

HOLIDAY ASSIGNMENT
CLASS – XI- SCIENCE : PHYSICS

Assignment-1

1. Distinguish between accuracy and precision. [1]

2. What is the angle between $\vec{A} \times \vec{B}$ and $\vec{B} \times \vec{A}$? [1]

3. Two vectors of equal magnitude but different directions have their resultant of same magnitude as each of them. What is the angle between the two vectors? [1]

4. A vector is given as $\vec{A} = 2\hat{i} + 3\hat{j} + \hat{k}$. Find the unit vector in the direction of \vec{A} . [1]

5. Write the dimension of Youngs Modulus. [1]

6. Using the principle of homogeneity of dimensions check the correctness of the equation,

$T^2 = \frac{4\pi^2 r^3}{GM}$.Where T is the time period, G is gravitational constant, M is mass and r is radius of the orbit. [2]

7. The least count of a stop watch is 0.5 s. The time of 40 oscillations of the pendulum is found to be 40 s. What is the percentage error in the time period? [2]

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8. The heat dissipated in a resistance can be determined from the relation : $H = \frac{I^2 R t}{4.2}$ cal.

If the maximum errors in the measurement of current, resistance and time are 2%, 1% and 2% respectively, What would be the maximum error in the measurement of dissipated heat. [2]

9. The van-der-Walls equation is given as, $(P + a/V^2)(V - b) = RT$. Find the dimensions of the constants a and b. [2]

10. Two vectors are given as, $\vec{A} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{B} = \hat{i} + 2\hat{j} + \hat{k}$. Find the angle between the two vectors. [2]

11. The relation between t and distance x is $t = ax^2 + bx$ where a and b are constants. Show that the instantaneous acceleration is directly proportional to the cube of instantaneous velocity. [3]

12. A ship is steaming due east at 12 m/s. A woman runs across the deck at 5 m/s towards north. Calculate the magnitude and direction of the velocity of the woman relative to the sea. [3]

13. A ball is allowed to fall freely from the top of a tower of height 100 m. At the same instant another ball is thrown upward from the base of the tower with an initial speed of 40 m/s. When and where will they meet? [3]

14. Two vectors are given as, $\vec{A} = n\hat{i} - \hat{j} - 2\hat{k}$ and $\vec{B} = 2\hat{i} + m\hat{j} + \hat{k}$. Find the value of m and n such that the two vectors are parallel to each other. [3]

15. The time period (T) of simple pendulum depends on length of the pendulum (l), mass of the bob (m) and acceleration due to gravity (g). Using dimension analysis derive the relation. [3]

16.a) State triangle law of vector addition and explain it. [2+3]

b) Derive the expression of the magnitude and direction of the resultant using triangle law.

17. Using calculus method prove the following equations of motion: [5]

a) $v = u + at$

b) $v^2 = u^2 + 2as$.

c) $S = ut + \frac{1}{2}at^2$

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Assignment-2

A. Answer the following questions

[1x5=5]

1. What is random error?
2. Write the dimension of universal gravitational constant?
3. Three vectors drawn in same order represent three sides of a triangle. What is the value of their resultant?
4. Under what condition is the average velocity equal to the instantaneous velocity?
5. What is the angle between $\mathbf{i} + \mathbf{j}$ and $\mathbf{i} - \mathbf{j}$?

B. Answer the following questions

[2x5=10]

1. The temperatures of two bodies measured by a thermometer are $t_1 = 20^\circ\text{C} \pm 0.5^\circ\text{C}$ and $t_2 = 50^\circ\text{C} \pm 0.5^\circ\text{C}$. Calculate the temperature difference and error therein.
2. If $x = 2at + 5bt^2$, where x and t are in metre and second respectively, then find the dimensions of a and b .
3. A body travels the first half of the total distance with velocity v_1 and second half with velocity v_2 . Calculate the average velocity.
4. Two vectors are given as $\mathbf{A} = 3\mathbf{i} - \mathbf{j} + 2\mathbf{k}$ and $\mathbf{B} = \mathbf{i} - 2\mathbf{j} - 3\mathbf{k}$. Find the projection of \mathbf{A} on \mathbf{B} .
5. Two buses start simultaneously towards each other from towns A and B, which are 480 km apart. The first bus takes 8 hours to travel from A to B, while the second bus takes 12 hours to travel from B to A. Determine when and where the buses will meet?

