Units and Measurements

Important Questions

Multiple Choice questions-

1. Electron volt is a unit of

(a) charge

(b) potential difference

(c) energy

(d) magnetic force

2. Light year is a unit of

(a) time

(b) distance

(c) sunlight intensity

(d) mass

3. Which of the following pairs has the same dimensions?

(a) specific heat and latent heat

(b) impulse and momentum

(c) surface tension and force

(d) moment of inertia and torque

4. Which of the following sets of quantities has the same dimensional formula?

(a) Frequency, angular frequency and angular momentum

(b) Surface tension, stress and spring constant

(c) Acceleration, momentum and retardation

(d) Work, energy and torque

5. If C and R denote capacitance and resistance respectively, what will be the dimensions of C x R?

(a) $[M^0L^0TA^0]$

(b) $[ML^0TA^{-2}]$

(c) $[ML^0TA^2]$

(d) $[MLTA^{-2}]$

6. A particle starting from the origin (0, 0) moves in a straight line in the (x, y) plane. Its coordinates at a later time are (The path of the particle makes with the x-axis an angle of

(a) 300

(b) 450

(c) 600

(d) 0

7. Resolution is

(a) a measure of the bias in the instrument

(b) None of these

(c) the smallest amount of input signal change that the instrument can detect reliably

(d) a measure of the systematic errors

8. Fundamental or base quantities are arbitrary. In SI system these are

(a) length, force, time, electric current, thermodynamic temperature, amount of substance, and luminous intensity

(b) length, mass, time, electric current, thermodynamic temperature, amount of substance, and luminous intensity

(c) as length, mass, time, electric charge, thermodynamic temperature, amount of substance, and luminous intensity

(d) length, mass, force, electric current, thermodynamic temperature, amount of substance, and luminous intensity

9. Unit for a fundamental physical quantity is

(a) defined as best of various reference standards

(b) the smallest measurable value of the physical quantity

(c) defined as average various reference standards

(d) reference standard for the physical quantity

10. The volume of a cube in m^3 is equal to the surface area of the cube in m^2. The volume of the cube is

(a) 64 m^3

(b) 216 m^3

(c) 512 m^3

(d) 196 m^3

Very Short:

1. If the size of the atom were enlarged to the tip of the sharp pin, how large would the height of Mount Everest be?

2. What does the LASER mean?
3. If the Universe were shrunk to the size of the Earth, how large would the Earth be on this scale?
4. A research worker takes 100 careful readings in an experiment. If he repeats the same experiment by taking 400 readings, then by what factor will the probable error be reduced?
5. What is the number of significant figures in 0.06070?
6. The density of a cube is calculated by measuring the length of one side and its mass. If the maximum errors in the measurement of mass and length are 3% and 2% respectively, then what is the maximum possible error in the measurement of density?
7. The mass of a body as measured by two students is given as 1.2 kg and 1.23 kg. Which of the two is more accurate and why?
8. Do the inertial and gravitational masses of ordinary objects differ in magnitude?
9. Are S.I. units Coherent? Why?
10. Do A.U. And Å represents the same magnitudes of distance?

Short Questions:

1. If the size of a nucleus is scaled up to the tip of a sharp pin, what roughly is the size of an atom?
2. (a) What do you mean by physical quantity?

   (b) What do you understand by:

   (i) Fundamental physical quantities?

   (ii) Derived physical quantities?
3. (a) Define the unit of a physical quantity.

   (b) Define

   (i) Fundamental units.

   (ii) Derived units.
4. Define one Candela.
5. What is the advantage of choosing wavelength of light radiation as standard of length?
6. Which type of phenomenon can be used as a measure of time? Give two examples of it.

7. Find the number of times the heart of a human being beats in 10 years. Assume that the heartbeats once in 0.8s.
8. Why it is not possible to establish a physical relation involving more than three variables using the method of dimensions?

