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11.0.A Daily Outline

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Chem 444A, Fire & Ice, Day 11, Feb 26 cfb DAY OUTLINE

Purpose:

- Complete Socratic discussion
- Guided play with Odyssey program
- Challenge questions from way back
- If time, initiate heat transfer experiment

Board

Find your group

Make a stick-on name tag with first name.

Look in folder for: Recorder Reports with comments – review with group
Instructions for your initial task today.

DON'T FORGET TO CLAP

Materials

Name tags (4 per table)

Premade name cards (set on tables) – shuffle the table locations D B C
E A

White board markers

Returns

- Recorder reports for Feb 24

Distributions

- Odyssey instructions
- Single copy of Alt Task A data table

Starting Comments 2 minutes max

- About their writing
- About reflector comment
- To collect challenge question work

Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.
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Initial Task Instructions: If:

- You did Alt Task A (data table), distribute a copy to each group. Prepare previous Spokesperson to point out interesting things to compare and talk about.
- You did Chal Qstn 2 (copy in folder), draw graph on board. Prepare your previous Spokesperson to describe what it is and why you did it that way.
- You talked about Chal Qstn 1 (deflate-gate; copy in your folder), prepare your previous Spokesperson to present convincing case to the class.
- You didn't do any of these things, consider a response to Chal Qstn 3 (copy in folder). Prepare your previous Spokesperson to present case to the class.

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Initial Task [25 min]

You have 5 minutes to get it together. Allow 5 min per item.

Task Three

4) Think of gas molecules flying around.
To become liquid, what happens to their position? Get closer together
What would cause molecules to "get together"? an attractive force
Do you have any evidence that such attractive forces exist?
Balloon charge effect; water on wax paper
Do you have any evidence that degree of attractive force varies with type of substance?
Water vs oil on wax paper; heating/cooling data and phase change T
So, consider the mp of two substances. One has higher mp.
One reason could be that those molecules stick to each other more?
So the T has to be raised higher in order for there to be enough KE to shake them loose.

[5] Another related factor: how much energy per gram does it take to make the phase change happen (how long is the plateau) – magnitude of the "latent heat"

Common term:
"latent heat of melting/freezing" or "latent heat of vaporization/condensation"
"latent" means something that exists but is hidden
Heat that exchanges but does not cause temp change
"sensible heat" is the term used for heat that causes a temperature change

Formal term "enthalpy of fusion" (applies whether melting or freezing)
or "enthalpy of vaporization" (for vaporizing/condensing)

how much heat involved per gram (or mole) of that substance for a complete phase change
If you know the heat of fusion of a substance, you can calculate how much energy it would be involved in a phase change (in either direction).

e.g. water: enthalpy of fusion is
enthalpy of vaporization is

Posted on BB links to these and sublimation

GO TO ODYSSEY – you have up to 20 minutes to play [25]

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5) Where does the stickiness come from? [15]

a) clue: balloon and electrical charge
atoms have e and p; simple bond shown as, can be equally shared e.g. N2
If unequal, could lead to permanently charged ends (polar)
Water is very polar. Oil is a little bit. N2 not at all.

b) other factors
compare: stearic (mp 69 C) and oleic (mp 13 C)
How do they differ structurally?
2 H atoms and double bond; Kink and packing in solid
Packing is a specific factor in solid/liquid phase change

Stearic is saturated fat (saturated with H atoms) butter, lard, wax
Oleic is unsaturated fat (2 fewer H because of double bond); MONO for One
Olive oil, corn oil
What would you expect to see in a polyunsaturated fat? More dbl bonds
Someone may ask about trans fats.

c) phase change affected by:
mass of molecule (bigger is harder to get moving),
stickiness/polarity (more sticky is harder to loosten up)
shape (sol/liq maximization of intermolecular interations)

C) Things we are delaying on

1) Fundamental nature of heat and energy
2) Rate of heating/cooling
3) Experimental technical issues, mostly which related to #2.

If there is time, ask "What is a Phase Diagram"
Tell me how to sketch one.

- Where draw horizontal line to represent normal water behavior?
- What happens if you go to place on earth where P is lower? What happens to mp and bp?
- To move left/right on horizontal axis, applying or removing heat. That's what we did to cause phase change. Can you hold fixed at a temperature, not provide heat, and cause a phase change from liquid to gas? How? Reduce pressure.
- Critical point

		mp ^{o}C	
stearic acid	$C_{18}H_{36}O_2$	69	
lauric acid	$C_{12}H_{24}O_2$	44	
oleic acid	$C_{18}H_{34}O_2$	13	
methyl salicylate	$C_8H_8O_3$	-9	
ethylene glycol	$C_2H_6O_2$	-13	
water	H_2O	0	

Task Four Those past challenge questions

Challenge Questions (attempt without consulting other sources of info):

1) Things we did apply to the deflate-gate controversy. What and explain how it applies? Does this confirm or dispute the claim that the Patriots let air out of the balls?
2) What are the major components of air? Predict (graph) their relative average speeds. (dinitrogen, dioxygen, carbon dioxide, water, argon) – how to calculate mass of a substance
3) Apply any relationship we've discussed to explaining why the inner planets are devoid of H_2 and He, whereas the outer planets are rich in them. [name the inner and outer planets] You can use the PhET to test this.

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