



# SHRI KRISHNA ACADEMY

BOARD EXAM (10,+1,+2) ,NEET AND JEE COACHING CENTRE

SBM SCHOOL CAMPUS,TRICHY MAIN ROAD,NAMAKKAL

CELL:9965531727-9443231727

**HALF YEARLY - DECEMBER - 2019**

**STD: XI**

**SUBJECT: PHYSICS**

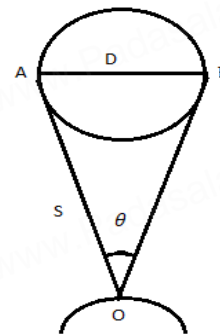
**TENTATIVE ANSWER KEY**

**MARKS : 70**

Q.N	SECTION - I		MARKS
	OPTION	ANSWER	
1	c)	velocity	1
2	a)	2.5 rad	1
3	b)		1
4	c)	zero	1
5	d)	$13.81 \text{ ms}^{-1}$	1
6	d)	stress	1
7	d)	centripetal force acts towards centre and centrifugal force appears to act away from the centre in a circular motion	1
8	d)	angular velocity increases and moment of inertia decreases	1
9	a)	perihelion and aphelion	1
10	e)	adiabatic	1
11	d)		1
12	c)	acceleration = $-k(x + a)$	1
13	d)	$\sin(x + vt)$	1
14	a) or b)	$6.28 \text{ radm}^{-1}$	1
15	d)	longitudinal and transverse	1

Q.N	SECTION - II	MARKS												
16	The principle of homogeneity of dimensions states that the dimensions of all the terms in a physical expression should be the same.	2												
17	<p>Velocity, <math>v = \frac{dx}{dt} = \frac{d}{dt}(2 - 5t + 6t^2)</math></p> <p>or <math>v = -5 + 12t</math></p> <p>For initial velocity, <math>t = 0</math></p> <p><math>\therefore</math> Initial velocity = <math>-5\text{ms}^{-1}</math></p> <p>The negative sign implies that at <math>t = 0</math> the velocity of the particle is along negative x direction.</p>	2												
18	<p>The force acting on an object is equal to the rate of change of its momentum.</p> $\vec{F} = \frac{d\vec{p}}{dt}$	2												
19	The center of gravity of a body is the point at which the entire weight of the body acts irrespective of the position and orientation of the body.	2												
20	<table border="1"> <thead> <tr> <th data-bbox="225 1330 300 1373">S.No.</th> <th data-bbox="443 1330 651 1373">Transverse waves</th> <th data-bbox="906 1330 1137 1373">Longitudinal waves</th> </tr> </thead> <tbody> <tr> <td data-bbox="252 1384 272 1417">1.</td> <td data-bbox="320 1384 778 1496">The direction of vibration of particles of the medium is perpendicular to the direction of propagation of waves.</td> <td data-bbox="794 1384 1252 1496">The direction of vibration of particles of the medium is parallel to the direction of propagation of waves.</td> </tr> <tr> <td data-bbox="252 1503 272 1536">2.</td> <td data-bbox="320 1503 778 1574">The disturbances are in the form of crests and troughs.</td> <td data-bbox="794 1503 1252 1574">The disturbances are in the form of compressions and rarefactions.</td> </tr> <tr> <td data-bbox="252 1581 272 1615">3.</td> <td data-bbox="320 1581 778 1653">Transverse waves are possible in elastic medium.</td> <td data-bbox="794 1581 1252 1653">Longitudinal waves are possible in all types of media (solid, liquid and gas).</td> </tr> </tbody> </table>	S.No.	Transverse waves	Longitudinal waves	1.	The direction of vibration of particles of the medium is perpendicular to the direction of propagation of waves.	The direction of vibration of particles of the medium is parallel to the direction of propagation of waves.	2.	The disturbances are in the form of crests and troughs.	The disturbances are in the form of compressions and rarefactions.	3.	Transverse waves are possible in elastic medium.	Longitudinal waves are possible in all types of media (solid, liquid and gas).	2
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3.	Transverse waves are possible in elastic medium.	Longitudinal waves are possible in all types of media (solid, liquid and gas).												
21	If the earth has no tilt, then seasons of the earth may change and existence of life on the earth would be affected.	2												
22	<ol style="list-style-type: none"> <li data-bbox="213 1989 1082 2022">1. Brownian motion increases with increasing temperature.</li> <li data-bbox="213 2029 1281 2101">2. Brownian motion decreases with bigger particle size, high viscosity and density of the liquid (or) gas.</li> </ol>	2												

