19

Version No.			
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ROLL NUMBER					

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②	②	②	②
●	③	③	③
④	④	④	●
⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	●	⑧
⑨	⑨	⑨	⑨

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PHYSICS HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed.

Do not use lead pencil.

حصہ اوّل لازمی ہے۔ اس کے جوابات اسی صفحہ پر دے کر ناظم مرکز کے حوالے کریں۔ کاٹ کر دوبارہ لکھنے کی اجازت نہیں ہے۔ لیڈ پنسل کا استعمال ممنوع ہے۔

Answer Sheet No. _____

ہر سوال کے سامنے دیے گئے، کریکولم کے مطابق درست دائرہ کو پر کریں۔ **Invigilator Sign.** _____

Fill the relevant bubble against each question according to curriculum: **Candidate Sign.** _____

	Question	A	B	C	D	A	B	C	D
1.	Which one of the following is a dimensionless quantity?	Strain	Spring constant 'K'	Young's constant 'Y'	Stress	○	○	○	○
2.	Real and apparent weights of a body seem to be equal when body moves with acceleration:	$a > g$	$a = g$	$a = 0$	$a < g$	○	○	○	○
3.	Gravity performs zero work when body moves:	Vertically	At an angle of $30°$	At an angle of $60°$	Horizontally	○	○	○	○
4.	Which one is **TRUE** for isothermal process?	$\Delta W = 0$	$\Delta Q = \Delta W$	$\Delta U = \Delta W$	$\Delta Q = 0$	○	○	○	○
5.	If the temperatures of source and sink of a Carnot engine (having efficiency η_1) are each increased by $200K$, then the efficiency η_2 will:	Decrease	Become 1	Remain unaffected	Increase	○	○	○	○
6.	Due to which phenomenon different colours appear in soap film in sunlight?	Diffraction of light	Scattering of light	Interference of light	Dispersion of light	○	○	○	○
7.	In Young's double slit experiment, the fringe spacing is:	$\frac{d}{\lambda L}$	$\frac{\lambda}{Ld}$	$\frac{L}{\lambda d}$	$\frac{\lambda L}{d}$	○	○	○	○
8.	For constructive interference, Path difference, $d =$	$\left(m+\frac{1}{2}\right)\lambda$	$\left(m-\frac{1}{2}\right)\lambda$	$m\lambda^2$	$m\lambda$	○	○	○	○
9.	When length of a simple pendulum is doubled, the ratio of old to new time period will be:	$1:1$	$1:2$	$1:\sqrt{2}$	$2:1$	○	○	○	○
10.	If 30 waves pass through a medium in 1 second with speed of $30ms^{-1}$ then the wave length of waves is:	$1m$	$2m$	$400m$	$20m$	○	○	○	○
11.	Stars moving away from the earth show:	Blue shift	Red shift	Violet shift	Black shift	○	○	○	○
12.	If tension in a stretched string is made four times then velocity of waves:	Becomes twice	Becomes half	Remains same	Becomes four times	○	○	○	○
13.	The dimension of spring constant K is:	$[MT^{-2}]$	$[ML^{-2}]$	$[MLT^{-1}]$	$[MLT^{2}]$	○	○	○	○
14.	The velocity of projectile at its **maximum** height is:	$v_i \operatorname{Cos}\theta$	Maximum	Zero	$v_i \operatorname{Sin}\theta$	○	○	○	○
15.	If $\vec{A} = 2\hat{i} - \hat{j} + 3\hat{k}$ then magnitude of $\vec{A}$ is:	$\sqrt{14}$	$\sqrt{18}$	14	4	○	○	○	○
16.	$F.\Delta t =$ _____	Time	Pressure	Impulse	Force	○	○	○	○
17.	In equation of continuity, the *'volume flow rate'* is equal to:	Ad	Ap	Av	$A\Delta t$	○	○	○	○

• $T = 2\pi\sqrt{\frac{l}{g}}$ • $v = f\lambda$ • $A = \sqrt{A_x^2 + A_y^2 + A_z^2}$ • $\eta = 1 - \frac{T_2}{T_1}$ • $v = \sqrt{\frac{T \times L}{M}}$ • $\varepsilon = \frac{\Delta L}{L_o}$ • $\sigma = \frac{F}{A}$ • $W = FS\operatorname{Cos}\theta$ • $T = 2\pi\sqrt{\frac{m}{K}}$

IIII

PHYSICS HSSC–I

Time allowed: 2:35 Hours **Total Marks Sections B and C: 68**

NOTE: Answer any FOURTEEN parts from Section 'B' and attempts any TWO questions from Section 'C' on the separately provided answer book. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q. 2 Answer any FOURTEEN parts. All parts carry equal marks. **(14 x 3 = 42)**

(i) Differentiate between 'precision' and 'accuracy'.

