

No of printed pages/Questions:5/35

O. P. JINDAL SCHOOL, SAVITRI NAGAR
Annual Examination :(2022 – 2023)

Class : XI
Subject: Physics(042)

MM: 70
Time:3 Hrs.

(Fifteen minutes extra will be given for reading the question paper.)

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 and E. You have to attempt only one of the choices in such questions.
5. Use of calculators is not allowed.

SECTION A

- Q1. The dimensional formula for impulse is
- (a) MLT^{-2} (b) MLT^{-1}
(c) $ML^{-2}T^{-1}$ (d) M^2LT^{-2}
- Q2. A particle is projected at 30° to the horizontal with a kinetic energy K . The kinetic energy at the highest point is
- (a) K (b) $3K/4$
(c) $K/4$ (d) $K/2$
- Q3. Angle between the forces $A=3i+4j+5k$ and $B=3i+4j-5k$ will be
- (a) 90° (b) 180°
(c) zero (d) 45°
- Q4. A player caught a cricket ball of mass 150 g moving at a rate of 20 m/s . If the catching process is completed in 0.1 s , the force of the blow exerted by the ball on the hand of the player is equal to
- (a) 150 N (b) 3 N
(c) 30 N (d) 300 N
- Q5. Which is the type of collision in which both the linear momentum and the kinetic energy of the system remain conserved?
- (a) Inelastic Collision (b) Elastic Collision
(c) Destructive collision (d) None of the options
- Q6. When a torque acting on a system is zero, then which of the following should not change?
- (a) Linear velocity (b) Angular momentum
(c) Angular displacement (d) Force acting on the body

Q7. What would be the maximum height reached by the body if the body is projected vertically from the surface of the earth of radius R with a velocity equal to half of the escape velocity?

- (a) R/4
(c) R/2

- (b) R
(d) R/3

Q8. The torque of a force $F = -3i\sqrt{v} + j\sqrt{v} + 5k\sqrt{v}$ acting at the point $r = 7i\sqrt{v} + 3j\sqrt{v} + i\sqrt{v}$ is

- (a) $14i\sqrt{v} - 38j\sqrt{v} + 16k\sqrt{v}$
(c) $-21i\sqrt{v} + 4j\sqrt{v} + 4k\sqrt{v}$

- (b) $4i\sqrt{v} + 4j\sqrt{v} + 6k\sqrt{v}$
(d) $-14i\sqrt{v} + 38j\sqrt{v} - 16k\sqrt{v}$

Q9. A liquid is flowing uniformly. The net external force causing the liquid to flow is

- (a) less than viscosity.
(c) equal to viscosity.

- (b) more than viscosity.
(d) not related to viscosity.

Q10. When water is heated from 0°C to 10°C , its volume will:

- (a) decreases

- (c) first decrease then increase
(b) increase
(d) not change

Q11. The monoatomic molecules have only three degrees of freedom because they can possess

- (a) only translatory motion

- (b) only rotatory motion

- (c) both translatory and rotatory motion
(d) translatory, rotatory and vibratory motion

Q12. Which of the following is not essential for S.H.M.?

- (a) Gravity

- (b) Restoring force

- (c) Inertia

- (d) Material medium

Q13. What is the angle between $P \times Q$ and $Q \times P$?

- (a) zero

- (b) $\pi/2$

- (c) π

- (d) none of the above

Q14. A 120 g mass has a velocity $v = (2i + 5j)$ m/s at a certain instant. Its KE is

- (a) 3J

- (b) 4J

- (c) 5J

- (d) 1.74 J

Q15. A force of 6 N acts on a body at rest and mass 1kg. During the time body attains a velocity of 30 m/s. the time for which the force acts on the body is

- (a) 10 s

- (b) 8 s

- (c) 7 s

- (d) 5 s

Note: Q16-18 are Assertion Reason type questions. Choose the correct option from the following options:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Q16. Assertion : A spring has potential energy, both when it is compressed or stretched.

Reason : In compressing or stretching, work is done on the spring against the restoring force.

Q17. Assertion : On a rainy day, it is difficult to drive a car or bus at high speed.

Reason : The value of coefficient of friction is lowered due to wetting of the surface.

Q18. **Assertion** : If the net external force on the body is zero, then its acceleration is zero.

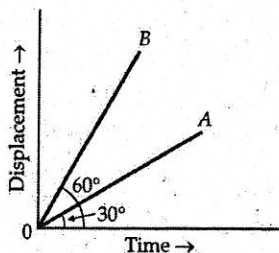
Reason : Acceleration does not depend on force.