23	Steel is more elastic than rubber. If an equal stress is applied to both steel and rubber, the steel produces less strain. So the Young's modulus is higher for steel than rubber. The object which has higher young's modulus is more elastic.	2
24	<p>Since</p> $T \propto \sqrt{l}$ <p>Therefore,</p> $T = \text{constant} \sqrt{l}$ $\frac{T_f}{T_i} = \sqrt{\frac{l + \frac{44}{100}l}{l}} = \sqrt{1.44} = 1.2$ <p>Therefore, <math>T_f = 1.2 T_i = T_i + 20\% T_i</math></p>	2
Q.N	<b>SECTION - III</b>	<b>MARKS</b>
25	$\lambda = \frac{1}{\sqrt{2\pi n d^2}}$ $n = \frac{N}{V} = \frac{P}{kT} = \frac{101.3 \times 10^3}{1.381 \times 10^{-23} \times 300}$ $= 2.449 \times 10^{25} \text{ molecules/m}^3$ $\lambda = \frac{1}{\sqrt{2 \times \pi \times 2.449 \times 10^{25} \times (1.2 \times 10^{-10})^2}}$ $= \frac{1}{15.65 \times 10^5}$ $\lambda = 0.63 \times 10^{-6} \text{ m}$	3
26	<p>Let AB = D be the diameter of the moon which is to be measured from the earth by an observer A.</p> <p>A telescope is focused on the moon and angle AOB is found.</p> $\text{Since } \theta = \frac{\text{Arc}}{\text{Radius}} = \frac{D}{S}$ $D = S \cdot \theta$ <p>i.e., Linear diameter = Distance x Angular diameter</p>	3



27	<p><b>Diagram + Explanation</b></p> <p><b>Motion along horizontal direction</b>  The particle has zero acceleration along <math>x</math> direction. So, the initial velocity <math>u_x</math> remains constant throughout the motion.</p> $x = u_x t + \frac{1}{2} a t^2.$ $x = u_x t$ <p><b>Motion along downward direction</b>  Here <math>u_y = 0</math> (initial velocity has no downward component), <math>a = g</math> (we choose the +ve <math>y</math>-axis in downward direction), and distance <math>y</math> at time <math>t</math></p> $y = u_y t + \frac{1}{2} a t^2,$ $y = \frac{1}{2} g t^2$ $y = \frac{1}{2} g \frac{x^2}{u_x^2} = \left( \frac{g}{2u_x^2} \right) x^2$ $y = Kx^2$ <p>where <math>K = \frac{g}{2u_x^2}</math> is constant</p> <p>The above equation is the equation of a parabola</p>	1  ½    1 ½
28	$F = \frac{mv^2}{r} = \frac{60 \times 50 \times 50}{10} = 15,000 \text{ N}$	3
29	<p><b>Total energy is conserved in inelastic collision</b></p> <p>Total energy contains the kinetic energy term and also a term <math>\Delta Q</math>, which includes all the losses that take place during collision. Note that loss in kinetic energy during collision is transformed to another form of energy like sound, thermal, etc.</p>	1

