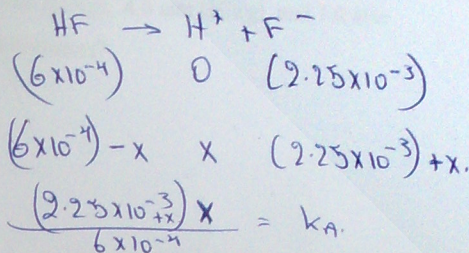


2] What is the pH of the solution prepared by mixing 25 mL of 0.024 M HF with 15 mL of 0.15 M NaF? $K_a(\text{HF}) = 1.5 \times 10^{-4}$

$$\frac{x^2 + (2.25 \times 10^{-3})x}{6 \times 10^{-4} - x}$$

$$4 \times 10^{-5}$$

- a) 4.39
- b) 7.00
- c) 7.39
- d) 4.03
- e) 2.97



2] Determine the pH of 0.15 M benzoic acid ($\text{C}_6\text{H}_5\text{COOH}$) $K_a(\text{benzoic acid}) = 7 \times 10^{-3}$

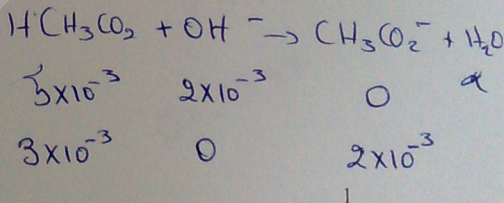
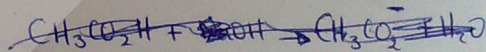
- a) 2.06
- b) 1.49
- c) 4.22
- d) 7.00
- e) 3.11

3] Calculate the pH at the halwaypoint for the titration of 100 mL of 0.1 M ethylamine ($\text{C}_2\text{H}_5\text{NH}_2$, $K_b = 4.2 \times 10^{-4}$) against 0.2 M nitric acid (HNO_3).

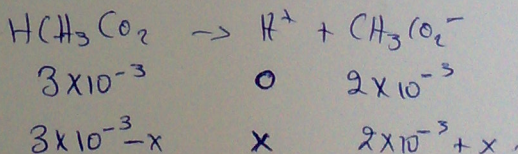
- a) 7.00
- b) 8.8
- c) 10.6
- d) 11.9
- e) 9.7

4] If 10 mL of 0.2 M NaOH is added to 20 mL of 0.25 M acetic acid ($\text{CH}_3\text{CO}_2\text{H}$, $K_a = 1.8 \times 10^{-5}$), what is the pH of the resultant solution?

- a) 4.56
- b) 5.34
- c) 3.22
- d) 11.67
- e) 6.12



$$\frac{(2 \times 10^{-3} + x)x}{(3 \times 10^{-3}) - x} = K_a$$



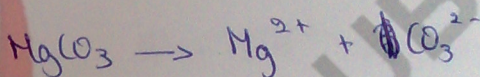
5] For the reaction: $2\text{Cl}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g}) \rightleftharpoons 4\text{HCl}(\text{g}) + \text{O}_2(\text{g})$ at 600°C

$K_p = 18.0$ atm. A system contains 2.0 atm $\text{Cl}_2(\text{g})$, 2.0 atm $\text{H}_2\text{O}(\text{g})$, 4.0 atm $\text{HCl}(\text{g})$, and 1.0 atm $\text{O}_2(\text{g})$ at 600°C . Which one of the following statements is correct?

- a) Net reaction will occur from left to right
- b) $K_c = K_p \cdot RT$
- c) Net reaction will occur from right to left
- d) No net forward or reverse reaction will occur

6] The solubility of magnesium carbonate (MgCO_3) in water at 20°C is 0.0089 mol/l, calculate K_{sp} for the salt.

