Unit 1 Day 1 Activity – "Thinking Like a Chemist" Name: Sanam Prasla
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A major goal for this class is for you to learn the concept of macro/micro thinking or "Thinking Like a Chemist". Thinking like a chemist is the ability to look at the macroscopic properties of a static substance or a substance undergoing a change and be able to simultaneously account for those properties on a microscopic (molecular) level. This activity will walk you through some of these concepts you likely mastered in CH301. You should work with a couple of neighbors. You will be stopped periodically and we will check in to make sure the entire class is making progress. Since this is student centered learning environment, the check in may take one of many forms: a group of students might be asked to approach the board and write their answers to selected questions on the board, an individual might be asked to give an explanation while still seated speaking into a microphone, we might ask a clicker question to poll the entire class or one of the instructors might provide a mini lecture. The experience will be most beneficial if you fully engage your brain and participate in this process. One or more platinum stars will be on the line.

1. Please state to the best of your ability a macroscopic description of the substances below the chemical names.

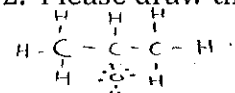
Iso-Propanol
- clear
- not viscous
- rubbing alcohol
- evaporating slow (stinkbere)

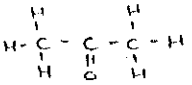
Acetone
- clear
- not viscous
- nailpolish remover
- evaporating faster

Given the condensed structural formulae, consider the microscopic properties.

$CH_3CHOHCH_3$ 8 + 12 + 6 CH_3COCH_3 6 + 12 + 6

2. Please draw the Lewis structure for each substance.





3. State the molecular geometry around each carbon.

tetrahedral
tetrahedral
tetrahedral

tetrahedral
trigonal planar
tetrahedral

4. State if each molecule is polar or nonpolar.

more polar (OH electroneg) polar

5. Explain your answers for the polarity question (4).

- assymetric - assymetric

6. What types of intermolecular forces (IMF) exist for each substance?

- dispersion
- hydrogen (OH)
- dipole-dipole

- induced dipole (disperson)
- London (van der waals)
- dipole dipole

7. Which substance do you think would have the higher boiling point?

iso-propanol ↑BP ↓VP

CHECK IN – IF CALLED ON BE PREPARED TO SHARE YOUR ANSWERS WITH THE REST OF THE CLASS

Now we are ready to look at the energy changes associated with a phase change. We will assume that both liquids are at room temperature (298K) and room pressure (1 atm).

Consider the process of the phase transition of going from a liquid to a gas (vaporization). Written generically as:

$$X(l) \longrightarrow X(g)$$

energy ↓

8. In general, which do you think would have the higher enthalpy, a substance in its liquid phase or the gas phase? gas phase, b/c has more energy

9. In general, what do you think the sign of the enthalpy of vaporization, $\Delta H°_{vaporization}$, is for the process? positive

10. Now comparing the two liquids in question, isopropanol and acetone, do you think that the enthalpy of vaporization, $\Delta H°_{vaporization}$, for isopropanol will be greater, less than or about the same as acetone? Why? greater; stronger IM forces (hydrogen bonding)

isopropanol has lower enthalpy in liquid so it was a GREATER CHANGE!

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11. In general, which do you think would have the higher entropy a substance in its liquid phase or the gas phase? gas; molec in gas are spread out.

12. In general, what do you think the sign of the entropy of vaporization, $\Delta S°_{vaporization}$, is for the process? positive

13. Now comparing the two liquids in question, isopronanol and acetone do you think that the entropy of vaporization, $\Delta S°_{vaporization}$, for isopropanol will be greater, less than or about the same as acetone? Why? same, b/c going from a liquid to gas is a big change in entropy

-both are liquids generating same amount of gas

CHECK IN – IF CALLED ON BE PREPARED TO SHARE YOUR ANSWERS WITH THE REST OF THE CLASS so change is same

14. What is the equation that relates the change in Gibb's free energy to changes in enthalpy and entropy? $\Delta G = \Delta H - T\Delta S$

15. What does the sign of change in free energy, $\Delta G°$, tell you about a physical change?

16. How could one affect the sign of change in free energy, $\Delta G°$?

17. What does it mean when $\Delta G° = 0$?

18. Thinking back to isopropanol and acetone, is there a temperature at which $\Delta G°_{vaporization} = 0$? If so, is it the same temperature for both substances or is one higher than the other?

lower Gibbs free energy : most stable (depends on temp)

↑temp, water turns into gas