CHEMISTRY

BOOKS - NTA MOCK TESTS

EQUILIBRIUM TEST (CHEMICAL)-1

Multiple Choice Question

1. Bromine monochloride (BrCl) decomposes into bromine and chlorine according to reaction $2BrCl(g) = Br_2(g) + Cl_2(g), K_c = 32$ at 500 K. If initially, pure BrCl is taken at concentration $3.3 \times 10^{-3} \text{mol L}^{-1}$, what is its molar concentration in the mixture at equilibrium state?

A. $1.23 \times 10^{-2} \text{mol L}^{-1}$

B. $2.8 \times 10^{-4} M$

C. $3.54 \times 10^{-3} \mathrm{mol\ L^{-1}}$

D. $4.76 \times 10^{-1} \mathrm{mol\ L^{-1}}$

Answer: B

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2. The first ionization constant of H_2S is 9.1×10^{-8}. Calculate the concentration of HS^- ion in its 0.1 M solution. How will this concentration be affected, if the solution is 0.1 M in HCl also? If the second dissociation constant of H_2S is 1.2×10^{-13}, then calculate the concentration of S^{2-} under both conditions. Select these four answers from the choices given below.

A.

$[HS^-]$	$[HS^-]$ 0.1 M HCl	$[S^{2-}]$	$[S^{2-}]$ 0.1 M HCl
9.54×10^{-5} M	9.1×10^{-8} M	1.2×10^{-13} M	1.092×10^{-19} M

B.

$[HS^-]$	$[HS^-]$ 0.1 M HCl	$[S^{2-}]$	$[S^{2-}]$ 0.1 M HCl
9.10×10^{-8} M	9.54×10^{-5} M	1.092×10^{-19} M	3.38×10^{-9} M

C.

$[HS^-]$	$[HS^-]$ 0.1 M HCl	$[S^{2-}]$	$[S^{2-}]$ 0.1 M HCl
1.092×10^{-19} M	3.38×10^{-9} M	9.1×10^{-8} M	9.54×10^{-5} M

D. None of these

Answer: A

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3. One mole of N_2 (g) is mixed with 2 moles of H_2 (g) in a 4 litre vessel. If 50% of N_2 (g) is converted to NH_3 (g) by the following reaction:

$$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$$

What will be the value of K_c for the following equilibrium ?

$$NH_3(g) \Leftrightarrow \frac{1}{2}N_2(g) + \frac{3}{2}H_2(g)$$

A. 256

B. 16

C. $\frac{1}{16}$

D. None of these

Answer: C

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4. For the equilibrium,

$PCl_5 \Leftrightarrow PCl_3 + Cl_2, K_c = \frac{\alpha^2}{(1-\alpha)V}$

temperature remaining constant.

A. K_c may increase or decrease with the change in volume depending upon its numerical value

B. K_c will increase with the increase in volume

C. K_c will increase with the decrease in volume

D. K_c will not change with the change in volume

Answer: D

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5. Which of the following is correct for the reaction?

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

A. $K_p = K_c$

B. $K_p < K_c$

C. $K_p > K_c$

D. Pressure is required to predict the correlation

Answer: B

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6. In the reaction, $H_2(g) + Cl_2(g) \Leftrightarrow 2HCl(g)$:

A. $K_p \neq K_c$

B. $K_p = K_c$

C. $K_p > K_c$

D. $K_p < K_c$

Answer: B

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7. In which of the following reactions, the concentration of product is higher than the concentration of reactant at equilibrium? (K = equilibrium constant)

A. $A \Leftrightarrow B, K = 0.001$

B. $M \Leftrightarrow N, K = 10$

C. $X \Leftrightarrow Y, K = 0.005$

D. $R \Leftrightarrow P, K = 0.01$

Answer: B

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8. The equilibrium constant K_c for the reaction $P_4(g) \Leftrightarrow 2P_2(g)$ is 1.4 at $400^\circ C$. Suppose that 3 moles of P_4

(g) and 2 moles of P_2 (g) are mixed in 2 litre container at $400^\circ C$. What is the value of reaction quotient (Q)?

