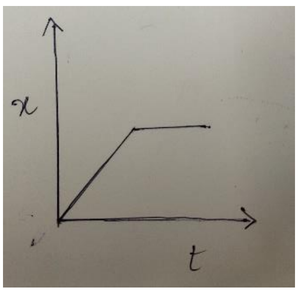
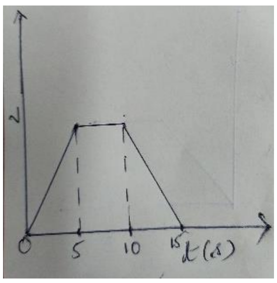
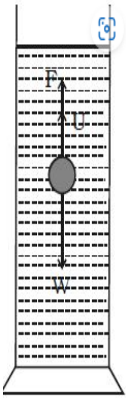
INDIAN SCHOOL AL WADI AL KABIR

CLASS XI

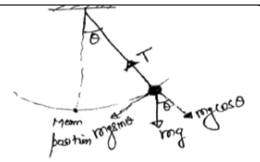
PHYSICS
FINAL EXAMINATION (2023 - 24)
ANSWER KEY

Q.NO.	ANSWERS	MARKS
1	d) increasing acceleration	1
2	c) 100m/s	1
3	b) Zero	1
4	(a) kinetic energy	1
5	(b) Angular momentum	1
6	a) $14\hat{i} - 38\hat{j} + 16\hat{k}$	1
7	a) $M^{-1}L^{3}T^{-2}$	1
8	b) pressure of the liquid.	1
9	d) Adiabatic change	1
10	b) 19200 J	1
11	b) $\frac{1}{2}k_BT$	1
12	d) Stationary waves	1
13	c) If Assertion is true but Reason is false.	1
14	a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.	1
15	a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.	1
16	d) If both Assertion and Reason are false.	1
17	Dimension of a is MLT^{-3} Dimension of b is MLT^{-4}	1 1
18	During the course of their performance, an ice skater, a ballet dancer or an acrobat take advantage of the principle of conservation of angular momentum (i.e. L=I w = constant), by stretching out arms and legs or vice-versa. On doing so, their moment of inertia increases/decreases. Hence angular velocity w of their spin motion decreases/increases accordingly.	2
19	pressure increases inside the cooker, which also increases the boiling point of water.	2
20	a)  b)  OR Initial motion under gravity	1+1 ½ +1/2

	U=0, s=50 $v^2= u^2+2gs$ $v^2=1000$ $v=10\sqrt{10}$ m/s Final motion with deceleration $u=10\sqrt{10}$ m/s a=-2m/s2 v=3m/s $v^2= u^2+2as$ 9=1000-4s s=991/4=247.75m Total distance=50+247.75=297.75m	Formula ½ ½ ½ ½
21	Travelling Amplitude=4cm Wavelength= $2\pi/k= 2\pi/0.010\,\pi=200$cm Frequency=$w/2\pi= 2\pi/2\pi=1s^{-1}$	½ ½ ½ ½
22	Statement Mass of the gun, M = 100 kg Mass of the shell, m = 0.020 kg Muzzle speed of the shell, v = 80 m/s Recoil speed of the gun = V Both the gun and the shell are at rest initially. Initial momentum of the system = 0 Final momentum of the system = $mv - MV$ Here, the negative sign appears because the directions of the shell and the gun are opposite to each other. According to the law of conservation of momentum: Final momentum = Initial momentum $mv - MV = 0$ $\therefore V = \frac{mv}{M}$ $= \frac{0.020 \times 80}{100 \times 1000} = 0.016$ m/s	1 ½ ½ ½ ½
23	$U=1/2\ kx^2$ Given, Work done = 20 joule, x = 0.1 m $Work\ done = Potential\ energy\ (U) = \frac{1}{2}kx^2$ $20 = \frac{1}{2}k \times 0.1^2; therefore, k = 4000\ N/m$ When it stretched further 0.1 m then x = 0.2 m, then P.E (U') = $\frac{1}{2} \times 4000 \times 0.2^2 = 80\ J$ Change in P.E = 80 – 20 = 60 J	½ ½ ½ ½ ½ ½
24	$g_d=g_s(1-d/R)$ gd/gs=R−d/R Thus for the depth where acceleration is 25% of the surface gravity we get gd as g/4 g/4=g(1−d/R)	1 1

