

ANNUAL EXAMINATION 2016

Time : Three Hours

PHYSICS XI (Theory)

Max. Marks : 70

General Instructions:

- (i) All questions are compulsory.
- (ii) Question numbers 1 to 5 carrying one mark each.
- (iii) Question numbers 6 to 10 carrying two marks each.
- (iv) Question numbers 11 to 22 carrying three marks each.
- (v) Question numbers 23 carrying four marks each.
- (vi) Question numbers 24 to 26 carrying five marks each.
- (vii) Question numbers 6 to 10 carrying two marks each.

1. Write the dimensional formula of universal gravitational constant. 1
2. Give the magnitude and direction of the net force acting on a cork of mass 10g floating on water. 1
3. Define 1 newton force. 1
4. Two objects of masses 2 kg and 4 kg are having the same magnitude of momentum, find the ratio of their speeds. 1
5. Why is it not necessary for a body following another body, to stop to avoid collision? 1
6. Using component of force show that it is easier to pull a lawn roller than to push it. 2
7. A car is moving on road with speed 54 kmh<sup>-1</sup>. What should be the value of torque if the bar is brought to rest in 15 seconds? Radius and moment of inertia of wheel about the axis of rotation are 0.35 m and 3kgm<sup>2</sup> respectively. 2
8. Two masses M and m are connected at the two ends of an inextensible, light string. The string passes over a smooth frictionless pulley. Calculate the acceleration of the masses and the tension in the string. M is heavier than m. 2
9. Derive an expression for the excess pressure inside a liquid drop. 2
10. State the laws of equipartition of energy. How much kinetic energy is associated with each molecule of a, (i) monoatomic, (ii) diatomic ideal gas, at T Kelvin temperature? 2
11. An elastic spring of force constant K is compressed by an amount x. Show that its potential energy is  $\frac{1}{2} Kx^2$ . 3
12. Show that terminal velocity V of a spherical object of radius r, density  $\rho$  falling vertically through a viscous fluid of density  $\sigma$  and coefficient of viscosity  $\eta$  given by 3

$$V = \frac{2(\rho - \sigma)r^2g}{9\eta}$$

13. Show that the average K.E. of a gas molecule is directly proportional to the temperature of the gas. Hence give the kinetic interpretation of temperature. 3
14. A body of mass  $m$  is placed on the floor of a lift. Find its apparent weight when the lift is : 3
- moving upward with uniform acceleration.  $mg + a$
  - moving downward with uniform acceleration.  $mg - a$
  - moving upward with constant speed.
15. Derive an expression for the height to which the liquid rises in a capillary tube of radius  $r$ . 3
16. Show that for a particle in linear SHM, the average kinetic energy over a period of oscillation is equal to average potential energy over the same period. 3
17. Derive the expression for work done by one mole of an ideal gas during isothermal expansion. 3
18. The following equation is dimensionally correct :  $X = 2at - 5bt^2$  where  $X = \frac{S}{t}$  Calculate  $a$  &  $b$  3
19. Identify conservative and non-conservative forces given below and write one main difference between them on the basis of work done : 3
- frictional force, electrostatic force, gravitational force and viscous force.
20. Derive an expression for the centripetal acceleration of a particle moving with uniform speed  $V$  along a circular path of radius  $r$ . 3
21. Density  $\rho$  of a piece of an object of mass  $m$  and volume  $V$  is given by the formula  $\rho = \frac{m}{V}$ . If  $m = (375.32 \pm 0.01)g$  and  $V = (136.41 \pm 0.01)cm^3$ , find percentage error in  $\rho$  3
22. Draw P-V diagram of expansion in case of (a) Isobaric process (b) Adiabatic process, and (c) Isothermal processes of an ideal gas. 3
23. Ravi came to stay in a multistoried building. He noticed that motor supplying water to the second floor is power rating  $X$  kW while of that supplying water to 8<sup>th</sup> floor is  $Y$  kW. He asked his father the reason behind the difference of the power ratings. His father explained him the reason. (a) What values does Ravi possess? (b) Which power rating is more  $X$  or  $Y$ ? 3
- © A motor pumps up-1000 kg of water through length of 10 m in 5 s. if the efficiency of the motor is 60% calculate the power of the motor in kilowatt. 4
24. Find the total energy of the particle executing SHM and show graphically the variation of potential energy and kinetic energy with time in SHM. What is the frequency of the particle executing SHM? 5

OR

Explain Doppler effect in sound Obtain an expression for apparent frequency of sound when source and listeners are (a) approaching each other (b) moving away from each other, 5

25. A body is projected at an angle  $\theta$  upward with the horizontal: (a) Obtain the condition for maximum horizontal range. (b) Prove that horizontal range of projectile is same when fired at an angle  $\theta$  and  $(90 - \theta)$  with the horizontal. © Obtain an expression for velocity of projectile at any instant  $t$ . 5

OR

~~Define angular velocity and centripetal acceleration. Derive an expression for the centripetal acceleration in case of uniform circular motion of an object with the help of a suitable diagram. 5~~

26. State and prove Bernoulli's theorem with the help of a suitable diagram. Give any two examples of application of Bernoulli's theorem in daily life 5

OR

Write Newton's formula for the speed of sound in gases. Why and what correction was applied by Laplace in this formula? Also deduce modified formula for speed of sound. 5

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25. Define coefficient of restitution & derive the relation b/w initial & final velocity of a given body before & after collision  
1720