CBSE

UNITS AND MEASUREMENTS WS 3

Class 11 - Physics

Section A

1. Dimensions of electrical resistance are **[1]**

   a) $[ML^2T^{-3}A^{-1}]$ b) $[ML^2T^{-3}A^{-2}]$

   c) $[ML^{-1}T^3A^2]$ d) $[ML^3T^3A^{-2}]$

2. The ratio of the dimensions of Planck constant and that of the moment of inertia is the dimensions of **[1]**

   a) time b) velocity

   c) frequency d) angular momentum

3. Which of the following is a dimensionless quantity? **[1]**

   a) Specific heat b) Strain

   c) Stress d) Quantity of heat

4. Dimensions of Hubble's constant are: **[1]**

   a) $[T^{-1}]$ b) $[M^0L^0T^{-2}]$

   c) $[MLT^4]$ d) $[MLT^1]$

5. If C and R denote capacitance and resistance, the dimensional formula of CR is **[1]**

   a) not expressible in terms of MLT b) $[M^0L^0T^{-1}]$

   c) $[M^0L^0T^1]$ d) $[M^0L^0T^0]$

6. The dimensions of Kinetic energy is same as that of **[1]**

   a) Pressure b) Work

   c) Momentum d) Force

7. Which of the following have same dimensions? **[1]**

   a) torque and force b) potential energy and force

   c) Planck's constant and momentum d) torque and potential energy

8. $[ML^2T^{-2}]$ are dimensions of: **[1]**

   a) moment of force b) force

   c) momentum d) power

9. Dimensional formula of self inductance is **[1]**

   a) $[ML^2T^{-2}A^{-1}]$ b) $[ML^2T^{-2}A^{-2}]$

   c) $|ML^2T^{-1}A^{-2}]$ d) $[MLT^{-2}A^{-2}]$

10. What is the dimension of surface tension? **[1]**

a) $[ML^1T^0]$ b) $[ML^0T^{-2}]$

c) $[M^1L^1T^{-2}]$ d) $[ML^1T^{-1}]$

11. The dimension of angular velocity is **[1]**

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

c) $[M^0L^0T^{-1}]$ d) $[ML^2T^{-2}]$

12. The dimensions of torque are: **[1]**

a) $[MLT^{-1}]$ b) $[ML^2T^2]$

c) $[ML^2T^{-2}]$ d) $[M^2L^2T^{-2}]$

13. The dimensions of strain are: **[1]**

a) $ML^{-1}T^{-2}$ b) it is dimensionless

c) L^2 d) L

14. Which of the following pair does not have similar dimensions? **[1]**

a) angle and strain b) stress and pressure

c) tension and surface tension d) Planck's constant and angular momentum

15. The dimension of RC is **[1]**

a) square of time b) time

c) inverse time d) square of inverse time

16. Which pairs do not have equal dimensions? **[1]**

a) Force and impulse b) Elastic modulus and pressure

c) Energy and torque d) Angular momentum and Planck's constant

17. Planck's constant (h), speed of light in vacuum (c) and Newton's gravitational constant (G) are three fundamental constants. Which of the following combinations of these has the dimension of length? **[1]**

a) $\sqrt{\frac{hc}{G}}$ b) $\frac{\sqrt{hG}}{c^{5/2}}$

c) $\frac{\sqrt{hG}}{c^{3/2}}$ d) $\sqrt{\frac{Gc}{h^{3/2}}}$

18. Which one of the following pairs of quantities has the same dimension? **[1]**

a) surface tension and stress b) momentum and impulse

c) pressure and force d) force and work done

19. **Assertion (A):** The quantity ($\frac{1}{\sqrt{\mu_0\varepsilon_0}}$ is dimensionally equal to velocity and numerically equal to velocity of light. **[1]**
Reason (R): μ_0 is permeability of free space and ε_0 is the permittivity of free space.

a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

20. **Assertion (A):** In mechanics, we treat length, mass and time as the three basic or fundamental quantities. **[1]**

Reason (R): Length, mass and time cannot be obtained from one another.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

21. **Assertion (A):** Dimensional constants are the quantities whose value are constant. **[1]**
Reason (R): Dimensional constants are dimensionless.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

22. **Assertion (A):** In the expression $F = 6\pi r v\eta$, the dimensions of η are $ML^{-1}T^{-1}$. **[1]**
Reason (R): The coefficient of viscosity and linear momentum have same dimensions.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

23. **Assertion (A):** Force cannot be added with power. **[1]**
Reason (R): The dimensions of force and pressure are different.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

24. **Assertion (A):** Energy cannot be divided by volume. **[1]**
Reason (R): Dimensions of energy and volume are different.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

25. **Assertion (A):** If the units of force and length are doubled, the unit of energy will be 4 times. **[1]**
Reason (R): The unit of energy is independent of the unit of force and length.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

26. **Assertion (A):** Strain is a non-dimensional quantity. **[1]**
Reason (R): Strain is a constant quantity.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

27. **Assertion (A):** Avogadro number is the number of atoms in one gram mole. **[1]**
Reason (R): Avogadro number is a dimensionless constant.

a) Both A and R are true and R is the correct
b) Both A and R are true but R is not the

explanation of A.

correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

28. **Assertion (A):** $\frac{L}{R}$ and CR both have same dimensions. **[1]**
Reason (R): $\frac{L}{R}$ and CR both have dimension of time.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