A. $3/2$

B. $2/3$

C. 1

D. None of these

Answer: B

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9. The equilibrium constant of the reaction $A_2(g) + B_2(g) \Leftrightarrow 2AB(g)$ at 373 K is 50. If 1 L of flask containing 1 mole of A_2 (g) is connected to 2 L flask containing

2 moles B_2 (g) at $100^\circ C$, the amount of AB produced at equilibrium at $100^\circ C$ would be

A. 0.93 mol

B. 1.87 mol

C. 2.80 mol

D. 3.74 mol

Answer: B

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10. The equilibrium, $SO_2Cl_2(g) \Leftrightarrow SO_2(g) + Cl_2(g)$ is attained at 298 K in a closed container and an inert gas, He is introduced. Which of the following is/are correct?

A. Concentration of $SO_2(g), Cl_2(g)$ and $SO_2Cl_2(g)$ remain unchanged

B. More $Cl_2(g)$ is formed

C. Concentration of SO_2(g) is reduced

D. More $SO_2Cl_2(g)$ is formed

Answer: A

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11. The reaction quotient (Q) predicts:

A. The direction of equilibrium to be attained.

B. The ratio of activities at equilibrium i.e.,K_c..

C. The ratio of activities at any time.

D. All of these

Answer: D

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12. $K_p = 0.04$ atm at 899 K for the equilibrium shown below. What is the equilibrium concentration of C_2H_6 when it is placed in a flask at 4.0 atm pressure and allowed to come to equilibrium?

$C_2H_6(g) \rightarrow C_2H_4(g) + H_2(g)$

A. 7.24 atm

B. 3.62 atm

C. 1 atm

D. 1.5 atm

Answer: B

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13. The equilibrium constant K_c for $A(g) \Leftrightarrow B(g)$ is 1.1, gas B will have a molar concentration greater than 1 if:

A. $[A] = 0.91$

B. $[A] > 0.91$

C. $[A] > 1$

D. All of these

Answer: D

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14. $X_2 + X^- \Leftrightarrow X_3^-$ (x = iodine) This reaction is set up in aqueous medium. We start with 1 mol of X_2 and 0.5 mol of X^- in 1L flask. After equilibrium is reached, excess of $AgNO_3$ gave 0.25 mol of yellow ppt. equilibrium constant is

A. 1.33

B. 2.66

C. 2.00

D. 3.00

Answer: A

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15. The partial pressure of $CH_3OH(g), CO_{(g)}$ and $H_{2(g)}$ in equilibrium mixture for the reaction,

$CO_{(g)} + 2H_{2(g)} \Leftrightarrow CH_3OH$ are 2.0, 1.0 and 0.1 atm respectively at $427^\circ C$. The value of K_p for decomposition of CH_3OH to CO and H_2 is:

A. 10^2atm^2

B. $2 \times 10^2 \text{atm}^{-2}$

C. 50atm^2

D. $5 \times 10^{-3} \text{atm}^2$

Answer: D

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16. 0.2 mole of NH4Cl are introduced into an empty container of 10 litre and heated to $327^\circ C$ to attain equilibrium as :

$NH_4Cl_{(s)} \rightarrow NH_{3(g)} + HCl_{3(g)} + HCl_{(g)}, \left(K_P = 0.36\text{atm}^2\right)$

The quantity of solid NH_4Cl left is:

A. 0.078 mole

B. 0.02 mole

C. 0.095 mole

D. 0.035 mole

Answer: A

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17. For the reaction :

$CH_{4(g)} + 2O_{2(g)} \Leftrightarrow CO_{2(g)} + 2H_2O_{(l)}, \quad \left(\Delta H = -170.8kJ/\text{mol}\right)$ Which of the following statements is not true?

