

**KENDRIYA VIDYALAYA SANGATHAN NEW DELHI  
IN SERVICE COURSE 2<sup>nd</sup> SPELL,  
KV NO. 1 ROORKEE  
SESSION ENDING EXAMINATION**

**XI – PHYSICS (THEORY)**

**SET- III**

**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:  
 $c = 3 \times 10^8 \text{ms}^{-1}$        $h = 6.6 \times 10^{-34} \text{Js}$       Boltzmann constant  $k = 1.38 \times 10^{23} \text{JK}^{-1}$

Avogadro's number  $N_A = 6.023 \times 10^{23}/\text{mole}$

**Section A**

- 1. State the number of significant figures in the followings:
  - (a) .00081 cm<sup>2</sup>
  - (b) 6.023x10<sup>23</sup>

OR

Name the two physical quantities which have the same dimension.

- 2. Two straight lines drawn on the same displacement-time graph make angles 30° and 60° with the time axis respectively; find the ratio of the two velocities?
- 3. How does Young's Modulus of Elasticity change with rise in temperature?
- 4. Name two practical applications of Pascal's law.

OR

Two soap bubbles of radii R and r such that  $R > r$ , which bubble has more excess pressure?

- 5. A body oscillates with SHM according to equation (in S.I. units)  
 $X=5 \cos(314t+ \pi/4)$  calculate the (a) Initial phase (b) Angular frequency.

**Section B**

- 6. Define angle of friction. Deduce its relation with coefficient of friction.
- 7. Find the center of mass of three particles at the vertices of an equilateral triangle. The

masses of the particles are 100g, 150g, & 200g respectively. Each side of equilateral triangle is 0.5m long.

8. Show that acceleration due to gravity decreases with depth.

OR

Write Kepler's second and third law of planetary motion.

9. The focal length of an equi convex lens is equal to the radius of curvature of either face. What is the value refractive index of the material of the lens?

OR

How does focal length of a lens change when red light incident on it is replaced by violet light? Give reason for your answer.

10. A steam engine delivers  $5.4 \times 10^8 \text{ J}$  of work per minute & services  $3.6 \times 10^9 \text{ J}$  of heat per minute from its boiler. What is the efficiency of engine? How much heat is wasted per minute.
11. Draw a ray diagram to show the image formation by a concave mirror when the object is kept between its focus and the pole.
12. Define degrees of freedom. Calculate the degrees of freedom of a diatomic gas molecule.

### Section C

13. A 4.5 cm needle is placed 12cm away from a convex mirror of focal length 15cm. Give the location of the image and the magnification. Describe what happens if the needle is moved farther from the mirror.
14. Define centripetal acceleration. Derive an expression for a centripetal acceleration of a particle moving with uniform speed  $v$  along a circular path of radius  $r$ .

OR

Two vectors A and B are acting at an angle  $\theta$ , derive an expression for its resultant both in magnitude in direction.

15. A man weighs 50 kg He stands on a weighing machine in a lift. Which is moving (a) Upward with a uniform speed 20 m/sec. (b) downwards with an uniform acceleration of  $5 \text{ m/s}^2$  (c) Upwards with an uniform acceleration of  $5 \text{ m/s}^2$  What would be the reading on the scale in each case. Take  $g = 10 \text{ m/s}^2$
16. Define elastic collision in one dimension. Obtain expression for velocities of the two bodies after such collision?
17. State and prove work – energy theorem for a constant force? A bullet weighing 10 g is fired with a velocity of 800 m/s. After passing through a mud wall 1 m thick, its velocity decreases to 100 m/s. Find the average resistance offered by the mud wall.
18. Define escape velocity. Derive the expression for the escape velocity of an object from the surface of the earth.

OR

Define orbital velocity of satellite. Derive the expression for it.

19. State parallel and perpendicular axes theorems.  
The moment of inertia of ring about its own axis is  $MR^2$ , find its moment of inertia about

its any diameter.

20. Draw the block diagram of a refrigerator. Define coefficient of performance & write its formula.

(OR)

What is an isothermal process? Derive an expression for the work done during an isothermal process.

21. Using postulates of Kinetic Theory of gases, derive an expression for the pressure exerted by an ideal gas?
22. What are Beats? Prove that beat frequency is equal to the difference between the frequencies of the superposing waves?
23. Show that simple pendulum executes simple harmonic motion. Find the expression for the time period of the simple pendulum?
24. Find the various modes of frequencies formed by the stationary waves in a string fixed at both the ends?

OR

Using appropriate ray diagram obtain relation for refractive index of water in terms of real and apparent depth.

25. a) Show that the trajectory of a projectile thrown at an angle  $\theta$  with the horizontal, is a parabola? Also find the time of flight of projectile.
- b) A cricketer can throw a ball to a maximum horizontal distance of 100 m. How high above the ground can the cricketer throw the same ball?

(OR)

- a) Derive the relation  $S = ut + \frac{1}{2} at^2$  by Calculus method for uniformly accelerated motion along a straight line, where the symbols have their usual meanings.
- b) From the top of a tower 100m in height a ball is dropped and at the same time another ball is projected vertically upwards from the ground with a velocity of 25m/s. Find when & where will the two balls meet? ( $g = 9.8 \text{ m/s}^2$ )
26. (a) What is need for banking? Derive an expression for the maximum velocity with which a car can safely negotiate a curved road banked at angle  $\theta$ . The coefficient of friction between the road and wheels is  $\mu$ .
- (b) Friction is necessary evil. Comment.

(OR)

Define the term impulse. State and prove impulse –momentum theorem.

A machine gun fires a bullet of mass 40 g with a speed of 1200 m/s. The person holding the gun can exert a maximum force of 144 N on it. What is the number of bullets that can be fired from the gun per second?

27. (a) What do you understand by the term capillarity? Derive an expression for the height to which the liquid rises in a capillary tube of radius 'a'?
- (b) Define angle of contact & write the factors on which it depends.

(OR)

- (a) Two boats moving in parallel directions close to each other get attracted. State and prove the physical principle involved in this phenomenon? Name any two applications of the principle.