

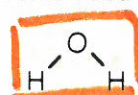
# Assignment #2

## POLAR AND NONPOLAR SOLVENTS

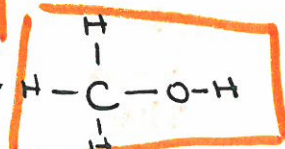
Key

Some of the more common solvents used in chemistry are listed below.

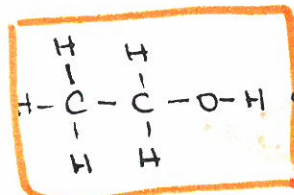
water (H<sub>2</sub>O) =



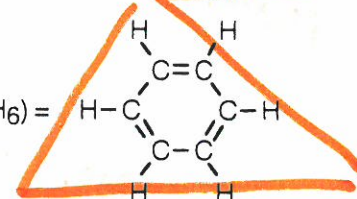
methanol (CH<sub>3</sub>OH)



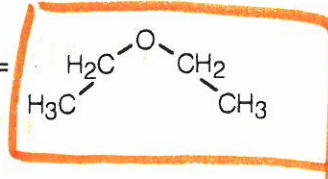
ethanol (CH<sub>3</sub>CH<sub>2</sub>OH)



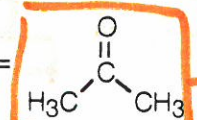
benzene (C<sub>6</sub>H<sub>6</sub>) =



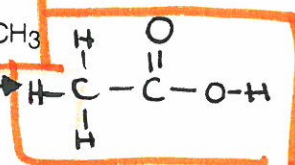
ethoxyethane (also known as diethyl ether or "hospital ether") =



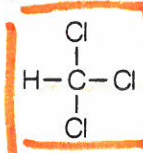
acetone (CH<sub>3</sub>COCH<sub>3</sub>) =



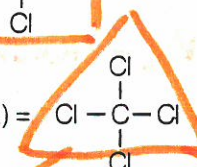
acetic acid (CH<sub>3</sub>COOH)



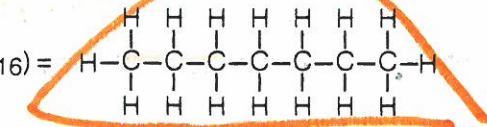
chloroform (CHCl<sub>3</sub>) =



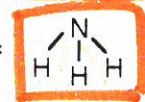
carbon tetrachloride (CCl<sub>4</sub>) =



heptane (C<sub>7</sub>H<sub>16</sub>) =



liquid ammonia (NH<sub>3</sub>) =



□ polar  
△ -non polar

### EXERCISE:

Classify each of the above solvents as either polar or nonpolar.

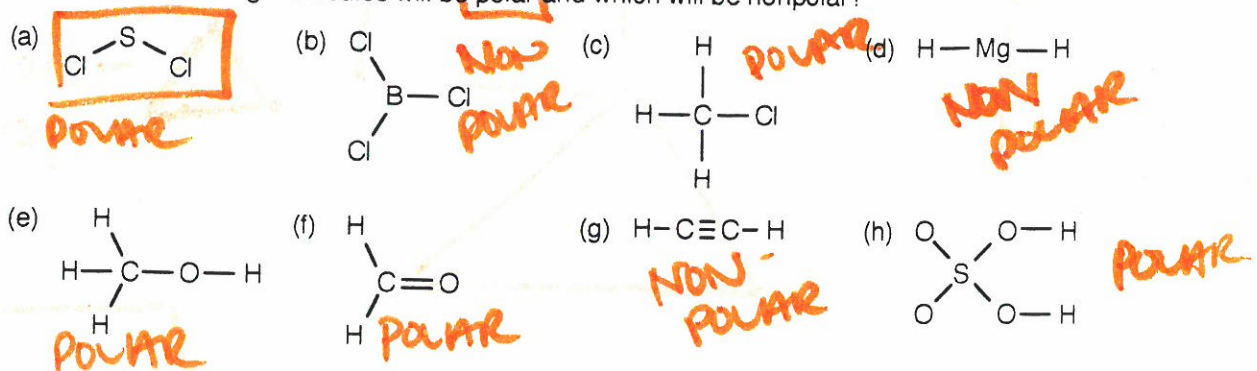
8.	Solvent	Polar or nonpolar?	Solvent	Polar or nonpolar?	Solvent	Polar or nonpolar?
	water	POLAR	ethoxyethane	POLAR	carbon tetrachloride	NON-POLAR
	methanol	POLAR	acetone	POLAR	heptane	NON-POLAR
	ethanol	POLAR	acetic acid	POLAR	liquid ammonia	POLAR
	benzene	NON-POLAR	chloroform	POLAR		