	<p>Further, if the two colliding bodies stick together after collision such collisions are known as completely inelastic collision or perfectly inelastic collision. Such a collision is found very often. For example when a clay putty is thrown on a moving vehicle, the clay putty (or Bubblegum) sticks to the moving vehicle and they move together with the same velocity.</p>	2
30	<p><b>Law of orbits:</b></p> <p>Each planet moves around the Sun in an elliptical orbit with the Sun at one of the foci.</p> <p><b>Law of area:</b></p> <p>The radial vector (line joining the Sun to a planet) sweeps equal areas in equal intervals of time.</p> <p><b>Law of period:</b></p> <p>The square of the time period of revolution of a planet around the Sun in its elliptical orbit is directly proportional to the cube of the semi-major axis of the ellipse.</p>	3
31	<p><b>(i) The law of length :</b></p> <p>For a given wire with tension <math>T</math> (which is fixed) and mass per unit length <math>\mu</math> (fixed) the frequency varies inversely with the vibrating length. Therefore,</p> $f \propto \frac{1}{l} \Rightarrow f = \frac{C}{l}$ $\Rightarrow l \times f = C, \text{ where } C \text{ is a constant}$ <p><b>(ii) The law of tension:</b></p> <p>For a given vibrating length <math>l</math> (fixed) and mass per unit length <math>\mu</math> (fixed) the frequency varies directly with the square root of the tension <math>T</math>,</p> $f \propto \sqrt{T}$ $\Rightarrow f = A\sqrt{T}, \text{ where } A \text{ is a constant}$	3



**(iii) The law of mass:**

For a given vibrating length  $l$  (fixed) and tension  $T$  (fixed) the frequency varies inversely with the square root of the mass per unit length  $\mu$ ,

$$f \propto \frac{1}{\sqrt{\mu}}$$

$$\Rightarrow f = \frac{B}{\sqrt{\mu}}, \text{ where } B \text{ is a constant}$$

32	DIAGRAM  EXPLANATION  COP EXPLANATION	$\frac{1}{2}$  $1 \frac{1}{2}$  1
33	<p>Since, the diameter of the pistons are given, we can calculate the radius of the piston</p> $r = \frac{D}{2}$ <p>Area of smaller piston, <math>A_1 = \pi \left( \frac{5}{2} \right)^2 = \pi(2.5)^2</math></p> <p>Area of larger piston, <math>A_2 = \pi \left( \frac{60}{2} \right)^2 = \pi(30)^2</math></p> $F_2 = \frac{A_2}{A_1} \times F_1 = (50N) \times \left( \frac{30}{2.5} \right)^2 = 7200N$ <p>This means, with the force of 50 N, the force of 7200 N can be lifted.</p>	3

Q.N	SECTION - IV	MARKS
<p>34 (a)</p>	$T \propto m^a l^b g^c$ $T = k. m^a l^b g^c$ $[T^1] = [M^a] [L^b] [LT^{-2}]^c$ $[M^0 L^0 T^1] = [M^a L^{b+c} T^{-2c}]$ <p>Comparing the powers of M, L and T on both sides, <math>a=0</math>, <math>b+c=0</math>, <math>-2c=1</math></p> <p>Solving for a,b and c <math>a = 0</math>, <math>b = 1/2</math>, and <math>c = -1/2</math></p> <p>From the above equation <math>T = k. m^0 l^{1/2} g^{-1/2}</math></p> $T = k \left( \frac{l}{g} \right)^{1/2} = k \sqrt{\frac{l}{g}}$ <p><math>k = 2\pi</math>, hence <math>T = 2\pi \sqrt{\frac{l}{g}}</math></p>	<p>1</p> <p>1</p> <p>2</p> <p>1</p>
<p>34 (b)</p>	<p>Definition</p> <p>Diagram + explanation</p> $I = \sum m(x+d)^2$ $I = \sum m(x^2 + d^2 + 2xd)$ $I = \sum (mx^2 + md^2 + 2dmx)$ $I = \sum mx^2 + \sum md^2 + 2d \sum mx$ $I_c = \sum mx^2$ <p>The term, <math>\sum mx = 0</math> because, x can take positive and negative values with respect to the axis AB. The summation (<math>\sum mx</math>) will be zero.</p> <p>Thus, <math>I = I_c + \sum md^2 = I_c + (\sum m)d^2</math></p> <p>Here, <math>\sum m</math> is the entire mass M of the object (<math>\sum m = M</math>)</p> $I = I_c + Md^2$	<p>1</p> <p>1 ½</p> <p>1</p> <p>1 ½</p>

