

KENDRIYA VIDYALAYA SANGATHAN NEW DELHI
IN SERVICE COURSE 2nd SPELL,
KV NO. 1 ROORKEE
SESSION ENDING EXAMINATION
XI – PHYSICS (THEORY)
SET -II

Time: Three Hours

Max. Marks: 70

General Instructions -

- (a) All questions are compulsory. There are 27 questions in all.
- (b) This question paper has 4 sections: Section A, Section B, Section C, and Section D.
- (c) Section A contains five questions of one mark each, Section B contains seven questions of two marks each, Section C contains twelve questions of three marks each, Section D contains three questions of five marks each.
- (d) There is no overall choice. However, an internal choice has been provided in two questions of one marks, two questions of two marks, four questions of three marks and all three questions of five marks each. You have to attempt only one of the given choices in such questions.
- (e) Use of calculators is not permitted.
- (f) You may use the following physical constants wherever necessary:

$$c = 3 \times 10^8 \text{ms}^{-1} \quad h = 6.6 \times 10^{-34} \text{Js} \quad \text{Boltzmann constant } k = 1.38 \times 10^{23} \text{JK}^{-1}$$
$$\text{Avogadro's number } N_A = 6.023 \times 10^{23} / \text{mole}$$

Section A

1. If $A = (12.00.1) \text{ cm}$ and $B = (8.50.5) \text{ cm}$. Find (i) $(A + B)$ (ii) $(A - B)$
2. The position of an object moving along x-axis is given by $x = a + bt^2$ where $a = 8.5 \text{ m}$, $b = 2.5 \text{ ms}^{-2}$ and t is measured in seconds. What is its velocity at $t = 0 \text{ s}$ and $t = 2 \text{ s}$?

OR

Draw velocity –time graph and acceleration-time for the object throwing vertically upwards.

3. At what temperature is the r.m.s velocity of hydrogen molecule equal to that of an oxygen molecule at 47°?
4. Name two important properties of a material medium responsible for the propagation of waves through it.

OR

Name two important properties of stationary waves.

5. Write the condition necessary for a motion to be Simple Harmonic Motion.

Section B

6. Find the dimensions of a/b in the equation: $F = a + bt^2$, where F is force, x is distance and t is time.
7. Determine a unit vector which is perpendicular to both $\hat{i} + 2\hat{j}$ and $\hat{j} + \hat{k}$.
8. Write the basic laws of limiting friction.
9. A cyclist speeding at 18 km/h on a level road takes a sharp circular turn of radius 3m without reducing the speed. The coefficient of static friction between the tyres and the road is 0.1. Will the cyclist slip while taking a turn?

OR

Two balls each of mass 0.06kg moving in opposite direction with a speed of 5 m/s collide and rebound with the same speed .What is the impulse imparted to each ball due to the other?

10. Write any two differences between Geostationary satellite and polar satellite.
11. Write two necessary conditions for the total internal reflection to take place.

OR

Which of the following properties of light: Velocity, wavelength and frequency, changes during the phenomenon (i) reflection (ii) refraction

12. Two thin lenses when in contact produce a net power of +10D. If they are at 0.25m apart, the net power falls to +6 D. Find the focal lengths of the two lenses

Section C

13. Prove the following :
 - (a) For two angles of projection with same velocity v ,
 - (i) Range is same
 - (ii) Heights are in the ratio $\tan^2 : 1$
 - (iii) If the range and maximum height are equal, the angle of projection is $\tan^{-1}(4)$.
14. State the Newton's second law of motion. A bullet of mass 0.04 kg moving with a speed of 90 m/s enters a heavy wooden block and is stopped after a distance of 60cm. What is the average resistive force exerted by the block on the bullet?
15. Draw the graph of equation $F_s = -kx$, where F_s is the spring force and x is the displacement of the block from equilibrium position. Using the graph ,show that maximum work done by the spring at x_m is $W_s = -kx_m^2/2$ (k = spring constant)

OR

State and prove work energy theorem for variable force.

16. State law of conservation of linear momentum. A body of mass 1kg initially at rest explodes and breaks into fragments of masses in the ratio 1:1:3. The two pieces of equal mass fly off perpendicular to each other with a speed of 30 m/s each. What is the velocity of heavier fragment?
17. Define moment of inertia. A ring, a disc and a sphere, all of the same radius and mass, roll down on an inclined plane from the same height h .Which of the three reaches the bottom (i) first, (ii) last ?

OR

Define centre of mass. From a uniform disc of radius R , a hole of radius $R/2$ is cut out. The centre of the hole is at $R/2$ from the centre of the original disc. Locate the centre of mass of the resulting flat body.

Derive a relation between torque applied and angular acceleration produced in a rigid body.

18. A torque of $2.0 \times 10^{-4} \text{ Nm}$ is applied to produce an angular acceleration of 4 rad s^{-2} in a rotating body.

What is the moment of inertia of the body?

19. (a) What is the value of 'g' at the center of earth?
(b) How much below the surface of earth does the acceleration due to gravity become 1% of its value at the earth's surface? Radius of earth = 6400km.
20. Prove that the motion of simple pendulum is simple harmonic motion. Derive an expression for its time period.
21. A liquid drop of diameter D breaks up into 27 tiny drop, if the resulting change in energy is $0.1454\pi D^2$. Calculate the surface tension of the liquid.

Or

Sixty four small identical drops of liquid combine to form a bigger drop of radius R. Find the resulting change in energy. Take surface tension of the liquid as.

22. Show that the average kinetic energy of a gas molecule is directly proportional to the absolute temperature of the gas. Hence give the kinetic interpretation of the temperature. Oxygen and hydrogen are at the same temperature, what is the ratio of kinetic energies of oxygen molecule and hydrogen molecule when oxygen is 16 times heavier than hydrogen?
23. A simple harmonic oscillation is represented by the equation, $y=0.40\sin(440t+0.61x)$ Here y and t are in m and s respectively. What are the values of (i) amplitude (ii) angular frequency (iii) frequency of oscillations and (iv) initial phase (v) time period (vi) maximum velocity?
24. Explain with reason, how the resolving power of a compound microscope will change when (i) frequency of the incident light on the objective lens is increased, (ii) focal length of the objective lens is increased (iii) aperture of objective lens is increased.

OR

Explain with reason, how the resolving power of a telescope will change when (i) frequency of the incident light on the objective lens is changed, (ii) focal length of the objective lens is increased (iii) aperture of objective lens is increased.

Section D

25. (a) Using Bernoulli's theorem derive Torricelli's law of efflux.
(b) What is venturimeter? Explain its principle and working with help of necessary diagram.

OR

State Stoke's law. Define terminal velocity and find an expression for the terminal velocity in case of a sphere falling through a viscous medium

26. State first law of thermodynamics. By using this law, derive relationship between C_p and C_v . What are the limitations of the first law of thermodynamics?

Or

Define an adiabatic process. Derive an expression for work done during an adiabatic process. What are the essential conditions for an adiabatic process to occur?

27. What are beats? Explain their formation analytically. Prove that the beat frequency is equal to the difference in frequencies of the superposing wave.

Or

What are stationary waves? Show that in the case of a closed organ pipe, the ratio of the frequencies

of the harmonics is 1:3:5:7.