I PUC

M – 2024

Register Number : | | | | | | |

Subject Code : 33

PHYSICS

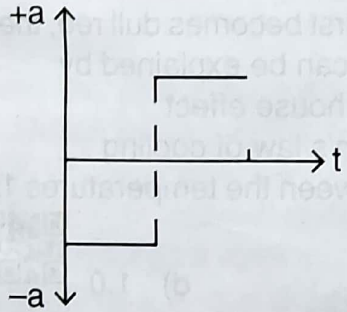
Time : 3 Hours 15 Minutes] [Total No. of questions : 48] [Max. Marks : 70

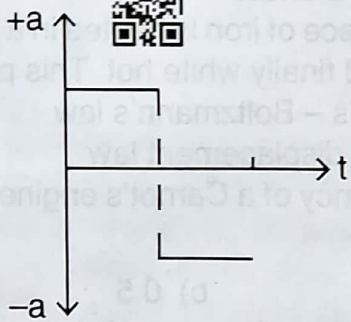
Instructions :
1) ***All*** *Parts are* ***compulsory****.*
2) *For Part – **A** questions, **first** written answers will be considered for awarding marks.*
3) *Answers without relevant diagram/figure/circuit, **wherever** necessary will **not** carry **any** marks.*
4) *Direct answers to the numerical problems without detailed solution will **not** carry **any** marks.*

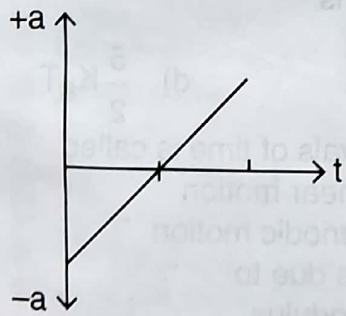
PART – A

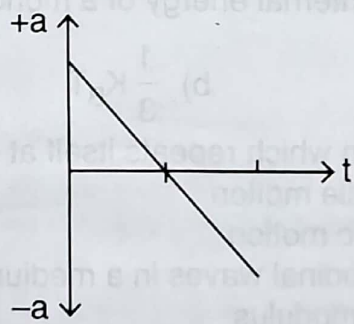
I. Pick out the correct option among the four given options for **all** of the following questions : **(15×1=15)**

1) The dimensional formula of pressure is
   a) $[MLT^{-2}]$ b) $[ML^2T^{-2}]$ c) $[ML^{-1}T^{-2}]$ d) $[MLT^{-3}]$
2) A ball is thrown vertically upward and allowed to move freely under gravity, the a-t graph of the motion of ball is

a)


b)


c)


d)


P.T.O.

3) In a projectile motion, the horizontal range is maximum for angle of projection

a) 0° b) 45° c) 60° d) 90°

4) The product of force and time is

a) Force b) Torque c) Impulse d) Acceleration

5) The recoil of a gun is an example for conservation of

a) Mass b) Charge c) Energy d) Momentum

6) The scalar product two vectors is zero $\left(\vec{A}.\vec{B} = 0\right)$, the angle between two vectors is

a) 0° b) 45° c) 90° d) 180°

7) Consider a system of two identical particles, one of the particle is at rest and other has an acceleration 'a'. The centre of mass has an acceleration

a) zero b) $\frac{a}{2}$ c) a d) 2a

8) The value of gravitational constant is

a) $6.67 \times 10^{-10}\ Nm^2\ kg^{-2}$ b) $6.67 \times 10^{-11}\ Nm^2\ kg^{-2}$

c) $6.67 \times 10^{-12}\ Nm^2\ kg^{-2}$ d) $6.67 \times 10^{-13}\ Nm^2\ kg^{-2}$

9) Which of the following materials is/are close to ideal plastic ?