<p><b>35</b> <b>(a)</b></p>	<p>SCALAR PRODUCT (ANY FIVE POINTS)</p> <p>VECTOR PRODUCT (ANY FIVE POINTS)</p> <p>Each point carries ½ mark</p>	<p>5</p>
<p><b>35</b> <b>(b)</b></p>	<p>The minimum speed required by an object to escape Earth's gravitational field</p> $E_i = \frac{1}{2} Mv_i^2 - \frac{GMM_E}{R_E}$ <p>When the object reaches a height far away from Earth and hence treated as approaching infinity, the gravitational potential energy becomes zero <math>U(\infty) = 0</math> and the kinetic energy becomes zero as well.</p> $E_f = 0$ <p>According to law of conservation of energy</p> $E_i = E_f$ $\frac{1}{2} Mv_i^2 - \frac{GMM_E}{R_E} = 0$ $\frac{1}{2} Mv_i^2 = \frac{GMM_E}{R_E}$ $\frac{1}{2} Mv_e^2 = \frac{GMM_E}{R_E}$ $v_e^2 = \frac{GMM_E}{R_E} \cdot \frac{2}{M}$ $v_e^2 = \frac{2GM_E}{R_E}$ $g = \frac{GM_E}{R_e^2},$ $v_e^2 = 2gR_E$ $v_e = \sqrt{2gR_E}$ $v_e = 11.2 \text{ km s}^{-1}$	<p>1</p> <p>½</p> <p>1</p> <p>2</p>



Newton's law of cooling states that the rate of loss of heat of a body is directly proportional to the difference in the temperature between that body and its surroundings

1

diagram

½

$$dQ = msdT$$

$$\frac{dQ}{dt} = \frac{msdT}{dt}$$

$$\frac{dQ}{dt} \propto -(T - T_s)$$

$$\frac{dQ}{dt} = -a(T - T_s)$$

36  
(a)  $-a(T - T_s) = ms \frac{dT}{dt}$

$$\frac{dT}{T - T_s} = -\frac{a}{ms} dt$$

$$\int_0^\infty \frac{dT}{T - T_s} = -\int_0^t \frac{a}{ms} dt$$

$$\ln(T - T_s) = -\frac{a}{ms} t + b_1$$

$$T = T_s + b_2 e^{-\frac{a}{ms} t}$$

$$b_2 = e^{b_1} = \text{constant}$$

1

1 ½

36  
(b) (i)

$$W = \int \vec{F} \cdot d\vec{r}$$

$$W = \int dW = \int \frac{dW}{dt} dt$$

$$\vec{v} = \frac{d\vec{r}}{dt}; d\vec{r} = \vec{v} dt.$$

$$\int \vec{F} \cdot d\vec{r} = \int \left( \vec{F} \cdot \frac{d\vec{r}}{dt} \right) dt = \int (\vec{F} \cdot \vec{v}) dt \quad \left[ \vec{v} = \frac{d\vec{r}}{dt} \right]$$

$$\int \frac{dW}{dt} dt = \int (\vec{F} \cdot \vec{v}) dt$$

$$\int \left( \frac{dW}{dt} - \vec{F} \cdot \vec{v} \right) dt = 0$$

$$\frac{dW}{dt} - \vec{F} \cdot \vec{v} = 0$$

Or

$$\frac{dW}{dt} = \vec{F} \cdot \vec{v}$$

2

Relevant example

1

ii)

$P = (\text{resistive force} + \text{mass} \times \text{acceleration}) (\text{velocity})$

$$P = \vec{F}_{\text{tot}} \cdot \vec{v} = (F_{\text{resistive}} + F) \vec{v}$$

$$P = \vec{F}_{\text{tot}} \cdot \vec{v} = (F_{\text{resistive}} + ma) \vec{v}$$

$$= [500 + (1250 \times 0.2)] \times 30$$

2

$$= 22.5 \text{ Kw}$$

37

(a)