Long Questions:

1. State the rules for writing the units of physical quantities in the S.I. system.
2. Explain the Triangular method.
3. What are the uses of dimensional analysis? Explain each of them.

Assertion Reason Questions:

1. **Directions:** Each of these questions contain two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

   (a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.
   (b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion
   (c) Assertion is correct, reason is incorrect
   (d) Assertion is incorrect, reason is correct

   Assertion: Dimensional constants are the quantities whose values are constant.
   Reason: Dimensional constants are dimensionless.

2. **Directions:** Each of these questions contain two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

   (a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.
   (b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion
   (c) Assertion is correct, reason is incorrect
   (d) Assertion is incorrect, reason is correct

   Assertion: Parallax method cannot be used for measuring distances of stars more than 100 light years away.

   Reason: Because parallax angle reduces so much that it cannot be measured accurately.

Case Study Questions:

1. Measurement of Physical Quantity All engineering phenomena deal with definite and measured quantities and so depend on the making of the measurement. We must be clear and precise in making these measurements. To make a measurement, magnitude of the physical quantity (unknown) is compared. The record of a measurement consists of three parts, i.e., the dimension of the quantity, the unit which represents a standard quantity and a number which is the ratio of the measured quantity to the standard quantity.

    1. A device which is used for measurement of length to an accuracy of about 10^{-5m}, is

        (a) Screw gauge

        (b) Spherometer

        (c) Vernier callipers

        (d) Either (a) or (b)

    2. Which of the technique is not used for measuring time intervals?

        (a) Electrical oscillator

        (b) Atomic clock

        (c) Spring oscillator

        (d) Decay of elementary particles

    3. The mean length of an object is 5cm. Which of the following measurements is most accurate?

        (a) 4.9cm

        (b) 4.805cm

        (c) 5.25cm

        (d) 5.4cm

    4. If the length of rectangle l = 105.cm, breadth b = 21.cm and minimum possible measurement by scale = 01.cm, then the area is

        (a) $22.0cm^2$

        (b) $21.0cm^2$

        (c) $22.5cm^2$

        (d) $21.5cm^2$

    5. Age of the universe is about 1010 yr., whereas the mankind has existed for 106 yr. For how many seconds would the man have existed if age of universe were 1 day?

        (a) 9.2 s

(b) 10.2 s

(c) 8.6 s

(d) 10.5 s

2. Normally, the reported result of measurement is a number that includes all digits in the number that are known reliably plus first digit that is uncertain. The digits that are known reliably plus the first uncertain digit are known as significant digits or significant

figures.

e.g., When a measured distance is reported to be 374.5m, it has four significant figures 3, 7,

4 and 5. The figures 3, 7, 4 are certain and reliable, while the digit 5 is uncertain. Clearly,

the digits beyond the significant digits reported in any result are superfluous.

i. In 4700m, significant digits are

(a) 2

(b) 3

(c) 4

(d) 5

ii. To determine the number of significant figures, scientific notation is

(a) a^b

(b) $ab \times 10^b$

(c) $a \times 10^2$

(d) $a \times 10^4$

iii. 5.74 g of a substance occupies $1.2cm^3$ Express its density by keeping the significant figures in view.

(a) 4.9 g cm^{-3}

(b) 5.2 g cm^{-3}

(c) 4.8 g cm^{-3}

(d) 4.4 g cm^{-3}

iv. Choose the correct option.

(a) Change in unit does not change the significant figure.

(b) 4 700. m=4700 mm, here there is a change of significant number from 4 to 2 due to change in unit.

(c) 4700 4 700 103 m = . m, here there is change in numbers of significant numbers.

(d) Change in unit changes the number of significant figure.

v. Consider the following rules of significant figures.

I. All the non-zero digits are significant.

II. All the zeroes between two non-zero digits are significant.

III. The terminal or trailing zero(s) in a number without a decimal point are significant.

Which of the above statement(s) is/are? correct?

(a) I and II

(b) II and III

(c) I and III

(d) All of these