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**ANNUAL EXAMINATION 2022-23**
**CLASS: XI SUBJECT: PHYSICS (042)**
**SET-B**

**Time: 3: Hrs** **M.M: 70**

**General Instructions**:
(1) There are 35 questions in all. All questions are compulsory
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.
(3) Section A contains eighteen MCQ of 1 mark each, Section B contains seven questions of two marks each, Section C contains five questions of three marks each, section D contains three long questions of five marks each and Section E contains two case study based questions of 4 marks each.
(4) There is no overall choice. However, an internal choice has been provided in section B, C &D. You have to attempt only one of the choices in such questions.
(5). Use of calculators is not allowed.

## SECTION A

1. Identify the pair whose dimensions are equal
a)Torque and work b)Stress and energy c)Force and stress d)Force and work

2. A body is projected with a speed v at an angle ɵ with horizontal to have maximum range. Velocity at the highest point is
a). √2 v b) 2 v c)V/ √2 d)V/2

3 A projectile has
a) minimum velocity at the point of projection and maximum at the maximum height.
b) maximum velocity at the point of projection and minimum at the maximum height.
c) zero velocity at the maximum height irrespective of the velocity of the projection.
d) same velocity at any point in its path.

4. In a uniform circular motion, the angle between velocity vector and acceleration vector is
a) π/2 b) π/3 c) π/4 d)π

5. For elevations which exceed or fall short of $45^0$ by equal amounts, the ranges
a) are equal b) may not be equal c) differ by unevenly d) can't say

6.A body whose momentum is constant must have constant
a) velocity b) force c) acceleration d) All of the above

7 Tension in the cable supporting an elevator, is equal to the weight of the elevator. From this, we can conclude that the elevator is going up or down with a
a) uniform velocity b) uniform acceleration c) variable acceleration d) either (b) or (c)

8 The force required to just move a body up the inclined plane is double the force required to just prevent the body from sliding down the plane. The coefficient of friction is μ. The inclination μ of the plane is
a) $\tan^{-1}$ μ b) $\tan^{-1}$ (μ/2) c) $\tan^{-1}$2μ d) $\tan^{-1}$3μ

9.A body falls from 80 m. its time of descent is (g=10 m/s2)
a) 3s b) 4s c) 5s d) 6s

10. A car covers 1/3 part of total distance with a speed of 20 km/hr and second 1/3 part with a speed of 30 km/hr and rest of 1/3 part with a speed of 60 km/hr , The average speed of the car is:
a) 30 km/hr b) 37 km/hr c)45 km/hr d)55 km/h

11. A body starts from rest , What is the ratio the distance traveled by the body during 4th and 3rd seconds?
a) 7:5 b) 5:7 c) 7:3 d )16:9

12. A body is thrown with speed 20m/s vertically upward , It will return to thrower's hand after a time of:(assume g=10m/s2)
a) 2 s b) 4 s c) 20 s d )never

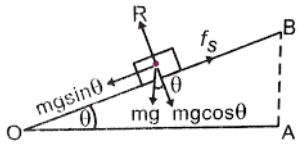
13 Two bodies have their moments of inertia I and 2I respectively about their axis of rotation .If their

kinetic energies are equal ,then the ratio of their angular momenta L1 / L2 is
a) 2 b) 1⁄2 c) /√2 d) 1 /√2

14. The escape velocity for a body projected vertically upwards from the surface of earth is 11 km/s. If the body is projected at an angle of 45°with the vertical, the escape velocity will be
(a) 11 2 km /s (b) 22 km/s (c) 11 km/s (d) 1 km/s
15. The height at which the acceleration due to gravity becomes g/9 (where g = the acceleration due to gravity on the surface of the earth) in terms of R, the radius of the earth, is
(a) R/√2 (b) R / 2 (c) √2R (d) 2 R
16. Density of water is maximum at
(a) 0°C (b) 0°K (c) 4°C (d) 100°C
17. ***Directions:*** (a) If both assertion and reason are true and the reason is the correct explanation of the assertion.
(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) If assertion is true but reason is false.
(d) If the assertion and reason both are false.
Assertion : To hear distinct beats, difference in frequencies of two sources should be less than 10.
Reason : More the number of beats per sec more difficult to hear them.
18. ***Directions:*** (a) If both assertion and reason are true and the reason is the correct explanation of the assertion.
(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) If assertion is true but reason is false.
(d) If the assertion and reason both are false.
Assertion : When a simple pendulum is made to oscillate on the surface of moon, its time period increases.
Reason : Moon is much smaller as compared to earth.

## SECTION B

19. Draw Velocity–time graph for motions with constant acceleration. (a) Motion in positive direction with positive acceleration, (b) Motion in positive direction with negative acceleration
20. Show that the trajectory of projectile is parabolic
21. On the basis of kinetic theory, derive an expression for pressure exerted by gas
22. Show that the coefficient of cubical expansion of ideal gas at constant pressure is equal to the reciprocal of its absolute temperature.
23. . A mass of 4 kg rests on a horizontal plane. The plane is gradually inclined until at an angle θ = 15° with the horizontal, the mass just begins to slide. What is the coefficient of static friction between the block and the surface ?