(ii) How are cranes able to lift heavy load without toppling? Explain briefly.

(iii) Prove that the equation $E = hf$ is dimensionally correct. (Where E = energy and f = frequency)

(iv) Co-relate Newton's third law of motion and conservation of momentum with the help of an example.

(v) What is impulsive force? Explain the effect of lengthening of time on impulsive force. Give one of its common life applications.

(vi) What will be the effect of gravity on vertical and horizontal components of projectile velocity? Give its mathematical expression(s).

(vii) Describe that work done is equal to area under the force-displacement graph.

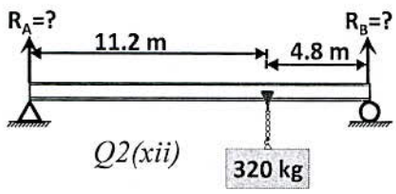
(viii) What is escape velocity (v_{esc})? Derive the expression $v_{esc} = \sqrt{2gR_e}$.

(ix) Why is a rifle barrel "rifled"? Give reason in context of conservation of angular momentum.

(x) Briefly explain the following terms:
(a) Moment of inertia of a body **(b)** Angular momentum

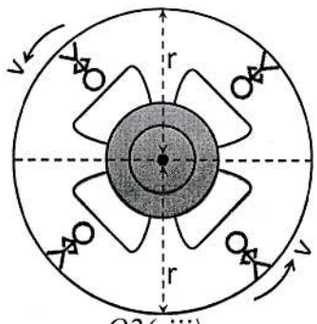
(xi) Which object will attain terminal velocity first, a lighter object or a heavier object? Justify your answer.

(xii) A $550\,kg$ uniform I-beam supports a load of $320\,kg$ as shown. Determine the reactions at the supports.



Q2(xii)

(xiii) In orbiting satellites artificial gravity is created to counter balance weightlessness. Determine the frequency 'f' required to produce this artificial gravity.



Q2(xiii)

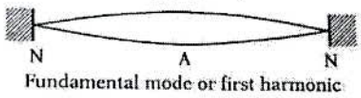
(xiv) What will be the frequency of a simple pendulum if its length is 2 meters?

(xv) How progressive waves differ from stationary waves? Give examples also.

(xvi) Discuss first mode of vibration in a stretched string. Derive expression for its frequency.

(xvii) What is meant by the path difference with reference to the interference of two waves?

(xviii) State Huygen's Principle. Use it to construct wave front after a time interval 't'.



Fundamental mode or first harmonic

Q2(xvi)

(xix) Is the energy degraded during all natural processes? Explain.

(xx) Find Moon's angular momentum using Earth-Moon distance $= 3.8 \times 10^8 m$ and Mass of Moon $= 7.35 \times 10^{22} kg$

SECTION – C (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. **(2 x 13 = 26)**

Q. 3 **a.** Show that the potential at a point is equal to work done in bringing a unit mass "m" from infinity to that point.

b. Differentiate 'molar specific heat at constant pressure (C_p)' and 'molar specific heat at constant volume (C_v)'. Justify that $C_p > C_v$. Also Prove that $C_p - C_v = R$

Q. 4 **a.** Describe S.H.M. Prove that the Projection of a body moving in a circular path executes S.H.M along the diameter. Also derive an expression for time period and frequency of this body.

b. A source of sound and observer are moving toward each other. What happens to the apparent pitch heard by the observer? What will happen if both are moving away from each other? Explain and prove.

Q. 5 **a.** State and derive Bernoulli's equation. Also give one of its applications.

b. Calculate the resultant of two forces of $30N$ and $40N$ acting at a point making angles of $0°$ and $120°$ with x-axis respectively.

Important formulae:

- $f = \frac{1}{T}$
- $F = \sqrt{F_x^2 + F_y^2}$
- $T = 2\pi\sqrt{\frac{l}{g}}$
- $\vec{L} = \vec{r} \times \vec{p}$
- $\bar{p} = m\bar{v}$
- $V_T = \frac{2\rho g r^2}{9\eta}$
- For equilibrium $\sum \tau_o = 0$, $\sum F_x = 0$, $\sum F_y = 0$
- Plank's Constant $h = 6.626 \times 10^{-34} JS$
- $F_R = \sqrt{F_{Rx}^2 + F_{Ry}^2}$
- $\theta = \tan^{-1}\left(\frac{F_{Ry}}{F_{Rx}}\right)$
- $J = F \times \Delta t$
- $\bar{\tau} = \bar{r} \times \bar{F}$
- $\Delta p = F \times \Delta t$
- $V_T = \frac{mg}{6\pi\eta r}$

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ROLL NUMBER					

PHYSICS HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed.

