CHEM1611 Problem Sheet 5 (Week 6)

Work through the ChemCAL modules "*Acids and Bases*", "*Organic Functional Groups*" and "*Alkanes - Structure and Nomenclature*".

1. Calculate the pH of the following.

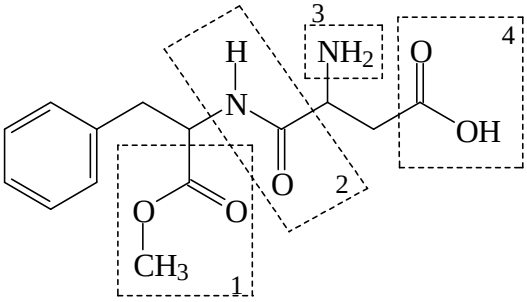
   (a) 0.012 M hydrochloric acid
   (b) 0.005 M sodium hydroxide
   (c) A solution made by dissolving 10.0 g of NaOH in 500 mL of water
   (d) A solution made by diluting 20 mL of 10 M nitric acid to 1.0 L
   (e) A solution made by mixing 30 mL of 2.0 M H_2SO_4 with 70 mL of 1.0 M KOH

2. Complete the following table.

acid	K_a of acid	pK_a of acid	conjugate base	K_b of base	pK_b of base
HNO_2	$10^{-3.15}$				
HCN		9.21			
NH_4^+					4.76
	$10^{-4.76}$		$CH_3CO_2^-$		
			CO_3^{2-}	$10^{-3.67}$	
HF				$10^{-10.83}$	
HPO_4^{2-}		12.38			
H_2O		15.74			
		–1.74	H_2O		
	10^{-34}		NH_2^-		

3. The ionic product of water, K_w, varies with temperature and has a value of approximately 2.49×10^{-14} M^2 at 37 °C. What is the pH of neutral water at blood temperature (37 °C)?

4. Aspartame is a non-nutritive sweetener. Determine its molecular formula and list the functional groups.

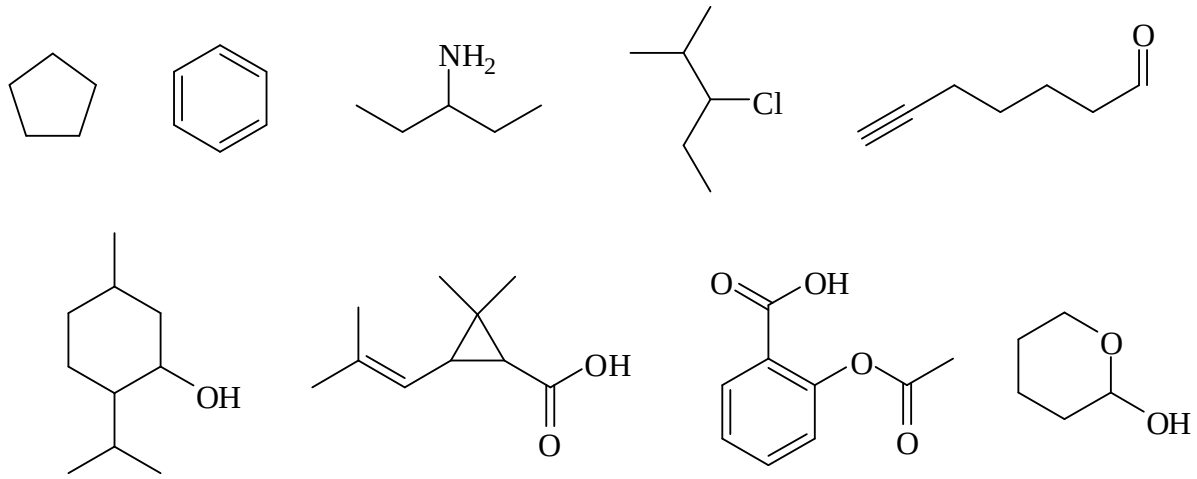


Molecular Formula: .....

Functional Groups:

1. .....
2. .....
3. .....
4. .....

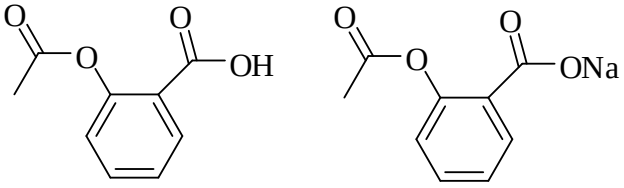
5. Determine the molecular formulas and identify the functional group(s) in the following compounds:



6. Given that a single hydrogen bond between HF molecules is stronger than a single hydrogen bond between H_2O molecules, explain why the boiling point of water is so high compared to the other hydrides.

Boiling Point °C		
NH_3: -33	H_2O: 100	HF: 20
PH_3: -88	H_2S: -60	HCl: -85

7. Aspirin, acetylsalicylic acid, is almost insoluble in water and taken (by humans) in pill form. (Note that it is very toxic to cats.) Aspro Clear is water soluble and taken after dissolving it in water. What is the link between chemical structure and solubility in this case?



Aspirin Aspro Clear