15.07.2019   Special Test-Physics   Time: 2½ hrs

STD: XI (A,B)   Marks: 100

I. Choose the correct answer: 15x1=15

1. The dimensional formula of Planck's constant h is _____.
   a) $[ML^2T^{-1}]$ b) $[ML^2T^{-3}]$ c) $[MLT^{-1}]$ d) $[ML^3T^{-3}]$

2. If the force is proportional to square of velocity, then the dimension of proportionality constant is _____.
   a) $[MLT^0]$ b) $[MLT^{-1}]$ c) $[ML^{-2}T]$ d) $[ML^{-1}T^0]$

3. If the length and the time period of an oscillating pendulum has errors of 1% and 3% respectively then the error in measurement of acceleration due to gravity is _____.
   a) 4%   b) 5%   c) 6%   d) 7%

4. Which of the following has the highest number of significant figures?
   a) 0.007 m²   b) 2.64x10²⁵ Kg   c) 0.0006032 m²   d) 6.3200 J

5. If π=3.14, then the value of π^2 is _____.
   a) 9.8596   b) 9.860   c) 9.86   d) 9.9

6. The dimension of $(\mu_0\varepsilon_0)^{\frac{1}{2}}$ is _____.
   a) length   b) time   c) velocity   d) force

7. Which among the following has the dimensional formula?
   a) Radius of gyration and Radius
   b) Velocity and position vector
   c) Velocity and force   d) Distance and energy

8. The submultiple value for prefix femto is _____.
   a) 10^{-18} b) 10^{-17} c) 10^{-16} d) 10^{-15}

9. Identify the unit vector in the following:
   a) $\hat{i}+\hat{j}$ b) $\frac{\hat{i}}{\sqrt{2}}$ c) $\hat{k}-\frac{\hat{j}}{\sqrt{2}}$ d) $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$

10. Two objects of masses m_1 and m_2 fall from the height h_1 and h_2 respectively. The ratio of the magnitude of their momenta when they hit the ground is _____.
   a) $\sqrt{\frac{h_1}{h_2}}$ b) $\sqrt{\frac{m_1h_1}{m_2h_2}}$ c) $\frac{m_1}{m_2}\sqrt{\frac{h_1}{h_2}}$ d) $\frac{m_1}{m_2}$

11. If a particle executes uniform circular motion, choose the correct statement _____
   a) The velocity and speed are constant
   b) The acceleration and speed are constant
   c) The speed and magnitude of acceleration are constant

12. If the velocity is $\vec{v}=2\hat{i}+t^2\hat{j}-9\hat{k}$, then the magnitude of acceleration at t=0.5s is _____.
   a) $\frac{1m}{s^2}$ b) $\frac{2m}{s^2}$ c) zero   d) $-1ms^{-2}$

13. An object is dropped in an unknown planet from height 50m, it reaches the ground in 2s. The acceleration due to gravity in this planet is _____.
   a) $g=\frac{20m}{s^2}$ b) $g=\frac{25m}{s^2}$ c) $g=\frac{15m}{s^2}$ d) $g=\frac{30m}{s^2}$

14. The S.I unit for current density _____
   a) Am^{-3} b) Am^{-2} c) Am^{-1} d) Am^2T^2

15. $1^0=$_____ rad
   a) $1.746x10^{-2}$ rad   b) $1.744x10^{-2}$ rad   c) $1.745x10^{-6}$ rad
   d) $1.745x10^{-2}$ rad

II. Answer any 12 of the following: 12x2=24

16. What are the different types of physical quantities? Explain briefly.

17. Write a short note on unit.

18. What are dimensionless quantities?

19. Define Steradian.

20. How to minimize the systematic error?

21. A Radar signal is beamed towards a planet and its echo is received 7 minutes later. If the distance between the planet and the earth is $6.3x10^{10}$m. Calculate the speed of the signal?

