📞: 99672 40893

Jars Education

Shop no. 2,3,4 hendre pada Badlapur west thane

Time : 1 Hour 15 Minute

STD 11 Science Chemistry
Chapter Based Test

Total Marks : 40

SECTION A

* Choose The Right Answer From The Given Options.[1 Marks Each] [4]

1. The heat released when the requisite amount of ions in the gaseous state combine to give 1 mol of crystal lattice is known as:

(A) Lattice energy
(B) Hydration energy
(C) Formation energy
(D) None of the above

2. For a spontaneous process:

(A) enthalpy change of the system must be negative
(B) entropy change of the system must be positive
(C) entropy change of the surrounding must be positive
(D) entropy change of the system plus surrounding must be positive

3. Free energy change for the process A(s) ⇌ B(l) will be:

(A) 0
(B) 1
(C) 2
(D) 3

4. Entropy is:

(A) A thermodynamic concept.
(B) A state function.
(C) Independent of path.
(D) All of the above.

* a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option. [3]

5. **Notes:** In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

Assertion (A) : Spontaneous process is an irreversible process and may be reversed by some external agency.

Reason (R) : Decrease in enthalpy is a contributory factor for spontaneity.

i. Both A and R are true and R is the correct explanation of A.
ii. Both A and R are true but R is not the correct explanation of A.
iii. A is true but R is false.
iv. A is false but R is true.

6. **Notes:** In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

Assertion (A) : A liquid crystallises into a solid and is accompanied by decrease in entropy.

Reason (R) : In crystals, molecules organise in an ordered manner.

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

2. Both A and R are true but R is not the correct explanation of A.
3. A is true but R is false.
4. A is false but R is true.

7. **Notes:** In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the Choices given below each question.

Assertion (A): Combustion of all organic compounds is an exothermic reaction.

Reason (R) : The enthalpies of all elements in their standard state are zero.

i. Both A and R are true and R is the correct explanation of A.
ii. Both A and R are true but R is not the correct explanation of A.
iii. A is true but R is false.
iv. A is false but R is true.

* Answer The Following Questions In One Sentence.[1 Marks Each] [4]

8. What are the ways by which the internal energy of a system can be changed?

9. The energy released in the neutralisation of H_2SO_4 and KOH is 57.1kJ mol^{-1}. Therefore, calculate the value of ΔH for the reaction:

$H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$

10. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following:

a. Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
b. Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
c. Assertion is true but Reason is false.
d. Both Assertion and Reason are false.

Assertion: Heat capacity is the amount of heat required to raise the temperature of a body by 1K.

Reason: Heat capacity is an extensive property and It depends upon the size of the body.

11. How is change in entropy during melting of solid related to its melting point?

SECTION B

* Given Section consists of questions of 2 marks each. [6]

1. Taking a specific example, show that ΔS_{total} is a criterion for the spontaneity of a change.

2. Will entropy increase or decrease in the following changes?

i. Sugar dissolved in water.
ii. Normal egg to hard boiled egg.

3. Calculate the electron gain enthalpy of fluorine from the data given below:

$\Delta_f H^\circ$ of KF = -560.8kJ mol^{-1}, Sublimation energy of K = 87.8kJ mol^{-1}, Dissociation energy of F, is 158.9kJ mol^{-1}, Lattice energy of KF is -807.5kJ mol^{-1} and Ionisation energy of K is 414.2kJ mol^{-1}.

SECTION C

* **Given Section consists of questions of 3 marks each.** **[9]**

1. Two moles of an ideal gas initially at 27°C and one atmospheric pressure are compressed isothermally and reversibly till the final pressure of the gas is 10atm. Calculate q, W and ΔU for the process.

2. i. State Hess's Law of constant heat summation. How does it follow from the first law of thermodynamics.

   ii. Determine $\Delta_r H^\circ$, at 298K for reaction:

   $$C(graphite) + 2H_2(g) \longrightarrow CH_4(g);\ \Delta_r H^\circ = ?$$

   You are given:

   a. $C(graphite) + O_2(g) \longrightarrow CO_2(g); \Delta_r H^\circ = -393.51 kJ/mol$

   b. $H_2(g) + \frac{1}{2}O_2(g) \longrightarrow H_2O(l); \Delta_r H^\circ = -285.8 kJ/mol$

   c. $CO_2(g) + 2H_2O(l) \longrightarrow CH_4(g) + 2O_2(g); \Delta_r H = +890.3 kJ/mol$

3. i. Classify the following processes as reversible or irreversible:

   a. Dissolution of sodium chloride.

   b. Evaporation of water at 373K and 1atm pressure.

   c. Mixing of two gases by diffusion.

   d. Melting of ice without rise in temperature.

   ii. When an ideal gas expands in vacuum, there is neither absorption nor evolution of heat. Why?

