Only one is correct

1. $x \rightleftharpoons y$ reaction is said to be in equilibrium, when :-
   (A) Only 10% conversion of x to y takes place
   (B) Complete conversion of x to y has taken place
   (C) Conversion of x to y is only 50% complete
   (D) The rate of change of x to y is just equal to the rate of change of y to x in the system

2. The equilibrium concentration of B $[(B)_e]$ for the reversible reaction $A \rightleftharpoons B$ can be evaluated by the expression:-
   (A) $K_c[A]_e^{-1}$ (B) $\frac{k_f}{k_b}[A]_e^{-1}$ (C) $k_f k_b^{-1}[A]_e$ (D) $k_f k_b [A]^{-1}$

3. In a chemical equilibrium, the rate constant for the backward reaction is 2×10^{-4} and the equilibrium constant is 1.5. The rate constant for the forward reaction is:-
   (A) 2×10^{-3} (B) 5×10^{-4} (C) 3×10^{-4} (D) 9.0×10^{-4}

4. For which reaction is $K_p = K_c$:-
   (A) $2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g)$ (B) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$
   (C) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ (D) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

5. For the reaction
   $CuSO_4.5H_2O_{(s)} \rightleftharpoons CuSO_4.3H_2O_{(s)} + 2H_2O_{(g)}$
   Which one is correct representation :–
   (A) $K_p = (P_{(H_2O)})^2$ (B) $K_c = [H_2O]^2$ (C) $K_p = K_c(RT)^2$ (D) All

6. $\log \frac{K_p}{K_c} + \log RT = 0$ is true relationship for the following reaction:-
   (A) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ (B) $2SO_2 + O_2 \rightleftharpoons 2SO_3$
   (C) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (D) (B) and (C) both

7. For a reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$, the value of K_c does not depends upon :-
   (a) Initial concentration of the reactants (b) Pressure
   (c) Temperature (d) Catalyst
   (A) Only c (B) a, b, c (C) a, b, d (D) a, b, c, d

8. For any reversible reaction if concentration of reactants increases then effect on equilibrium constant:-
   (A) Depends on amount of concentration (B) Unchange
   (C) Decrease (D) Increase

9. If some He gas is introduced into the equilibrium $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$ at constant pressure and temperature then equilibrium constant of reaction:
   (A) Increase (B) Decrease (C) Unchange (D) Nothing can be said

10. The equilibrium constant for the reaction ;
$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ at temperature
T is 4×10^{-4}. The value of K_c for the reaction.

$NO(g) \rightleftharpoons \frac{1}{2}N_2(g) + \frac{1}{2}O_2(g)$ at the same temperature is :

(A) 0.02 (B) 50 (C) 4×10^{-4} (D) 2.5×10^{-2}

11. The equilibrium constant for the given reaction :

$$SO_3(g) \rightleftharpoons SO_2(g) + \frac{1}{2}O_2(g) \; ; K_c = 5 \times 10^{-2}$$

The value of K_c for the reaction :
$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$, will be
(A) 400 (B) 2.40×10^{-3} (C) 9.8×10^{-2} (D) 4.9×10^{-2}

12. For the following three reactions 1, 2 and 3, equilibrium constants are given :
(1) $CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$; K_1
(2) $CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$; K_2
(3) $CH_4(g) + 2H_2O(g) \rightleftharpoons CO_2(g) + 4H_2(g)$; K_3
Which of the following relations is correct ?

(A) $K_1\sqrt{K_2} = K_3$ (B) $K_2K_3 = K_1$ (C) $K_3 = K_1K_2$ (D) $K_3 \cdot K_2^3K_1^2$

13. Sulfide ion in alkaline solution reacts with solid sulfur to form polysulfide ions having formulas S_2^{2-}, S_3^{2-}, S_4^{2-} and so on. The equilibrium constant for the formation of S_2^{2-} is 12 (K_1) & for the formation of S_3^{2-} is 132 (K_2), both from S and S^{2-}. What is the equilibrium constant for the formation of S_3^{2-} from S_2^{2-} and S?

(A) 11 (B) 12 (C) 132 (D) None of these

14. What should be the value of K_c for the reaction $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$, if the amount are $SO_3 = 48$ g, $SO_2 = 12.8$ g and $O_2 = 9.6$ g at equilibrium and the volume of the container is one litre?

