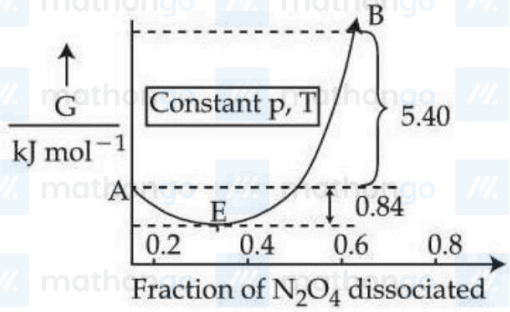
Q1. 21 January Shift 1

For the reaction, $N_2O_4 \rightleftharpoons 2NO_2$, graph is plotted as shown below. Identify correct statements. A. Standard free energy change for the reaction is -5.40 kJ mol^{-1}. B. As $\Delta G^{\ominus}$ in graph is positive, N_2O_4 will not dissociate into NO_2 at all. C. Reverse reaction will go to completion. D. When 1 mole of N_2O_4 changes into equilibrium mixture, value of $\Delta G^{\ominus} = -0.84$ kJ mol^{-1} E. When 2 mole of NO_2 changes into equilibrium mixture, $\Delta G^{\ominus}$ for equilibrium mixture is -6.24 kJ mol^{-1}.



Choose the correct answer from the options given below :

(1) D and E only (2) A and D only (3) B and C only (4) C and E only

Q2. 22 January Shift 1

Dissociation of a gas A_2 takes place according to the following chemical reaction. At equilibrium, the total pressure is 1 bar at 300 K.

$A_2(g) \rightleftharpoons 2\,A(g)$

The standard Gibbs energy of formation of the involved substances has been provided below:

Substance	ΔG_f°/kJ mol^{-1}
A_2	-100.00
A	-50.832

The degree of dissociation of $A_2(g)$ is given by $\left(x \times 10^{-2}\right)^{1/2}$ where $x =$ ____. (Nearest integer).

[Given: R $= 8$ J mol^{-1} K^{-1}, $\log 2 = 0.3010, \log 3 = 0.48$]

Assume degree of dissociation is not negligible.

Q3. 23 January Shift 1

Consider the general reaction given below at 400 K

$x\,A(g) \rightleftharpoons y\,B(g)$

The values of K_p and K_c are studied under the same condition of temperature but variation in x and y.

(i) $K_p = 85.87$ and $K_c = 2.586$ appropriate units

(ii) $K_p = 0.862$ and $K_c = 28.62$ appropriate units.

The values of x and y in (i) and (ii) respectively are:

(1) (i) 1, 3 (ii) 2, 1 (2) (i) 4, 1 (ii) 4, 1 (3) (i) 3, 1 (ii) 3, 1 (4) (i) 1, 2 (ii) 2, 1

Q4. 23 January Shift 1

For the following gas phase equilibrium reaction at constant temperature,

$\mathrm{NH_3(g) \rightleftharpoons 1/2\ N_2(g) + 3/2H_2(g)}$

if the total pressure is $\sqrt{3}$ atm and the pressure equilibrium constant $(\mathrm{K_p})$ is 9 atm, then the degree of dissociation is given as $\left(x \times 10^{-2}\right)^{-1/2}$. The value of x is ____. (nearest integer)

Q5. 23 January Shift 2

$\mathrm{X_2(g) + Y_2(g) \rightleftharpoons 2Z(g)}$

$\mathrm{X_2(g)}$ and $\mathrm{Y_2(g)}$ are added to a 1 L flask and it is found that the system attains the above equilibrium at $\mathrm{T(K)}$ with the number of moles of $\mathrm{X_2(g)}$, $\mathrm{Y_2(g)}$ and $\mathrm{Z(g)}$ being 3,3 and 9 mol respectively (equilibrium moles). Under this condition of equilibrium, 10 mol of $\mathrm{Z(g)}$ is added to the flask and the temperature is maintained at $\mathrm{T(K)}$. Then the number of moles of $\mathrm{Z(g)}$ in the flask when the new equilibrium is established is ____. (Nearest integer)

Q6. 24 January Shift 2

Consider the following gaseous equilibrium in a closed container of volume ' V ' at $\mathrm{T(K)}$.

$\mathrm{P_2(g) + Q_2(g) \rightleftharpoons 2PQ(g)}$

2 moles each of $\mathrm{P_2(g)}$, $\mathrm{Q_2(g)}$ and $\mathrm{PQ(g)}$ are present at equilibrium. Now one mole each of ' $\mathrm{P_2}$ ' and ' $\mathrm{Q_2}$ ' are added to the equilibrium keeping the temperature at $\mathrm{T(K)}$. The number of moles of P_2, Q_2 and PQ at the new equilibrium, respectively, are

(1) $1.66, 1.66, 1.66$
(2) $2.56, 1.62, 2.24$
(3) $2.67, 2.67, 2.67$
(4) $1.21, 2.24, 1.56$

Q7. 28 January Shift 2

Observe the following equilibrium in a 1 L flask.

$\mathrm{A(g) \rightleftharpoons B(g)}$

At $\mathrm{T(K)}$, the equilibrium concentrations of A and B are 0.5 M and 0.375 M respectively. 0.1 moles of A is added into the flask and heated to $\mathrm{T(K)}$ to establish the equilibrium again. The new equilibrium concentrations (in M) of A and B are respectively

(1) $0.53, 0.4$.
(2) $0.742, 0.557$.
(3) $0.557, 0.418$.
(4) $0.367, 0.275$.

ANSWER KEYS

1. (1)	**2.** 33	**3.** (2)	**4.** 125	**5.** 15	**6.** (3)	**7.** (3)