A. Addition of $CH_{4(g)}$ or $O_{2(g)}$ at equilibrium will cause a shift to right

B. The reaction is exothermic

C. At equilibrium, the concentration of $CO_{2(g)}$ and $H_2O_{(l)}$ are not equal

D. The equilibrium constant for the reaction is given by $K_p = \frac{[CO_2]}{[CH_4][O_2]^2}$

Answer: D

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18. In which of the following reactions, increase in the volume at constant temperature does not affect the number of moles at equilibrium ?

A. $2NH_3 \rightarrow N_2 + 3H_2$

B. $C_{(g)} + (1/2)O_{2(g)} \rightarrow CO_{(g)}$

C. $H_{2(g)} + O_{2(g)} \rightarrow H_2O_{2(g)}$

D. None of these

Answer: D

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19. For the reversible reaction,

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ at $500^\circ C$, the value of K_p is 1.44×10^{-5} when partial pressure is measured in atmosphere. The corresponding value of K_c, with concentration in mole litre $^{-1}$, is -

A. $\frac{1.44 \times 10^{-5}}{(0.082 \times 500)^{-2}}$

B. $\frac{1.44 \times 10^{-5}}{(8.314 \times 773)^{-2}}$

C. $\frac{1.44 \times 10^{-5}}{(8.314 \times 500)^{-2}}$

D. $\frac{1.44 \times 10^{-5}}{(0.082 \times 773)^{-2}}$

Answer: D

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20. At constant temperature, the equilibrium constant (K_p) for the decomposition reaction $N_2O_4(g) \Leftrightarrow 2NO_2(g)$ is expressed by $K_p = \frac{4x^2}{1-x^2}P$, where P = pressure, x = extent of decomposition. Which one of the following statements is true?

A. K_p remains constant with change in P and x

B. K_p increases with increase of P

C. K_p increases with decrease of x.

D. K_p increases with increase of x.

Answer: A

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21. In which of the following equilibrium, change in the volume of the system does not alter the number of moles -

A. $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$

B. $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

C. $N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$

D. $SO_2Cl_2 \Leftrightarrow SO_2(g) + Cl_2(g)$

Answer: C

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22. The equilibrium constant for the disproportionation of $HgCl^+$ and $HgCl_3^-$ is ....

Given, $HgCl^+ + Cl^- \Leftrightarrow HgCl_2, K_1 = 3 \times 10^6$

$HgCl_2 + Cl^- \Leftrightarrow HgCl_3^-, K_2 = 9$

A. 27×10^6

B. 3.3×10^{-7}

C. 3.3×10^{-6}

D. 3×10^{-6}

Answer: D

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

A. $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}$

B. $PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$

C. $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$

D. $SO_2Cl_{2(g)} \Leftrightarrow SO_{2(g)} + Cl_{2(g)}$

Answer: A

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24. For the following three reaction (i), (ii) and (iii) equilibrium constants are given

(i) $CO_{(g)} + H_2O_{(g)} \Leftrightarrow CO_{2(g)} + H_{2(g)}\, K_1$

(ii) $CH_{4(g)} + H_2O_{(g)} \Leftrightarrow CO_{(g)} + 3H_{2(g)}\, K_2$

(iii) $CH_{4(g)} + 2H_2O_{(g)} \Leftrightarrow CO_{2(g)} + 4H_{2(g)}\, K_3$

Which of the following relation is correct ?

A. $K_3 \cdot K_2^3 = K_1^2$

B. $K_2 \cdot K_3 = K_1$

C. $K_1\sqrt{K_2} = K_3$

D. $K_3 = K_1K_2$

Answer: D

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25. The pK_a of a weak acid, HA, is 4.80. The pK_b of a weak base, BOH is 4.78. The pH of an aqueous solution of the corresponding salt, BA, will be

A. 9.22

B. 9.58

C. 4.79

D. 7.01

Answer: D

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26. Which of the following buffer solutions turns invalid on addition of 10 mL of 1.0 M HCl?