(A) 64 (B) 30 (C) 42 (D) 8.5

15. In the reaction, $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, the amount of each PCl_5, PCl_3 and Cl_2 is 2 mole at equilibrium and total pressure is 3 atmosphere. The value of K_p will be

(A) 1.0 atm. (B) 3.0 atm. (C) 2.9 atm. (D) 6.0 atm.

16. For the reaction : $P \rightleftharpoons Q + R$. Initially 2 moles of P was taken. Up to equilibrium 0.5 moles of P was dissociated. What would be the degree of dissociation :-

(A) 0.5 (B) 1 (C) 0.25 (D) 4.2

17. 4 moles of PCl_5 are heated at constant temperature in closed container. If degree of dissociation for PCl_5 is 0.5 calculate total number of moles at equilibrium :-

(A) 4.5 (B) 6 (C) 3 (D) 4

18. In the reaction $2P(g) + Q(g) \rightleftharpoons 3R(g) + S(g)$. If 2 moles each of P and Q taken initially in a 1 litre flask. At equilibrium which is true:-

(A) [P] < [Q] (B) [P] = [Q] (C) [Q] = [R] (D) None of these

19. For the reaction $A + 2B \rightleftharpoons 2C + D$, initial concentration of A is a and that of B is 1.5 times that of A. Concentration of A and D are same at equilibrium. What should be the concentration of B at equilibrium ?

(A) $\frac{a}{4}$ (B) $\frac{a}{2}$ (C) $\frac{3a}{4}$ (D) All of the above.

20. For the reaction $3A(g) + B(g) \rightleftharpoons 2C(g)$ at a given temperature, $K_c = 9.0$. What must be the volume of the flask, if a mixture of 2.0 mol each of A, B and C exist in equilibrium?

(A) 6L (B) 9L (C) 36 L (D) None of these

21. For the following gases equilibrium. $N_2O_4(g) \rightleftharpoons 2NO_2(g)$

K_p is found to be equal to K_c. This is attained when temperature is

(A) 0°C (B) 273 K (C) 1 K (D) 12.19 K

22. The degree of dissociation of SO_3 is α at equilibrium pressure p^0.

K_p for $2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$

(A) $\frac{p^0\alpha^3}{2(1-\alpha)^3}$ (B) $\frac{p^0\alpha^3}{(2+\alpha)(1-\alpha)^2}$ (C) $\frac{p^0\alpha^2}{2(1-\alpha)^2}$ (D) None of these

23. For the reaction : $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$, the degree of dissociated (α) of HI(g) is related to equilibrium constant K_P by the expression

(A) $\frac{1+2\sqrt{K_p}}{2}$ (B) $\sqrt{\frac{1+2K_p}{2}}$ (C) $\sqrt{\frac{2K_p}{1+2K_p}}$ (D) $\frac{2\sqrt{K_p}}{1+2\sqrt{K_p}}$

24. The equilibrium constant for the reaction

$A(g) + 2B(g) \rightleftharpoons C(g)$

is 0.25 dm^6mol^{-2}. In a volume of 5 dm^3, what amount of A must be mixed with 4 mol of B to yield 1 mol of C at equilibrium.

(A) 3 moles (B) 24 moles (C) 26 moles (D) None of these

25. The equilibrium constant K_C for the reaction,

$A(g) + 2B(g) \rightleftharpoons 3C(g)$ is 2×10^{-3}

What would be the equilibrium partial pressure of gas C if initial pressure of gas A & B are 1 & 2 atm respectively.

(A) 0.0625 atm (B) 0.1875 atm (C) 0.21 atm (D) None of these

26. A 20.0 litre vessel initially contains 0.50 mole each of H_2 and I_2 gases. These substances react and finally reach an equilibrium condition. Calculate the equilibrium concentration of HI if $K_{eq} = 49$ for the reaction $H_2 + I_2 \rightleftharpoons 2HI$.