SECTION D

* **Case study based questions** **[4]**

1. Read the passage given below and answer the following questions from (i) to (v).

A system in thermodynamics refers to that part of universe in which observations are made and remaining universe constitutes the surroundings. The surroundings include everything other than the system. System and the surroundings together constitute the universe. The universe = The system + The surroundings However, the entire universe other than the system is not affected by the changes taking place in the system. Therefore, for all practical purposes, the surroundings are that portion of the remaining universe which can interact with the system. Usually, the region of space in the neighbourhood of the system constitutes its surroundings.

The wall that separates the system from the surroundings is called boundary.

Types of the System We, further classify the systems according to the movements of matter and energy in or out of the system.

1. Open System In an open system, there is exchange of energy and matter between system and surroundings. The presence of reactants in an open beaker is an example of an open system. Here the boundary is an imaginary surface enclosing the beaker and reactants.
2. Closed System In a closed system, there is no exchange of matter, but exchange of energy is possible between system and the surroundings. The presence of reactants in a closed vessel made of conducting material e.g., copper or steel is an example of a closed system.
3. Isolated System In an isolated system, there is no exchange of energy or matter between the system and the surroundings. The presence of reactants in a thermos flask or any other closed insulated vessel is an example of an isolated system.

The State of the System The system must be described in order to make any useful calculations by specifying quantitatively each of the properties such as its pressure (p), volume (V), and temperature (T) as well as the composition of the system. We need to describe the system by specifying it before and after the change. You would recall from your Physics course that the state of a system in mechanics is completely specified at a given instant of time, by the position and velocity of each mass point of the system. In thermodynamics, a different and much simpler concept of the state of a system is introduced. It does not need detailed knowledge of motion of each particle because, we deal with average measurable properties of the system. We specify the state of the system by state functions or state variables. The state of a thermodynamic system is described by its measurable or macroscopic (bulk) properties. We can describe the state of a gas by quoting its pressure (p), volume (V), temperature (T), amount (n) etc. Variables like p, V, T are called state variables or state functions because their values depend only on the state of the system and not on how it is reached. In order to completely define the state of a system it is not necessary to define all the properties of the system; as only a certain number of properties can be varied independently. This number depends on the nature of the system. Once these minimum number of macroscopic properties are fixed, others automatically have definite values. The state of the surroundings can never be completely specified; fortunately it is not necessary to do so.

By conventions of IUPAC in chemical thermodynamics. The q is positive, when heat is transferred from the surroundings to the system and the internal energy of the system increases and q is negative when heat is transferred from system to the surroundings resulting in decrease of the internal energy of the system.

Let us consider the general case in which a change of state is brought about both by doing work and by transfer of heat. We write change in internal energy for this case as:

$$\triangle \mathrm{U} = \mathrm{q} + \mathrm{w}$$

For a given change in state, q and w can vary depending on how the change is carried out. However, $\mathrm{q} + \mathrm{w} = \triangle \mathrm{U}$ will depend only on initial and final state. It will be independent of the way the change is carried out. If there is no transfer of energy as heat or as work (isolated system) i.e., if w = 0 and q = 0, then $\triangle \mathrm{U} = 0$. The equation i.e., $\triangle \mathrm{U} = \mathrm{q} + \mathrm{w}$ is mathematical statement of the first law of thermodynamics, which states that The energy of an isolated system is constant. It is commonly stated as the law of conservation of energy i.e., energy can neither be created nor be destroyed.

i. $\triangle \mathrm{U} = \ ....$
   a. q + w
   b. q + v
   c. q + m
   d. q + z

ii. Which of the following is not an example of state variable?
   a. Pressure
   b. Ionic radius
   c. Volume
   d. Amount

iii. $\triangle \mathrm{U} = \mathrm{q} + \mathrm{w}$ is termed as ...
   a. Third law of thermodynamics
   b. Second law of thermodynamics
   c. First law of thermodynamics
   d. None of above

iv. A ... in thermodynamics refers to that part of universe in which observations are made.

a. Universe
b. System
c. Surrounding
d. Boundary

v. Which of the following is a type if system ?
a. Open system
b. Closed system
c. Lsolated system
d. All the above

SECTION E

*** Given Section consists of questions of 5 marks each. [10]**

1. Sodium carbonate, Na_2CO_3 can be obtained by heating sodium hydrogen carbonate, $NaHCO_3$ as $2NaHCO_3(s) \rightarrow Na_2CO_3(s) + H_2O(g) + CO_2(g)$.

The essential data are,

	$NaHCO_3$(s)	**Na_2CO_3(s)**	**CO_2(g)**	**H_2O(g)**
$\Delta_f H^\circ$ $(\mathrm{kJ\ mol^{-1}})$	-947.7	-1130.9	-393.51	-241.82
S°_m $(\mathrm{J\ mol^{-1}})$	102.1	136	188.83	213.74

Calculate the temperature above which $NaHCO_3$ decomposes to give products at 1 bar.

2. Graphically show the total work done in an expansion when the state of an ideal gas is changed reversibly and isothermally from (p_i, V_i) to (p_f, V_f). With the help of a pV plot compare the work done in the above case with that carried out against a constant external pressure p_f.

----- -----