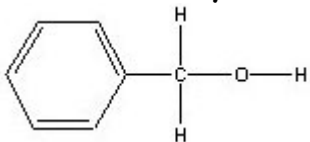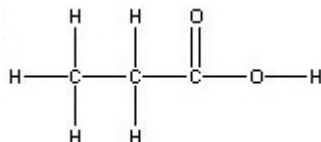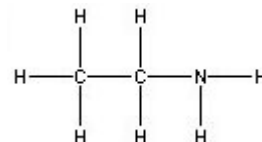**Question 1**
5 Points

Classify each of the following structural formulae as a(n) **amine**, **ketone**, **carboxylic acid**, **alcohol** or **aldehyde**.
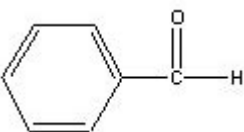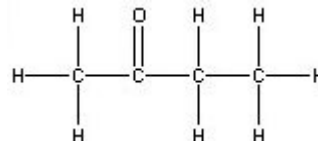

Alcohol   **Carboxylic acid**   **Amine**

Aldehyde   **Ketone**

Question 2
6 Points

Match the **compound** on the right with the **functional group** classification on the left.

1. alcohol   **6** $CH_3OCH_2CH_3$ 4. aldehyde   **1** $C_6H_5CH_2OH$

2. carboxylic acid   **3** $CH_3CH_2NH_2$ 5. ketone   **2** CH_3CH_2COOH

3. amine   **4** CH_3CHO 6. ether   **5** $CH_3COCH_2CH_3$

Question 3
16 Points

What is the **electron-pair** geometry of **NOCl**? **Trigonal planar**

There are **1** lone pair(s) around the central atom, so the geometry of

NOCl is **Angular/Bent**. The bond angle about the central **nitrogen** atom is **120**.

What is the **electron-pair** geometry of **H₂S**? **Tetrahedron**

There are **2** lone pair(s) around the central atom, so the geometry of

H₂S is Angular/Bent. The bond angle about the central **sulfur** atom is **109**.

Question 4
10 Points

The molecular geometry for the following five molecules is given below. Label these molecules as either **Polar** or **Non Polar**.

1. CF_4 Tetrahedron   **Non Polar**

2. CH_2Cl_2 Tetrahedron   **Polar**

3. H_2CO Trigonal Planar   **Polar**

4. N_2 Linear   **Non Polar**

5. HCN   Linear   **Polar**

Question 5
12 Points

Classify each of the following substances:

3	$Ba(OH)_2$	1.	strong acid
1	$HClO_4$	2.	weak acid
4	NH_3	3.	strong base
5	$NaNO_3$	4.	weak base
2	HNO_2	5.	salt: soluble
6	$Co_3(PO_4)_2$	6.	salt: not soluble

Question 6
6 Points

The formula for the **conjugate base** of **HBr** is **Br^-**.

The formula for the **conjugate base** of **NH_4^+** is **NH_3**.

Question 7
8 Points

The $[H^+]$ in an aqueous solution is **8.46×10^{-2} M.**

1. The pH of this solution is: **1.07**

2. The $[OH^-]$ in the solution is: **1.18×10^{-13}**

3. The pOH is: **12.93**

4. The solution is: (acidic/basic/neutral) **Acidic**

Question 8
5 Points

Determine the pH of an aqueous solution of **0.468 M hypochlorous acid**, **HClO** (aq), $K_a = 3.5 \times 10^{-8}$.

$$Ka[Acid] = 3.5 \times 10^{-8}(0.468) = 1.64 \times 10^{-8}$$
$$[H_3O^+] = (1.64 \times 10^{-8})^{\frac{1}{2}} = 1.28 \times 10^{-4}$$

$$pH = -\log_{10}[H_3O^+] = -\log_{10}(1.28 \times 10^{-4}) = 3.89$$

pH: **3.89**

Question 9
10 Points

A 1.00 liter buffer solution contains **0.41 M hydrofluoric acid** and **0.53 M potassium fluoride**.
If **0.27 moles** of **sodium hydroxide** are added to this system,
indicate whether the following will, **increase**, **decrease** or **not change**.
(Assume that the volume does not change upon the addition of **sodium hydroxide**.)

1. The number of moles of **HF** will: **Decrease**

2. The number of moles of **F^-** will: **Increase**

3. The equilibrium concentration of H_3O^+ will: **Decrease**

4. The pH will: **Increase**

5. The ratio of $[HF] / [F^-]$ will: **Decrease**

Question 10
7 Points

Sulfur dioxide reacts with **oxygen gas** to produce **sulfur trioxide**.

How many moles of **oxygen gas** are necessary to form **50.4g** of **sulfur trioxide**?

$$2SO_2 + O_2 = 2SO_3$$

$$\frac{50.4g\ SO_3 \quad | \quad 1\ mol\ SO_3}{\qquad\qquad |\ 80.07\ g\ SO_3} = 0.629\ mol\ SO_3$$

$$\frac{0.625\ mol\ SO_3 \quad | \quad 1\ O_2}{\qquad\qquad |\ 2\ SO_3} = 0.315\ mol\ O_2$$
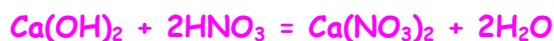
0.315 mol

Question 11
9 Points

Calcium hydroxide reacts with **nitric acid** to produce **calcium nitrate** and **water**.

An aqueous solution of **calcium hydroxide** is standardized by titration with a **0.204 M** solution of **nitric acid**.

If **16.2** mL of base are required to neutralize **12.6** mL of the acid, what is the molarity of the **calcium hydroxide** solution?

$$Ca(OH)_2 + 2HNO_3 = Ca(NO_3)_2 + 2H_2O$$

$$0.204 \times 0.0126 = 2.57\times10^{-3}\ mol\ HNO_3$$

$$\frac{2.57\times10^{-3}\ mol\ HNO_3 \quad | \quad 1\ Ca(OH)_2}{\qquad\qquad |\ 2\ HNO_3} = 1.29\times10^{-3}\ mol\ Ca(OH)_2$$

$$M = 1.29\times10^{-3}/0.0162 = 0.0793$$

0.0793M

Question 12
6 Points
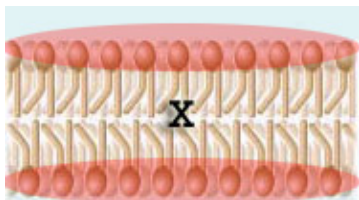
1. A membrane with a hydrophilic head group is depicted on the left; circle the **polar ends** of the membrane.

2. From the list below circle the molecule(s) that might be

   X: H_2O **CH₄** CH_2F_2 **BF₃**