Units and Measurement

Assertion Reason Questions

Two statements are given one labelled Assertion
(A) and the other labelled Reason (R). Select the correct answer to these question from the codes
(a), (b), (c) and (d) as given below.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is also false.

1. Assertion (A): Force and pressure cannot be added.
Reason (R): The dimensions of force and pressure are different.

Ans. (a) Both A and R are true and R is the correct explanation of A.
Explanation: Two quantities with different dimensions cannot be added due to dimensional consistency. Since force and pressure (Force per unit area) have distinct dimensions, they cannot be combined.

2. Assertion (A): Dimensional constants are the quantities whose values are constant.
Reason (R): Dimensional constants are dimensionless.

Ans. (c) A is true but R is false.
Explanation: Dimensional constants are the quantities whose value are constant and they posses dimension for example velocity of light in vacuum, universal gravitational constant, boltsman, plank constant, etc.

3. Assertion (A): When we change the unit of measurement of a quantity, its numerical value changes.
Reason (R): Smaller the unit of measurement smaller is its numerical value.

Ans. (c) A is true but R is false.
Explanation: Assertion is correct that changing the unit of measurement changes the numerical value of the quantity.

For example: Let the mass of the body to be 1 kg. Its mass in cgs unit,

$$m = 1\ \text{kg} \times \frac{1000\,\text{g}}{\text{kg}}$$

$$= 1000\ \text{g}$$

Hence, the numerical value of the mass gets changed.
Also, we see that smaller the unit of measurement, greater is its numerical value.

4. Assertion (A): Number of significant figure in 0.005 is one and in 0.500 is three.
Reason (R): This is because zeros are not significant.

Ans. (c) A is true but R is false.
Explanation: A zero between the decimal point and the first non-zero digit in a value smaller than one is not relevant. However, the zeros to the right of the final non-zero digit are essential.

5. Assertion (A): Surface energy of a liquid is numerically equal to its surface tension.
Reason (R): The dimensional formula of surface energy and surface tension is $[ML^0T^{-2}]$.

Ans. (b) Both A and R are true and R is not the correct explanation of A.
Explanation: The potential energy per unit area of the surface film is called the surface energy.
Surface tension = Surface energy

$$\text{Surface tension} = \frac{\text{Force}}{\text{Length}} = \frac{[MLT^{-2}]}{[L]}$$

$$= [ML^0T^{-2}]$$

$$\text{Surface energy} = \frac{\text{Energy}}{\text{Area}} = \frac{[ML^2T^{-2}]}{[L^2]}$$

$$= [ML^0T^{-2}]$$

Thus, both Assertion and Reason are true, but reason is not a correct explanation for the assertion.

6. Assertion (A): The measure of physical quantity is independent of the system of units.
Reason (R): The smaller is unit, the bigger is the measure of the physical quantity and vice-versa.

Ans. (a) Both A and R are true and R is the correct explanation of A.
Explanation: The measure of the physical quantity is given by X = nu, where n is the size of the unit and n is the numerical value of the physical quantity X for the selected unit. It follows that if the size of the chosen unit is small, then the numerical value of the quantity will be large and vice-versa. Thus, both assertion-reasons are correct.

7. Assertion (A): The number of significant figures in 0.100 is 1.
Reason (R): The zeros at the end of a number are meaningless.

Ans. (d) A is false and R is also false. always
Explanation: All zeros to the right of the last non-zero digit after the decimal point are significant. Therefore, the number of significant figures is 0.100 is 3.