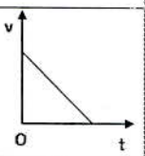
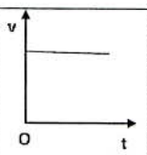
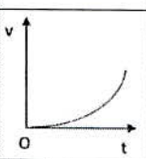
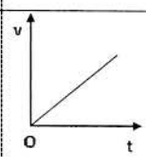
Do not use lead pencil.

حصہ اوّل لازمی ہے۔ اس کے جوابات اسی صفحہ پر دے کر نظم مرکز کے حوالے کریں۔ کاٹ کر دوبارہ لکھنے کی اجازت نہیں ہے۔ لیڈ پنسل کا استعمال ممنوع ہے۔

Answer Sheet No. _____

ہر سوال کے سامنے دیے گئے، کریکولم کے مطابق درست دائرہ کو پر کریں۔ **Invigilator Sign.** _____

Fill the relevant bubble against each question according to curriculum: **Candidate Sign.** _____

	Question	A	B	C	D	A	B	C	D
1.	In Young's double slit experiment, the fringe spacing is:	$\frac{d}{\lambda L}$	$\frac{\lambda}{Ld}$	$\frac{L}{\lambda d}$	$\frac{\lambda L}{d}$	○	○	○	○
2.	The SI unit of product of pressure and volume is:	Watt	Pascal	Newton	Joule	○	○	○	○
3.	According to first law of thermodynamics, which one is **correct**?	$C_p = 1 + \frac{R}{C_v}$	$R = \frac{C_v}{C_p}$	$C_p = R + C_v$	$C_p + C_v = R$	○	○	○	○
4.	One radian = _____.	157.3°	90°	57.3°	180°	○	○	○	○
5.	If $\vec{A} = 5\hat{i} - \hat{j}$ then this vector makes an angle of _____ with positive x-axis.	449°	249°	349°	149°	○	○	○	○
6.	A car is moving on a motorway. Point out the **correct** velocity-time graph which shows zero acceleration of car.					○	○	○	○
7.	A stone is thrown to perform projectile motion. Which one of the following is **TRUE** for its vertical acceleration?	Constant	Maximum at highest point only	Maximum at the point of projection only	Zero	○	○	○	○
8.	Gravity performs zero work when body moves:	Horizontally	At angle of 30°	At angle of 60°	Vertically	○	○	○	○
9.	Power, $P =$ _____	$\vec{F}.\vec{v}$	$\vec{F}/\vec{A}$	$\vec{F}/\vec{v}$	$\vec{F}.\vec{d}$	○	○	○	○
10.	The ratio of angular momentum and angular velocity is qual to:	Moment of inertia	Angular acceleration	Torque	Mass	○	○	○	○
11.	Real and apparent weights of a body seem to be equal when:	$a = 0$	$a < g$	$a > g$	$a = g$	○	○	○	○
12.	The fluid speed is measured by:	Barometer	Hydrometer	Monometer	Venturi meter	○	○	○	○
13.	If the period of oscillation of mass M suspended from a spring is $2S$, then the period of mass $16M$ will be:	$2S$	$4S$	$8S$	$1S$	○	○	○	○
14.	The total energy of a particle executing S.H.M is proportional to:	Frequency of oscillation	Velocity of particle	Square of amplitude of motion	Displacement from mean position	○	○	○	○
15.	The fundamental frequency of an open organ pipe is "f". What will be fundamental frequency if its one end is closed?	$1f$	$2f$	$3f$	$0.5f$	○	○	○	○
16.	The speed of sound in air **does not** depend upon:	Density	Humidity	Temperature	Pressure	○	○	○	○
17.	Due to which phenomenon different colours appear in soap film in sunlight?	Diffraction of light	Scattering of light	Interference of light	Dispersion of light	○	○	○	○

- $\theta = \tan^{-1}\left(\frac{F_y}{F_x}\right)$
- $T = 2\pi\sqrt{\frac{m}{K}}$
- $2\pi rad = 360°$
- $L = I\omega$
- $(K.E)_{max} = \frac{1}{2}kx_o^2$
- $f_n = \frac{(2n-1)v}{4L}$
- $f_{closed} = \frac{V}{4L}$
- $f_{open} = \frac{V}{2L}$
- $v = \sqrt{\frac{E}{\rho}}$
- $f_n = \frac{nv}{2l}$
- $v = \sqrt{\frac{\gamma RT}{m}}$

IIII

PHYSICS HSSC–I

Time allowed: 2:35 Hours **Total Marks Sections B and C: 68**

NOTE: Answer any FOURTEEN parts from Section 'B' and attempts any TWO questions from Section 'C' on the separately provided answer book. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q. 2 Answer any FOURTEEN parts. All parts carry equal marks. (14 x 3 = 42)

(i) Describe the terms 'error' and 'uncertainty' in context of measurements.

(ii) The length and width of a mobile phone is $(8.30 \pm 0.01)cm$ and $(4.60 \pm 0.01)cm$ respectively. Calculate the area of mobile phone and uncertainty in area.

