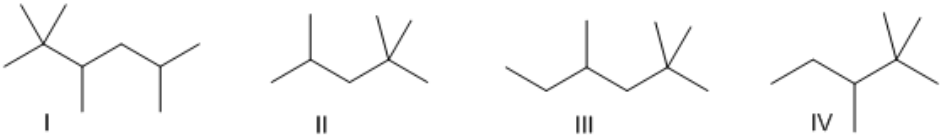
Preparatory chemistry course, Practical worksheets,

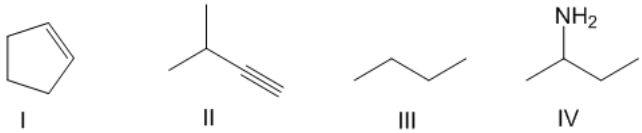
Chemical structure, nomenclature, acids and bases

1. Which of the following is the correct bond-line structure for $(CH_3)_2CHCH_2C(CH_3)_3$?:

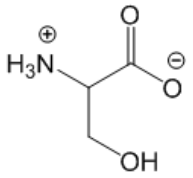


2. Which of the following is the correct bond-line structure for $CH_3C{\equiv}C(CH_2)_2CH(CH_3)_2$?

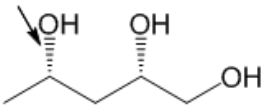
3. Which of the following compounds contains an alkene functional group?



4. Draw all lone pairs of electrons for the following compound:



5. The indicated bond in the following compound is_____ of the paper.



   a. In the plane
   b. Out of the plane
   c. Behind the plane
   d. None of these

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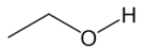
6. The pH scale measures how acidic or basic a substance is. Please determine the pH of a 0.001 mol/l HCl and a 0.1 mol/l NaOH solution.

7. A solution has a pH of 10.6. Determine its proton concentration.

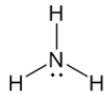
8. Determine the pH of a 500 ml solution of 0.005 mole HCl.

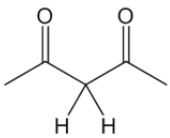
9. How many grams of NaOH do you need to make up 200 ml of a 20 mmol/l solution of NaOH in water? Determine the pH of this solution.

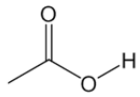
10. Use the pK_a table below to rank the following compounds in order of decreasing acidity.

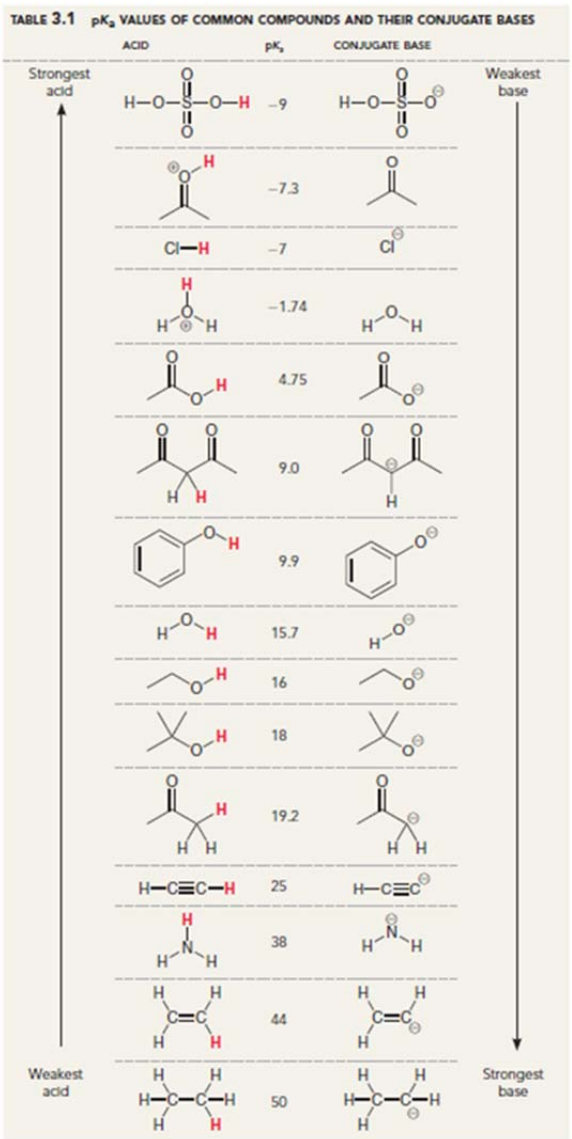
a. 

b. 

c. 

d. 

e. 



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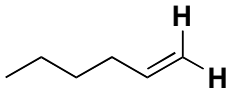
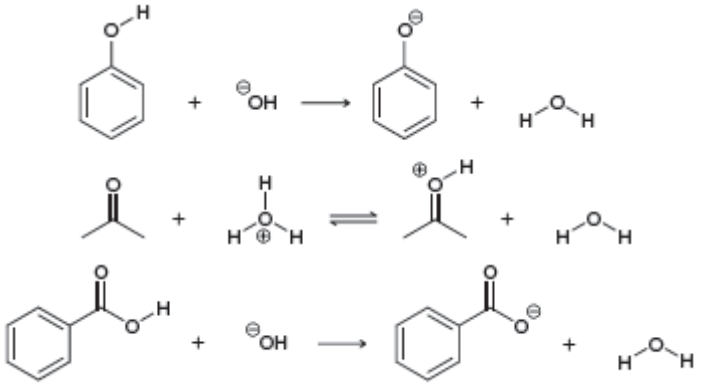
11. Using the pK_a table what is the strongest base?
    a. H_2O
    b. Br^-
    c. NH_3
    d. OH^-
    e. $CH_3CH_2^-$

12. The equilibrium constant K_a for an acid in an aqueous medium is 1×10^5. What can you say about this material? Is it a strong or weak acid? Is it a strong or weak base?

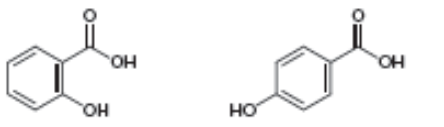
13. Using the pK_a table which base below is needed to deprotonate the following structure?
    a. $CH_3CH_2^-$
    b. F^-
    c. NH_2^-
    d. OH^-
    e. $C_6H_5O^-$



14. For each of the following acid-base reactions, draw a mechanism and then clearly label the acid, base, conjugate acid, and conjugate base.



15. Consider the pk_a values of the following constitutional isomers. Salicylic acid is more acidic than its constitutional isomer. Try to explain why.



Salicylic acid
$pK_a = 3.0$

para-Hydroxybenzoic acid
$pK_a = 4.6$

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16. What is a Lewis acid? Which of the following structures are Lewis acids?
    a. BF_3
    b. H_2O
    c. NH_3
    d. $AlCl_3$

17. Identify the Lewis acid and the Lewis base in the reaction between BH_3 and tetrahydrofurane (THF):