According to Bernoulli's theorem, the sum of pressure energy, kinetic energy, and potential energy per unit mass of an incompressible, non-viscous fluid in a streamlined flow remains a constant

1

Diagram and Explanation

1

$$W = F_A d = P_A V$$

$$E_{PA} = P_A V = P_A V \times \left( \frac{m}{m} \right) = m \frac{P_A}{\rho}$$

Potential energy of the liquid at A,

$$PE_A = mg h_A,$$

Due to the flow of liquid, the kinetic energy of the liquid at A,

$$KE_A = \frac{1}{2} m v_A^2$$

1

$$\left. \begin{aligned}
 E_A &= EP_A + KE_A + PE_A \\
 E_A &= m \frac{P_A}{\rho} + \frac{1}{2} mv_A^2 + mg h_A \\
 E_B &= m \frac{P_B}{\rho} + \frac{1}{2} mv_B^2 + mg h_B
 \end{aligned} \right\}$$

1

From the law of conservation of energy,

$$\left. \begin{aligned}
 EA &= EB \\
 m \frac{P_A}{\rho} + \frac{1}{2} mv_A^2 + mgh_A &= m \frac{P_B}{\rho} + \frac{1}{2} mv_B^2 + mgh_B \\
 \frac{P_A}{\rho} + \frac{1}{2} v_A^2 + gh_A &= \frac{P_B}{\rho} + \frac{1}{2} v_B^2 + gh_B = \text{constant}
 \end{aligned} \right\}$$

1

Thus, the above equation can be written as

$$\frac{P}{\rho g} + \frac{1}{2} \frac{v^2}{g} + h = \text{constant}$$

37  
(b)

diagram for PE, KE AND TE

1

### a. Expression for Potential Energy

For the simple harmonic motion, the force and the displacement are related by Hooke's law

$$\vec{F} = -k\vec{r}$$

$$F = -kx$$

$$F = -\frac{dU}{dx}$$

$$-\frac{dU}{dx} = -kx$$

$$dU = kx dx$$

$$U(x) = \int_0^x k x' dx' = \frac{1}{2} k (x')^2 \Big|_0^x = \frac{1}{2} k x^2$$

$$U(x) = \frac{1}{2} m \omega^2 x^2$$

$$x = A \sin \omega t$$

$$U(t) = \frac{1}{2} m \omega^2 A^2 \sin^2 \omega t$$

### b. Expression for Kinetic Energy

Kinetic energy

$$KE = \frac{1}{2} m v_x^2 = \frac{1}{2} m \left( \frac{dx}{dt} \right)^2$$

$$x = A \sin \omega t$$

$$v_x = \frac{dx}{dt} = A \omega \cos \omega t$$

$$= A \omega \sqrt{1 - \left( \frac{x}{A} \right)^2}$$

$$v_x = \omega \sqrt{A^2 - x^2}$$

$$KE = \frac{1}{2} m v_x^2 = \frac{1}{2} m \omega^2 (A^2 - x^2)$$

$$KE = \frac{1}{2} m \omega^2 A^2 \cos^2 \omega t$$

### c. Expression for Total Energy

Total energy is the sum of kinetic energy and potential energy

$$E = KE + U \quad 0$$

$$E = \frac{1}{2} m \omega^2 (A^2 - x^2) + \frac{1}{2} m \omega^2 x^2$$

$$E = \frac{1}{2} m \omega^2 A^2 = \text{constant}$$

$$E = \frac{1}{2} m \omega^2 A^2 \sin^2 \omega t + \frac{1}{2} m \omega^2 A^2 \cos^2 \omega t$$

$$= \frac{1}{2} m \omega^2 A^2 (\sin^2 \omega t + \cos^2 \omega t)$$

$$(\sin^2 \omega t + \cos^2 \omega t) = 1$$

$$E = \frac{1}{2} m \omega^2 A^2 = \text{constant}$$

2

38  
(a)**Newton's formula**

Explanation

$$PV = \text{Constant}$$

$$PdV + VdP = 0$$

$$P = -V \frac{dP}{dV} = B_T$$

$$v_T = \sqrt{\frac{B_T}{\rho}} = \sqrt{\frac{P}{\rho}}$$

$$v_T = \sqrt{\frac{(0.76 \times 13.6 \times 10^3 \times 9.8)}{1.293}}$$

$$= 279.80 \text{ m s}^{-1} \approx 280 \text{ ms}^{-1} \text{ (theoretical value)}$$