(iii) Prove that the magnitude of vector product of two vectors is equal to area of Parallelogram.

(iv) In simple harmonic motion, at mean position velocity is maximum while acceleration is zero. Why?

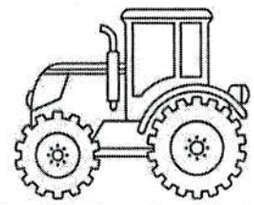
(v) Differentiate between 'elastic' and 'inelastic' collisions with examples.

(vi) At what angle a stone is thrown such that its horizontal distance and vertical height become equal?

(vii) Calculate escape velocity for Mars if radius and acceleration due to gravity for Mars are $3.4 \times 10^6 m$ and $3.7 m/s^2$ respectively.

(viii) If a satellite is in the state of free fall, then why does it not fall on the earth?

(ix) Yellow light of wavelength $5893 \times 10^{-10} m$ is directed upon two narrow slits $0.20 cm$ apart in Young's experiment. Find the position of the first bright and dark fringes on a screen $200 cm$ away.

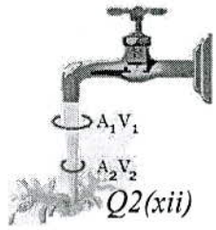


Q2(x)

(x) Which wheel of the tractor shown in figure shall rotate faster when tractor moves with uniform velocity? Explain briefly.

(xi) Does the magnitude of viscous force in fluid flow depend on the shape and velocity of the object? Justify your answer.

(xii) When water falls from a tap its cross-sectional area decreases as it comes down. Why?



Q2(xii)

(xiii) Calculate acceleration of simple pendulum executing S.H.M with time period of $0.60S$ at displacement $0.05m$

(xiv) What will be the frequency of a simple pendulum if its length is 2 meters?

(xv) Discuss stationary waves in a stretched string when string is plucked at quarter length of string.

(xvi) What is meant by the path difference with reference to the inference of two waves?

(xvii) Prove $2d \operatorname{Sin}\theta = m\lambda$, Bragg's law, for diffraction of X-rays through crystals.

(xviii) Is the energy degraded during all natural processes? Explain briefly.

(xix) Why do bowlers shine one side of cricket ball? Explain with reference to Bernoulli effect.

(xx) Describe the terms 'beat' and 'beat frequency'. How are beats useful for tuning the musical instruments?

SECTION – C (Marks 26)

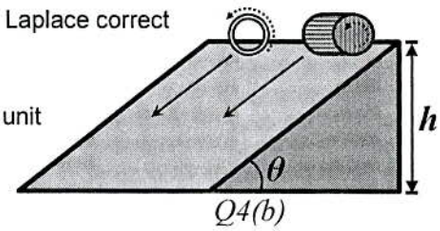
Note: Attempt any TWO questions. All questions carry equal marks. (2 x 13 = 26)

Q. 3 **a.** What is meant by scalar product of two vectors? Express the scalar product of two vectors in terms of their rectangular components. Also prove that $\vec{A}.\vec{B} = \vec{B}.\vec{A}$

b. What is Newtons' formula for the speed of sound in the air? How did Laplace correct this formula? Explain in detail.

Q. 4 **a.** Show that the potential at a point is equal to work done in bringing a unit mass "m" from infinity to that point.

b. Calculate and compare the velocities of Ring (hoop) and Disc (cylinder) at the bottom of inclined plane of height 'h'.



Q4(b)

Q. 5 **a.** Differentiate 'molar specific heat at constant pressure (C_p)' and 'molar specific heat at constant volume (C_v)'. Justify that $C_p > C_v$. Also Prove that $C_p - C_v = R$

b. An object is at rest, a constant force acts on it and it starts moving with constant acceleration of $10 m/s^2$. How much distance will it travel in 3rd second of its Journey.

Important formulae:

- $v = r\omega$ • $a = -\omega^2 x$ • $v_{esc} = \sqrt{2gR}$ • $R = \frac{v_o^2 \operatorname{Sin} 2\theta}{g}$ • $H = \frac{v_o^2 \operatorname{Sin}^2 \theta}{2g}$ • $\vec{A}.\vec{B} = AB\operatorname{Cos}\theta$ • $T = \frac{2\pi}{\omega}$ • $F_d = 6\pi\eta r v_T$ • $f = \frac{1}{T}$
- $L = I\omega$ • $y_{bright} = \frac{L\lambda}{d}$ • $y_{dark} = \frac{L\lambda}{2d}$ • $v_f = v_i + at$ • $2aS = v_f^2 - v_i^2$ • $S = v_i t + \frac{1}{2}at^2$ • $\bar{L} = \bar{r} \times \bar{p}$ • $\bar{p} = m\bar{v}$ • $T = 2\pi\sqrt{\frac{l}{g}}$

