

Equilibrium JEE Main PYQ – 3

Total Time: 25 Minute

Total Marks: 40

Instructions

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1. Test will auto submit when the Time is up.
2. The Test comprises of multiple choice questions (MCQ) with one or more correct answers.
3. The clock in the top right corner will display the remaining time available for you to complete the examination.

Navigating & Answering a Question

1. The answer will be saved automatically upon clicking on an option amongst the given choices of answer.
2. To deselect your chosen answer, click on the clear response button.
3. The marking scheme will be displayed for each question on the top right corner of the test window.

Equilibrium

1. At a certain temperature, only 50% HI is dissociated into H_2 and I_2 at equilibrium. The equilibrium constant is : (+4, -1)

- a. 1
- b. 3
- c. 0.5
- d. 0.25

2. Consider the following reversible chemical reactions : (+4, -1)

$A_2(g) + Br_2(g) \rightleftharpoons [K_1]2AB(g) \dots(1)$ $6AB(g) \rightleftharpoons [K_2]3A_2(g) + 3B_2(g) \dots(2)$ The relation between K_1 and K_2 is :

[9-Jan-2019-(II)]

- a. $K_2 = K_1^3$
- b. $K_2 = K_1^{-3}$
- c. $K_1K_2 = 3$
- d. $K_1K_2 = \frac{1}{3}$

3. Equimolar solutions of the following compounds are prepared separately in water. Which will have the lowest pH value ? (+4, -1)

[23-Apr-2013-Online]

- a. $BeCl_2$
- b. $SrCl_2$
- c. $CaCl_2$
- d. $MgCl_2$

4. For the following reactions, equilibrium constants are given : $S(s) + O_2(g) \rightleftharpoons SO_2(g)$; $K_1 = 10^{52}$ $2S(s) + 3O_2(g) \rightleftharpoons 2SO_3(g)$; $K_2 = 10^{129}$ The equilibrium constant for the reaction, $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ is : (+4, -1)

- a. 10^{181}
- b. 10^{154}
- c. 10^{25}
- d. 10^{77}

5. Gaseous N_2O_4 dissociates into gaseous NO_2 according to the reaction (+4, -1)
 $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ At 300 K and 1 atm pressure, the degree of dissociation of N_2O_4 is 0.2. If one mole of N_2O_4 gas is contained in a vessel, then the density of the equilibrium mixture is :

- a. 1.56 g/L
- b. 3.11 g/L
- c. 4.56 g/L
- d. 6.22 g/L

6. In reaction $A + 2B \rightleftharpoons 2C + D$, initial concentration of B was 1.5 times of $[A]$, but (+4, -1)
at equilibrium the concentrations of A and B became equal. The equilibrium constant for the reaction is :

[9-Apr-2013-Online]

- a. 8
- b. 4
- c. 12
- d. 6

7. What happens when an inert gas is added to an equilibrium keeping volume (+4, -1)
unchanged ?

- a. More product will form
- b. Less product will form

- c. More reactant will form
- d. Equilibrium will remain unchanged

8. What is the molar solubility of $Al(OH)_3$ in 0.2 M NaOH solution? Given that, (+4, -1)
solubility product of $Al(OH)_3 = 2.4 \times 10^{-24}$:

[12-Apr-2019-(I)]

- a. 12×10^{-23}
- b. 12×10^{-21}
- c. 3×10^{-19}
- d. 3×10^{-22}

9. K_{sp} of $BaSO_4$ is 8×10^{-11} . If the solubility in presence of 0.1 M CaSO_4 is? (+4, -1)

10. 20 mL of $0.1\text{ M NH}_4\text{OH}$ is mixed with 40 mL of 0.05 M HCl . The pH of the mixture (+4, -1)
is nearest to: (Given: $K_b(\text{NH}_4\text{OH}) = 1 \times 10^{-5}$, $\log 2 = 0.30$, $\log 3 = 0.48$, $\log 5 = 0.69$, $\log 7 = 0.84$, $\log 11 = 1.04$)

[25-Jul-2022-Shift-1]

- a. 3.2
- b. 4.2
- c. 5.2
- d. 6.2

Answers

1. Answer: d

Explanation:

$$2HI \rightleftharpoons H_2 + I_2$$
$$K_{eq} = \frac{\left(\frac{\alpha}{2}\right)^2}{(1-\alpha)^2} = \frac{\alpha^2}{4(1-\alpha)^2}$$
$$K_{eq} = \frac{\left(\frac{1}{2}\right)^2}{4(1/2)^2} = \frac{1}{4}$$

Concepts:

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Equilibrium in Chemical changes

The chemical equilibrium in a reversible reaction is the state at which both forward and backward reactions occur at the same speed.