A. 100 mL of buffer solution having 0.15 M NH_3 and NH_4Cl each

B. 100 mL of buffer solution having 0.2 M NH_3 and NH_4Cl each

C. 100 mL of buffer solution having 0.2 M NH_3 and $0.1 M NH_4Cl$

D. 100 mL of buffer solution having 0.5 M NH_3 and $0.1 M NH_4Cl$

Answer: D

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27. The two equilibrium, $AB \Leftrightarrow A^+ + B^-$ and $AB + B^- \Leftrightarrow AB_2^-$ are simultaneously maintained in a solution with equilibrium constants, K_1 and K_2 respectively. The ratio of A^+ to AB_2^- in the solution is

A. Directly proportional to the concentration of B^-

B. Inversely proportional to the concentration of B^-

C. Inversely proportional to the square of the concentration of B^-

D. Directly proportional to the square of the concentration of B^-

Answer: C

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28. An equilibrium mixture at 300 K has N_2O_4 and NO_2 at 0.28 atm and 1.10 atm pressures. If the volume of container doubled at same temperature. Calculate the new equilibrium pressures for the gases.

A. 0.095, 0.64 atm

B. 1.095, 2.64 atm

C. 1.250, 2.30 atm

D. 3.250, 1.50 atm

Answer: A

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29. The Henderson's equation for acetic acid and sodium acetate buffer is given by the expression.

A. $pH = pK_a - \log\frac{[CH_3COONa]}{[CH_3COOH]}$

B. $pH = pK_a + \log\frac{[CH_3COONa]}{[CH_3COOH]}$

C. $pOH = pK_a - \log\frac{[CH_3COONa]}{[CH_3COOH]}$

D. $pOH = pK_a - \log\frac{[CH_3COOH]}{[CH_3COONa]}$

Answer: B

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30. An amount of solid NH_4HS is placed in a flask already containing ammonia gas at a certain temperature and 0.50 atm. pressure . Ammonium hydrogen sulphide decomposes to yield NH_3 and H_2S gases in the flask. When the decomposition reaction reaches equilibrium , the total pressure in the flask rise to 0.84 atm . The equilibrium constant for NH_4 HS decomposition at this temperature is

A. 0.30atm^2

B. 0.18atm^2

C. 0.17atm^2

D. 0.11atm^2

Answer: D

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Single Choice

1. Bromine monochloride (BrCl) decomposes into bromine and chlorine according to reaction $2BrCl(g) = Br_2(g) + Cl_2(g), K_c = 32$ at 500 K. If initially, pure BrCl is taken at concentration $3.3 \times 10^{-3} \text{mol L}^{-1}$, what is its molar concentration in the mixture at equilibrium state?

A. $1.23 \times 10^{-2} \text{mol L}^{-1}$

B. $2.8 \times 10^{-4} M$

C. $3.54 \times 10^{-3} \text{mol L}^{-1}$

D. $4.76 \times 10^{-1} \text{mol L}^{-1}$

Answer: B

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2. The first ionization constant of H_2S is 9.1×10^{-8}. Calculate the concentration of HS^- ion in its 0.1 M solution. How will this concentration be affected, if the solution is 0.1 M in HCl also? If the second dissociation constant of H_2S is 1.2×10^{-13}, then calculate the concentration of S^{2-} under both conditions. Select these four answers from the choices given below.

A.

$[HS^-]$	$[HS^-]$ 0.1 M HCl	$[S^{2-}]$	$[S^{2-}]_{0.1\,M\ HCl}$
9.54×10^{-5} M	9.1×10^{-8} M	1.2×10^{-13} M	1.092×10^{-19} M

B.

$[HS^-]$	$[HS^-]$ 0.1 M HCl	$[S^{2-}]$	$[S^{2-}]$ 0.1 M HCl
9.10×10^{-5} M	9.54×10^{-5} M	1.092×10^{-19} M	3.38×10^{-9} M

C.

$[HS^-]$	$[HS^-]$ 0.1 M HCl	$[S^{2-}]$	$[S^{2-}]$ 0.1 M HCl
1.092×10^{-19} M	3.38×10^{-9} M	9.1×10^{-8} M	9.54×10^{-5} M

D. None of these

Answer: A

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3. One mole of N_2 (g) is mixed with 2 moles of H_2 (g) in a 4 litre vessel. If 50% of N_2 (g) is converted to NH_3 (g) by the following reaction:

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

What will be the value of K_c for the following equilibrium ?

