St. Xavier's Sr. Sec. School
Delhi-54

Final Examination in **PHYSICS – Std. 11**
29-2-2016

M. Marks : 70
Time : 3 hrs.

Roll N | | |

Total printed pages :	03
Total printed questions :	26

INSTRUCTIONS*:*

i) In section A, Q. Nos. 1 to 5 carry 1 mark each.
ii) In section B, Q. Nos. 6 to 10 carry 2 marks each.
iii) In section C, Q. Nos. 11 to 22 carry 3 marks each.
iv) In section D, Q. Nos. 23 carries 4 marks.
v) In section E, Q. Nos. 24 to 26 carries 5 marks.
vi) Use pencil for the diagrams and graphs.
vii) Answers should be to the point.
viii) Use log tables if necessary.

Section - A

1. Why an air bubble in water rises from the bottom and grows bigger in size. (1)
2. Why does oil spread on cold water but remains as a drop on hot water? (1)
3. Why is C_p greater than C_v ? (1)
4. Why the steering wheel of a heavy vehicle is bigger than light vehicle? (1)
5. What will be the change in momentum of a particle if kinetic energy of the particle is doubled? (1)

Section - B

6. What do mean by streamline motion of a liquid. Derive a relation to show that during streamline motion speed is inversely proportional to the area of cross section of the tube through which it is flowing.

(OR)

A non viscous liquid is flowing through a horizontal tube of variable cross-section. The velocity of liquid through section of $5cm^2$ is $2ms^{-1}$. Calculate the velocity through the cross-section of $3cm^2$and pressure difference across the cross-sections. Given that density of liquid is $1000kg/m^3$. (2)

7. Derive an expression for the potential energy stored in a spring of spring constant 'K' if it is stretched to a distance of 'X'. (2)
8. A rocket is fired vertically upward with a speed of 5km/s form the surface of the earth. How far from the earth does the rocket go before returning to the earth?
Mass of the earth=6.0×10^{24}kg, G= $6.67 \times 10^{-11} Nm^2kg^{-2}$. (2)

9. A circular track of radius 300m is banked at an angle of 15°. If the co-efficient of friction between the wheels and the track is 0.2, calculate the maximum speed with which the car can negotiate the turn without skidding. (2)

10. A particle tied to one end of the string whirls in a vertical circular path. Write the equations of tension in the string when the particle at lowest and highest points on the vertical circular path.
Why highest point is known as the critical point? (2)

Section - C

11. A wire of length L is stretched by a length l. Explain the characteristics of the force that is applied in the process hence calculate the potential energy stored in the wire. (3)

12. Establish a relation to show that viscous force acting on a small rigid spherical body moving through a viscous liquid increases with velocity of the body. (3)

13. Write the characteristics of liquid molecules in the surface film? Establish the relation between surface tension and the surface energy. (3)

14. Derive an expression for the average pressure exerted on the walls of the container by an ideal gas. (3)

15. State the law of equipartition of energy. Determine the value C_p/C_v for a diatomic gas at

(i) room temp (ii) high temp. (3)

16. Write the characteristics of head on elastic collision. Two particles of mass m_1 and m_2 move with velocities u_1 and u_2 ($u_1 > u_2$) respectively. Assuming that first particle approaches the second particle, the particles undergo an elastic head on collision. Derive the expression for velocity of the first particle after collision. (3)

17. A circular object rolls down on an inclined plane without slipping. Draw a necessary force diagram and derive a relation for acceleration. Compare the acceleration of a disc and solid sphere. (3)

18. What do you mean by gravitational field intensity at a point? Derive an expression for gravitational intensity a point which is at height of 'h' form the surface of earth. Show graphically the variation for gravitational field intensity with height. (3)

19. Define phase and epoch with reference to oscillatory motion.
Explain how, SHM may be regarded as the projection of uniform circular motion along the diameter of the circle.

