

HOLIDAY HOMEWORK
Class XI (2026-27)
PHYSICS (042)

- 1.) What is the number of significant figures in
- 0.06070
 - 21900
 - 2.900
 - 0.17080
 - 234578.00
- 2.) If $x = a + bt + ct^2$ where x is in meter and t in seconds, what is the dimension of a , b , and c ?
- 3.) Write the dimensions of:
- Gravitational constant
 - Planck's constant
 - Torque
 - Surface tension
 - Coefficient of viscosity
 - Angular momentum.
 - Coefficient of elasticity
 - Young's modulus (Y).
- 4.) Give an example of
- a physical quantity which has a unit but no dimensions.
 - a physical quantity which has neither unit nor dimensions.
 - a constant which has a unit.
 - a constant which has no unit.
- 5.) Convert 10 N into dyne using dimensional analysis.
- 6.) The potential energy of a particle varies the distance x from a fixed origin as $U = \frac{A\sqrt{x}}{x^2 + B}$, where A and B are dimensional constants, then find the dimensional formula for AB .
- 7.) Check the dimensional correctness of the relation $v = \sqrt{\frac{2GM}{R}}$ where v is velocity, M is mass of earth, G is gravitational constant and R is the radius of earth.

8.) Given that the period T of oscillation of a gas bubble from an explosion underwater depends on P , d , and E , where the symbols are pressure, density, and total energy of the explosion. Find dimensionally a relation for T .

9.) If the velocity of light c , the constant of gravitation G , and Plank's constant h be chosen as fundamental units, find the value of a gram, a centimetre, and a second in terms of new units of mass, length, and time respectively.

(Given $c = 3 \times 10^{10} \text{ cms}^{-1}$, $G = 6.67 \times 10^{-8} \text{ dyne cm}^2 \text{ g}^{-2}$ and $h = 6.6 \times 10^{-27} \text{ erg-s}$).

10.) The radius of Earth is $6.37 \times 10^6 \text{ m}$ and its average density is $5.517 \times 10^3 \text{ kg m}^{-3}$. Calculate the mass of Earth to correct significant figures.

11.) By the method of dimensions, find the value of acceleration of 8m/s^2 into km/hr^2 .

12.) If E , m , L and G denote energy, mass, angular momentum, and gravitational constant respectively, determine the dimensions of $\frac{EL^2}{m^5 G^2}$.

13.) A calorie is a unit of heat or energy and is equivalent to 4.2 J where $1\text{J} = 1\text{kgm}^2\text{s}^{-2}$. Suppose we employ a system of units in which the unit of mass equals $\alpha \text{ kg}$, the unit of length equals $\beta \text{ m}$, the unit of time is $\gamma \text{ s}$. Show that a calorie has a magnitude $4.2\alpha^{-1} \beta^{-2} \gamma^2$ in terms of the new units.

14.) A book with many printing errors contains four different formulas for the displacement y of a particle undergoing a certain periodic motion:

(a) $y = a \sin \frac{2\pi t}{T}$

(b) $y = a \sin vt$

(c) $y = \left(\frac{a}{T}\right) \sin \frac{t}{a}$

(d) $y = \left(\frac{a}{\sqrt{2}}\right) \left(\sin \frac{2\pi t}{T} + \cos \frac{2\pi t}{T}\right)$

where a = maximum displacement of the particle, v = speed of the particle, T = time-period of motion. Rule out the wrong formulas on dimensional grounds.

15.) Evaluate

a) $24.36 + 0.0623 + 256.2$

b) $\frac{23.34 \times 12.6}{2.334}$

c) 1.25×2.245

16.) The frequency of vibration f of a mass m suspended from a spring of spring constant K is given by a relation of this type $f = C m^x K^y$; where C is a dimensionless quantity. Find the value of x and y .

17.) If the velocity of light (c), gravitational constant (G) and Planck's constant (h) are chosen as fundamental units, then find the dimensions of mass in new system.

18.) Find the value of 60 W on a system having 100 g , 20 cm and 1 minute as the fundamental units.

19.) The period of vibration of a tuning fork depends on length (l) of its prongs, density (d) and Young's modulus (Y) of its material. Determine the expression of time period of vibration using the method of dimensions.