- a) 4.1×10^{-4}
- b) 5.6×10^{-6}
- c) 7.9×10^{-5}
- d) 2.9×10^{-6}
- e) 7.8×10^{-9}



$$0.0089 \quad 0 \quad 0$$

$$0.0089$$

$$(0.0089)^2$$

$$K_{sp} =$$

7] What mass of NH_4Cl ($\text{MM} = 53.5$ g/mol) must be added to 0.5 L of 0.45 M NH_3 to prepare a buffer solution with pH of 10.55? Assume no variation of volume, $K_b(\text{NH}_3) = 1.4 \times 10^{-4}$

- a) 9.4 g
- b) 4.7 g
- c) 3.5 g
- d) 7.6 g
- e) 6.2 g

$$pK_a = 10.14, \quad K_a = 7.14 \times 10^{-11}$$

$$\text{pH} = \text{p}K_a + \log \frac{[\text{B}]}{[\text{A}]}$$

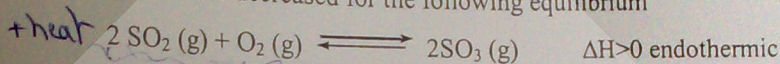
$$10.55 = 10.14 + \log \frac{0.225}{x}$$

$$0.225$$

$$2.51x = 0.02$$

$$0.008957$$

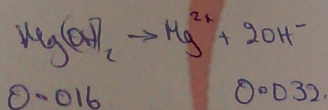
8] Imagine that the temperature is decreased for the following equilibrium



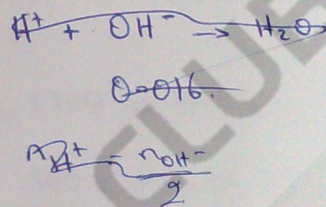
What effect would be expected

- a) no shift in the equilibrium occurs
- b) the equilibrium shifts to the right
- c) the equilibrium shifts to the left
- d) not enough information to answer

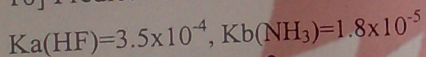
9] In a titration, 20 mL of HCl requires 32 mL of 0.5 M Mg(OH)₂ for complete neutralization. Calculate the molar concentration of acid.



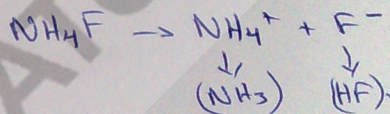
- a) 0.64 M
- b) 1.6 M
- c) 1.92 M
- d) 3.20 M
- e) 1.60 M



10] Predict whether an aqueous solution of NH₄F is



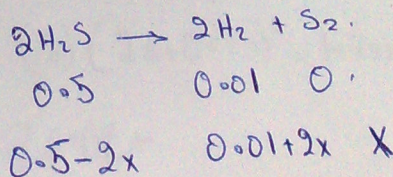
- a) acidic
- b) basic
- c) neutral
- d) not enough information to answer



11] $K_p = 3.1 \times 10^{-8}$ for $2\text{H}_2\text{S} (\text{g}) \rightleftharpoons 2\text{H}_2 (\text{g}) + \text{S}_2 (\text{g})$, what is the equilibrium partial pressure of S₂ if H₂S, initially at 0.5 atm and H₂, initially at 0.01 atm, are allowed to come to equilibrium?

$K_p = 3.1 \times 10^{-8}$

- a) 8.8×10^{-3}
- b) 1.3×10^{-3}
- c) 7.75×10^{-5}
- d) 3.1×10^{-6}
- e) 2.85×10^{-4}



$$\frac{x (0.01 + 2x)^2}{(0.5 - 2x)^2} = 3.1 \times 10^{-8}$$

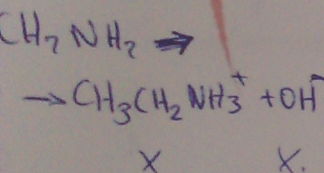
12] Consider the reaction : $\text{CH}_4(\text{g}) + 2 \text{O}_2(\text{g}) \rightleftharpoons \text{CO}_2(\text{g}) + 2 \text{H}_2\text{O}(\text{l})$

Which of the following causes the equilibrium shown to shift to the reverse (left) direction?

