

1) Which of the following solutions is a buffer?

- ① 50 mL of 0.1 M acetic acid mixed with 25 mL of 0.05 M NaOH
2. 100 mL of 0.1 M acetic acid mixed with 25 mL of 0.5 M NaOH
- ③ 50 mL of 0.1 M acetic acid mixed with 25 mL of 0.05 M sodium acetate
4. 50 mL of 0.1 M acetic acid mixed with 25 mL of 0.2 M HCl
5. 50 mL of 0.1 M sodium acetate mixed with 25 mL of 0.05 M NaOH

- a. 1 and 3
- b. 3 only
- c. 1, 2 and 5
- d. 3, 4 and 5
- e. 2, 4 and 5

a

2) A 10.00 mL sample of a weak acid is titrated with 0.0500 M NaOH. The volume of NaOH required to reach the phenolphthalein endpoint was 23.64 mL. The pH after the addition of 11.82 mL of NaOH was 5.25.

a) What is the concentration of the weak acid?

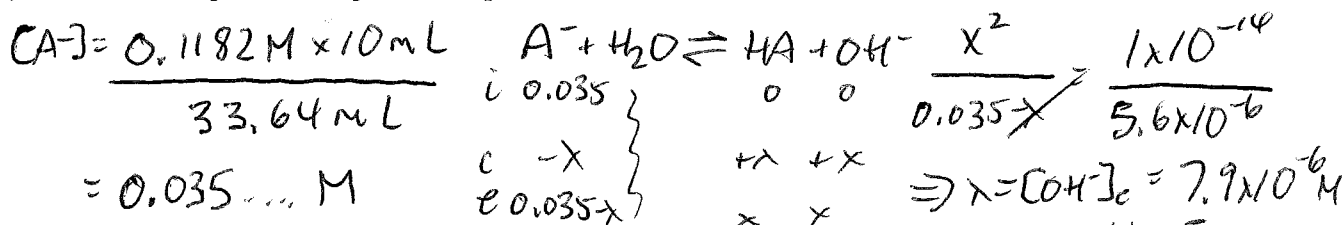
$$\frac{23.64 \text{ mL} \times 0.05 \text{ moles}}{10 \text{ mL}} = 0.1182 \text{ M}$$

b) What is the K_a of the weak acid?

$pK_a = 5.25$ (11.82 mL is the $\frac{1}{2}$ -equiv. point)

$$K_a = 5.6 \times 10^{-6}$$

c) Determine the pH at the equivalence point.



$pOH = 5.10$

d) Determine the pH if an additional 5.00 mL of NaOH is added past the endpoint.

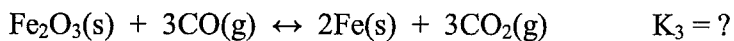
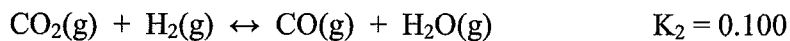
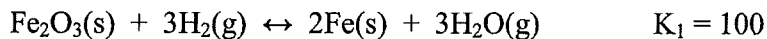
$$[OH^-]_e = \frac{0.05 \text{ M} \times 5}{38.64} = 6.47 \times 10^{-3} \text{ M}$$

$$pH = 8.90$$

turn over.....

$pOH = 2.19$, $pH = 11.81$

3) Consider the following equilibrium reactions and corresponding K_p values:



a) Determine the value for K_3

$$K_3 = K_1 \times \left(\frac{1}{K_2}\right)^3 = \boxed{1 \times 10^5}$$

b) Given 5 moles of CO_2 , 4 moles of H_2 , 3 moles of CO , 2 moles of H_2O , 3 moles of Fe_2O_3 and 2 moles of Fe , determine if the second reaction is at equilibrium, if not which direction will it proceed in?

$$Q = \frac{3 \times 2}{5 \times 4} = \frac{6}{20} = 0.3 \text{ Not at equilibrium}$$

Q too big, rxn \leftarrow

c) The first reaction is known to be endothermic, describe the effects of increasing temperature on the reaction and the K value.

Heat will drive the rxn \rightarrow , thus increasing the K value.