

DAV PUBLIC / MODEL SCHOOL, WEST BENGAL ZONE
ONLINE MID-TERM PEN PAPER ASSESSMENT
SESSION 2020-2021

CLASS : XI
SUBJECT : PHYSICS

MAXIMUM MARKS : 35
TIME : 1½ HOURS

1. a) Derive the dimensional formula for universal gravitational constant. 2
b) 5.74 gm of a substance occupies 1.2 cm³. Express its density with appropriate number of significant figures.
2. A projectile is fired with a velocity u making an angle θ with the horizontal. Show that its trajectory is parabola. 2

OR

If R is the horizontal range for a projectile with angle of projection θ with the horizontal and h is the maximum height reached by it, show that the maximum range can be expressed as $R_{\max} = \frac{R^2}{8h} + 2h$.
3. A simple pendulum of length 1m has a wooden bob of mass 1 Kg. It is struck by a bullet of mass 10⁻² Kg. moving with a speed of 2x10² ms⁻¹. If the bullet gets embedded into the bob, obtain the height to which the bob rises before swinging back. Take g = 10 ms⁻². 2
4. A body tied to one end of a string is made to revolve in a vertical circle. Derive the expression for (i) the tension in the string at any point (ii) minimum velocity at the lowest point for just looping the loop. 2
5. Plot the spring force F as a function of displacement x and hence from the graph find an expression for the potential energy of an elastic stretched spring. 2

OR

Prove the work energy theorem for a particle under the action of a variable force.
6. a) Given that the displacement of an oscillating particle is given by $y = A \sin(Bx + Ct + D)$ where x is position and t is time. Find the dimensional formula for (ABCD). 3
b) Write any two limitations of dimensional analysis.
7. a) Draw a graph to show the variation of the frictional force with the applied force and mark the limiting friction in the graph. 3
b) Define angle of repose and derive its relation with coefficient of static friction.
8. a) What do you mean by "precision" of a measurement? 3
b) The percentage error in the measurement of mass and speed are 2% and 3% respectively. How much will be the maximum error in measurement of kinetic energy obtained by measuring mass and speed?

9. A particle located at x = 0 at time t = 0, starts moving along the positive x-direction with a velocity v that varies as $v = \alpha\sqrt{x}$. Show that the displacement of the particle varies with time as $x \propto t^2$ 3

OR

The relation between time t and distance x is given as $t = \alpha x^2 + \beta x$ where α and β are constants. If v be the instantaneous velocity, show that the retardation is $2\alpha v^3$.
 10. An electric motor is used to lift an elevator and its load of total mass 1500 Kg to a height of 20m. The time taken for the job is 20s. What is the rate at which the work is done? If the efficiency of the motor is 75%, at which rate is the energy supplied to the motor? 3
 11. a) Derive the expression for the maximum safe speed for a car to negotiate a banked circular road. Given, the angle of banking is θ , the coefficient of friction between the tyre and the road is μ and the radius of the circular road is r. 5
b) A train has to negotiate a curve of 400 m. By how much should the outer rail be raised with respect to the inner rail for a speed of 48 Km/hr? The distance between the rails is 1m. Ignore friction.
 12. a) A man rows directly across a flowing river in time t₁ and rows an equal distance down the stream in time t₂. If u be the speed of the man in still water and v that of stream then show that $t_1 : t_2 = \sqrt{u+v} : \sqrt{u-v}$ 5
b) Determine the sine of the angle between the vectors $\vec{A} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{B} = 2\hat{i} - 2\hat{j} + 4\hat{k}$.
- OR**
- a) Derive an expression for the centripetal acceleration of a particle moving with uniform speed along a circular path of radius r.
 - b) A ball is projected upwards from the top of a tower with a velocity 50m/s making an angle 30° with the horizontal. The height of the tower is 70 m. After how much time from the instant of throwing will the ball reach the ground?
