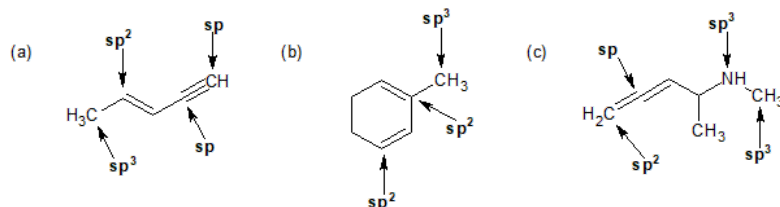


## 2.15: SOLUTIONS TO ADDITIONAL EXERCISES

### HYBRIDIZATION

2-1



2-2

Longest to shortest bond length:  $b > a > c$

Strongest to weakest bond:  $c > a > b$

2-3

Sigma bonds: 7

Pi bonds: 0

2-4

Sigma bonds: 5

Pi bonds: 1

2-5

Sigma bonds: 3

Pi bonds: 2

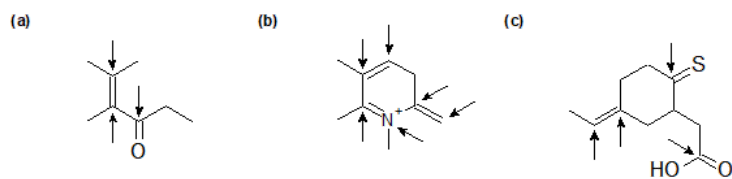
### HYBRIDIZATION, ELECTRON GEOMETRY, AND MOLECULAR SHAPE

2-6 Correct answer is (b)  $sp^3$ , tetrahedral.

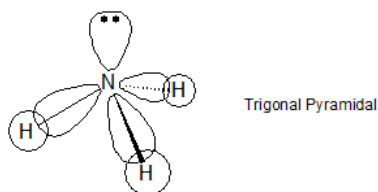
2-7

- a) Tetrahedral
- b) Trigonal bipyramidal
- c) Tetrahedral
- d) Trigonal planar

2-8



2-9



2-10 Boron has trigonal planar geometry. The hydrogen atoms are at a  $120^\circ$  angle from each other to be as far apart as possible.

## BOND ROTATION

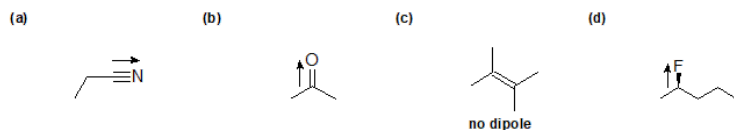
**2-11** This molecule can rotate freely around the middle bond as there are no major steric hindrance interactions.

**2-12** This molecule cannot rotate freely around the middle bond as the large bromine substituents attached at the ortho positions of the benzene rings experience significant steric hindrance with each other.

**2-13** No; the pi-bond prevents free rotation about the C=C bond.

## POLARITY OF BONDS AND MOLECULES

**2-14**



**2-15**

- a) 2
- b) No dipole moment
- c) 1

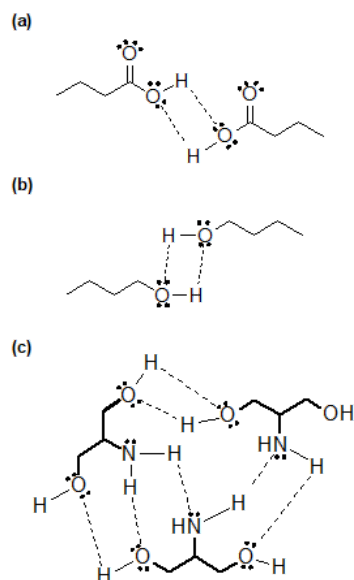
**2-16** True

## INTERMOLECULAR FORCES (IMFS)

**2-17**

- a) Cannot H-bond
- b) Can H-bond
- c) Can H-bond
- d) Can H-bond
- e) Cannot H-bond
- f) Cannot H-bond

**2-18**



**2-19**

- a) London Dispersion Forces
- b) Dipole-Dipole Interactions
- c) Ionic Forces
- d) Hydrogen bonding

## IMFS AND SOLUBILITY

2-20

- a) Not miscible
- b) Miscible
- c) Not miscible
- d) Soluble
- e) Not soluble
- f) Soluble

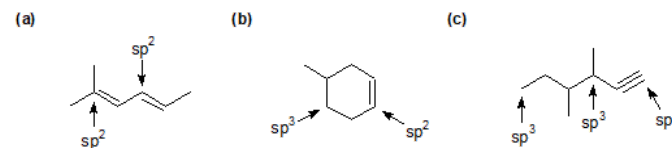
2-21 Caffeine will dissolve in dichloromethane (DCM) significantly more than in hexanes as DCM is a more polar solvent and caffeine is a polar molecule (like dissolves like).

## HYDROCARBONS AND AN INTRODUCTION TO ISOMERISM

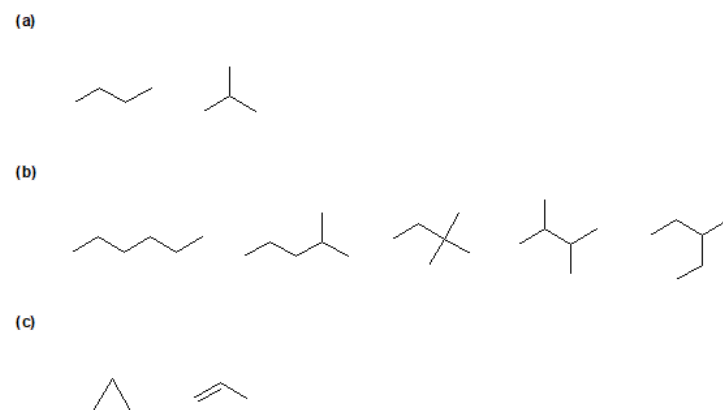
2-22

- a) Alkene
- b) Alkane
- c) Alkyne
- d) Alkane
- e) Alkene
- f) Alkene

2-23



2-24



2-25 It does not have cis/trans configuration, as the triple bond in the compound  $(\text{CH}_3)_2\text{CHC}\equiv\text{CCH}_3$  holds the four carbons in a straight line due to the  $sp$  hybridization of the middle two carbons (which have a linear geometric configuration).

## ORGANIC COMPOUNDS WITH OXYGEN

2-26

- a) Ether
- b) Ketone
- c) Carboxylic acid
- d) Alcohol and Amine
- e) Amide
- f) Ether and Alkene

2-27

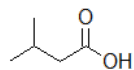
- a) Alcohol and Amine (We will learn that the most correct classification for hydroxyl groups bonded to benzene rings is phenol)
- b) Alcohol, Ether, Ketone, Amine and Alkene
- c) Ester, Ether, Amine and Alkene

2-28

- a) Aldehyde and carboxylic acid
- b) Alcohol, Ketone, Amine
- c) Alcohol, Ketone, Carboxylic acid

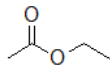
2-29

(a)



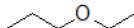
- carboxylic acid

(b)



- ester

(c)



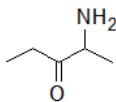
- ether

## ORGANIC COMPOUNDS WITH NITROGEN

2-30 Compound B has a slight dipole moment due to the cis configuration of the amine groups. Since it has a dipole moment, it experiences dipole-dipole interactions in addition to hydrogen bonding, thus increasing its boiling point.

2-31

(a)



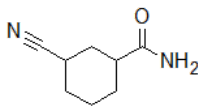
- ketone  
- amine

(b)



- nitrile

(c)



- amide  
- nitrile

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