29. **Assertion:** The dimensional formula for product of resistance and conductance is same as for dielectric constant. **[1]**
Reason: Both have dimensions of time constant.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

30. **Assertion (A):** The kinetic energy, with any reference, must be positive. **[1]**
Reason (R): In the expression for kinetic energy, the velocity appears with power 2.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

31. What are the dimensions of rate of flow? **[1]**
32. Which of the following has the same dimensions as **Planck's constant**: Torque, gravitational constant and angular momentum? **[1]**
33. Write the dimensions and SI unit of linear momentum. **[1]**
34. Give an example of a physical quantity which has a unit but no dimensions. **[1]**
35. Define dimensions of a physical quantity. **[1]**
36. Write three physical quantities having dimensions $[ML^2T^{-2}]$. **[1]**
37. Can a quantity have units but still be dimensionless? **[1]**
38. Give an example of a constant which has a unit. **[1]**
39. Can a quantity have dimensions but still has no units? **[1]**
40. Find the dimensions of latent heat and specific heat? **[1]**
41. Name the constant whose dimensions are same as that of angular momentum? **[1]**
42. The density of wood is 0.5 g cm^{-3}. Write this value in SI units. **[1]**
43. If the unit of force is 100 N, unit of length is 10 m and unit of time is 100 s. What is the unit of mass in this system of units? **[1]**

    Main concept used: After writing dimensions of given physical quantities, then co-relate them.
44. Do all physical quantities have dimensions? If no, name three physical quantities that are dimensionless. **[1]**
45. Give two examples of non-dimensional variables. **[1]**
46. Write the names of three-dimensional constants. **[1]**
47. Give an example of a constant which has no unit. **[1]**
48. If the units of force and length each are doubled, then how many times would the unit of energy be affected? **[1]**
49. Name two physical quantities having the dimensions $[ML^2T^{-2}]$. **[1]**
50. Obtain the dimensional formula for coefficient of viscosity. **[1]**

51. Is Avogadro's number a dimensionless quantity? **[1]**

52. Find out the dimensions of universal gravitational constant used in Newton's law of gravitation. **[1]**

Section B

53. Define fundamental and derived quantities, List fundamental quantities and fundamental units in the SI system? **[2]**

54. Calculate the dimensions of force and impulse taking velocity, density and frequency as basic quantities. **[2]**

55. What is meant by the term measurement of a physical quantity? How is the result of measurement of a physical quantity expressed? **[2]**

56. Distinguish between the dimensions and unit of a physical quantity. **[2]**

57. Find the dimensions of linear momentum and surface tension in terms of velocity v, density ρ and frequency ν as fundamental quantities. **[2]**

58. What are the dimensional formulae of the following: **[2]**

    i. pressure

    ii. power

    iii. density

    iv. angle?

59. Derive the dimensions formula of physical quantities. **[2]**

    i. Tension

    ii. Velocity gradient

    iii. Linear mass density

    iv. Impulse

60. In what way is the knowledge of the dimensions of a physical quantity useful? **[2]**

Section C

61. The velocity of a freely falling body is a function of the distance fallen through (h) and acceleration due to gravity g. Show by the method of dimensions that v = $K\sqrt{gh}$ **[3]**

62. Explain this statement clearly: **[3]**

    To call a dimensional quantity **large** or **small** is meaningless without specifying a standard for comparison. In view of this, reframe the following statements wherever necessary:

    i. atoms are very small objects.

    ii. a jet plane moves with great speed.

    iii. the mass of Jupiter is very large.

    iv. the air inside this room contains a large number of molecules.

    v. a proton is much more massive than an electron.

    vi. the speed of sound is much smaller than the speed of light.

63. A great physicist of this century (P.A.M. Dirac) loved playing with numerical values of Fundamental constants of nature. This led him to an interesting observation. Dirac found that from the basic constants of atomic physics (c, e, mass of electron, mass of proton) and the gravitational constant G, he could arrive at a number with the dimension of time. Further, it was a very large number, its magnitude being close to the present estimate on the age of the universe (15 billion years). From the table of fundamental constants in the book, try to see if you too can construct this number (or any other interesting number you can think of). If its coincidence with the age of the universe were significant, what would this imply for the constancy of fundamental constants? **[3]**

64. The frequency v of an oscillating drop may depend upon radius r of the drop, density ρ of the liquid and surface tension S of the liquid. Establish an expression for v dimensionally. **[3]**

Section D

65. Write down the classification of physical quantities on the basis of dimension. **[5]**

Section E

66. **State True or False:** **[10]**

(a) Energy and torque have same dimensional formula. **[1]**

(b) To call a dimensional quantity large or small is meaningless without specifying a standard for comparison. **[1]**

(c) Avogadro's number is a dimensionless quantity. **[1]**

(d) Rate of flow has the dimensions of velocity. **[1]**

(e) Pressure and Young's modulus of elasticity have different dimensions. **[1]**

(f) All the dimensionless quantities are unitless. **[1]**

(g) Moment and momentum have the same dimensions. **[1]**

(h) A physical quantity can have dimensions but still be dimensionless. **[1]**

(i) All constants are dimensionless. **[1]**

(j) Pressure and energy per unit volume are dimensionally equivalent physical quantities. **[1]**