Version No.			
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ROLL NUMBER					

Answer Sheet No._____

Sign. of Candidate _____

Sign. of Invigilator _____

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

PHYSICS HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes

حصہ اوّل لازمی ہے۔ اس کے جوابات اسی صفحہ پر دے کر ناظم مرکز کے حوالے کریں۔ کاٹ کر دوبارہ لکھنے کی اجازت نہیں ہے۔ لیڈ پنسل کا استعمال ممنوع ہے۔

Fill the relevant bubble against each question:

ہر سوال کے سامنے دیے گئے درست دائرہ کو پُر کریں۔

1. Which of the following is the base unit of pressure? ◯ $kg\,ms^{-1}$ ◯ $kg\,m^{-1}s^{-2}$ ◯ $kg\,m^{2}s^{-2}$ ◯ $kg\,m^{-2}s^{-1}$

2. Error in the measurement of radius of sphere is 1%. The error in the calculated value of its volume is: ◯ 1% ◯ 2% ◯ 3% ◯ 4%

3. If $A_x = A_y$, then the angle between vector $\vec{A}$ and X-axis is: ◯ 30° ◯ 45° ◯ 60° ◯ 90°

4. If the magnitudes of scalar and vector products of two vectors $\vec{A}$ and $\vec{B}$ are same, then angle between them will be: ◯ 30° ◯ 45° ◯ 60° ◯ 90°

5. Distance covered by a freely falling body in 2 seconds will be: ◯ 9.8 m ◯ 4.9 m ◯ 29.4 m ◯ 19.6 m

6. If a ball is thrown with a speed of $30\,ms^{-1}$ in a direction 30° with X-axis, then time of flight is: ◯ $3s$ ◯ $4s$ ◯ $5s$ ◯ $6s$

7. If the radius of moon is $1600\ km$ and g on the surface of moon is $1.6\,ms^{-2}$, then the escape velocity on moon is: ◯ $1600ms^{-1}$ ◯ $1800ms^{-1}$ ◯ $2000ms^{-1}$ ◯ $2263ms^{-1}$

8. The angular velocity of the second hand of a clock, in radians per second, is: ◯ $\frac{\pi}{2}$ ◯ $\frac{\pi}{3}$ ◯ $\frac{\pi}{4}$ ◯ $\frac{\pi}{30}$

9. Which of the following is **TRUE** for orbital velocity? ◯ $v \propto r$ ◯ $v \propto \frac{1}{\sqrt{r}}$ ◯ $v \propto \frac{1}{r}$ ◯ $v \propto \sqrt{r}$

10. A $2m$ high tank is full of water. If a hole appears at its middle, then the speed of efflux is: ◯ $2.42\,ms^{-1}$ ◯ $3.42\,ms^{-1}$ ◯ $4.42\,ms^{-1}$ ◯ $5.42\,ms^{-1}$

11. For what displacement the P.E becomes one fourth of its maximum value? ◯ $x = x_0$ ◯ $x = \frac{x_0}{2}$ ◯ $x = \frac{x_0}{\sqrt{2}}$ ◯ $x = \frac{x_0}{4}$

12.	A simple pendulum suspended from the ceiling of a lift has time period T, when the lift is at rest. When the lift falls freely, the time period is:	◯ 0	◯ $\frac{T}{g}$	◯ $\frac{g}{T}$	◯ Infinite
13.	Increase in velocity of sound in air for $1°C$ rise in temperature is:	◯ $1.61 ms^{-1}$	◯ $61.0 ms^{-1}$	◯ $0.61 ms^{-1}$	◯ $0.16 ms^{-1}$
14.	The distance between two consecutive crests or troughs is equal to:	◯ λ	◯ 2λ	◯ $\frac{\lambda}{2}$	◯ $\frac{\lambda}{4}$
15.	It is possible to distinguish between transverse and longitudinal waves from the property of:	◯ Refraction	◯ Reflection	◯ Polarization	◯ Diffraction
16.	For isothermal process, first law of thermodynamics can be written as:	◯ $\Delta Q = \Delta U$	◯ $\Delta Q = 0$	◯ $\Delta Q = -\Delta U$	◯ $\Delta Q = \Delta W$
17.	According to first law of thermodynamics:	◯ $\Delta U = \Delta W - \Delta Q$	◯ $\Delta U = \Delta Q - \Delta W$	◯ $\Delta W = \Delta Q + \Delta U$	◯ $\Delta Q = \Delta U - \Delta W$

Important formulae:

