

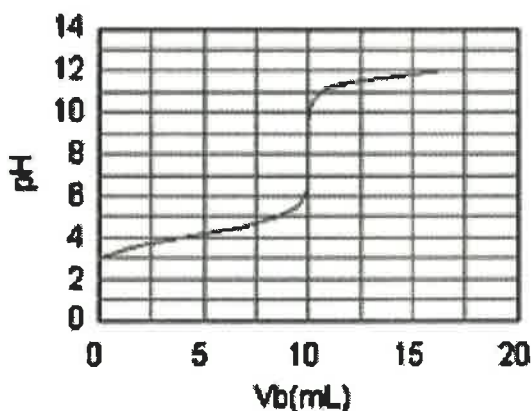
CHEM106 Problem Set 1

Name: Key

Date Due: Wednesday, September 11, 2019

Answer the following questions. Each problem must be answered completely with all work shown and your answer boxed. Record your final answer on this sheet and staple your work to the sheet. Failure to comply with these rules will result in no credit being given for the problem. You may work in groups, but remember: You must be able to answer these problems on your own on a test, so don't just turn something in that the group has worked out.

1) This question has 4 parts. The curve for the titration of 50.0 mL of 0.0200 M $C_6H_5COOH(aq)$ with 0.100 M $NaOH(aq)$ is given below.



What is the pH of the solution at: i) the equivalence point?, ii) 25% of the way to the equivalence point, iii) 50% of the way to the equivalence point, iv) 75% of the way to the equivalence point

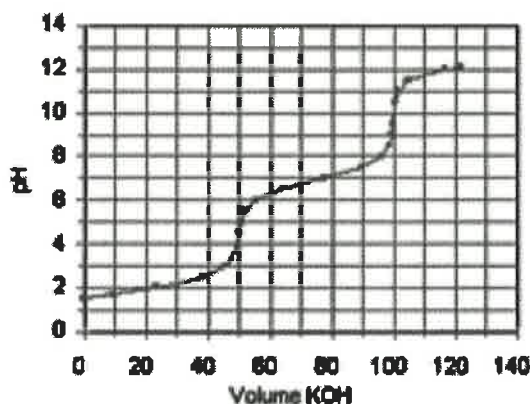
$EP = 10 \text{ mL} = 8$
 $25\% = 2.5 \text{ mL} = 3.8$
 $50\% = 5 \text{ mL} = 4.2$
 $75\% = 7.5 \text{ mL} = 4.8$

2) For the titration of 50.0 mL of 0.020 M aqueous salicylic acid with 0.020 M $KOH(aq)$, calculate the pH after the addition of 25.0 mL of $KOH(aq)$. For salicylic acid, $pK_a = 2.97$.

We have added $\frac{1}{2}$ of the number of moles of salicylic acid, so $pH = pK_a$ because $[HA] = [A^-]$

$pH = 2.97$

3) The titration curve for the titration of 0.100 M $\text{H}_2\text{SO}_3(\text{aq})$ with 0.100 M $\text{KOH}(\text{aq})$ is given below.



$pK_{a1} = 2$
 $pK_{a2} = 6.5$

Estimate pK_{a1} and pK_{a2} of H_2SO_3 .

4) This question has 5 parts.

a) If the interaction between two species is proportional to $1/r^2$, which of the following is likely involved?

- A) chloromethane molecules in the liquid phase
- B) Na^+ and H_2O in solution
- C) bromine molecules in the liquid phase
- D) Na^+ and Cl^- ions in the gas phase
- E) ions in an ionic solid

Ion-Dipole

b) If the interaction between two species is proportional to $1/r^3$, which of the following is likely involved?

- A) chloromethane molecules in the liquid phase
- B) ions in an ionic solid
- C) bromine molecules in the liquid phase
- D) chloromethane molecules in the solid phase
- E) Na^+ and H_2O

Dipole-Dipole

c) If the interaction between two species is proportional to $1/r^6$, which of the following is likely involved?

- A) H_2O interacting with the hydroxyl group of methanol
- B) Lipid molecules in a cell membrane
- C) Li^+ and H_2O
- D) Na^+ and H_2O
- E) ions in an ionic solid

Ind. Dipole-Ind Dipole
 or

LDF

d) Which of the following has the highest boiling point?

- A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$
- B) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{I}$
- C) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
- D) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{F}$
- E) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$

Most polar = Highest BP.

e) Which of the following is the strongest intermolecular force between molecules?

- A) dipole-dipole
- B) hydrogen bonding
- C) dipole-induced dipole
- D) London
- E) ion-dipole

Hydrogen bonding is most correct, but I told you that Hydrogen bonding is just a special case of Dipole-Dipole. So ion-dipole is also correct. I guess