

THERMODYNAMICS

Q1 A system absorb 10 kJ of heat at constant volume and its temperature rises from 270°C to 370°C. The value of ΔU is -

- (a) 100 kJ (b) 10 kJ (c) 0 kJ (d) 1 kJ

Q.2 Based on the first law of thermodynamics, which one of the following is correct?

- (a) For an isothermal process, $q = +w$ (b) For an isochoric process, $\Delta U = -q$
(c) For an adiabatic process, $\Delta U = -w$ (d) For a cyclic process, $q = -w$

Q.3 The species which by definition has ZERO standard molar enthalpy of formation at 298 K is

- (a) Br₂(g) (b) Cl₂(g) (c) H₂O(g) (d) CH₄(g)

Q.4 A system absorbs 600 J of heat and works equivalent to 300 J on its surroundings. The change in internal energy is;

- (a) 300 J (b) 400 J (c) 500 J (d) 600 J

Q.5 If the internal energy of an ideal gas decreases by the same amount as the work done by the system, the process is :- (a) cyclic (B) isothermal (C) adiabatic (D) isolated

Q.6 Enthalpy of sublimation of a substance is equal to

- (i) enthalpy of fusion + enthalpy of vapourisation (ii) enthalpy of fusion
(iii) enthalpy of vapourisation (iv) twice the enthalpy of vapourisation

Q.7 Considering entropy(S) thermodynamic parameters the criteria for the spontaneity of any process is:

- (a) $\Delta S_{\text{system}} + \Delta S_{\text{surroundings}} > 0$ (b) $\Delta S_{\text{system}} - \Delta S_{\text{surroundings}} < 0$
(c) $\Delta S_{\text{system}} > 0$ (d) $\Delta S_{\text{surroundings}} > 0$

Q.8 The work done in case of isothermal free expansion is

- (a) maximum (b) minimum (c) zero (d) positive

Q.9 Which of the following are not state functions?

- (i) $q + w$ (ii) q (iii) w (iv) $H - TS$

- (1) (i) and (iv) (2) (ii) and (iii) (3) (i), (ii) and (iii) (4) (i), (ii), and (iv)

Q.10 Which of the equations represents enthalpy of formation of H₂O?

- (a) $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l}); \Delta H = -ve$
(b) $2\text{H}_2\text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g}); \Delta H = +ve$
(c) $\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \longrightarrow \text{H}_2\text{O}(\text{l}) \quad \Delta H = +ve$
(a) $2\text{H}_2\text{O}(\text{g}) \longrightarrow 2\text{H}_2(\text{g}) + \text{O}_2(\text{g}); \Delta H = +ve$

Q.11 Assertion: Many endothermic reactions which are non-spontaneous at room temperature become spontaneous on increasing the temperature

Reason: Endothermic reactions become spontaneous at high temperatures if ΔS is +ve and $T\Delta S > \Delta H$

Q.12 Assertion (A): Among the two O – H bonds in H₂O molecule, the energy required to break the first O – H bond and the other O – H bond is different.

Reason (R): This is because the electronic environment around the oxygen is the same even after breakage of one O – H bond.

Q.13 Assertion : The difference between ΔH and ΔU is not significant for systems consisting of only solids and/or liquids.

Reason : Solids and liquids do not suffer any significant volume changes upon heating.

Q.14 Write the sign of ΔH and ΔS for the change $\text{Cl}_2(\text{g}) \rightarrow 2\text{Cl}(\text{g})$.

Q.15 The enthalpy of reaction for the reaction : $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l})$ is $\Delta_r H = -572 \text{ kJ mol}^{-1}$. What will be standard enthalpy of formation of H₂O (l) ?

Q.16 The enthalpy of formation of methane at constant pressure and 300 K is – 78.84 kJ. What will be the enthalpy of formation at constant volume?

Q.17 What will be the enthalpy change for the given reaction?

$\text{H}_2(\text{g}) + \text{Br}_2(\text{g}) \rightarrow 2\text{HBr}(\text{g})$ Given that the Bond energy of the H₂, Br₂ and HBr is 435 kJ mol⁻¹, 192 kJ mol⁻¹, as well as 368 kJ mol⁻¹, respectively

Q.18 Calculate the enthalpy for the reaction:



Given that; $\Delta_f H \text{ CO(g)} = -110 \text{ kJ mol}^{-1}$, $\Delta_f H \text{ CO}_2\text{(g)} = -393 \text{ kJ mol}^{-1}$ $\Delta_f H \text{ N}_2\text{O(g)} = 81 \text{ kJ mol}^{-1}$
 $\Delta_f H \text{ N}_2\text{O}_4\text{(g)} = 9.7 \text{ kJ mol}^{-1}$