- $V_{sphere} = \frac{4}{3}\pi r^3$
- $g = 9.8 ms^{-2}$
- $T_{flight} = \frac{2v_i \sin\theta}{g}$
- $|\overline{A}\cdot\overline{B}| = AB\cos\theta$
- $v_{esc} = \sqrt{2gR}$
- $|\overline{A}\times\overline{B}| = AB\sin\theta$
- $v_2 = \sqrt{2g(h_1 - h_2)}$
- $S = r\theta$
- $P.E_{inst} = \frac{1}{2}kx^2$
- $P.E_{\max} = \frac{1}{2}kx_o^2$
- $\omega = \frac{\theta}{t}$
- $v_t = v_o + (0.61)t$
- $v_o = 332 ms^{-1}$ at $0°C$
- $T = 2\pi\sqrt{\frac{l}{g}}$
- $C_p - C_v = R$

ROLL NUMBER					

PHYSICS HSSC–I

Time allowed: 2:35 Hours **Total Marks Sections B and C: 68**

NOTE: Answer any FOURTEEN parts from Section 'B' and attempts any TWO questions from Section 'C' on the separately provided answer book. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q. 2 Answer any FOURTEEN parts. All parts carry equal marks. (14 x 3 = 42)

(i) From the Stokes' law, the drag force can be expressed as $F_D = 6\pi\eta rv$, then find the dimensions of co-efficient of viscosity η?

(ii) $\bar{A}$ and $\bar{B}$ are two mutually pendicular vectors equal in magnitude. Show their sum and difference through Head to Tail Rule with neat diagram.

(iii) Given $|\bar{A}| = 3.2$, $|\bar{B}| = 5.1$ and $\theta = 60°$ between $\bar{A}$ and $\bar{B}$. Find $|\bar{A}\cdot\bar{B}|$ and $|\bar{A}\times\bar{B}|$

(iv) Briefly explain the circumstances in which velocity $\vec{v}$ and acceleration $\vec{a}$ of a car are:
(a) Parallel (b) Anti parallel

(v) The horizontal range of a projectile is 4 times of its maximum height ($R = 4H$). What is its angle of projection?

(vi) When a rocket re-enters the atmosphere, its nose cone becomes very hot. Where does this heat energy come from?

(vii) Express power (P) as scalar product of force ($\bar{F}$) and velocity ($\bar{v}$).

(viii) Derive a mathematical relation for orbital velocity and prove that $v_o \propto \frac{1}{\sqrt{r}}$

(ix) A circular disc of $49kg$ and radius $50cm$ is rotating at a speed of 120 rev/min. Calculate its K.E?

(x) Explain how swing is produced in a fast moving cricket ball? (Bernoulli effect)

(xi) What is meant by banking of roads? Also show that $v = \sqrt{gr\tan\theta}$

(xii) The deviation of second order diffracted image formed by an optical grating having $5000lines/cm$ is $32°$. Calculate the wavelength of light used.

(xiii) A body of mass m suspended from a spring with force constant k, vibrates with f_1. When its length is cut into half and same body is suspended from one of the halves, the frequency is f_2. Find out $\frac{f_1}{f_2}$?

(xiv) Why does sound travel faster in solids than in gases?

(xv) What will be the wavelength of the note emitted by a closed organ pipe $32.4cm$ long at $0°C$?

(xvi) Prove that speed of sound through Hydrogen is 4 times as compared to its speed in Oxygen. Whereas $\rho_{Hydrogen} : \rho_{Oxygen} = 1:16$

(xvii) An oil film spreading over a wet footpath shows colours. Explain how does it happen?

(xviii) If the Young's double slit experiment is performed in water, what will happen to the interference pattern?

(xix) Briefly explain the working principle of Carnot engine.

(xx) Discuss that increase in entropy means degradation of energy.

SECTION – C (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. (2 x 13 = 26)

Q. 3 **a.** Explain vector and scalar products of two vectors with neat diagrams. **(05)**

b. Describe time of flight and range of projectile using diagram. Derive mathematical formulae for both. **(04)**

c. Show that $S = v_i t + \frac{1}{2}at^2$ is dimensionally correct. **(04)**

Q. 4 **a.** State and explain Bernoulli's Equation giving all details of it with diagram. **(05)**

b. Show that earth's gravitational field is a conservative field. **(04)**

c. The earth rotates on its axis once a day so that its original time $T_1 = 24$ hours. Suppose, by some process the earth expands so that the radius becomes double as large as at present. Determine T_2 (new time required for one revolution) after expansion using law of conservation of angular momentum. **(04)**

Q. 5 **a.** Show that motion of a simple pendulum is SHM. Derive formulae for its time period. **(05)**

b. Prove that $v_t = v_0 + (0.61)t$ **(04)**

c. Derive $C_p - C_v = R$ **(04)**

Important formulae:

