KENDRIYA VIDYALAYA SANGATHAN, PATNA REGION
SESSION ENDING EXAMINATION, 2017–18
CLASS – XI
PHYSICS

Sl. No. 861

TIME – 3 HOURS]
[MAX. MARKS – 70

General Instructions :

(i)   All questions are compulsory.

(ii)   Question No. 1 to 5 are VSA Type carrying one mark each.

(iii)   Question No. 6 to 10 are SA Type carrying two marks each.

(iv)   Question No. 11 to 22 are SA Type carrying three marks each.

(v)   Question No. 23 are value based question carrying four marks.

(vi)   Question No. 24 to 26 is LA Type carrying five marks each.

(vii)   There is no overall choice. However internal choice has been given in some questions. You have to attempt only these questions.

(viii) Use of calculator is not permitted.

SECTION – A

1.   Write the four fundamental forces, in ascending order of their relative strengths. 1

2.   What is the angle of friction between two surfaces in contact, if the coefficient of friction is $1/\sqrt{3}$? 1

3.   Name the process in which 1

    (a)   Two bodies stick together after collision.

    (b)   Total momentum and total kinetic energy of the entire system is conserved.

4.   State the conditions of translational and rotational equilibrium of rigid bodies. 1

5.   In a car lift, compressed air exerts a force F1 on a small piston having a radius of 5.0 cm. This pressure is transmitted to a second piston of radius 10.0 cm. If the mass of the car to be lifted is 1350 kg, calculate F1. (g = 9.8 m/s²) 1

SECTION – B

6.   A constant force F acts on a body of mass m and changes its velocity from u to v after covering a distance S. Show that work done is equal to change in its kinetic energy. 2

[Turn Over

7. (a) State Law of conservation of angular momentum.

   (b) A child stand at the centre of turntable with his two arms outstretched. The turntable is set rotating with an angular speed of 40 revolution /min. How much is the angular speed of the child if he folds his hands back so that moment of Inertia reduces to 2/5 times the initial value ? Assume that there is no slipping.   2

OR

What is the moment of inertia of a ring about a tangent to the circle of the ring ?

8. Obtain the expression for the orbital velocity of a satellite.   2

9. Derive the relation : $C_p - C_v = R$. Where symbols have their usual meaning.   2

10. The travelling wave incident (a) at a rigid boundary and (b) at an open boundary is represented by $Y(x, t) = a \sin(wt - kx)$. Write the mathematical expression for the wave form after reflection from (a) rigid boundary (b) open boundary   2

SECTION – C

11. The Time period of a oscillation of a simple pendulum depends on   3

    (a) Mass m of the bob

    (b) Length L of the pendulum

    (c) Acceleration due to gravity g at a place

    Derive an expression for its Time period using method of Dimensions.

12. Vernier calipers have 20 divisions on its sliding scale and 10 divisions on main scale is equal to 1 cm. A screw gauge of pitch 1 mm has 100 divisions on its circular scale. Find the Least count of Vernier scale and Screw Gauge.

    State which of the two- Vernier calipers or Screw Gauge is more Precise ? Justify your answer.   3

OR

In an experiment, refractive index of glass was observed to be 1.45, 1.56 1.54, 1.44, 1.54, 1.53, calculate (i) Mean value of refractive index (ii) Mean absolute error (iii) Fractional error.

13. (a) Derive (i) $S = ut + \frac{1}{2} at^2$ by Calculus method.

    (b) An insect trapped in a circular groove of radius 12 cm moves along the groove steadily and completes 7 revolutions in 100 s. What is the (i) angular speed (ii) the magnitude of acceleration ?   3

14. A car is taking a circular turn on a Banked road. (Take μ_s = coefficient of static friction between tires and road).

    (a) Draw the free- body diagram for the system showing all forces.

(b) Obtain the expression for the maximum possible speed of a car on a road to avoid slipping.   3

15. Show that, the relative velocity of separation after the collision is equal to the relative velocity of the approach, when two bodies suffer one dimensional elastic collision.   3

16. Find the Centre of mass of three particles at the vertices of an equilateral triangle. The masses of the particles are 100g, 150g, and 200g respectively. Each side of the equilateral triangle is 0.5 m long.   3

17. Show that the value of g decreases with the altitude or height. Draw the graph showing the variation of acceleration due to gravity with (i) height above the earth's surface and (ii) depth below the earth's surface.   3

18. (a) Draw the stress versus strain Graph for (i) Ductile materials (ii) Brittle materials (iii) Elastomers

     (b) Write the expression for Ascent Formula.

        Water rises in capillary tube while mercury falls in the same tube. Why ?   3

19. Draw the block diagram of a Heat Engine. A Carnot engine absorbs 1000J of heat from a reservoir at 127°C and rejects 600J of heat energy during each cycle. Calculate (i) Efficiency of the engine (ii) Amount of useful work done during each cycle.   3

20. State first law of Thermodynamics. Obtain the expression for work done to expand ideal gas under Isothermal condition.   3

21. Write two assumptions of Kinetic theory of gas. What are the degrees of freedom in following cases –   3

     (a) A molecule of monoatomic gas-Helium is capable of translatory motion only.

     (b) A molecule of diatomic gas-Oxygen is capable of both translational and rotational motion.

     (c) The triatomic linear molecule.

     (d) The triatomic non-linear molecule.

22. State the laws of vibrations of stretched strings.   3

SECTION- D

23. Ashutosh and Gaurav were travelling by a bus. All of a sudden, driver applied powerful brake to stop the bus within a very short distance. Ashutosh and Gaurav experienced a forward jerk. Gaurav was holding a handle in the bus but Ashutosh was not, he was just about to fall in the bus, at the instant Gaurav saved him by pulling his arm.

     (a) What values were shown by Gaurav ?

(b) When a bus suddenly stops, in which direction a passenger will experience a jerk and why ?   4

SECTION – E

24. A projectile is fired with a velocity u making an angle θ with the horizontal.

(a) Show that its trajectory is parabola.

(b) Obtain the expression for its : (i) Time of Flight (ii) Horizontal Range

(c) A projectile can have the same range R for two angles of projection. If t_1 and t_2 be the time of flight in the two cases, then prove that $t_1 t_2 = 2R/g$.   5

OR

(a) State parallelogram Law of addition of vector and find the magnitude and direction of resultant of two vectors P and Q.

(b) What will be the angle between A and B, if the area of the parallelogram drawn with A and B as its adjacent sides is ½ (AB)

25. State and Prove Bernoulli's Theorem. What is Magnus Effect ?   5

OR

(a) Define Terminal velocity for motion of small spherical body through a viscous medium.

(b) Obtain an expression for the terminal velocity.

(c) If 27 drops of rain were to combine to form one new large spherical drop, then what should be the velocity of this large spherical drop ? (Given : Terminal velocity of 27 drops of equal size falling through the air is 0.20 m/s).

26. (a) Plot (i) displacement versus time graph (ii) velocity vs time graph for a body executing simple harmonic motion.   5

(b) Show that for a particle in linear S.H.M. the average kinetic energy over a period of oscillation equals the average potential energy over the same period.

OR

(a) What is Doppler's Effect of sound ?

(b) Obtain an expression for apparent frequency of sound when source and listener are approaching each other.

(c) Draw the fundamental modes of vibration of stationary waves in :

(i) Closed pipe

(ii) An Open pipe

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