

1.16: ADDITIONAL EXERCISES

BOND FORMATION: THE OCTET RULE

1-1 Identify the number of valence electrons for each of the following elements. Then, identify the maximum number of covalent bonds it can form with other atoms while keeping a neutral net charge.

- a) Oxygen
- b) Carbon
- c) Chlorine
- d) Sulfur
- e) Hydrogen
- f) Boron

1-2 Which of the following atoms can bond with Br - to satisfy the octet rule?

- a) Mg^{+2}
- b) O^{-2}
- c) Cl^-
- d) K^+

1-3 Draw the Lewis dot structure of the correct answer from the previous problem **1-2 (a) - (d)**.

1-4 Identify which of the following compounds could not form due to an unfilled octet.

- a) NCl_3
- b) NaOH
- c) PCl
- d) CF_4

LEWIS STRUCTURES

1-5 Draw the Lewis structures for the following compounds.

- a) H_2O
- b) O_3
- c) BH_3
- d) SOCl_2

1-6 Name the element that corresponds to each electronic configuration and identify how many valence electrons it has.

- a) $1s^2 2s^2 2p^6$
- b) $1s^2 2s^2 2p^6 3s^2$
- c) $1s^2 2s^2 2p^4$
- d) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$

1-7 Draw the Lewis structures for PF_3 and PF_5 .

1-8 Draw the Lewis structure for furan.

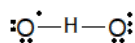


1-9 Identify the correct Lewis structure for hydroperoxyl, HO_2 .

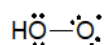
(a)



(b)



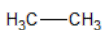
(c)



ELECTRONEGATIVITY AND BOND POLARITY

1-10 For the indicated bond in each of the following compounds, identify which atom is more electronegative, if applicable.

(a)



(b)



(c)



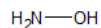
(d)



(e)



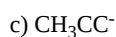
(f)



1-11 For each of the compounds in the previous problem, add a dipole moment arrow.

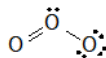
FORMAL CHARGES

1-12 For the following compounds, draw the structural formula. Then calculate the formal charge on each atom other than hydrogen.

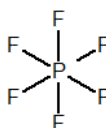


1-13 Identify the formal charge for the following compounds.

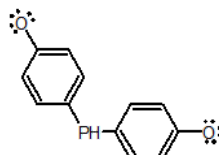
(a)



(b)



(c)



1-14 Identify the formal charges for the central carbon in each of the following compounds.

(a)



(b)



(c)



(d)

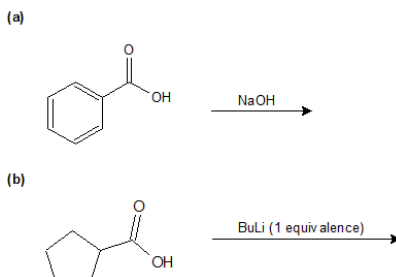


IONIC STRUCTURES

1-15 Identify the substituent ions that make up the following salts.

- NaCl
- MgBr₂
- KNO₃
- NaH₂PO₄

1-16 Identify the products of the following reactions.

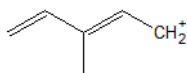


1-17 Give the correct nomenclature or write the correct chemical formula for the following ionic compounds.

- NaCN
- calcium oxalate
- Al(OH)₃
- tin (II) phosphate
- potassium hypochlorite

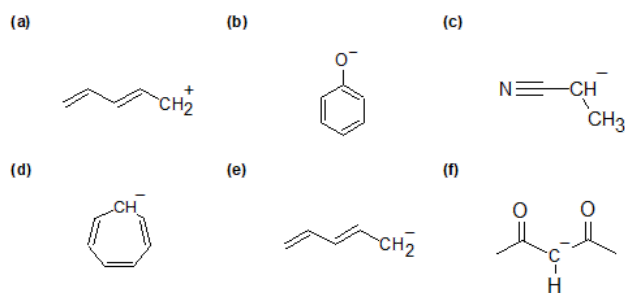
RESONANCE

1-18 For the following structure, draw its resonance structure(s).



1-19 Which resonance form from the previous problem has the most stable carbocation? Explain your answer.

1-20 Draw the important resonance forms to show the delocalization of charges in the following compounds.

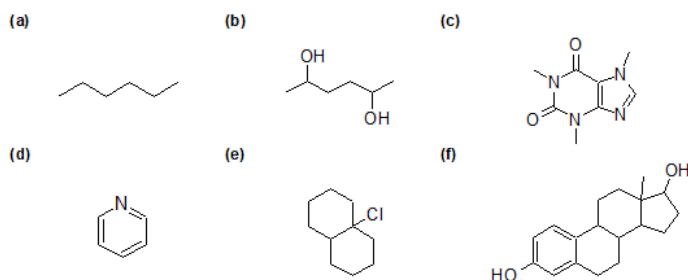


1-21 Explain how resonance contributes to the lower pK_a of acetic acid CH₃CO₂H (pK_a= 4.75) compared to the pK_a of ethanol CH₃CH₂OH (pK_a=15.9).

1-22 Draw the resonance structure(s) for fulminic acid (HCNO).

STRUCTURAL, MOLECULAR AND EMPIRICAL FORMULAS

1-23 Identify the molecular and empirical formula for the following structures.



1-24 Draw all possible structural formulas for the following compounds.

- a) C_4H_{10}
- b) CHN
- c) C_4H_9Cl

1-25 True or False: You can always calculate the exact molecular weight of a molecule from its empirical formula.

1-26 For the following molecular formulas, provide the empirical formula.

- a) $C_4H_4O_2$
- b) $C_8H_6N_2$
- c) $C_9H_{21}N_3O_3$

ACIDS AND BASES - ARRHENIUS, BRONSTED-LOWRY, AND LEWIS

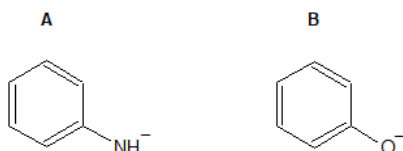
1-27 Briefly explain the three different definitions of acids and bases.

1-28 Calculate the K_a of nitric acid (HNO_3). pK_a of nitric acid is -1.4.

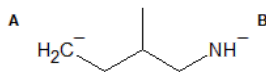
1-29 Rank the following in order of decreasing acidity: NH_4^+ HF H_3O^+ H_2O

1-30 Rank the following in order of decreasing basicity: HSO_4^- H_2O CH_3COO^- NH_2^-

1-31 Identify which compound is the stronger base. Identify which compound is the stronger acid.



1.32 Identify which group is more likely to grab a H^+ .



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