**EXERCISE:**

9. Which of the following are expected to be polar and which are expected to be nonpolar?

- (a) H-H (N-P) (b) H-O (P) (c) O-Cl (P) (d) Cl-Cl (N-P)

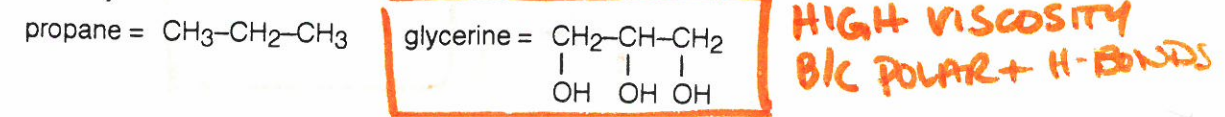
10. Which of the following molecules will be polar and which will be nonpolar?



14. Which of the following substances would you expect to involve hydrogen bonds?

- (a) CH<sub>4</sub> (b) HCl (c) H<sub>2</sub>O (d) H<sub>2</sub>S (e) CH<sub>3</sub>-NH<sub>2</sub> (f) CH<sub>3</sub>-SH (g) CH<sub>3</sub>-CH<sub>2</sub>-OH (h) HF

15. Suggest a reason why liquid propane has a very low viscosity, whereas liquid glycerine has a very high viscosity.



18. Bromine, Br<sub>2</sub>, is highly soluble in hexane (C<sub>6</sub>H<sub>14</sub> = CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub>) but only slightly soluble in water. Why might this situation occur?  
 19. What advantage might a molecule have as a solvent if it had a long nonpolar carbon chain ending with an ionic group, such as CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>COO<sup>-</sup>Na<sup>+</sup>?  
 20. Why can't a nonpolar solvent dissolve an ionic compound?  
 21. Why is the polar solvent water able to dissolve small amounts of nonpolar liquid pentane, C<sub>5</sub>H<sub>12</sub>(l)?  
 22. You have water, methanol (CH<sub>3</sub>OH) and ethanol (CH<sub>3</sub>CH<sub>2</sub>OH) available to act as solvents. Which of these three solvents do you expect to dissolve the greatest amount of each of the following?

- (a) KCl (b) CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>Br (c) octane (CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub>)

**SUMMARY EXERCISES:**

23. Classify each of the following with respect to the most important type(s) of bonding or force(s) existing between the particles.

- (a) 2 molecules of O<sub>2</sub> in O<sub>2</sub>(s) → LF (g) 2 molecules of CH<sub>3</sub>F in CH<sub>3</sub>F(l) → H-bond  
 (b) 2 atoms of Xe in Xe(s) → LF (h) 2 molecules of CCl<sub>4</sub> (symmetric) in CCl<sub>4</sub>(l) → LF  
 (c) 2 molecules of BrCl in BrCl(l) → dipole (i) 2 molecules of NOCl in NOCl(s) → dipole  
 (d) 2 molecules of CH<sub>3</sub>CH<sub>2</sub>NH<sub>2</sub> in CH<sub>3</sub>CH<sub>2</sub>NH<sub>2</sub>(l) → H (j) F and Cs in CsF(s) → ionic  
 (e) an atom of C and an atom of Cl in CCl<sub>4</sub> → covalent (k) 2 molecules of NH<sub>2</sub>OH in NH<sub>2</sub>OH(l) → H-bond  
 (f) 2 molecules of BF<sub>3</sub> (symmetric) in BF<sub>3</sub>(l) → LF (l) atoms of He and Kr → LF

24. Which should melt at a higher temperature?

- (a) He or Xe (b) HBr or Kr (c) CH<sub>3</sub>-CH<sub>3</sub> or HO-CH<sub>2</sub>CH<sub>2</sub>-OH (d) F<sub>2</sub> or Br<sub>2</sub> (e) CH<sub>4</sub> or CCl<sub>4</sub> (f) H<sub>2</sub>O or H<sub>2</sub>Te (g) CH<sub>4</sub> or CH<sub>3</sub>F (h) HI or HCl

25. Octane, CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub>, should be a good solvent for which of the following?

- (a) I<sub>2</sub>(s) (b) NaCl(s) (c) H<sub>2</sub>O(l) (d) C<sub>10</sub>H<sub>8</sub>(s) (symmetric)