

Recitation Worksheet 1 (10.1-10.2 and 10.8-10.9)

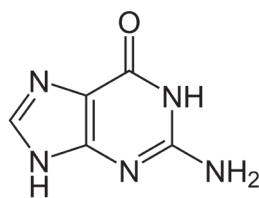
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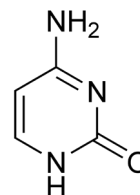
Instructions:

- Please enter your first and last name as it appears on the eLC classlist (do not use a nickname).
 - Your UGA myID is a combination of letters and numbers (example: Dr. Abdelrahman MyID is ema88805).
Do not use your 81x number.
 - If you do not have access to a printer, type your answers in the worksheet PDF and then upload it to **Gradescope** by Friday, January 27th at 11:59 pm. Write your work on separate sheets of paper, convert to a PDF and upload to the "Recitation Worksheet 1 Dropbox" on eLC.
 - If you are using an app to annotate the worksheet, make sure the pages are in the correct order and have the same layout as the original or Gradescope will not be able to read it.
 - If you have access to a printer, print out the worksheet, write your answer in the answer boxes, and show your work on it when appropriate. Then convert it to a PDF and upload to **Gradescope** by Friday, January 27th at 11:59 pm. You do not need to upload anything to eLC. The pages must be in the correct order and have the same layout as the original, or Gradescope will not be able to read it.
 - There is a **Gradescope App** available for both iOS and Android devices that allows you to scan and submit your printed work or you can submit your fillable PDF directly. Detailed instructions on how to access and use the app can be found on your CHEM 1212 class eLC page under content → Welcome module → Gradescope → Gradescope new mobile app.
 - Answers must be written in the corresponding answer box, or no credit will be awarded.
 - The instructions for uploading worksheets to Gradescope can be found in the Content area of eLC in the Welcome Module.
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- Double-stranded DNA consists of nucleobases that tie the DNA strands together. Nucleobases form specific pairs via intermolecular forces, example guanine pairs with cytosine. What is the **major** intermolecular force that exists between guanine and cytosine?

- London dispersion forces
- Dipole-dipole forces
- Hydrogen bonding
- Ion-dipole forces



Guanine



Cytosine

2. If water is placed in a plastic graduated cylinder, an inverted "U-shaped" meniscus is observed. The reason behind the inverted "U-shaped" meniscus is

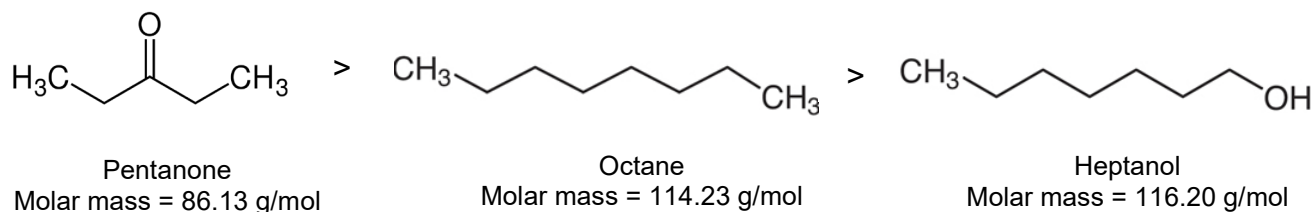
- A. The cohesive forces between the water molecules are stronger than the adhesive forces between the water molecules and the walls of the container
- B. The viscosity of the water is greater than the viscosity of the plastic
- C. Surface tension of the water prevents it from "beading up" inside the container
- D. The molecules of water are forced closer together because of London forces
- E. The cohesive forces between the water molecules are weaker than the adhesive forces between the water molecules and the walls of the container

3. Which of the choices below from A – E represents the correct order of the compounds below in **order of increasing** viscosity?

CH₃CHOHCH₂OH CH₃CH₂OH CH₃CH₂SH CH₃CH₂CH₂CH₂OH

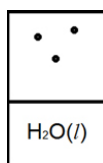
- A. CH₃CHOHCH₂OH < CH₃CH₂OH < CH₃CH₂SH < CH₃CH₂CH₂CH₂OH
- B. CH₃CH₂CH₂CH₂OH < CH₃CH₂SH < CH₃CH₂OH < CH₃CHOHCH₂OH
- C. CH₃CHOHCH₂OH < CH₃CH₂CH₂CH₂OH < CH₃CH₂OH < CH₃CH₂SH
- D. CH₃CH₂OH < CH₃CH₂SH < CH₃CH₂CH₂CH₂OH < CH₃CHOHCH₂OH
- E. CH₃CH₂SH < CH₃CH₂OH < CH₃CH₂CH₂CH₂OH < CH₃CHOHCH₂OH

4. At room temperature, the vapor pressure pattern is pentanone > octane > heptanol. Which one of the following statements is **FALSE**?



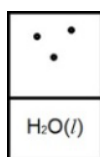
- A. A substance with higher vapor pressure is held together by weaker binding forces
- B. Heptanol has the lowest vapor pressure and strongest intermolecular force due to hydrogen bonding
- C. Octane has lower vapor pressure than pentanone due to London dispersion forces
- D. Heptanol would have a higher boiling point than octane
- E. Pentanone would have a higher boiling point than octane

5. Below is a representation of liquid water in equilibrium with its water vapor in a rigid container at 20.0 °C. The circles represent water vapor. (One dot = 100 mm Hg)

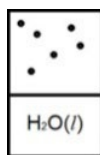


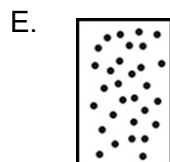
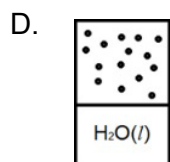
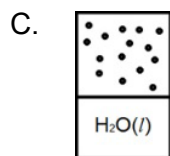
Which diagram below best represents liquid water in equilibrium with its water vapor at 32.7 °C? The heat of vaporization of water is 40.7 kJ/mol. (R = 8.314 J/K·mol)

A.