Or

A constant force acting on a body of mass 3.0 kg changes its speed from 2.0 m s-1 to 3.5 m s-1 in 25 s. The direction of the motion of the body remains unchanged. What is the magnitude and direction of the force ?
24. Find the angle between force F=3i+4j-5k unit and displacement s= 5i+4j+3k
25. Check the dimensional correctness of $v = \frac{\sqrt{GM}}{R}$

## SECTION C

26. Prove analytically that in case of an open organ pipe of length L, the frequencies of vibrating air column are given by f= n(v/2L)

27. If R is the horizontal range for Θ inclination and h is the maximum height reached by the projectile show that the max. range is $R^2/8h+2h$

28. A man of mass 70 kg, stands on a weighing machine in a lift, which is moving

(a) upwards with a uniform speed of 10 $ms^{-1}$.

(b) downwards with a uniform acceleration of 5 $ms^{-2}$.

(c) upwards with a uniform acceleration of 5 $ms^{-2}$.

What would be the readings on the scale in each case?

(d) What would be the reading if the lift mechanism failed and it hurtled down freely under gravity?

Or

Two masses M and m are connected at the ends of two inextensible string passing over a pulley. Calculate the acceleration of the masses and the tension in the string

29. If the radius of a soap bubble is r and surface tension of the soap solution is T. Keeping the temperature constant, what is the excess of pressure in the soap bubble?

Or

Explain why

(a) The angle of contact of mercury with glass is obtuse, while that of water with glass is acute.

(b) Water on a clean glass surface tends to spread out while mercury on the same surface tends to form drops. (Put differently, water wets glass while mercury does not.)

(c) Surface tension of a liquid is independent of the area of the surface

30. At what height above the surface of the earth w the acceleration due to gravity be 25% of its value on the surface of the earth? Assume that the radius of the earth is 6400 km

## SECTION D

31. i) Deduce the relationship between torque and angular momentum and thus explain the geometrical meaning of angular momentum

ii) Find the torque of a force 7i-3j-5k about origin which acts on a particle whose position vector is i+j-k .

Or

i)Define torque. On what factors does it depend. Give its dimensional formula. Explain how torque can be expressed as a vector product of two vectors also give the direction of torque

ii) Show that in the absence of an external force the velocity of the centre of mass is conserved.

32. i) Derive an expression for the kinetic and potential energies of a simple harmonic oscillator. Hence show that total energy is conserved in SHM. In which position of the oscillator energy is wholly kinetic and wholly potential.

ii) A body oscillates with SHM according to the equation (in SI units), $x = 5 \cos [2\pi t + \pi/4]$. At t = 1.5 s, calculate the (a) displacement, (b) speed.

Or

i)Show that SHM may be regarded as the projection of uniform circular motion along the diameter of the circle. Hence derive an expression for displacement of particle in SHM.

ii)Derive an expression for velocity of a particle executing SHM. When is the particle velocity i) maximum minimum?

33. i)State first law of thermodynamics. Apply first law of thermodynamics to adiabatic process and prove that $PV^y$ is a constant

ii)Applying first law of thermodynamics , obtain an adiabatic relation between P and V. Hence obtain the relation between P and T and V and T

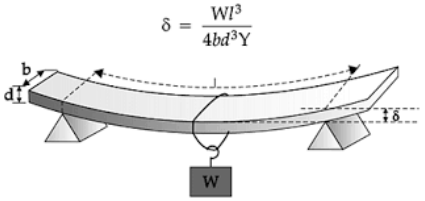
Or

Describe an analytical method for determining the work done during the expansion of gas.

Show that the slope of adiabatic curve at any point is γ times the slope of isothermal curve.

## SECTION E

34. A bridge has to be designed such that it can withstand the load of the flowing traffic, the force of winds and its own weight. Similarly, in the design of buildings the use of beams and columns is very common. In both the cases, the overcoming of the problem of bending of beam under a load is of prime importance. The beam should not bend too much or break. Let us consider the case of a beam loaded at the centre and supported near its ends as shown in Fig.




The use of pillars or columns is also very common in buildings and bridges. A pillar with rounded ends as supports less load than that with a distributed shape at the ends The precise design of a bridge or a building has to take into account the conditions under which it will function, the cost and long period, reliability of usable material, etc.

i)Why are the bridges made of I shape?

ii)Bridges are declared unsafe after long use?

iii)How does the elasticity of material change with temperature

iv)Explain why should the beams used in construction of bridge have large depth and small breadth?

35. The spring force is an example of a variable force which is conservative. The spring is light and may be treated as massless. In an ideal spring, the spring force Fs is proportional to x where x is the displacement of the block from the equilibrium position. The displacement could be either positive]. This force law for the spring is called Hooke's law and is mathematically stated as $Fs = -kx$ The constant k is called the spring constant. Its unit is N $m^{-1}$. The spring is said to be stiff if k is large and soft if k is small.

i) What is the unit of spring force?

ii) What is the potential energy stored in spring?

iii) Draw a plot of spring force and displacement

iv)Two springs A & B with constants $k_A$ and $k_B$ with ($k_A > k_B$) are given. In which spring more work will be done if they are stretched by the same amount.