- a) removal of CH_4
- b) removal of H_2O
- c) addition of CH_4
- d) decreasing the volume of the container
- e) none of these

13] The percent dissociation is 4.45% in a 1 M solution of ethylamine ($\text{CH}_3\text{CH}_2\text{NH}_2$), calculate K_b ?

- a) 7.4×10^{-4}
- b) 6.3×10^{-5}
- c) 2.1×10^{-3}
- d) 3.6×10^{-6}
- e) 5.7×10^{-4}



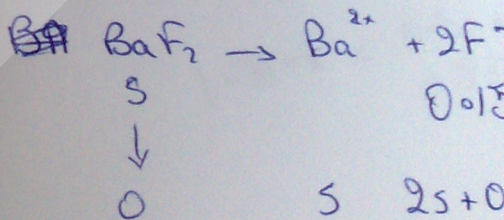
$$\frac{x}{1} \times 100 = 4.45$$

$$100x = 4.45$$

$$x = 0.0445 \text{ M}$$

14] What is the solubility of BaF_2 in 0.15 M NaF . $K_{sp}(\text{BaF}_2) = 1.7 \times 10^{-6}$

- a) 1.7×10^{-6}
- b) 2.7×10^{-5}
- c) 6.8×10^{-6}
- d) 1.3×10^{-3}
- e) 7.56×10^{-5}

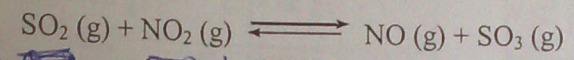


$$(s)(2s + 0.15)^2 = 1.7 \times 10^{-6}$$

$$s(4s^2 + \dots)$$

15] A reaction mixture was prepared by mixing 0.2 mol SO₂, 0.2 mol NO₂, 0.15 mol NO and 0.15 mol SO₃ in a 5 litre reaction vessel. At 260°C, K_p=0.25 for

533k V=5L



$K_p = 0.25$

~~0.15~~ ~~0.15~~ ~~1.31~~
~~0.15~~ ~~x~~ ~~0.15-x~~
~~1.31-x~~ ~~1.31-x~~

What is the equilibrium concentration of SO₂?

α.

- (a) [SO₂]=0.0466
- b) [SO₂]=0.0366
- (c) [SO₂]=0.233
- d) [SO₂]=0.175
- e) [SO₂]=0.2

$Q > K_p$
 \Rightarrow left.

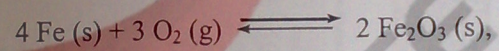
$R = \frac{nRT}{V}$

~~$n_T = 0.4 + 2x + 0.3 - 2x$~~

$\frac{(1.31-x)^2}{(1.75+x)^2} = 0.25$

Bonus:

Which equation correctly describes the relationship between K_p and K_c for the following reaction?



- a) K_p=K_c
- (b) K_p=K_c × (RT)⁻³
- c) K_p=K_c × (RT)⁻⁵
- d) K_p=K_c × (RT)³
- e) K_p=K_c × (RT)⁵

0 - (3)

$P = K_c (RT)^{\Delta n}$

$1.31-x = 0.5x + 0.87$

$1.05x =$

2.62

$\frac{(x-1.031)}{(x+1.075)} = 0.75$

$1.7161 - 2(1.031)(x) + x^2$

$= 0.25$

$2.0675 + 2(1.075)(x) + x^2$

$0.75x + 0.4375 = x$

Multiple choice Questions. Choose One Answer

	a	b	c	d	e
1	X				
2		X			
3			X		
4	X			X	
5	X				
6			X		
7		X		X	
8			X		
9		X		X	
10	X				
11			X		
12	X				
13			X		
14					X
15	X				
16		X			



THE DEBATE CLUB

Handwritten red marks resembling a series of vertical lines or a stylized signature on the right side of the page.