SECTION B

Q19. \hat{i} and \hat{j} are unit vectors along X – and Y – axis. Find the magnitude and direction of (i) $\hat{i} + \hat{j}$ and (ii) $\hat{i} - \hat{j}$.

OR

Two straight lines drawn on the same displacement – time graph makes angles 30° and 60° with time – axis respectively, as shown in figure. Which line represents greater velocity? What is the ratio of the two velocities?



Q20. Find the value of p so that the vectors $A = 2\hat{i} + p\hat{j} + \hat{k}$ and $B = 4\hat{i} - 2\hat{j} - 2\hat{k}$ are perpendicular to each other.

Q21. Assuming the earth to be a sphere of uniform mass density, how much would a body weigh half way down to the center of the earth if its weight 250 N on the surface?

OR

What do you mean by geostationary satellite? Write its two uses.

Q22. What is the working principle of hydraulic lift? Explain its working.

Q23. A shell of mass 0.02 kg is fired by a gun of mass 100 kg . If the muzzle speed of the shell is 80 ms^{-1} , What is the recoil speed of the gun?

Q24. What is relative density? Density of a substance is 1.5 gcm^{-3} , calculate its relative density.

OR

Define the terms Moment of inertia and radius of gyration.

A particle of mass 1 kg , at a distance of 1 m from the axis of rotation. What will be its MI about the axis?

Q25. A ball dropped from a tower strikes the ground in 6 s . Find the velocity with which the ball strikes the ground and height of the tower.

SECTION C

Q26. (i) Using 2nd law of motion show that force is the product of mass and acceleration.

(ii) Using 2nd law of motion show that impulse is equal to change in momentum.

OR

State and explain Work-Energy theorem and hence show that work done by a constant force is equal to change in kinetic energy.

Q27. (i) Explain why machine parts are jammed in winter?

(ii) In Millikan's oil drop experiment, what is the terminal speed of a drop of radius $2.0 \times 10^{-5}\text{ m}$ and density $1.2 \times 10^3\text{ kg m}^{-3}$? Take the viscosity of air at the temperature of the experiment to be $1.8 \times 10^{-5}\text{ Nsm}^{-2}$.

OR

Explain why :

- (i) The angle of contact of mercury with glass is obtuse, while that of water with glass is acute.
(ii) Water on a clean glass surface tends to spread out while mercury one the same surface tends to form drops.
(iii) A drop of liquid under no external forces is always spherical in shape.

Q28. State Hooke's law.

Represent graphically the variation of extension with load in elastic body. On the graph mark:

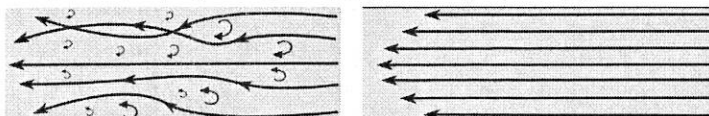
- (i) Hooke's law region (ii) Elastic limit (iii) Yield point (iv) Breaking point

Q29. How acceleration due to gravity varies with depth? Hence calculate acceleration due to gravity at the centre of earth.

Q30. What is degree of freedom? Find the degrees of freedom of mono, di and triatomic gases?

SECTION D

Q31. (i) Identify the type of flow of fluids in given figures and write their one (for each) important characteristics.



- (ii) Show that for incompressible non-viscous fluid product of velocity and area of cross-section at every point of tube of flow is constant.

OR

- (i) Write the characteristics of Ideal fluid.
(ii) State and prove Bernoulli's principle for the flow of non-viscous fluid in streamline flow.

Q32. (i) What is stress and strain.
(ii) The length of a metallic wire is L_1 when tension is T_1 and L_2 when tension is T_2 . Find the original length of the wire.

OR

- (i) Derive the expression for Young's Modulus and hence show that steel is more elastic than rubber.
(ii) Define limit of elasticity.

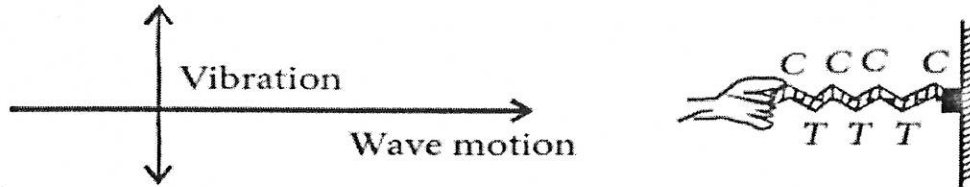
Q33. (i) Derive the expression for gravitational potential energy stored in an object of mass m , when object is brought from infinity to a point at a height h in gravitational field of earth.
(ii) Why is gravitational potential energy always negative?
(iii) How gravitational potential energy is connected to gravitational potential?