	$\Rightarrow d = 3/4 \times R$ $= 4800 km$ OR Three laws $T^2 \propto R^3$ $\Rightarrow \left(\frac{T_1}{T_2}\right)^2 = \left(\frac{R_1}{R_2}\right)^3$ $\Rightarrow \left(\frac{T_1}{T_2}\right) = \left(\frac{R_1}{R_2}\right)^{3/2} = \left(\frac{1}{2}\right)^{3/2}$ $\Rightarrow \frac{T_2}{T_1} = (2)^{3/2} = \sqrt{8}$ $\Rightarrow T_2 = \sqrt{8} \times T_1 = \sqrt{8} \times 7 = 20 hours$	½ ½ ½+½+½ ½ ½ ½
25	(a) within the elastic limit, stress developed is directly proportional to the strain produced in a body. (b)more elastic/ more Young's modulus (b) For a wire of radius r stretched under a force F, Let l' be the extension when both the load and the radius are increased to four times, $Y = \frac{FL}{\pi r^2 L}$ or $l = \frac{FL}{\pi r^2 Y}$ $l' = \frac{4F X L}{\pi (4r)^2 L} = \frac{FL}{4\pi r^2 Y} = \frac{l}{4}$	1 1 ½ ½
26	Ploughing of fields is essential for preserving moisture in the soil. By ploughing, the fine **capillaries** in the soil are broken. This ensures that water does not rise to the surface of the soil due to capillary action and evaporate  W = F + U According to Stoke's law, the viscous force F is given by **$F = 6\pi\eta av$** The buoyant force U = Weight of liquid displaced by the sphere **$= 4/3\ \pi a^3 \sigma g$** The weight of the sphere, W = **$4/3\ \pi a^3 \rho g$** Substituting in equation (2), **$4/3\ \pi a^3 \rho g = 6\pi\eta av + 4/3\ \pi a^3 \sigma g$** **So, $V = 2/9\ [a^2 (\rho-\sigma)g]/\eta$**	1 ½ ½ ½ ½
27	Statement Four postulates	1 (½+½+½+½)

28	a.	½ ½

	 Now restoring torque $\tau_R = mg\sin\theta \times l = mgl\sin\theta$ For small angle θ, $\sin\theta \simeq \theta$ $\Rightarrow \tau_R = mgl\theta$ $\Rightarrow -I\frac{d^2\theta}{dt^2} = mgl\theta$ $\Rightarrow -ml^2\frac{d^2\theta}{dt^2} = mgl\theta$ $\Rightarrow \frac{d^2\theta}{dt^2} = -\frac{g}{l}\theta = -\omega^2\theta$ (where $\omega = \sqrt{g/l}$) $\Rightarrow \frac{d^2\theta}{dt^2} \propto -\theta$ Hence motion of bob is SHM b) T=0.05s A=40cm v_{max}= wA= 2π/T×40= 2π/0.05×40=16πm/s	1 ½+½
29	i) b) upto *OB* ii) b) B iii) c) OO_1 OR a) point B iv) d) The stress corresponding to point E	1 1 1 1
30	i) a) frictional force is directly proportional to the normal reaction. ii) c)kinetic friction is greater than static friction. iii) d)force of friction is more between rough surfaces than between smooth surfaces. iv) a)0.5 **OR** c)1.5 m/s^2	1 1 1 1
31	Projectile definition Diagram/Graph Writing the x components of 2^{nd} equation of motion, $x = v_0 cos\theta(t)$ t=x/$v_0 cos\theta$ Writing the y components of 2^{nd} equation of motion, $y = v_0 sin\theta(t) - \frac{1}{2}gt^2$ Substitution for time Form of parabola $y=ax+bx^2$ b)Writing the y components of 2^{nd} equation of motion, $y = v_0 sin\theta(t) - \frac{1}{2}gt^2$ Substitution for time for maximum height Substitution and Final expression for maximum height, $H = \frac{v_0^2 \sin^2\theta}{2g}$ OR a) Statement of triangle law of vector addition b)diagram derivation Final expression c) when θ= 0^0 , R= A+B and θ=90^0, R=$\sqrt{A^2+B^2}$	1 ½ ½ ½ ½ ½ ½ ½ ½ 1 ½ 2 ½ ½ ½
32		1

	(a)Bernoulli's principle states that in a streamline flow of an ideal liquid , the sum of pressure energy, potential energy per unit volume and kinetic energy per unit volume is always a constant. Let ρ be the density of the fluid. Whatever mass of the fluid enters the pipe at section A in time Δt, an equal mass of fluid flows out at section b in time Δt. At section A Work done on the liquid column of certain mass m = W = force x displacement W = P_1 x a_1 x displacement = P_1 x volume of water = P_1 x mass/density = $P_1 m/\rho$= pressure energy Kinetic energy = $\frac{1}{2} mv_1^2$ Potential energy = mgh_1 Total energy at A = $P_1 m/\rho + \frac{1}{2} mv_1^2 + mgh_1$ Similarly total energy ay B = $P_2 m/\rho + \frac{1}{2} mv_2^2 + mgh_2$ According to law of conservation of energy T.E at A = T.E at B $P_1 m/\rho + \frac{1}{2} mv_1^2 + mgh_1 = P_2 m/\rho + \frac{1}{2} mv_2^2 + mgh_2$ Dividing by m/ρ we get $P_1 + \rho v_1^2/2 + \rho gh_1 = P_2 + \rho v_2^2/2 + \rho gh_2$ i.e $P + \rho v^2/2 + \rho gh$ = a constant any one application OR Difference streamline and turbulent flow of a liquid Any application of pascals law- explanation Given:The area of the input piston is Ai=0.05 m^2. The area of the output piston is Ao=0.70 m^2. The output force is given as Fo=12000 N According to Pascal's Law, Pi=Po Fi/Ai=Fo/Ao Fi/0.05=120000/0.70 Fi=857 N Pi= Fi/Ai= 857/0.05=17140Pa	½ ½ ½ ½ ½ ½ 1 1 1½ 1 1 ½
33	Definition -Simple harmonic motion Derivation- Expression for displacement, velocity and acceleration Graph-displacement with time +velocity with time OR (a) Expression for total energy Graphical representation (b) Expression for Time period (Diagram +derivation)	1 2 1+1 2 1 (½+1½)