C. Answer the following questions

[3x5=15]

1. The viscous force(F) acting on a sphere of radius r falling freely through a viscous fluid depends on the coefficient of viscosity(η), radius of the sphere and the terminal velocity(v). Using dimension analysis obtain the relation between them.
2. in successive measurements, the readings of the period of oscillation of a simple pendulum were found to be 2.63 s, 2.56 s, 2.42 s, 2.71 s, and 2.80 s in an experiment. Calculate a) mean

value of the period of oscillation, b) absolute error in each measurement, c) mean absolute error, d) relative error, e) percentage error .

3. A policeman starts chasing a thief in his jeep with a constant velocity v . When he was at a distance d away, the thief rides on his bike and starts moving away with a constant acceleration a , starting from rest. Show that the police will be able to catch the thief if $v \geq 2ad$.

4. A person travelling along eastward with a speed of 3 km/h finds that wind seems to blow from north. On doubling his speed, the wind appears to flow from north-east. Find the magnitude of the actual velocity of the wind.

5. The position of a particle is given by: $\mathbf{r} = 3.0t\mathbf{i} - 2.0t^2\mathbf{j} + 4.0\mathbf{k}$ m.

Where t is in seconds and the coefficients have proper units for \mathbf{r} to be in metres.

a) Find the \mathbf{v} and \mathbf{a} of the particle.

b) What is the magnitude and direction of velocity of the particle at $t = 2$ s.]

D. Answer the following questions:

[5x2=10]

1. a) State parallelogram law of vector addition and explain it.

b) What is its difference with triangle law of vector addition?

c) Two vectors of magnitudes 3 and 4 give a resultant of magnitude 2. What is the dot product of the two vectors?

2. a) State the principle of homogeneity of dimension.

b) Write four drawbacks of dimension analysis with proper examples.

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ASSIGNMENT-3

A. Answer the following questions

[1x5=5]

1. Pulling any heavy object is easier than pushing it. Explain.
2. What is null vector? Give examples.
3. Magnitude of force experienced by a certain object moving with speed v is given by $f = kv^2$, where k is a constant. Find the dimension of k .
4. There are some quantities whose dimensions are same but they are different in both definitions and applications. Give examples of four such pairs.
5. Is it possible that the position- time graph has a negative slope? Give example.

B. Answer the following questions

[2x5=10]

1. The percentage errors of measurement in a, b, c and d are 1%, 2%, 4% and 2% respectively then what is the percentage error in the quantity $P = \frac{a^2 b^3}{\sqrt{cd^3}}$.
2. Check the correctness of the equation: $v^2 = u^2 + a^2 S$.
3. Convert 1 joule into erg using dimension analysis.
4. For any two vectors **A** and **B** prove that,
 $(\mathbf{A} \times \mathbf{B})^2 = A^2 B^2 - (\mathbf{A} \cdot \mathbf{B})^2$.
5. A boy travels 10 m due north and then 7 m due east. Find the displacement of the boy.

C. Answer the following questions

[3x5=15]

1. The fundamental frequency of a stretched string(v) depends on, the length of the string(l), the tension on the string(T), and mass per unit length(μ). Find the relation between them using dimension analysis.
2. Two vectors are given as $\mathbf{A} = 3\mathbf{i} - \mathbf{j} + 2\mathbf{k}$ and $\mathbf{B} = \mathbf{i} - 2\mathbf{j} - 3\mathbf{k}$. Find the unit vector perpendicular to both \mathbf{A} and \mathbf{B} .
3. State the polygon law of vector addition. Derive it using triangle law.
4. Two balls are thrown simultaneously. A vertically upwards with a speed of 20 m/s from the ground, and B vertically downwards from a height of 40 m with the same speed and along the same line of motion. At what points do the balls will collide?
5. In a harbour, wind is blowing at the speed of 72 km/h and the flag on the mast of a boat anchored in the harbour flutters along the north east direction. If the boat starts moving at a speed of 5 km/h to the north, what is the direction of the flag on the mast of the boat?

D. Answer the following questions

[5x2=10]

1. Considering gravitational constant(G), Planck's constant(h) and speed of light(c) as the fundamental quantities, express the dimensions of mass, length and time in terms of G , h and c .
2. The velocity of a train increases at a constant rate α from 0 to v and then finally decreases to 0, at a constant rate β . If the total distance covered by the particle be x , then show that the total time taken will be,

$$t = \frac{x}{v} + \frac{v}{2} \left[\frac{1}{\alpha} + \frac{1}{\beta} \right]$$