OR

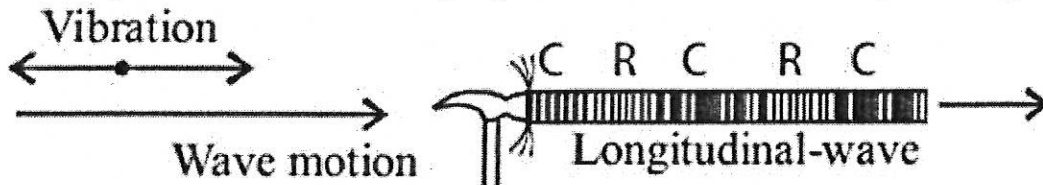
- (i) What is escape velocity on earth's surface? Derive expression for same.
(ii) How escape velocity depends upon the mass of object?
(iii) Escape velocity for an object of mass 1 kg on earth surface is $2 \times 10^{11} \text{ ms}^{-1}$, what is orbital velocity for the same object?

SECTION E

Q34. Transverse waves forms if the particles of the medium vibrate at right angle to the direction of wave motion energy propagation, the wave is called transverse wave. These are propagated as crests and troughs.



Longitudinal waves forms if the particles of the medium vibrate in the direction of wave motion, the wave is called longitudinal. These are propagated as compressions and rarefactions and wave is also known as pressure or compressional wave. Wave on spring or sound waves in air are examples of longitudinal waves.



- (i) What are the characteristics of medium required to propagate mechanical wave?
- (ii) Does electromagnetic wave require any medium to propagate?
- (iii) Differentiate between Transverse waves and longitudinal waves
- (iv) Give examples of each longitudinal waves and transverse waves.

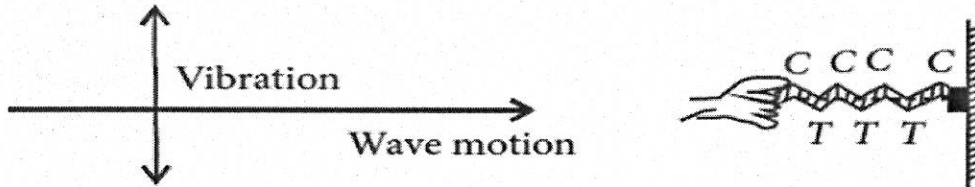
Q35. Newton's first law of motion states that if the net external force on a body is zero, its acceleration is zero. Acceleration can be non zero only if there is a net external force on the body. To summaries, if the net external force is zero, a body at rest continues to remain at rest and a body in motion continues to move with a uniform velocity. This property of the body is called inertia. Inertia means 'resistance to change'. Consider a book at rest on a horizontal surface. It is subjected to two external forces: the force due to gravity (i.e. its weight W) acting downward and the upward force on the book by the table, the normal force R . R is a self-adjusting force. This is an example of the kind of situation mentioned above. The forces are not quite known fully but the state of motion is known. We observe the book to be at rest. Therefore, we conclude from the first law that the magnitude of R equals that of W . A statement often encountered is : Since $W = R$, forces cancel and, therefore, the book is at rest". This is incorrect reasoning. The correct statement is: "Since the book is observed to be at rest, the net external force on it must be zero, according to the first law. This implies that the normal force R must be equal and opposite to the weight W ".

- (i) The book on table is at rest, which force balances the weight of the book?
- (ii) What is inertia?
- (iii) A iron ball and a wooden ball of same size are given. Compare the inertia of both the balls.
- (iv) Balanced forces are acting on an object. Is object necessarily at rest?

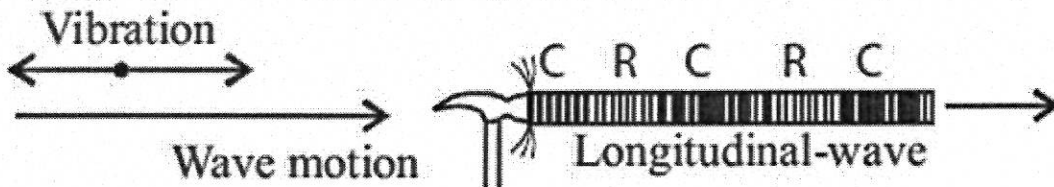


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4/20