(i) Putty
(ii) Mud
(iii) Steel

a) (i) and (ii) b) (i) and (iii) c) (ii) and (iii) d) (i), (ii) and (iii)

10) Dynamic lift due to spinning of a ball is

a) Magnus effect b) Doppler's effect
c) Pascal's effect d) Torricelli effect

11) When a piece of iron is heated in a hot flame, it first becomes dull red, then reddish yellow and finally white hot. This phenomenon can be explained by

a) Stefan's – Boltzmann's law b) Green house effect
c) Wien's displacement law d) Newton's law of cooling

12) The efficiency of a Carnot's engine working between the temperatures 127°C and 27°C is

a) 0.25 b) 0.5 c) 0.75 d) 1.0

13) The total internal energy of a mono atomic gas is

a) $\frac{1}{2}K_BT$ b) $\frac{1}{3}K_BT$ c) $\frac{3}{2}K_BT$ d) $\frac{5}{2}K_BT$

14) The motion which repeats itself at regular intervals of time is called

a) Projectile motion b) Curvilinear motion
c) Periodic motion d) Non-periodic motion

15) The longitudinal waves in a medium propagates due to

a) Shear modulus b) Bulk modulus
c) Young's modulus d) Both Shear and Bulk modulus

II. Fill in the blanks by choosing appropriate answer given in the brackets for all the following questions : **(5×1=5)**

(Surface tension, 180°, Vector, Elliptical, 90°, Absolute temperature)

16) A physical quantity having both magnitude and direction is called _____
17) All planets move in _____ orbits with sun situated at one of the foci.
18) The spherical shape of a liquid drop is due to _____
19) At constant pressure, the volume of a gas is directly proportional to its _____
20) At rigid boundary, there is a phase difference of _____ between incident and reflected wave.

PART – B

III. Answer **any five** of the following questions : **(5×2=10)**

21) Write any two rules of writing significant figures.
22) A stone tied at one end of a string 80 cm long and is whirled in a horizontal circle with constant speed. If the frequency of revolution of stone is 2 Hz., then calculate magnitude of tangential velocity.
23) Write any two advantages of friction.
24) What are conservative and non-conservative forces ?
25) Mention the expression for kinetic energy of a rotating body and explain the terms.
26) State and explain Newton's law of gravitation.
27) Mention any two factors on which thermal capacity of a body depends.
28) State and explain first law of thermodynamics.
29) Draw a graph of kinetic energy and potential energy of an oscillating particle with displacement.

PART – C

IV. Answer **any five** of the following questions : **(5×3=15)**

30) Derive an expression for time taken to reach maximum height by a projectile.
31) Prove law of conservation of linear momentum using Newton's laws of motion.
32) Derive an expression for potential energy of a spring by graphical method.
33) To maintain a rotor at a uniform angular speed of 120 $rads^{-1}$. Engine needs to transmit a torque of 180 Nm. What is the power required by the engine ?
34) Define :
    i) Longitudinal strain
    ii) Shear strain
    iii) Volume strain.
35) Distinguish between streamline flow and turbulent flow.
36) On what factors does the rate of transfer of heat through a conductor depends ?
37) State and explain Boyle's law.
38) Write Newton's formula for speed of sound in gas and give Laplace correction to Newton's formula.

PART – D

V. Answer **any three** of the following questions : **(3×5=15)**

39) Derive the kinematic equation of uniformly accelerated motion, $v^2 = v_0^2 + 2ax$, using v-t graph, where terms have their usual meaning.

40) Derive an expression for magnitude and direction of resultant of two vectors acting at a point.

41) Prove law of conservation of mechanical energy in case of freely falling body.

42) a) Define torque. **1**

b) Obtain the relation $\vec{\tau} = \frac{d\vec{L}}{dt}$. **4**

43) a) What is isothermal process ? **1**

b) Obtain an expression for work done in isothermal process. **4**

44) Show that a stretched string vibrates with all harmonics.

VI. Answer **any two** of the following questions : **(2×5=10)**

45) A ship of mass 3×10^7 kg initially at rest is pulled by a force of 5×10^4 N through a distance of 3 m. Assuming that resistance of water is negligible, find the speed of the ship after travelling 3 m distance.

46) Calculate the orbital velocity and period of revolution of an artificial satellite of the earth moving at an altitude of 200 km.

Given,

Radius of the earth = 6400 km

Mass of the earth = 6×10^{24} kg

$G = 6.7 \times 10^{-11}$ $Nm^2 kg^{-2}$.

47) A body cools from 80°C to 50°C in 5 minute. Calculate the time it takes to cool from 60°C to 30°C. The temperature of surrounding is 20°C.

48) A body oscillates with SHM according to the equation, $x = 5\cos\left(2\pi t + \frac{\pi}{4}\right)$ m.

At t = 1.5 s, calculate (a) displacement, (b) speed and (c) acceleration of the body.