$NH_3(g) \Leftrightarrow \frac{1}{2}N_2(g) + \frac{3}{2}H_2(g)$

A. 256

B. 16

C. $\frac{1}{16}$

D. None of these

Answer: C

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4. For the equilibrium,

$$PCl_5 \Leftrightarrow PCl_3 + Cl_2, K_c = \frac{\alpha^2}{(1-\alpha)V}$$

temperature remaining constant.

A. K_c may increase or decrease with the change in volume depending upon its numerical value

B. K_c will increase with the increase in volume

C. K_c will increase with the decrease in volume

D. K_c will not change with the change in volume

Answer: D

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5. Which of the following is correct for the reaction?

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

A. $K_p = K_c$

B. $K_p < K_c$

C. $K_p > K_c$

D. Pressure is required to predict the correlation

Answer: B

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6. In the reaction, $H_2(g) + Cl_2(g) \Leftrightarrow 2HCl(g)$:

A. $K_p \neq K_c$

B. $K_p = K_c$

C. $K_p > K_c$

D. $K_p < K_c$

Answer: B

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7. In which of the following reactions, the concentration of product is higher than the concentration of reactant at equilibrium? (K = equilibrium constant)

A. $A \Leftrightarrow B, K = 0.001$

B. $M \Leftrightarrow N, K = 10$

C. $X \Leftrightarrow Y, K = 0.005$

D. $R \Leftrightarrow P, K = 0.01$

Answer: B

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8. The equilibrium constant K_c for the reaction $P_4(g) \Leftrightarrow 2P_2(g)$ is 1.4 at $400^\circ C$. Suppose that 3 moles of P_4 (g) and 2 moles of P_2 (g) are mixed in 2 litre container at $400^\circ C$. What is the value of reaction quotient (Q)?

A. $3/2$

B. $2/3$

C. 1

D. None of these

Answer: B

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9. The equilibrium constant of the reaction $A_2(g) + B_2(g) \Leftrightarrow 2AB(g)$ at 373 K is 50. If 1 L of flask containing 1 mole of A_2 (g) is connected to 2 L flask containing 2 moles B_2 (g) at $100^\circ C$, the amount of AB produced at equilibrium at $100^\circ C$ would be

A. 0.93 mol

B. 1.87 mol

C. 2.80 mol

D. 3.74 mol

Answer: B

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10. The equilibrium, $SO_2Cl_2(g) \Leftrightarrow SO_2(g) + Cl_2(g)$ is attained at 298 K in a closed container and an inert gas, He is introduced. Which of the following is/are correct?

A. Concentration of $SO_2(g), Cl_2(g)$ and $SO_2Cl_2(g)$ remain unchanged

B. More $Cl_2(g)$ is formed

C. Concentration of SO_2(g) is reduced

D. More $SO_2Cl_2(g)$ is formed

Answer: A

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11. The reaction quotient (Q) predicts:

A. The direction of equilibrium to be attained.

B. The ratio of activities at equilibrium i.e.,K_c..

C. The ratio of activities at any time.

D. All of these

Answer: D

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12. $K_p = 0.04$ atm at 899 K for the equilibrium shown below. What is the equilibrium concentration of C_2H_6 when it is placed in a flask at 4.0 atm pressure and allowed to come to equilibrium?