But the speed of sound in air at 0°C is experimentally observed as 332 ms<sup>-1</sup> which is close upto 16% more than theoretical value (Percentage error is

$$\frac{(332 - 280)}{332} \times 100\% = 15.6\%). \text{ This error is}$$

not small

**Laplace correction**

Explanation

$$PV^\gamma = \text{constant}$$

2 ½

$$V^\gamma dP + P (\gamma V^{\gamma-1} dV) = 0$$

$$\gamma P = -V \frac{dp}{dV} = B_A$$

$$v_A = \sqrt{\frac{B_A}{\rho}} = \sqrt{\frac{\gamma P}{\rho}} = \sqrt{\gamma} v_T$$

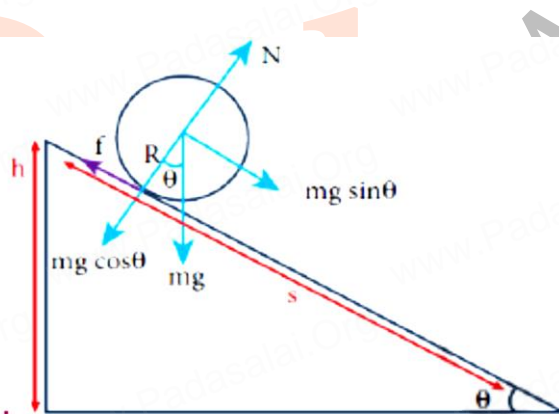
Since air contains mainly, nitrogen, oxygen, hydrogen etc, (diatomic gas), we take  $\gamma = 1.47$ . Hence, speed of sound in air is  $v_A = (\sqrt{1.4})(280 \text{ m s}^{-1}) = 331.30 \text{ m s}^{-1}$ , which is very much closer to experimental data.

2 ½

38

(b)

Explanation



$$* \quad mg \sin \theta - f = ma$$

$$* \quad Rf = I\alpha$$

$$* \quad I = MK^2$$

$$* \quad \alpha = \frac{a}{R}$$

$$* \quad f = ma \left( \frac{K^2}{R^2} \right)$$

$$* \quad a = \frac{g \sin \theta}{\left( 1 + \frac{K^2}{R^2} \right)}$$

1

1

3



# MARK ANALYSIS

## (WITHOUT CHOICE)

PART	Questions	Total Questions	Book Back Questions	Interior Questions	Total Marks
I	1 Mark	15	7	8	15
II	2 Marks	9	5	4	18
III	3 Marks	9	7	2	27
IV	5 Marks	10	10	-	50
<b>Total Marks</b>		<b>110</b>	<b>88</b>	<b>22</b>	<b>110</b>
<b>Percentage</b>			<b>80 %</b>	<b>20 %</b>	<b>100 %</b>

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## SHRI KRISHNA ACADEMY

### ✍ CREATIVE QUESTIONS

ONE MARKS, TWO MARKS, THREE MARKS AND FIVE MARKS AVAILABLE IN ALL SUBJECTS

### ✍ MATERIALS(GUIDE)

X - STD , XI - STD, XII - STD AVAILABLE IN ALL SUBJECTS

### ✍ FULL TEST QUESTION PAPERS

X - STD , XI - STD, XII - STD AVAILABLE IN ALL SUBJECTS

### ✍ ONE MARK TEST QUESTION PAPER for X, XI, XII AVAILABLE in ALL SUBJECTS.

→ For MORE DETAILS - **99655 31727 , 94432 31727**