



Read the passage given below and answer the following questions:

Every system is associated with a definite amount of energy, called the internal energy (U or E) of the system. It is the sum of chemical, electrical, mechanical or any other form of energy that anyone may think of. However, gravitational energy is generally neglected. It is a state function, i. e. independent on the path followed. It may change when

- (i) Heat flows into or out of the system,
- (ii) Work is done on or by the system.
- (iii) Matter enters or leaves the system.

It is an extensive property, i. e. depends upon the mass of the substance. It depends only on temperature. The absolute value of internal energy possessed by a substance cannot be calculated because it is not possible to predict the exact values of different forms of energy. Thus, we can just calculate the change in internal energy, which is achieved by changing the state of a system.

First law of thermodynamics was proposed by Helmholtz and Robert Mayer who stated that the energy of an isolated system is constant, i. e. energy can neither be created nor be destroyed but can be converted from one form to another. That's why it is also called law of conservation of energy. When a system undergoes isothermal change $\Delta U = 0$, i.e., there is no increase or decrease in the internal energy of the system then the first law of thermodynamics reduces to $q + W = 0$ or $q = -W$.

In these questions (i-iv) a statement of Assertion followed by a statement of Reason is given. Choose the correct answer out of the following choices :)

- (A) Assertion and Reason both are correct statements and Reason is correct explanation for Assertion.
- (B) Assertion and Reason both are correct statements but Reason is not correct explanation for Assertion.
- (C) Assertion is correct statement but Reason is incorrect statement.
- (D) Assertion is incorrect statement but Reason is correct statement.

13. **Assertion** : First law of thermodynamics is identical to the law of conservation of energy.

Reason : It states that the total energy of the universe is constant. *d*

14. **Assertion** : Internal energy is an extensive property.

Reason : Internal energy depends upon the amount of the system. *C*

15. **Assertion** : There is no exchange in internal energy in a cyclic process. Reason Cyclic process is the one in which

Reason : The system returns to its state after a number of reactions. *d*

16. **Assertion** : For an isothermal reversible process $Q = W$, i.e., work done by the system equals the heat absorbed by the system." *d*

Reason : Enthalpy change (ΔH) is zero for isothermal process.

OR

Assertion At constant temperature and pressure whatever heat absorbed by the system is used in doing work.

Reason Internal energy change is zero.

SECTION - B (2 × 5 = 10 Marks)

17. 3.0 g of H_2 react with 29.0 g of O_2 to form H_2O .

(i) Which is limiting reagent

(ii) Calculate the maximum amount of H_2O that can be formed.

18. (i) How many electrons in an atom have the following quantum numbers?

(i) $n=4, m_s = -1/2$

(ii) $n=3, l=0$

(iii) What will be the conjugate acids for the following bronsted bases H_2SO_4 and HCO_3^-

19. (i) In terms of period and group, where would you locate the element with $Z=114$?

(ii) Why do elements in the same group possess similar physical and chemical properties?