

CLASS : - XI  
TIME ALLOWED:- 3 HRS.  
GENERAL INSTRUCTIONS:-

SUBJECT:- PHYSICS  
MAX.MARK:- 70

- All questions are compulsory. There are 26 questions in all.
- This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
- Section A contains five questions of one mark each,  
Section B contains five questions of two marks each,  
Section C contains twelve questions of three marks each,  
Section D contains one value based question of four marks and  
Section E contains three questions of five marks each.
- There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.
- You may use the following values of physical constants wherever necessary.

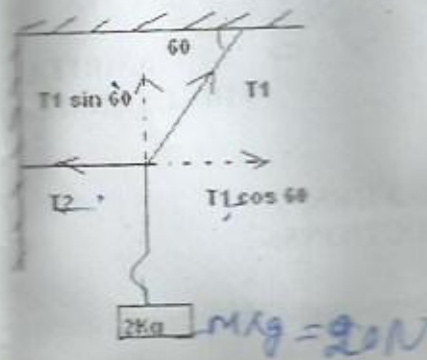
Volume =  $\frac{4}{3}\pi r^3$

Section A

- 1 What is the percentage error in volume of a sphere, when error in measuring its radius is 2%? 1
- 1 2 By using dimensions, show that energy per unit volume is equal to the pressure.
- 1/2 3 If  $\vec{A} \times \vec{B} = \vec{0}$ , what can be said about non zero vectors?  $3 \times \frac{1}{2} = \frac{3}{2}$   
 $\frac{1}{26} \%$
- 1 4 How will kinetic energy of a body change if its momentum is doubled? 1
- 1 5 Magnitude of force  $F$  experienced by a certain body moving with speed  $v$  is given by  $F = Kv^2$ , where  $k$  is a constant. Find the dimensions of  $K$ . 1

Section B

- 2 6 What do you mean by significant figures? Find the significant figures in 0.0200 and 1200 cm. 2
- 1 7 From a uniform disc of radius  $R$ , a circular hole of the radius  $R/2$  is cut off. The centre of the hole is at  $R/2$  from the centre of the original disc. Locate the centre of gravity of the resulting flat body. 2
- 2 8 What do you mean by friction? Show static, limiting and kinetic friction graphically. 2
- 1/2 9 Calculate the tensions  $T_1$  and  $T_2$  in the strings. 2



- 10 Derive relation between areal velocity and angular momentum. 2

### Section C

- 11 The wavelength ( $\lambda$ ) of matter waves may depend upon Planck's constant ( $h$ ), mass ( $m$ ) and velocity ( $v$ ) of the particle. Use the method of dimensions to derive the formula. 3
- 12 State and prove parallel and perpendicular axis theorem. 3
- 13 A disc of mass 200 kg and radius 0.5 m is rotating at the rate of 8 r.p.s. find the work done to bring the disc to rest. If the disc is stopped in 11 rotations, calculate the breaking torque. 3
- 14 Derive an equation for distance travelled by a body in  $n$ th second. 3  
An object is moving with uniform acceleration. Its velocity after 5 seconds is 25 m/s and after 8 seconds, it is 34 m/s. find the distance travelled by the object in 12<sup>th</sup> second. 44-5
- 15 Derive the equations of motion by using calculus method and write down their name. 3
- 16 Define parallelogram law of vector of addition. Derive the expression for the magnitude and direction of the resultant. 3

- 17 Define and derive the expression for centripetal acceleration. 3

- 18 A particle starts from origin at  $t = 0$  with a velocity  $5 \hat{i}$  m/s and moves in XY-plane under the action of a force, which produces a constant acceleration of  $3 \hat{i} + 2 \hat{j}$  m/s<sup>2</sup>. 3  
(a) What is the y-coordinate of the particle at the instant its x-coordinate is 84 m?  
(b) What is the speed of the particle at this time?

- 19 Two masses  $M$  and  $m$  are connected at the two ends of an inextensible string. The string passes over a smooth frictionless pulley. Obtain the acceleration of the masses and the tension in string. 3

- 20 State Newton's 2<sup>nd</sup> law of motion and prove that it is real law of motion. 3

- 21 Prove that in an elastic one-dimensional collision between two bodies, the relative velocity of approach before collision is equal to the relative velocity of separation after the collision. 3

- 22 Draw a plot of a spring force versus displacement  $x$ . hence find an expression for the P.E of an elastic stretched spring. Draw a graph for energy versus position. 3

### Section D

- 23 Having seen a big stone falling from the top of a tower Ravi pulled his friend Kiran away. The stone hit Ravi slightly and he got hurt. But he was saved from a major accident. 4  
(a) What made Ravi act in such a way.

- (b) From the top of a tower 100 m in height, a ball is dropped and at the same time another ball is projected vertically upwards from the ground with a velocity of 25 m/s. Find when and where the two balls meet. Take  $g = 9.8 \text{ m/sec}^2$ .

Section E

- 24 What do you mean by banking of road? Find the expression for maximum speed of a vehicle which can be achieved while taking a turn on a banked road. 5

5

OR

State the principle of conservation of linear momentum. Derive principle of conservation of linear momentum using Newton's law of motion.

Why is it easier to pull a lawn roller than to push it? Explain.

- 25 State and prove work-energy theorem for a variable force. 5

A particle moves along X-axis  $x=0$  to  $x=2\text{m}$  under the influence of a force given by  $(x^2 + 2x) \text{ N}$ . Calculate the work done.

5

OR

State and prove conservation of mechanical energy for a freely falling body under the effect of gravity. Draw and explain the graph for the same.

- 26 A projectile is fired with a certain velocity  $u$  making an angle  $\theta$  with the horizontal. Show that its trajectory is parabolic. Find the total time of flight, maximum height and horizontal range. 5

5

OR

(a) Prove that the horizontal range is same when angle of projection is (i) greater than  $45^\circ$  by certain value and (ii) less than  $45^\circ$  by the same value.

(b) A stone is thrown horizontally with a speed of  $\sqrt{2gh}$  from the top of a wall of height  $h$ . It strikes the level of ground through the foot of the wall at a distance  $x$  from the wall. What is the value of  $x$ ?

.....BEST OF LUCK.....