Equilibrium JEE Main PYQ - 3

Total Time: 25 Minute **Total Marks:** 40

Instructions

Instructions

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

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2. Consider the following reversible chemical reactions : **(+4, -1)**
$A_2(g) + Br_2(g) <=> [K_1]2AB(g)$ ....(1) $6AB(g) <=> [K_2]3A_2(g) + 3B_2(g)$ ...(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. $MgCl_2$

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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 eqilibrium 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 $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ 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 : **(+4, -1)**

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 at equilibrium the concentrations of A and B became equal. The equilibrium constant for the reaction is : **(+4, -1)**

[9-Apr-2013-Online]

a. 8

b. 4

c. 12

d. 6

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

a. More product will form

b. Less product will form

c. More reactant will form

d. Equilibrium will remain unchanged

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

[12-Apr-2019-(I)]

a. 12×10^{-23}

b. 12×10^{-21}

c. 3×10^{-19}

d. 3×10^{-22}

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

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10. $20\,mL$ of $01\,M\,NH_4OH$ is mixed with $40\,mL$ of $005\,M\,HCl$ The pH of the mixture is nearest to: (Given: $K_b\,(NH_4OH) = 1 \times 10^{-5}, \log 2 = 030, \log 3 = 048, \log 5 = 069, \log 7 = 084, \log 11 = 104$) **(+4, -1)**

[25-Jul-2022-Shift-1]

a. 3.2

b. 4.2

c. 5.2

d. 6.2

Answers

1. **Answer: d**

Explanation:

$$\underset{1-\alpha}{2HI} <=> \underset{\frac{\alpha}{2}}{H_3} + \underset{\frac{\alpha}{2}}{I_2}$$

$$K_{eq} = \frac{\left(\frac{\alpha}{2}\right)^2}{(1-\alpha)^2} = \frac{\alpha^2}{4(1-\alpha)^2}$$

$$K_{eq} = \frac{\left(\frac{1}{2}\right)^2}{4(1/2)^2} = \frac{1}{4}$$

Concepts:

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Equilibrium in Chemical changes

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Read More: Calculating Equilibrium Concentration

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- Heterogeneous Equilibrium

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

Check Out: Equilibrium Important Questions

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2. Answer: b

Explanation:

$A_2(g) + B_2(g) <=> [k_1]2AB$ ....(1)

$\Rightarrow\ e(1) \times 3$

$6\ AB(g) <=> 3A_2(g) + 3B_2(g)$
$\Rightarrow \left(\frac{1}{k_1}\right)^3 = k_2 \Rightarrow k_2 = (k_1)^{-3}$

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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.

$\underset{\text{Amphoteric}}{Be(OH)2}$ $\underset{\text{Weak base}}{Mg(OH)2}$

$Ca(OH)2$ $\underset{\text{Strong base}}{Sr(OH)2}$ $Ba(OH)2$

Hence, $Ba(OH)2$ will have lowest pH.

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4. **Answer: c**

Explanation:

$$2SO_2\,(g) + O_2\,(g) \rightarrow 2SO_3\,(g)$$
$$K_{eq} = \frac{[SO_3]^2}{[O_2][SO_2]^2}$$
$$= \frac{K_2}{K_1} = \frac{10^{129}}{10^{104}} = 10^{25}$$

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Check Out: Equilibrium Important Questions

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5. Answer: b

Explanation:

$$PV = nRT \Rightarrow 1 \times V = 1 \times 0.0821 \times 300$$
$$\Rightarrow V = 24.63$$
$$d = \frac{\text{mass of mixture}}{\text{vol}}$$
$$= \frac{0.8\times92+0.4\times45}{24.63} = 3.11\, gm/\text{ lit}$$

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Check Out: Equilibrium Important Questions

6. **Answer: b**

Explanation:

$$\begin{array}{ccccccc} A & + & 2B & \rightleftharpoons & 2C & + & D \\ a & & 1.5a & & 0 & & 0 \\ (a-x) & & (1.5a-2x) & & 2x & & x \end{array}$$

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

Given, at equilibrium

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

$\therefore \quad a = 2x$

On solving $K_c = 4$

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Check Out: Equilibrium Important Questions

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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.

Concepts:

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Check Out: Equilibrium Important Questions

---

8. Answer: d

Explanation:

$$Al(OH)_3 <=> Al^{+3} + 3OH^-$$
$$S' \; 0.2 + 3(S') \simeq 0.2$$
$$S; \times (0.2)^3 = k_{sp} = 2.4 \times 10^{-24}$$
$$(S') = 3 \times 10^{-22} M$$

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9. **Answer: 8 - 8**

Explanation:

The correct answer is 8.

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Check Out: Equilibrium Important Questions

10. **Answer: c**

Explanation:

The correct option is (C).

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- $COCl_2\ (g) \rightleftharpoons CO\ (g) + Cl_2\ (g)$

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.

- $CO_2\ (g) + C\ (s) \rightleftharpoons 2CO\ (g)$
- $CaCO_3\ (s) \rightleftharpoons CaO\ (s) + CO_2\ (g)$

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

Check Out: Equilibrium Important Questions