CBSE Class – XI

Physics (Set 4)

Last year Paper (2015-16)

Time: 3 Hrs. M.M: 70

General Instructions:

(i) Question 1 to 5 one mark.

(ii) Question 6 to 10 each two mark.

(iii) Question 11 to 22 each three mark.

(iv) Question 23 is value based question and carry four marks.

(v) Questions 24 to 26 each five mark.

Section A

1. Find the dimensions of pressure.

2. A force of 10 N acts on a particle along a direction making an angle of $37°$ with the vertical. Find the component of the vertical direction.

3. A person travelling on a straight line with uniform velocity v_1 for some time and v_2 for next equal time. Find average velocity.

4. Mention the physical quantities, remain conserved in an inelastic collision?

5. Two spherical balls of mass M and radius R placed at distance a apart. Write expression for the force between them.

Section B

6. What is the heat associated with adiabatic process and what is the change in internal energy for isothermal process?

7. A ball is thrown vertically upwards. Draw its

(i) velocity-time curve.

(ii) acceleration-time curve.

8. Estimate will be angle of projection of a projectile for which range R and maximum height H are equal.

9. Obtain the equation, $\omega = \omega_0 \alpha t$.

Or

Why is the weight of a body at the poles more than the weight at the equator? Explain.

10. What is Kepler's law of periods? Express it mathematically.

Section C

11. (i) In van der Wiaal's equation

$$\left[p+\left(\frac{a}{V^2}\right)\right](V-b)=RT$$

what are the dimensions of a and b?

where p is pressure, V is volume, T is temperature and R is gas constant.

(ii) Find the relative error in Z, if Z = $\frac{A^4B^{1/3}}{CD^{3/2}}$.

12. Two parallel rail tracks run North-South. Train A moves North with a speed of 54 km/h and train B moves South with a speed of 90 km/h. What is the

(i) velocity of B w.r.t. A?

(ii) velocity of ground with respect to B?

(iii) velocity of a monkey running on the roof of the train A against its motion (with a velocity of 18 km/h w.r.t. the train A) as observed by a man standing on the ground?

13. A projectile is fired with speed u making an angle 0 with horizontally from the surface of the earth. Prove that the projectile will hit the surface of the earth with same speed and at the same angle.

14. A block of mass m is held against a rough vertical wall by pressing it with a finger. If the coefficient of friction between the block and the wall is p, and the acceleration due to gravity is g, calculate the minimum force required to be applied by the finger to hold the block against the wall?

15. A railway car of mass 20 tonne moves with an initial speed of 54 km/h. On applying brakes, a constant negative acceleration of 0.3 m/s2 is produced.

(i) What is the braking force action on the railway car?

(ii) In what time will it stop?

(iii) What distance will be covered by railway car before it finally stops?

16. Establish a relation between angular momentum and moment of inertia of a rigid body. Define moment of inertia in terms of it.

17. Find an expression for the orbital speed of a satellite revolving around the earth in a circular orbit at a height h above the surface of the earth.

18. Draw stress-strain graph for a metallic solid and show

(i) elastic limit

(ii) region of plasticity

(iii) point of ultimate tensile strength

(iv) fracture point on the graph

Or

The sap in trees, which consists mainly of water in summer, rises in a system of capillaries of radius r = $2.5\times10^{-5}m$. The surface tension of sap is T = $7.28\times10^{-2}N/m$ and the angle of contact is 0°. Does the surface tension alone account for the supply of water to the top of all trees?

19. Do State law of equipartition of energy. Use this law to calculate specific heats of monoatomic, diatomic and triatomic gases.

20. An insulated container containing monoatomic gas of molar mass m is moving with a velocity v_0. If the container is suddenly stopped, find the change in temperature.

21. Show that the motion of a particle represented by y = $\sin\omega t - \cos\omega t$ is simple harmonic with a period of $\frac{2\pi}{\omega}$.

22. What correction was applied by Laplace in Newton's formula for speed of sound waves? Does it lead to correct value of speed of sound in air?

Section D

23. We daily observe that motion of any object falling freely is continuously accelerated and the value of acceleration is found to be about 9.8 m/s2 near the earth's surface. However, rain drops falling due to condensation of water vapour in a cloud do not faR on the ground with an excessively high speed although on an average a cloud is moving at a height of more than-a kilometre from the earth's surface. Arvind's father did not know the cause of this. He thought that size and mass of rain drops are extremely small, negligible force of gravity acts on rain drop and so the falling speed of rain drop is quite small.

One day he asked his son Arvind about his thinking. Arvind explained the real cause that

acceleration due to force of gravity is same for all freely falling bodies irrespective of their size and mass. However, in case of rain drop there is a retarding force too which is due to viscosity of air medium. As a result after falling through certain distance rain drops acquire a constant terminal speed whose values are proportional to square o drop and inversely proportional to the coefficient of viscosity of the viscous medium.

(i) Is the explanation given by Arvind is correct?

(ii) What qualities were displayed by Arvind in your opinion?

(iii) Explain viscosity and coefficient of viscosity.

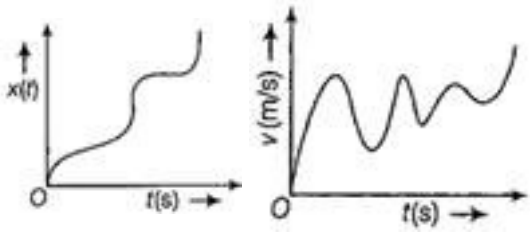
Section E

24. A particle is thrown over a triangle from one end of a horizontal base that grazing the vertex falls on the other end of the base. If a and P be the base angles and 0 be the angle of projection, then show that $\tan\theta = \tan\alpha + \tan\beta$

Or

(i) A balloon is ascending at the rate of 14 m/s at a height of 98 m above the ground, when a packet is dropped from it. After how much time and with what velocity does it reach the ground?

(ii) Do the following two graphs represent same types of motion? Name the motion.



25. (i) Prove that the isothermal elasticity of a gas is equal to its pressure.

(ii) Prove that the adiabatic elasticity of the gas is $\gamma \times p$, where p is pressure of the gas and $\gamma = \frac{C_p}{C_v}$, where C_p and C_v being the specific heats of the gas at constant pressure and constant volume respectively.

Or

In a refrigerator, one removes heat from a lower temperature and deposits to the surroundings at a higher temperature. In this process, mechanical work has to be done,

which is provided by an electric motor. If the motor is of 1 kW power and heat is transferred from $-3^{\circ}C$ to $27^{\circ}C$, find the heat taken out of the refrigerator per second assuming its efficiency is 50% of a perfect engine.

26. The difference between the length of a certain brass rod and that of steel rod is claimed to be constant at all temperatures. Is it possible?
If the earth was a homogeneous sphere and a straight hole bored in it through its centre. Show that if a body were dropped into the hole, it would execute a simple harmonic motion. Also, find its time period.

Or

(i) Derive an expression for finding the velocity of an approaching aero plane using radar waves.
(ii) An ultrasonic wave of frequency 45000 Hz sent out by sonar shows a frequency rise of 600 Hz on reflection from an approaching submarine. If the velocity of sound in water is 1500 m/s, then calculate the speed of the submarine.