22. Define scalar and vector with example.

23. Define angular displacement and angular velocity.

24. Difference between distance and displacement.

25. Two vectors are given as $\vec{r}=2\hat{i}+3\hat{j}+5\hat{k}$ and $\vec{F}=3\hat{i}-2\hat{j}+4\hat{k}$, find the resultant vector $\vec{\tau}=\vec{r}x\vec{F}$

26. A particle moves along the x-axis in such a way that its co-ordinates x varies with time t according to the equation x=2-5t+6t². What is the initial velocity of the particle?

27. Check whether the following vectors are orthogonal.
   i) $\vec{A}=2\hat{i}+3\hat{j}$ $\vec{B}=4\hat{i}-5\hat{j}$
   ii) $\vec{C}=5\hat{i}+2\hat{j}$ $\vec{D}=2\hat{i}-5\hat{j}$

28. A train was moving at the rate of 54kmh⁻¹ when brakes were applied. It came to rest within a distance of 225m. Calculate the retardation produced in the train.

29. Define projectile and trajectory.

III. Answer any 12 of the following: 12x3=36

30. What are the limitations in dimensional analysis?

31. A particle moves in a circle of radius 10m. Its linear speed is given by v=3t where t is in second and v is in ms⁻¹.

   a) Find the centripetal and tangential acceleration at t=2s

   b) Calculate the angle between the resultant acceleration and the radius vector.

32. An iron ball and a feather are both falling from a height of 10m.

   a) What are the time taken by the iron ball and feather to reach the ground?

   b) What are the velocities of iron ball and feather when they reach the ground? $g=\frac{10m}{S^2}$

33. The velocity of three particles A,B,C are given below. Which particle travels at the greatest speed?

   $\vec{V_A} = 3\hat{i}-5\hat{j}+2\hat{k}$ $\vec{V_B} = \hat{i}+2\hat{j}+3\hat{k}$ $\vec{V_C} = 5\hat{i}+3\hat{j}+4\hat{k}$

34. Derive tangential acceleration.

35. Given two vectors $\vec{A}=2\hat{i}+4\hat{j}+5\hat{k}$ and $\vec{B}=\hat{i}+3\hat{j}+6\hat{k}$ find the product $\vec{A}.\vec{B}$ and the magnitudes of $\vec{A}\ and\ \vec{B}$. What is the angle between them?

36. Two vectors $\vec{A}$ and $\vec{B}$ of magnitude 5units and 7units respectively makes an angle 60⁰ with each other. Find the magnitude of the resultant vectors and the direction with respect to the vector $\vec{A}$.
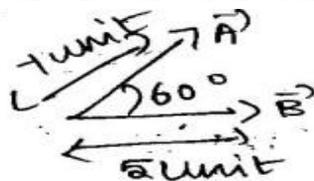
37. Check the correctness of the equation $\frac{1}{2}mv^2$=mgh using dimensional analysis method.

38. A physical quantity x is given by $x=\frac{a^2b^3}{c\sqrt{d}}$. If the percentage errors of measurement in a,b,c and d are 4%, 2%, 3% and 1% respectively, then calculate the percentage error in the calculation of x.

39. Explain propagation of error in sum of the two quantities.

40. State scalar produt and vector product.

41. Write the different types of measurement system.

42. Derive centripetal acceleration.

43. A swimmer's speed in the direction of flow of a river is 12km h⁻¹. Against the direction of flow of the river the swimmer's speed 6kmh⁻¹. Calculate the swimmer's speed still water and the velocity of the river flow.

IV. Answer any 5 of the following: 5x5=25

44. Explain in detail the various types of errors.

45. Explain in detail the triangle law of addition.

46. Explain the equations of uniformly accelerated motion by calculus method.

47. Explain the propagation of errors in multiplication and division.

48. Explain the properties of scalar product.

49. Obtain an expression for the Time period T of a simple pendulum. The time period T depends upon (i) mass 'm' of the bob (ii) length 'l' of the pendulum and (iii) acceleration due to gravity 'g' at the place where the pendulum is suspended constant (K=2π).

50. Explain the properties of vector product.