(A) 0.78 M (B) 0.039 M (C) 0.033 M (D) 0.021 M

27. At 675 K, $H_2(g)$ and CO_2 (g) react to form CO(g) and H_2O (g), K_p for the reaction is 0.16. If a mixture of 0.25 mole of $H_2(g)$ and 0.25 mol of CO_2 is heated at 675 K, mole % of CO(g) in equilibrium mixture is :

(A) 7.14 (B) 14.28 (C) 28.57 (D) 33.33

28. The vapour density of N_2O_4 at a certain temperature is 30. What is the % dissociation of N_2O_4 at this temperature?

(A) 53.3% (B) 106.6% (C) 26.7% (D) None

29. The equilibrium constant K_P (in atm) for the reaction is 9 at 7 atm and 300 K.

$A_2(g) \rightleftharpoons B_2(g) + C_2(g)$

Calculate the average molar mass (in gm/mol) of an equilibrium mixture.

Given : Molar mass of A_2, B_2 and C_2 are 70, 49 & 21 gm/mol respectively.

(A) 50 (B) 45 (C) 40 (D) 37.5

30. Vapour density of the equilibrium mixture of the reaction

$2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$ is 6.0

Percent dissociation of ammonia gas is:

(A) 13.88 (B) 58.82 (C) 41.66 (D) None of these

31. The equilibrium $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ shifts forward if :-

(A) A catalyst is used.

(B) An adsorbent is used to remove SO_3 as soon as it is formed.

(C) Small amounts of reactants are removed.

(D) None of these

32. In manufacture of NO, the reaction $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}$, ΔH +ve is favourable if :-

(A) Pressure is increased (B) Pressure is decreased

(C) Temperature is increased (D) Temperature is decreased

33. For the reaction $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, the degree of dissociation varies inversely as the square root of pressure of the system. Supposing at constant temperature If the volume is increased 16 times the intial volume, the degree of dissociation for this reaction will becomes :-

(A) 4 times (B) $\frac{1}{4}$ times (C) 2 times (D) $\frac{1}{2}$ times

34. In which of the following reactions, increase in the pressure at constant temperature does not affect the moles at equliibrium :

(A) $2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$ (B) $C(g) + \frac{1}{2}O_2(g) \rightleftharpoons CO(g)$

(C) $H_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons H_2O(g)$ (D) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

35. Change in volume of the system does not alter the number of moles in which of the following equilibrium

(A) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ (B) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

(C) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ (D) $SO_2Cl_2(g) \rightleftharpoons SO_2(g) + Cl_2(g)$

36. The conditions favourable for the reaction :

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$; $\Delta H° = -198$ kJ

are :

(A) low temperature, high pressure
(B) any value of T and P
(C) low temperature and low pressure
(D) high temperature and high pressure

37. Densities of diamond and graphite are 3.5 and 2.3 gm/mL.

C (diamond) $\rightleftharpoons$ C (graphite) $\quad \Delta_r H = -1.9$ kJ/mole

favourable conditions for formation of diamond are

(A) high pressure and low temperature
(B) low pressure and high temperature
(C) high pressure and high temperature
(D) low pressure and low temperature

38. The equilibrium $SO_2Cl_2(g) \rightleftharpoons SO_2(g) + Cl_2(g)$ is attained at 25°C in a closed rigid container and an inert gas, helium is introduced. Which of the following statements is/are correct.

(A) concentrations of SO_2, Cl_2 and SO_2Cl_2 do not change
(B) more chlorine is formed
(C) concentration of SO_2 is reduced
(D) more SO_2Cl_2 is formed

39. The yield of product in the reaction

$$2A(g) + B(g) \rightleftharpoons 2C(g) + Q \text{ kJ}$$

would be lower at :

(A) low temperature and low pressure
(B) high temperature & high pressure
(C) low temperature and to high pressure
(D) high temperature & low pressure

40. What is the effect of the reduction of the volume of the system for the equilibrium

$2C(s) + O_2(g) \rightleftharpoons 2CO(g)$?

(A) The equilibrium will be shifted to the left by the increased pressure caused by the reduction in volume.
(B) The equilibrium will be shifted to the right by the decreased pressure caused by the reduction in volume.
(C) The equilibrium will be shifted to the left by the increased pressure caused by the increase in volume.
(D) The equilibrium will be shifted to the right by the increased pressure caused by the reduction in volume.