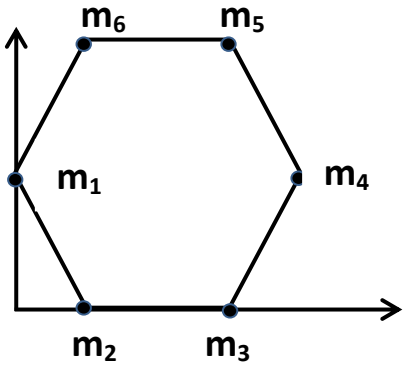
(OR)

Write the expressions for kinetic and potential energy as a function time of a particle oscillating
simple harmonically. Show that total energy of a simple harmonic oscillator is independent of time.
Show the variation of kinetic energy and potential energy graphically with respect to time.
What is significance of the points of intersection of the graphs? (3)

20. Under what essential conditions adiabatic and isothermal processes take place? Show that the slope of adiabatic curve is steeper than the slope of isothermal curve at the corresponding point. (3)

21. (i)State perpendicular axes theorem. Using this theorem, calculate the moment of inertia of a solid circular disc about an axis passing through the diameter?
(ii)Two identical discs, one is rotating about the axis passing through the center and perpendicular to the plane and second is rotating about the axis passing through the diameter with the same angular velocity. Which one will have more rotational kinetic energy?

22. In the adjoining system of particles, six point objects are placed at the vertices of a regular hexagon of side 10cm as shown in the figure. Calculate the position vector of center of mass. Given $m_1 = m_3 = m_5 = 2kg$ and $m_2 = m_4 = m_6 = 4kg$ (3)



Section – D

23. A child visits rail museum with his father and is amazed to see the model of steam engine. Being a science student, curious to know, he asks his father about its working. His father explains him all the concepts about it in detail, clearly explaining that its efficiency cannot be 100%.
(i) Give the working principle and block diagram of steam engine.
(ii) What do you mean by thermal efficiency? Explain why it is impossible to design a heat engine with 100% efficiency?
(iii) State second law of thermodynamics that is applicable to a heat engine.
(iv) What values are possessed by this child? (4)

Section - E

24. Explain why a liquid with concave meniscus rises in a capillary, using the concept of pressure difference across a meniscus. Derive an expression for experimentally determining the surface tension of a liquid by capillary rise method, ignoring the height correction. What happens to the capillary rise for a tube of insufficient height? (2+2+1)

(OR)

Plot a graph showing variation of emissive power with wavelength for black bodies at different temperature. Explain the following from the graph:
(i) Stefan's law.
(ii) Wein's displacement law.
(iii) What conclusion can be drawn from the peak of the graphs?
(iv) Why does a body heated to a very high temperature appear red in colour?
(1+1+1+1+1)

25. (i) What do you mean by escape velocity?
(ii) Derive an expression for escape velocity of an object from the surface of a planet. Does it depend on location from where it is projected? (1+3½+½)

(OR)

(i) What do you mean satellite velocity? Derive an expression for satellite velocity.
(ii) What are geostationary satellites? Calculate the height of the orbit above surface of earth so that satellite can be used for communication. (3+2)

26. (i) What is simple harmonic motion? What is the relationship between acceleration and displacement of the particle executing SHM?
(ii) Write the equation for SHM having following characteristics:
Amplitude = 0.01m, frequency 600Hz, initial phase = π.
(iii) A cylindrical cork is floating in a liquid of density ρ. The cork is slightly depressed and then released. It starts oscillating up and down simple harmonically. Find the time period of oscillation. Ignore the damping due to viscosity of liquid. (1+1+3)

(OR)

(i) A SHM is expressed by the equation x= A sin ωt. Draw and explain the graphs to show the variation of displacement, velocity and acceleration for one complete cycle of SHM.
(ii) What is the value of velocity amplitude and acceleration amplitude of a particle executing SHM?
(iii) Derive the expression for time period of simple pendulum oscillating simple harmonically.

(1½+1+2½)

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