$C_2H_6(g) \rightarrow C_2H_4(g) + H_2(g)$

A. 7.24 atm

B. 3.62 atm

C. 1 atm

D. 1.5 atm

Answer: B

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13. The equilibrium constant K_c for $A(g) \Leftrightarrow B(g)$ is 1.1, gas B will have a molar concentration greater than 1 if:

A. $[A] = 0.91$

B. $[A] > 0.91$

C. $[A] > 1$

D. All of these

Answer: D

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14. $X_2 + X^- \Leftrightarrow X_3^-$ (x = iodine) This reaction is set up in aqueous medium. We start with 1 mol of X_2 and 0.5 mol of X^- in 1L flask. After equilibrium is reached, excess of $AgNO_3$ gave 0.25 mol of yellow ppt. equilibrium constant is

A. 1.33

B. 2.66

C. 2.00

D. 3.00

Answer: A

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15. The partial pressure of $CH_3OH(g), CO_{(g)}$ and $H_{2(g)}$ in equilibrium mixture for the reaction,

$CO_{(g)} + 2H_{2(g)} \Leftrightarrow CH_3OH$ are 2.0, 1.0 and 0.1 atm respectively at $427^\circ C$. The value of K_p for decomposition of CH_3OH to CO and H_2 is:

A. 10^2atm^2

B. $2 \times 10^2 \text{atm}^{-2}$

C. 50atm^2

D. $5 \times 10^{-3} \text{atm}^2$

Answer: D

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16. 0.2 mole of NH4Cl are introduced into an empty container of 10 litre and heated to $327^{\circ}C$ to attain equilibrium as :

$NH_4Cl_{(s)} \rightarrow NH_{3(g)} + HCl_{3(g)} + HCl_{(g)}, \left(K_P = 0.36\text{atm}^2\right)$

The quantity of solid NH_4Cl left is:

A. 0.078 mole

B. 0.02 mole

C. 0.095 mole

D. 0.035 mole

Answer: A

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17. For the reaction :

$CH_{4(g)} + 2O_{2(g)} \Leftrightarrow CO_{2(g)} + 2H_2O_{(l)}$, Which of the $(\Delta H = -170.8 kJ/\text{mol})$

following statements is not true?

A. Addition of $CH_{4(g)}$ or $O_{2(g)}$ at equilibrium will cause a shift to right

B. The reaction is exothermic

C. At equilibrium, the concentration of $CO_{2(g)}$ and $H_2O_{(l)}$ are not equal

D. The equilibrium constant for the reaction is given by $K_p = \frac{[CO_2]}{[CH_4][O_2]^2}$

Answer: D

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18. In which of the following reactions, increase in the volume at constant temperature does not affect the number of moles at equilibrium ?

A. $2NH_3 \rightarrow N_2 + 3H_2$

B. $C_{(g)} + (1/2)O_{2(g)} \rightarrow CO_{(g)}$

C. $H_{2(g)} + O_{2(g)} \rightarrow H_2O_{2(g)}$

D. None of these

Answer: D

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19. For the reversible reaction,

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ at $500^\circ C$, the value of K_p is 1.44×10^{-5} when partial pressure is measured in atmosphere.

The corresponding value of K_c, with concentration in mole litre $^{-1}$, is -

A. $\frac{1.44 \times 10^{-5}}{(0.082 \times 500)^{-2}}$

B. $\frac{1.44 \times 10^{-5}}{(8.314 \times 773)^{-2}}$

C. $\frac{1.44 \times 10^{-5}}{(8.314 \times 500)^{-2}}$

D. $\frac{1.44 \times 10^{-5}}{(0.082 \times 773)^{-2}}$

Answer: D

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20. At constant temperature, the equilibrium constant (K_p) for the decomposition reaction $N_2O_4(g) \Leftrightarrow 2NO_2(g)$ is expressed by $K_p = \frac{4x^2}{1-x^2}P$, where P = pressure, x = extent of decomposition. Which one of the following statements is true?

A. K_p remains constant with change in P and x

B. K_p increases with increase of P

C. K_p increases with decrease of x.

D. K_p increases with increase of x.

Answer: A

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21. In which of the following equilibrium, change in the volume of the system does not alter the number of moles -

A. $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$

B. $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

C. $N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$

D. $SO_2Cl_2 \Leftrightarrow SO_2(g) + Cl_2(g)$

Answer: C

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22. The equilibrium constant for the disproportionation of $HgCl^+$ and $HgCl_3^-$ is ....

