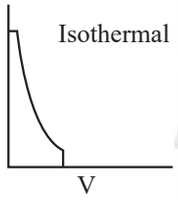
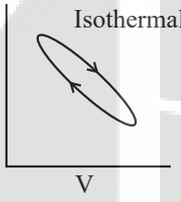
CHAPTER 5

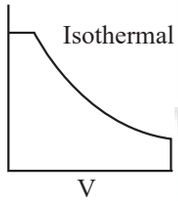
Thermodynamics

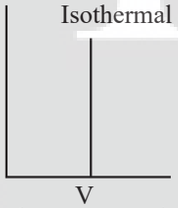
Measurement of ΔU & ΔH, Work Done and Heat Capacity

1. Which of the following p-V curve represents maximum work done? *(2022)*

a.


b.


c.


d.


2. Which one among the following is the correct option for right relationship between C_P and C_V for one mole of ideal gas? *(2021)*

a. $C_P - C_V = R$ b. $C_P = RC_V$
c. $C_V = RC_P$ d. $C_P + C_V = R$

3. The correct option for free expansion of an ideal gas under adiabatic condition is : *(2020)*

a. $q = 0, \Delta T < 0$ and $w > 0$ b. $q < 0, \Delta T = 0$ and $w = 0$
c. $q > 0, \Delta T > 0$ and $w > 0$ d. $q = 0, \Delta T = 0$ and $w = 0$

4. Under isothermal condition, a gas at 300 K expands from 0.1 L to 0.25 L against a constant external pressure of 2 bar. The work done by the gas is (Given that 1 L bar = 100 J) *(2019)*

a. –30 J b. 5 kJ
c. 25 J d. 30 J

5. A gas is allowed to expand in a well insulated container against a constant external pressure of 2.5 atm from an initial volume of 2.50 L to a final volume of 4.50 L. The change in internal energy ΔU of the gas in joules will be: *(2017-Delhi)*

a. +505 J b. 1136.25 J
c. –500 J d. –505 J

Enthalpies For Different Types of Reactions

6. At standard conditions, if the change in the enthalpy for the following reaction is –109 kJ mol^{-1}

$H_2(g) + Br_2(g) \rightarrow 2HBr(g)$

Given that bond energy of H_2 and Br_2 is 435 kJ mol^{-1} and 192 kJ mol^{-1}, respectively, what is the bond energy (in kJ mol^{-1}) of HBr? *(2020-Covid)*

a. 736 b. 518
c. 259 d. 368

7. The bond dissociation energies of X_2, Y_2 and XY are in the ratio of 1 : 0.5 : 1. ΔH for the formation of XY is –200 kJ mol^{-1} *(2018)*

The bond dissociation energy of X_2 will be

a. 200 kJ mol^{-1} b. 100 kJ mol^{-1}
c. 400 kJ mol^{-1} d. 800 kJ mol^{-1}

8. The heat of combustion of carbon to CO_2 is –393.5 kJ/mol. The heat released upon formation of 35.2 g of CO_2 from carbon and oxygen gas is: *(2015)*

a. + 315 kJ b. – 630 kJ
c. – 3.15 kJ d. – 315 kJ

Spontaneity, Entropy, Gibbs Energy Change and Equilibrium

9. For irreversible expansion of an ideal gas under isothermal condition, the correct option is: *(2021)*

a. $\Delta U \neq 0, \Delta S_{total} \neq 0$ b. $\Delta U = 0, \Delta S_{total} \neq 0$
c. $\Delta U \neq 0, \Delta S_{total} = 0$ d. $\Delta U = 0, \Delta S_{total} = 0$

10. For the reaction, $2Cl(g) \rightarrow Cl_2(g)$, the correct option is: *(2020)*

a. $\Delta_r H > 0$ and $\Delta_r S < 0$
b. $\Delta_r H < 0$ and $\Delta_r S < 0$
c. $\Delta_r H < 0$ and $\Delta_r S < 0$
d. $\Delta_r H > 0$ and $\Delta_r S > 0$

11. If for a certain reaction $\Delta_r H$ is 30 kJ mol^{-1} at 450 K, the value of $\Delta_r S$ (in JK^{-1} mol^{-1}) for which the same reaction will be spontaneous at the same temperature is *(2020-Covid)*

a. –33 b. 33

c. –70 d. 70

12. In which case change in entropy is negative? *(2019)*

a. Evaporation of water

b. Expansion of a gas at constant temperature

c. Sublimation of solid to gas

d. $2H(g) \rightarrow H_2(g)$

13. For a given reaction, $\Delta H = 35.5$ KJ mol^{-1} and $\Delta S = 83.6$ JK^{-1} mol^{-1}. The reaction is spontaneous at: (Assume that ΔH and ΔS do not vary with temperature) *(2017-Delhi)*

a. T > 298 K b. T < 425 K

c. T > 425 K d. All temperatures

14. For a sample of perfect gas when its pressure is changed isothermally from P_i to P_f, the entropy change is given by: *(2016 - II)*

a. $\Delta S = nRT \ln\left(\frac{P_f}{P_i}\right)$ b. $\Delta S = nRT \ln\left(\frac{P_i}{P_f}\right)$

c. $\Delta S = nR \ln\left(\frac{P_f}{P_i}\right)$ d. $\Delta S = nR \ln\left(\frac{P_i}{P_f}\right)$

15. The correct thermodynamic conditions for the spontaneous reaction at all temperatures is: *(2016 - I)*

a. $\Delta H < 0$ and $\Delta S < 0$

b. $\Delta H < 0$ and $\Delta S = 0$

c. $\Delta H > 0$ and $\Delta S < 0$

d. $\Delta H < 0$ and $\Delta S > 0$

16. For the reaction, $X_2O_4(l) \rightarrow 2XO_2(g)$, $\Delta U = 2.1$ kcal, $\Delta S = 20$ cal K^{-1} at 300 K. Hence, ΔG is: *(2014)*

a. –2.7 kcal b. 9.3 kcal

c. –9.3 kcal d. 2.7 kcal

Clausius Clapeyron Equation

17. Consider the following liquid-vapour equilibrium.

Liquid $\rightleftharpoons$ Vapour. Which of the following relations is correct? *(2016 - I)*

a. $\frac{d\ln P}{dT^2} = \frac{-\Delta H_v}{T^2}$ b. $\frac{d\ln P}{dT} = \frac{-\Delta H_v}{RT^2}$

c. $\frac{d\ln G}{dT^2} = \frac{\Delta H_v}{RT^2}$ d. $\frac{d\ln P}{dT} = \frac{-\Delta H_v}{RT}$

Answer Key

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
c	a	d	a	d	d	d	a	b	c	d	d	c	d	d	a	b