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Read More: [Calculating Equilibrium Concentration](#)

Types of Chemical Equilibrium

There are two types of chemical equilibrium:

- Homogeneous Equilibrium
- Heterogeneous Equilibrium

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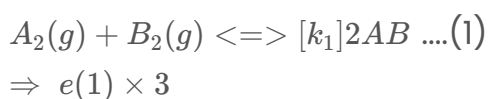
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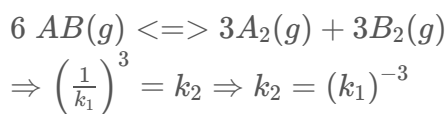
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Check Out: [Equilibrium Important Questions](#)

2. Answer: b

Explanation:





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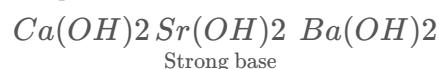
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3. Answer: a

Explanation:

Metal halide on hydrolysis with water form corresponding hydroxides.

The basic strength of hydroxide increases as we move down in a group. This is because of the increase in size which results in decrease of ionization energy which weakens the strength of $M - O$ bonds in MOH and thus increases the basic strength.



Hence, $\text{Ba}(\text{OH})_2$ will have lowest pH.

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4. Answer: c

Explanation:

$$2\text{SO}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightarrow 2\text{SO}_3 (\text{g})$$
$$K_{eq} = \frac{[\text{SO}_3]^2}{[\text{O}_2][\text{SO}_2]^2}$$
$$= \frac{K_2}{K_1} = \frac{10^{129}}{10^{104}} = 10^{25}$$

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5. Answer: b

Explanation:

$$PV = nRT \Rightarrow 1 \times V = 1 \times 0.0821 \times 300$$

$$\Rightarrow V = 24.63$$

$$d = \frac{\text{mass of mixture}}{\text{vol}}$$
$$= \frac{0.8 \times 92 + 0.4 \times 45}{24.63} = 3.11 \text{ gm/lit}$$

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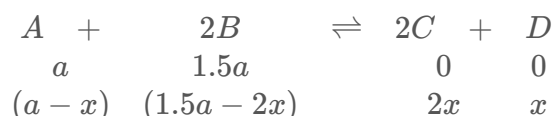
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Check Out: [Equilibrium Important Questions](#)

6. Answer: b

Explanation:



$$\text{Hence } K_c = \frac{(2x)^2 \times x}{(a-x)(1.5a-2x)^2}$$

Given, at equilibrium

$$\therefore (a-x)(1.5a-2x)$$

$$\therefore a = 2x$$

On solving $K_c = 4$

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7. Answer: d

Explanation:

On adding inert gas at constant volume the total pressure of the system is increased, but the partial pressure of each reactant and product remains the same. Hence no

effect on the state of equilibrium.

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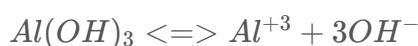
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8. Answer: d

Explanation:



$$S' + 0.2 + 3(S') \simeq 0.2$$

$$S; \times (0.2)^3 = k_{sp} = 2.4 \times 10^{-24}$$

$$(S') = 3 \times 10^{-22} \text{M}$$

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9. Answer: 8 – 8

Explanation:

The correct answer is 8.

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In the case of physical processes such as the melting of solid, dissolution of salt in water etc., the equilibrium is called **physical equilibrium** while the equilibrium associated with chemical reaction is known as [chemical equilibrium](#).

Equilibrium in Chemical changes

The chemical equilibrium in a reversible reaction is the state at which both forward and backward reactions occur at the same speed.

The stage of the reversible reaction at which the concentration of the reactants and products do not change with time is called the equilibrium state.

Read More: [Calculating Equilibrium Concentration](#)

Types of Chemical Equilibrium

There are two types of chemical equilibrium:

- Homogeneous Equilibrium
- Heterogeneous Equilibrium

Homogenous Chemical Equilibrium

In this type, the reactants and the products of chemical equilibrium are all in the same phase. **Homogenous equilibrium** can be further divided into two types: Reactions in which the number of molecules of the products is equal to the number of molecules of the reactants. For example,

- $\text{H}_2 (\text{g}) + \text{I}_2 (\text{g}) \rightleftharpoons 2\text{HI} (\text{g})$
- $\text{N}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{NO} (\text{g})$

Reactions in which the number of molecules of the products is not equal to the total number of reactant molecules. For example,

- $2\text{SO}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2\text{SO}_3 (\text{g})$
- $\text{COCl}_2 (\text{g}) \rightleftharpoons \text{CO} (\text{g}) + \text{Cl}_2 (\text{g})$

Heterogeneous Chemical Equilibrium

In this type, the reactants and the products of chemical equilibrium are present in different phases. A few examples of **heterogeneous equilibrium** are listed below.

- $\text{CO}_2 (\text{g}) + \text{C} (\text{s}) \rightleftharpoons 2\text{CO} (\text{g})$
- $\text{CaCO}_3 (\text{s}) \rightleftharpoons \text{CaO} (\text{s}) + \text{CO}_2 (\text{g})$

Thus, the different types of chemical equilibrium are based on the phase of the reactants and products.

Check Out: [Equilibrium Important Questions](#)

10. Answer: c

Explanation:

The correct option is (C).

Concepts:

1. Equilibrium:

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