20.) Check the correctness of the relation $h = \frac{2\sigma\cos\theta}{r^2dg}$, where h is height, σ is surface tension, θ is angle of contact, r is radius, d is density and g in acceleration due to gravity.

21.) Draw distance time graph of a body moving with

- a) positive constant acceleration
- b) negative constant acceleration
- c) zero acceleration.

22.) The acceleration a (in m/s^2) of a body, starting from rest varies with time t (s) following the equation $a = 3t + 4$. Determine the velocity of the body at time $t = 2\text{s}$.

23.) Displacement of a particle is given by the expression $x=3t^2 + 7t - 9$, where x is in meters and t is in seconds. What is acceleration?

24.) A car moving on a straight highway with speed of 126km/hr is brought to a stop within 200 m . What is the retardation of the car (assumed uniform) and how long does it take for the car to stop?

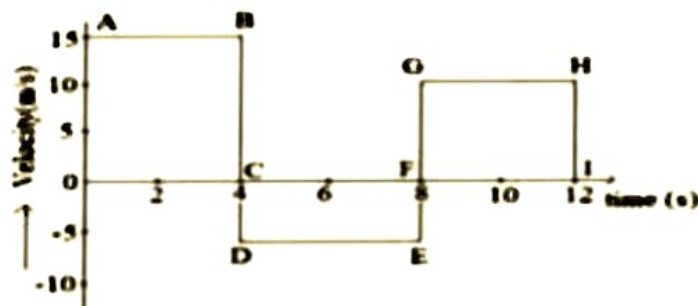
25.) Read each statement below carefully and state with reasons and examples, if it is true or false; A particle in one-dimensional motion

- a) with zero speed at an instant may have non-zero acceleration at that instant
- b) with zero speed may have non-zero velocity
- c) with constant speed must have zero acceleration
- d) with a positive value of acceleration must be speeding up.

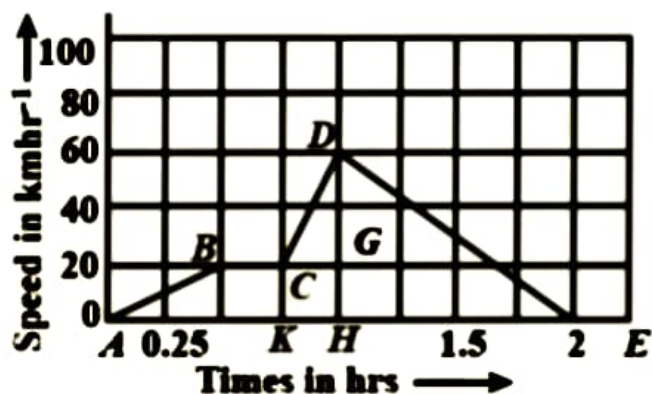
26.) The position of a particle is given by $S(t)=5t \hat{i} +6t^2 \hat{j} -10 \hat{k}$ where t is in seconds. Find the velocity $v(t)$ and acceleration $a(t)$ of the particle at $t = 1\text{s}$.

27.) Velocity time graph of a moving particle is shown. Find the displacement and distance

- (a) $0 - 4\text{ s}$
- (b) $0 - 8\text{ s}$
- (c) $0 - 12\text{ s}$ from the graph.



28.) A train moves from one station to another in 2 hours' time, its speed during the motion is shown in graph above. Determine the maximum acceleration during the journey and distance covered during the time interval from 0.75 hour to 1.00 hour.



29.) A woman starts from her home at 9.00 am, walks with a speed of 5 km h^{-1} on a straight road up to her office 2.5 km away, stays at the office up to 5.00 pm, and returns home by an auto with a speed of 2.5 km h^{-1} . Choose suitable scales and plot the x-t graph of her motion.

30.) A passenger arriving in a new town wishes to go from the station to a hotel located 10 km away on a straight road from the station. A dishonest cab man takes him along a circuitous path 23 km long and reaches the hotel in 28 min. What is

- (a) the average speed of the taxi,
- (b) the magnitude of average velocity? Are the two equal?

31.) A man walks on a straight road from his home to a market 2.5 km away with a speed of 5 km h^{-1} . Finding the market closed, he instantly turns and walks back home with a speed of 7.5 km h^{-1} . What is the

- (a) Magnitude of average velocity, and
- (b) Average speed of the man over the interval of time
 - (i) 0 to 30 min.
 - (ii) 0 to 50 min.
 - (iii) 0 to 40 min.