Given, $HgCl^+ + Cl^- \Leftrightarrow HgCl_2, K_1 = 3 \times 10^6$

$HgCl_2 + Cl^- \Leftrightarrow HgCl_3^-, K_2 = 9$

A. 27×10^6

B. 3.3×10^{-7}

C. 3.3×10^{-6}

D. 3×10^{-6}

Answer: D

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

A. $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}$

B. $PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$

C. $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$

D. $SO_2Cl_{2(g)} \Leftrightarrow SO_{2(g)} + Cl_{2(g)}$

Answer: A

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24. For the following three reaction (i), (ii) and (iii) equilibrium constants are given

(i) $CO_{(g)} + H_2O_{(g)} \Leftrightarrow CO_{2(g)} + H_{2(g)}\, K_1$

(ii) $CH_{4(g)} + H_2O_{(g)} \Leftrightarrow CO_{(g)} + 3H_{2(g)}\, K_2$

(iii) $CH_{4(g)} + 2H_2O_{(g)} \Leftrightarrow CO_{2(g)} + 4H_{2(g)}\, K_3$

Which of the following relation is correct ?

A. $K_3 \cdot K_2^3 = K_1^2$

B. $K_2 \cdot K_3 = K_1$

C. $K_1\sqrt{K_2} = K_3$

D. $K_3 = K_1K_2$

Answer: D

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25. The pK_a of a weak acid, HA, is 4.80. The pK_b of a weak base, BOH is 4.78. The pH of an aqueous solution of the corresponding salt, BA, will be

A. 9.22

B. 9.58

C. 4.79

D. 7.01

Answer: D

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26. Which of the following buffer solutions turns invalid on addition of 10 mL of 1.0 M HCl?

A. 100 mL of buffer solution having 0.15 M NH_3 and NH_4Cl each

B. 100 mL of buffer solution having 0.2 M NH_3 and NH_4Cl each

C. 100 mL of buffer solution having 0.2 M NH_3 and $0.1MNH_4Cl$

D. 100 mL of buffer solution having 0.5 M NH_3 and $0.1MNH_4Cl$

Answer: D

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27. The two equilibrium, $AB \Leftrightarrow A^+ + B^-$ and $AB + B^- \Leftrightarrow AB_2^-$ are

simultaneously maintained in a solution with equilibrium constants, K_1 and K_2 respectively. The ratio of A^+ to AB_2^- in the solution is

A. Directly proportional to the concentration of B^-

B. Inversely proportional to the concentration of B^-

C. Inversely proportional to the square of the concentration of B^-

D. Directly proportional to the square of the concentration of B^-

Answer: C

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28. An equilibrium mixture at 300 K has N_2O_4 and NO_2 at 0.28 atm and 1.10 atm pressures. If the volume of container doubled at same temperature. Calculate the new equilibrium pressures for the gases.

A. 0.095, 0.64 atm

B. 1.095, 2.64 atm

C. 1.250, 2.30 atm

D. 3.250, 1.50 atm

Answer: A

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29. The Henderson's equation for acetic acid and sodium acetate buffer is given by the expression.

A. $pH = pK_a - \log\frac{[CH_3COONa]}{[CH_3COOH]}$

B. $pH = pK_a + \log\frac{[CH_3COONa]}{[CH_3COOH]}$

C. $pOH = pK_a - \log\frac{[CH_3COONa]}{[CH_3COOH]}$

D. $pOH = pK_a - \log\frac{[CH_3COOH]}{[CH_3COONa]}$

Answer: B

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30. An amount of solid NH_4HS is placed in a flask already containing ammonia gas at a certain temperature and 0.50 atm. pressure . Ammonium hydrogen sulphide decomposes to yield NH_3 and H_2S gases in the flask. When the decomposition reaction reaches equilibrium , the total pressure in the flask rise to 0.84 atm . The equilibrium constant for NH_4 HS decomposition at this temperature is

A. $0.30 \mathrm{atm}^2$

B. $0.18 \mathrm{atm}^2$

C. $0.17 \mathrm{atm}^2$

D. $0.11 \mathrm{atm}^2$

Answer: D

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