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الملف Worksheet about Chemical equilibrium

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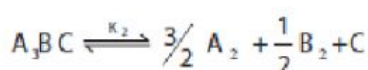
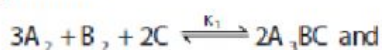


Unit **8** Physical and chemical Equilibrium

Choose the best answer.

- If  $K_b$  and  $K_f$  for a reversible reaction are  $0.8 \times 10^{-5}$  and  $1.6 \times 10^{-4}$  respectively, the value of the equilibrium constant is,
  - 20
  - $0.2 \times 10^{-1}$
  - 0.05
  - none of these

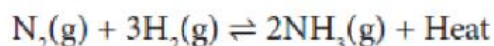
- At a given temperature and pressure, the equilibrium constant values for the equilibria



The relation between  $K_1$  and  $K_2$  is

- $K_1 = \frac{1}{\sqrt{K_2}}$
  - $K_2 = K_1^{-1/2}$
  - $K_1^2 = 2K_2$
  - $\frac{K_1}{2} = K_2$
- The equilibrium constant for a reaction at room temperature is  $K_1$  and that at 700 K is  $K_2$ . If  $K_1 > K_2$ , then
    - The forward reaction is exothermic
    - The forward reaction is endothermic
    - The reaction does not attain equilibrium
    - The reverse reaction is exothermic

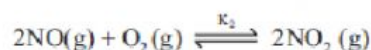
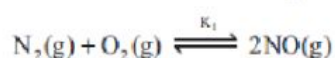
4. The formation of ammonia from  $N_2(g)$  and  $H_2(g)$  is a reversible reaction



What is the effect of increase of temperature on this equilibrium reaction

- a) equilibrium is unaltered
  - b) formation of ammonia is favoured
  - c) equilibrium is shifted to the left
  - d) reaction rate does not change
5. Solubility of carbon dioxide gas in cold water can be increased by
- a) increase in pressure
  - b) decrease in pressure
  - c) increase in volume
  - d) none of these
6. Which one of the following is incorrect statement ?
- a) for a system at equilibrium,  $Q$  is always less than the equilibrium constant
  - b) equilibrium can be attained from either side of the reaction
  - c) presence of catalyst affects both the forward reaction and reverse reaction to the same extent
  - d) Equilibrium constant varied with temperature

7.  $K_1$  and  $K_2$  are the equilibrium constants for the reactions respectively.

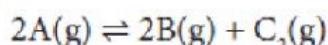


What is the equilibrium constant for the reaction  $\text{NO}_2(\text{g}) \rightleftharpoons \frac{1}{2}\text{N}_2(\text{g}) + \text{O}_2(\text{g})$

a)  $\frac{1}{\sqrt{K_1 K_2}}$       b)  $(K_1 = K_2)^{1/2}$

c)  $\frac{1}{2K_1 K_2}$       d)  $\left(\frac{1}{K_1 K_2}\right)^{3/2}$

8. In the equilibrium,



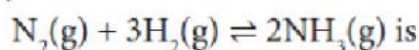
the equilibrium concentrations of A, B and  $\text{C}_2$  at 400 K are  $1 \times 10^{-4}$  M,  $2.0 \times 10^{-3}$  M,  $1.5 \times 10^{-4}$  M respectively. The value of  $K_c$  for the equilibrium at 400 K is

- a) 0.06      b) 0.09  
c) 0.62      d)  $3 \times 10^{-2}$

9. An equilibrium constant of  $3.2 \times 10^{-6}$  for a reaction means, the equilibrium is

- a) largely towards forward direction  
b) largely towards reverse direction  
c) never established  
d) none of these

10.  $\frac{K_c}{K_p}$  for the reaction,



- a)  $\frac{1}{RT}$       b)  $\sqrt{RT}$   
c)  $RT$       d)  $(RT)^2$

11. For the reaction  $\text{AB}(\text{g}) \rightleftharpoons \text{A}(\text{g}) + \text{B}(\text{g})$ , at equilibrium, AB is 20% dissociated at a total pressure of P. The equilibrium

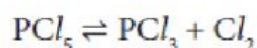
constant  $K_p$  is related to the total pressure by the expression

- a)  $P = 24 K_p$       b)  $P = 8 K_p$   
c)  $24 P = K_p$       d) none of these

12. In which of the following equilibrium,  $K_p$  and  $K_c$  are not equal?

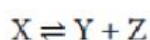
- a)  $2 \text{NO}(\text{g}) \rightleftharpoons \text{N}_2(\text{g}) + \text{O}_2(\text{g})$   
b)  $\text{SO}_2(\text{g}) + \text{NO}_2 \rightleftharpoons \text{SO}_3(\text{g}) + \text{NO}(\text{g})$   
c)  $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$   
d)  $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$

13. If  $x$  is the fraction of  $\text{PCl}_5$  dissociated at equilibrium in the reaction



then starting with 0.5 mole of  $\text{PCl}_5$ , the total number of moles of reactants and products at equilibrium is

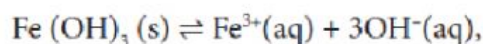
- a)  $0.5 - x$       b)  $x + 0.5$   
c)  $2x + 0.5$       d)  $x + 1$
14. The values of  $K_{r_1}$  and  $K_{r_2}$  for the reactions



$\text{A} \rightleftharpoons 2\text{B}$  are in the ratio 9 : 1 if degree of dissociation and initial concentration of X and A be equal then total pressure at equilibrium  $P_1$ , and  $P_2$  are in the ratio

