $a = \omega^2 x_o$ and $F = \mu mg$ **(1.5) marks** $ma = \mu mg \quad \therefore \quad a = \mu g$ hence $\mu g = \omega^2 x_o \quad \because \quad \omega = 2\pi f$ $\therefore \quad x_o = \mu g/(2\pi f)^2$ $x_o = 0.72 \times 9.8/(2 \times 3.142 \times 3)^2 = \mathbf{0.0198\ m}$ **(1.5) marks**
ix)	*Ray Diagram* **(01) mark** **Why X-rays?** **X-rays** has wavelengths much shorter than those of visible light, comparable to the separation between the atomic planes of crystalline solids like NaCl crystal. **(01) mark** Derivation of $\mathbf{m\lambda = 2d\sin\theta}$ with necessary steps. **(02) marks**  **<u>Note : The letters in figure (A,B,C,D) are not sensitive</u>**

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x)	**Data:** **(01) mark** $r = 0.1\ mm = 1 \times 10^{-4}\ m$ $\eta = 1.8 \times 10^{-5}\ Pa.s$ $\rho = 850\ kg/m^3$ $F_d = ?$ Solution: By Stoke's Law $F_d = 6\pi\eta r v_t$ $\because$ $v_t = \frac{2\rho g r^2}{9\eta}$ $\therefore F_d = 6\pi r^3 \times \frac{2\rho g}{9}$ **(01) mark** $F_d = 6 \times 3.142 \times (1 \times 10^{-4})^3 \times \frac{2 \times 850 \times 9.8}{9}$ $= \mathbf{3.489 \times 10^{-8}\ N}$ **(02) marks**
xi)	**Data:** **(01) mark** $L = 20\ m$ $A = 1\ mm^2 = 1 \times 10^{-6}\ m^2$ $R = 5\ \Omega$ $\sigma = ?$ Solution: $\sigma = \frac{L}{RA}$ **(01) mark** $\sigma = \frac{20}{5 \times 1 \times 10^{-6}} =$ **4×10^6 Siemens/m** **(02) marks**
xii)	**Statement**: In the absence of an external force the total momentum of the system before and after collision remains constant. **(01) mark** **Data:** **(01) mark** $m_1 = 100\ g = 0.1\ kg$ $m_2 = 10\ kg$ $u_1 = 0$ $u_2 = 0$ $v_1 = 1000\ ms^{-1}$ $v_2 = ?$ Solution: $m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$ **(01) mark** $v_2 = \frac{m_1u_1 + m_2u_2 - m_1v_1}{m_2} = \frac{0.1 \times 0 + 10 \times 0 - 0.1 \times 1000}{10} =$ **$-10ms^{-1}$** **(01) mark**

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Q.No.2	Solution and Instructions	
xiii)	$T = 2\pi\sqrt{\frac{l}{g}}$ $[T] = [2][\pi]\sqrt{\frac{[L]}{[g]}}$ since 2 and π are dimensionless; $[T] = \sqrt{\frac{[L]}{[LT^{-2}]}}$ $[T] = \sqrt{\frac{1}{[T^{-2}]}}$ $[T] = \sqrt{[T^2]}$ T = T L.H.S = R.H.S **(02) marks**	$x = m\frac{\lambda}{2}$ $[x] = [m]\,\frac{[\lambda]}{[2]}$ $[L] = [m]\,\frac{[L]}{[2]}$ since m and 2 are dimensionless; L = L L.H.S = R.H.S **(02) marks**
xiv)	Newton's formula for speed of sound; $v = \sqrt{\frac{P}{\rho}}$ **(01) marks** **Laplace correction;** Newton assumed that propagation of sound waves is an **isothermal process**. But according to Laplace when sound waves travel through air, there is compression and rarefaction in the particles of the medium. Where there is compression, the temperature rises. At rarefaction particles go apart and there is fall of temperature. Therefore, the temperature does not remain constant. As sound waves travel through air with a speed of 330 ms^{-1}, the changes in air pressure, volume and temperature is taken place so rapidly. The process is not isothermal but it is **adiabatic process** hence Boyle's law is not applicable. The total quantity of heat of the system as a whole remains constant. **(02) marks** **Laplace corrected formula** $v = \sqrt{\frac{\gamma P}{\rho}}$ **(01) marks**	

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(Section C) Marks 32

Q.No.	Solution and Instructions
3a.	Bernoulli's principle (01) mark Assumptions (01) mark Diagram (01) mark Derivation (05) marks
3b.	Definition of electric dipole (01) mark Diagram clearly showing the direction of electric fields and their rectangular components (1.5) marks Derivation (5.5) marks
4a.	• <u>Addition of vectors by "Head to tail rule"</u> Diagram (01) mark Description (01) mark • <u>Addition of vectors by 'rectangular component method"</u> Diagram (1.5) marks Description (4.5) marks
4b.	Name the acceleration due to change in direction of linear velocity **OR** definition of centripetal acceleration (01) mark Diagrams; (both in terms of **arc length** and change in **velocity vector**) (01) mark **Derivation** • In terms of linear velocity (05) marks • In terms of angular velocity (01) mark

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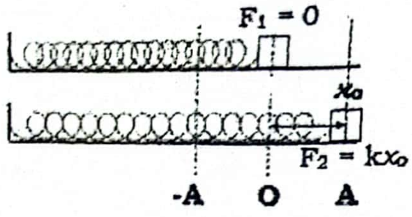
Q.No.	Solution and Instructions
5a.	Definition of Simple Harmonic motion **(01) mark** Reference diagram **(01) mark**  Derivation **(06) marks**
5b.	Definition of Doppler's effect **(01) mark** **(i) listener moves towards stationary source:** Diagram **(0.5) marks** Derivation; $f' = \left(\frac{v+v_o}{v}\right) f_s$ **(03) marks** **(ii) source moves towards stationary listener:** Diagram **(0.5) marks** Derivation $f' = \left(\frac{v}{v-v_s}\right) f_s$ **(03) marks** ❖ f_s ; is the frequency of the source; please consider if student use "f" instead of f_s

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