Q1 - 25 July - Shift 2

Ka_1, Ka_2 and Ka_3 are the respective ionization constants for the following reactions (a),(b), and (c).

(a) $H_2C_2O_4 \rightleftharpoons H^+ + HC_2O_4^-$

(b) $HC_2O_4^- \rightleftharpoons H^+ + HC_2O_4^{2-}$

(c) $H_2C_2O_4 \rightleftharpoons 2H^+ + C_2O_4^{2-}$

The relationship between K_{a_1}, K_{a_2} and K_{a_3} is given as

(A) $K_{a_3} = K_{a_1} + K_{a_2}$ (B) $K_{a_3} = K_{a_1} - K_{a_2}$

(C) $K_{a_3} = K_{a_1} / K_{a_2}$ (D) $K_{a_3} = K_{a_1} \times K_{a_2}$

Space for your notes:

Q2 - 26 July - Shift 1

At 298 K, the equilibrium constant is 2×10^{15} for the reaction :

$Cu(s) + 2Ag^+(aq) \rightleftharpoons Cu^{2+}(aq) + 2Ag(s)$

The equilibrium constant for the reaction

$\frac{1}{2}Cu^{2+}(aq) + Ag(s) \rightleftharpoons \frac{1}{2}Cu(s) + Ag^+(aq)$

is $x \times 10^{-8}$. The value of x is _____.
(Nearest Integer)

Space for your notes:

Q3 - 28 July - Shift 2

At 600K, 2 mol of NO are mixed with 1 mol of O_2.

$$2NO_{(g)} + O_2(g) \rightleftarrows 2NO_2(g)$$

The reaction occurring as above comes to equilibrium under a total pressure of 1 atom. Analysis of the system shows that 0.6 mol of oxygen are present at equilibrium. The equilibrium constant for the reaction is _____. (Nearest integer).

Space for your notes:

Answer Key

Q1 (D) **Q2** (2) **Q3** (2)

Q1 (D)

$$H_2C_2O_4 \rightleftharpoons H^+ + HC_2O_4^- \quad K_{a_1}$$

$$H_2C_2O_4^- \rightleftharpoons H^+ + C_2O_4^{2-} \quad K_{a_2}$$

$$H_2C_2O_4 \rightleftharpoons 2H^+ + C_2O_4^{2-} \quad K_{a_3} = K_{a_1} \times K_{a_2}$$

Q2 (2)

$$K'_{eq} = \frac{1}{\sqrt{K_{eq}}} = \frac{1}{\sqrt{2 \times 10^{15}}} = x \times 10^{-8}$$

$$\Rightarrow \frac{1}{\sqrt{20}} \times \frac{1}{10^7} = x \times 10^{-8}$$

$$\Rightarrow \frac{1}{\sqrt{20}} \times 10^{-7} = x \times 10^{-8}$$

$$\frac{10}{\sqrt{20}} = x$$

$$\Rightarrow x = \frac{\sqrt{10}}{\sqrt{2}} = \sqrt{5} = 2.236$$

$$\simeq 2.24$$

Q3 (2)

$$2NO + O_2 \rightarrow 2NO$$

2	1	-
2-2x	1-x	2x
1.2	0.6	0.8

$$K_p = \frac{\left(\frac{0.8}{2.6}\right)^2}{\left(\frac{1.2}{2.6}\right)^2\left(\frac{0.6}{2.6}\right)} = 1.925$$