- a) 36 : 1      b) 1 : 1  
c) 3 : 1      d) 1 : 9

15. In the reaction,

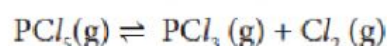


if the concentration of  $\text{OH}^{-}$  ions is decreased by  $\frac{1}{4}$  times, then the

equilibrium concentration of  $\text{Fe}^{3+}$  will

- a) not changed
- b) also decreased by  $\frac{1}{4}$  times
- c) increase by 4 times
- d) increase by 64 times

16. Consider the reaction where  $K_p = 0.5$  at a particular temperature



if the three gases are mixed in a container so that the partial pressure of each gas is initially 1 atm, then which one of the following is true

- a) more  $\text{PCl}_3$  will be produced
  - b) more  $\text{Cl}_2$  will be produced
  - c) more  $\text{PCl}_5$  will be produced
  - d) none of these
17. Equimolar concentrations of  $\text{H}_2$  and  $\text{I}_2$  are heated to equilibrium in a 1 litre flask. What percentage of initial concentration of  $\text{H}_2$  has reacted at equilibrium if rate constant for both forward and reverse reactions are equal
- a) 33%
  - b) 66%
  - c)  $(33)^2\%$
  - d) 16.5 %

18. In a chemical equilibrium, the rate constant for the forward reaction is  $2.5 \times 10^2$  and the equilibrium constant is 50. The rate constant for the reverse reaction is,

- a) 11.5
- b) 5
- c)  $2 \times 10^2$
- d)  $2 \times 10^{-3}$

19. Which of the following is not a general

characteristic of equilibrium involving physical process

- a) Equilibrium is possible only in a closed system at a given temperature
- b) The opposing processes occur at the same rate and there is a dynamic but stable condition
- c) All the physical processes stop at equilibrium
- d) All measurable properties of the system remains constant

20. For the formation of Two moles of  $\text{SO}_3(\text{g})$  from  $\text{SO}_2$  and  $\text{O}_2$ , the equilibrium constant is  $K_1$ . The equilibrium constant for the dissociation of one mole of  $\text{SO}_3$  into  $\text{SO}_2$  and  $\text{O}_2$  is

a)  $\frac{1}{K_1}$       b)  $K_1^2$

c)  $\left(\frac{1}{K_1}\right)^{\frac{1}{2}}$       d)  $\frac{K_1}{2}$

21. Match the equilibria with the corresponding conditions,

- i) Liquid  $\rightleftharpoons$  Vapour
  - ii) Solid  $\rightleftharpoons$  Liquid
  - iii) Solid  $\rightleftharpoons$  Vapour
  - iv) Solute (s)  $\rightleftharpoons$  Solute (Solution)
- 1) melting point
  - 2) Saturated solution
  - 3) Boiling point
  - 4) Sublimation point
  - 5) Unsaturated solution

|     | (i) | (ii) | (iii) | (iv) |
|-----|-----|------|-------|------|
| (a) | 1   | 2    | 3     | 4    |
| (b) | 3   | 1    | 4     | 2    |
| (c) | 2   | 1    | 3     | 4    |
| (d) | 3   | 2    | 4     | 5    |

22. Consider the following reversible reaction at equilibrium,  $A + B \rightleftharpoons C$ , If the concentration of the reactants A and B are doubled, then the equilibrium constant will

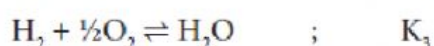
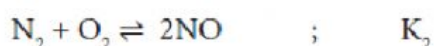
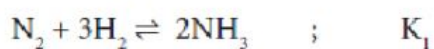
- a) be doubled    b) become one fourth  
c) be halved    d) remain the same

23.  $[\text{Co}(\text{H}_2\text{O})_6]^{2+} (\text{aq}) (\text{pink}) + 4\text{Cl}^- (\text{aq}) \rightleftharpoons [\text{CoCl}_4]^{2-} (\text{aq}) (\text{blue}) + 6\text{H}_2\text{O} (\text{l})$

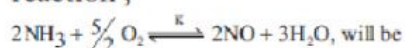
In the above reaction at equilibrium, the reaction mixture is blue in colour at room temperature. On cooling this mixture, it becomes pink in colour. On the basis of this information, which one of the following is true ?

- a)  $\Delta H > 0$  for the forward reaction  
b)  $\Delta H = 0$  for the reverse reaction  
c)  $\Delta H < 0$  for the forward reaction  
d) Sign of the  $\Delta H$  cannot be predicted based on this information.

24. The equilibrium constants of the following reactions are :



The equilibrium constant (K) for the reaction ;





$$\text{a) } K_2^3 K_3 / K_1 \quad \text{b) } K_1 K_3^3 / K_2$$

$$\text{c) } K_2 K_3^3 / K_1 \quad \text{d) } K_2 K_3 / K_1$$

25. A 20 litre container at 400 K contains  $\text{CO}_2$  (g) at pressure 0.4 atm and an excess of SrO (neglect the volume of solid SrO). The volume of the container is now decreased by moving the movable piston fitted in the container. The maximum volume of the container, when pressure of  $\text{CO}_2$  attains its maximum value will be :

Given that :  $\text{SrCO}_3 (\text{S}) \rightleftharpoons \text{SrO} (\text{S}) + \text{CO}_2(\text{g})$

$K_p = 1.6 \text{ atm}$  (NEET 2017)

- a) 2 litre            b) 5 litre  
c) 10 litre          d) 4 litre