32.) Graphically derive the three equations of motion.

33.) A particle is moving along a straight line and its position is given by the relation

$$x = (t^3 - 6t^2 - 15t + 40) \text{ m. Find}$$

- (a) The time at which velocity is zero.
- (b) Position and displacement of the particle at that point.
- (c) Acceleration.

34.) A man went on his bike from Delhi to Gurgaon at a speed of 60 km/hr and came back at a speed of 40 km/hr . What is his average speed for the entire journey?

35.) A balloon is ascending at the rate of 4.9 m/s . A packet is dropped from the balloon when situated at a height of 245 m. How long does it take the packet to reach the ground? What is its final velocity?

36.) Establish the relation $S_{nth} = u + \frac{a}{2}(2n-1)$ where the letters have their usual meanings.

37.) A stone is dropped from the top of a cliff and is found to travel 44.1m during the last second before it reaches the ground. What is the height of the cliff? ($g = 9.8m/s^2$)

38.) The displacement x of a particle moving in one dimension under the action of constant force is related to the time by the equation $t = \sqrt{x} - 3$ where x is in meters and t is in seconds. Find the velocity of the particle at $t = 3s$ and $t = 6s$.

39.) A stone is dropped into water from a bridge 44.1m above the water. Another stone is thrown vertically downward 1 sec later. Both strike the water simultaneously. What was the initial speed of the second stone?

40.) A car accelerates from rest at a constant rate α for some time, after which it decelerates at a constant rate β and comes to rest. If the total time elapsed is t , then what is the maximum velocity acquired by the car?

41.) The conversion of 1 MW power in a new system having basic unit of mass, length, and time as 10 kg, 1 dm and 1 minute respectively is:

- a) 2.16×10^{13} unit
- b) 1.26×10^{12} unit
- c) 2.16×10^{10} unit
- d) 2×10^{14} unit

42.) In a new system, unit of mass is 10kg, unit of length is 5m and unit of time is 10s. Then, in the new system 20 g/cc is equal to:

- a) 2.5×10^2 new units
- b) 2.5×10^3 new units
- c) 2.5×10^4 new units
- d) 2.5×10^5 new units

43.) Force F is given in terms of time t and distance x by $F = A \sin Ct + B \cos Dx$. Then the dimensions of A/B and C/D are

- a) $[M^0L^0T^0]$, $[M^0L^0T^{-1}]$
- b) $[MLT^{-2}]$, $[M^0L^{-1}T^0]$
- c) $[M^0L^0T^0]$, $[M^0LT^{-1}]$
- d) $[M^0LT^{-1}]$, $[M^0L^0T^0]$

44.) Number of significant figures in expression $4.327g/2.51cm^3$ is

- a) 2
- b) 4
- c) 3
- d) 5

45.) $[MLT^{-1}] + [MLT^{-1}] = \dots\dots\dots$

- a) $[M^0L^0T^0]$ b) $[MLT^{-1}]$
c) $2[MLT^{-1}]$ d) None of these

46.) A body starts from rest and travels with uniform acceleration of 2 m/s^2 . If its velocity is v after making a displacement of 9 m , then v is

- (a) 8 m/s (b) 6 m/s (c) 10 m/s (d) 4 m/s

47.) The slope of the velocity – time graph for retarded motion is

- a) Zero
b) Positive
c) Negative
d) Neutral

48.) A car moving on a straight road covers one third of a certain distance with 20 km/h and the rest with 60 km/h . The average speed is:

- a) 40 km/h
b) 50 km/h
c) 36 km/h
d) 55 km/h

49.) A body moves along a straight line with acceleration 3 ms^{-2} for 2 seconds and then with acceleration 4 ms^{-2} for 3 seconds. What is his average acceleration?

- a) 3.4 ms^{-2}
b) 3.5 ms^{-2}
c) 3.6 ms^{-2}
d) 3.7 ms^{-2}

50.) A vehicle travels half the distance L with speed v_1 and the other half with speed v_2 , then its average speed is

- (a) $\frac{v_1 + v_2}{2}$ (b) $\frac{2v_1 + v_2}{v_1 + v_2}$ (c) $\frac{2v_1v_2}{v_1 + v_2}$ (d) $\frac{L(v_1 + v_2)}{v_1v_2}$