- $v_{orbital} = \sqrt{\frac{GMe}{r}}$
- $\omega = \frac{2\pi}{T}$
- $\sin(2\theta) = 2\sin\theta\cos\theta$
- $R = \frac{vi^2\sin(2\theta)}{g}$
- $H = \frac{vi^2\sin^2\theta}{2g}$
- $K.E_{rot} = \frac{1}{2}I\omega^2$
- $I_{disc} = \frac{1}{2}mr^2$
- $I_{sphere} = \frac{2}{5}mr^2$

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ROLL NUMBER					

Answer Sheet No. _____

Sign. of Candidate _____

Sign. of Invigilator _____

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

PHYSICS HSSC–I
SECTION – A (Marks 17)
Time allowed: 25 Minutes

حصہ اوّل لازمی ہے۔ اس کے جوابات اسی صفحہ پر دیے گئے نام مرکز کے حوالے کریں۔ کاٹ کر دوبارہ لکھنے کی اجازت نہیں ہے۔ لیڈ پنسل کا استعمال ممنوع ہے۔

Fill the relevant bubble against each question:

ہر سوال کے سامنے دیے گئے درست دائرہ کو پُر کریں۔

1. Which of the following pairs has same dimension? ◯ Pressure, Density ◯ Impulse, Momentum ◯ Stress, Strain ◯ Momentum, Inertia

2. The number of significant figures in 0.000125010 are: ◯ 3 ◯ 4 ◯ 5 ◯ 6

3. Two forces of magnitudes F_1 and F_2 acting at right angle to each other have the resultant of the magnitude: ◯ $\frac{F_1+F_2}{2}$ ◯ $F_1^2+F_2^2$ ◯ $\sqrt{F_1^2+F_2^2}$ ◯ $\frac{F_1^2+F_2^2}{2}$

4. The distance covered by a body in time t, starting from rest is: ◯ at^2 ◯ $2at^2$ ◯ a^2t ◯ $\frac{1}{2}at^2$

5. The horizontal range of projectile is same for the angles: ◯ 30° and 40° ◯ 40° and 50° ◯ 60° and 70° ◯ 80° and 90°

6. A ball of mass $100g$ is thrown vertically upward at a speed of $25ms^{-1}$. If no energy is lost, determine the height it would reach. (Loss in K.E=Gain in P.E) ◯ $31.9m$ ◯ $1.28m$ ◯ $63.78m$ ◯ $321.5m$

7. The mass of a body is m, its speed is v and K.E is E. When mass is doubled and its speed is reduced to half, then K.E will be: ◯ $2E$ ◯ $\frac{E}{2}$ ◯ $4E$ ◯ $\frac{E}{4}$

8. The angular displacement of one radian is: ◯ 47.3° ◯ 57.3° ◯ 67.3° ◯ 77.3°

9. The ratio of the linear velocities of the points at distances r and $\frac{r}{4}$ from the axis of rotation of a rigid body is: ◯ 0.25 ◯ 0.5 ◯ 2 ◯ 4

10. Two rain drops have radii in the ratio $2:3$. The ratio between their terminal velocities will be: ◯ $2:3$ ◯ $3:2$ ◯ $4:9$ ◯ $9:4$

11. The length of a second pendulum is:	○ $70cm$	○ $80cm$	○ $90cm$	○ $100cm$
12. When amplitude of a wave becomes double, its energy becomes:	○ 2 times	○ $\frac{1}{2}$ times	○ 4 times	○ $\frac{1}{4}$ times
13. According to Laplace correction, sound travels in air under the condition of:	○ Isothermal process	○ Adiabatic process	○ Isochoric process	○ Isobaric process
14. The velocity of sound in air would become double to its velocity at $0°C$ at temperature:	○ $313°C$	○ $586°C$	○ $819°C$	○ $1172°C$
15. Fringe spacing =	○ $L\frac{\lambda}{D}$	○ $D\frac{\lambda}{L}$	○ $\frac{\lambda}{DL}$	○ $\frac{L}{\lambda D}$
16. According to first law of thermodynamics, Which one is correct?	○ $C_p + C_v = R$	○ $C_p = 1 + \frac{R}{C_v}$	○ $R = \frac{C_v}{C_p}$	○ $C_p = R + C_v$
17. A Carnot engine works between ice point and steam point. Its efficiency will be:	○ 26.81%	○ 53.36%	○ 62.46%	○ 71.23%

Important formulae:

- $P = \frac{F}{A}$
- $g = 9.8ms^{-2}$
- $Density = \frac{M}{V}$
- $R = \frac{vi^2 \sin(2\theta)}{g}$
- $\vec{P} = m\vec{v}$
- $\%Efficiency = \left(\frac{T_1 - T_2}{T_1}\right)100\%$
- $\delta = \frac{F}{A}$
- $S = r\theta$
- $\varepsilon = \frac{\Delta L}{L}$
- $\omega = \frac{\theta}{t}$
- $\vec{J} = \vec{F} \times \Delta t$
- $K.E = \frac{1}{2}mv^2$
- $v_t = v_o + (0.61)t$
- $v_o = 332ms^{-1}$ at $0°C$
- $T = 2\pi\sqrt{\frac{l}{g}}$
- $S = v_i t + \frac{1}{2}at^2$
- $P.E = mgh$
- $2\pi \ radians = 360°$
- $\frac{v_t}{v_o} = \sqrt{\frac{T}{T_o}}$
- $V_{terminal} = \frac{2\rho gr^2}{9\eta}$

ROLL NUMBER					

22

PHYSICS HSSC–I

Time allowed: 2:35 Hours **Total Marks Sections B and C: 68**

NOTE: Answer any FOURTEEN parts from Section 'B' and attempts any TWO questions from Section 'C' on the separately provided answer book. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q. 2 Answer any FOURTEEN parts. All parts carry equal marks. **(14 x 3 = 42)**

(i) Briefly describe necessary conditions for SHM.

(ii) What is torque? Define torque as vector product of $\vec{r}$ and $\vec{F}$.

(iii) For $\vec{A}$ show that $|\vec{A}| = \sqrt{A_x^2 + A_y^2}$

(iv) Find the change in momentum for an object subjected to a given force for a given time and state law of motion in terms of momentum.

(v) Two balls are projected in directions at $15°$ and $45°$ with the horizontal. If both attained the same range then find the ratio of their initial speeds.

(vi) Calculate the work done in kilojoules in lifting a mass of 10kg at a steady velocity through a vertical height of $10m$?

(vii) If radius of moon is $\frac{1}{6}$ times radius of earth and gravity on moon is $\frac{1}{5}$ times gravity on earth, then find the escape velocity at the surface of moon?

(viii) Show that angular momentum $L = mvr$

(ix) Find the relation between linear velocity and angular velocity.

(x) Discuss working principle of aerofoil.

(xi) Show that in SHM, the acceleration is zero when the velocity is greatest and the velocity is zero when the acceleration is greatest.

(xii) Discuss the interchanging between K.E. and P.E during SHM.

(xiii) As a result of distant explosion, an observer senses a ground tremor and then hears the explosion. Explain the time difference in it.

(xiv) The speed of sound in air at $0°C$ is $332ms^{-1}$. What will be its speed at $25°C$?

(xv) Under what conditions two or more sources of light behave as coherent sources?

(xvi) In Young's double slit experiment, if the distance between the slits is halved and distance between slit and screen is doubled, then find the change in fringe width?

(xvii) A garden hose of inner radius $1.25cm$ carries water at $2.60ms^{-1}$. The nozzle at the end has radius $0.30cm$. How fast does the water emerge out through the nozzle?

(xviii) Show that $\frac{n_2}{n_1} = \tan i_p$ (polarization of transverse waves)

(xix) Is it possible to convert internal energy (ΔU) into mechanical energy? Explain with an example.

(xx) Describe the terms 'specific heat' and 'molar specific heat' of gases.

SECTION – C (Marks 26)

Note: Attempt any TWO questions. All questions carry equal marks. **(2 x 13 = 26)**

Q. 3

a. Explain vector and scalar products of two vectors with neat diagrams. **(05)**

b. Describe two conditions of equilibrium. **(04)**

c. What are the dimensions and units of gravitational constant G in the formula $F = \frac{Gm_1m_2}{r^2}$? **(04)**

Q. 4

a. Explain and derive a mathematical relation for Absolute Potential Energy. **(05)**

b. What is meant by moment of inertia of a body? Derive a formula for it. **(04)**

c. What is the aero foils lift (in newtons) on a wing of area $88m^2$ if the air passes at speed over its top surface at $280ms^{-1}$ and bottom surface at $150ms^{-1}$? **(04)**

Q. 5

a. Explain Doppler's effect in detail with its special cases. **(05)**

b. The radius of sphere 'r' is measured with a Vernier Callipers as $(r \pm \Delta r) = (2.25 \pm 0.01)cm$. Calculate the volume of sphere. **(04)**

c. A Carnot engine utilizes an ideal gas. The source temperature is $227°C$ and sink temperature is $127°C$. Find the efficiency of the engine. Also find heat input from the source and heat rejected to the sink when $10000J$ of work is done? **(04)**

Important formulae:

- $Fringe\,Spacing = L\frac{\lambda}{D}$
- $R = \frac{v_i^2 \sin(2\theta)}{g}$
- $Work = \vec{F} \cdot \vec{d}$
- $v_t = v_o + (0.61)t$
- $v = r\omega$
- $v_{esc} = \sqrt{2gR}$
- $Weight = mg$
- $v_o = x_o\sqrt{\frac{k}{m}}$
- $\%Efficiency = \left(\frac{T_1 - T_2}{T_1}\right) \times 100\% = \left(\frac{Q_1 - Q_2}{Q_1}\right) \times 100\%$