B.





6. A vapor volume of 1.17 L forms when a sample of liquid acetonitrile, CH_3CN absorbs 1.00 kJ of heat at its normal boiling point (81.6 °C and 1 atm). What is ΔH_{vap} in kJ/mol of CH_3CN ? (**Hint:** you can use the ideal gas law to solve this problem). Keep your answers to two sig figs.

kJ/mol

7. For a particular liquid, raising its temperature from 25 °C to 45 °C causes its vapor pressure to double. What is the enthalpy of vaporization of this liquid?

- A. 115 kJ/mol
- B. 288 kJ/mol
- C. 27.3 kJ/mol
- D. 2.53 kJ/mol
- E. 270 kJ/mol

8. What quantity of energy in kJ does it take to convert 0.250 kg of solid methanol (CH_3OH) at 120 K to gaseous methanol at 400 K? Keep your answer to two sig figs.

kJ

Melting point	176 K
Boiling point	338 K
Heat of fusion	2.2 kJ/mol
Heat of vaporization	35.2 kJ/mol
Specific heat (solid)	105 J/mol·K
Specific heat (liquid)	81.3 J/mol·K
Specific heat (gas)	48.0 J/mol·K

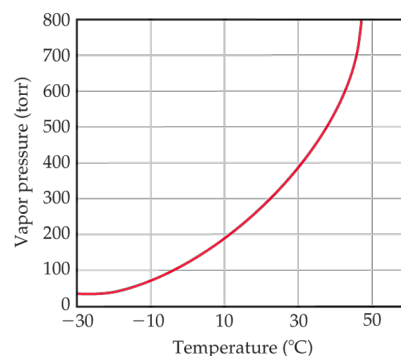
9. Calculate the quantity of heat released in kJ when 15.7 g of benzene (C_6H_6) in the liquid phase at $50.0\text{ }^\circ\text{C}$ is converted to solid benzene at $2.0\text{ }^\circ\text{C}$. Keep your answer to two sig figs.

kJ

Melting point	$5.4\text{ }^\circ\text{C}$
Boiling point	$90.1\text{ }^\circ\text{C}$
Heat of fusion	9.9 kJ/mol
Heat of vaporization	30.7 kJ/mol
Specific heat (solid)	$1.51\text{ J/g}\cdot^\circ\text{C}$
Specific heat (liquid)	$1.80\text{ J/g}\cdot^\circ\text{C}$
Specific heat (gas)	$1.92\text{ J/g}\cdot^\circ\text{C}$

10. The graph shown to the right represents the vapor pressure of CS₂, a volatile liquid. Which of the following statements regarding CS₂ is true? Select all that apply.

- A. CS₂ has weaker intermolecular forces compared to water
- B. The vapor pressure of CS₂ is greater than the vapor pressure of water
- C. The normal boiling point of CS₂ is approximately 30 °C
- D. The vapor pressure of CS₂ is 200 torr at 10 °C



11. Indicate the **most significant** intermolecular force in each of the compounds or compound pairs below. For each molecule select one of the following choices:

- A. London dispersion forces
- B. Dipole-dipole forces
- C. Hydrogen bond
- D. Ion-dipole forces

For your answer choice insert the letters A – D in the answer box. Example, if the answer is London dispersion forces, then the answer is choice A.

i. LiCl (in water)

ii. Cl₃PO

iii. SF₆

iv. $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3 - \text{CH} - \text{CH}_3 \end{array}$

v. H₂NNH₂

12. Which of the following choices A – E represents the correct order of the compound below of **decreasing** vapor pressure?



- A. $\text{C}_6\text{H}_6 > \text{C}_6\text{H}_5\text{CH}_3 > \text{C}_6\text{H}_5\text{OH} > \text{C}_6\text{H}_5\text{NH}_2$
- B. $\text{C}_6\text{H}_5\text{OH} > \text{C}_6\text{H}_5\text{NH}_2 > \text{C}_6\text{H}_5\text{CH}_3 > \text{C}_6\text{H}_6$
- C. $\text{C}_6\text{H}_5\text{NH}_2 > \text{C}_6\text{H}_5\text{OH} > \text{C}_6\text{H}_6 > \text{C}_6\text{H}_5\text{CH}_3$
- D. $\text{C}_6\text{H}_5\text{CH}_3 > \text{C}_6\text{H}_6 > \text{C}_6\text{H}_5\text{NH}_2 > \text{C}_6\text{H}_5\text{OH}$
- E. $\text{C}_6\text{H}_5\text{OH} > \text{C}_6\text{H}_6 > \text{C}_6\text{H}_5\text{NH}_2 > \text{C}_6\text{H}_5\text{CH}_3$

13. Which of the following compound has the **highest** surface tension?

- A. $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$
- B. $\text{CH}_3\text{CH}_2\text{OCH}_3$
- C. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
- D. $\text{OHCH}_2\text{CH}_2\text{OH}$
- E. $\text{CH}_2\text{OHCHOHCH}_2\text{OH}$

14. Which statements about vapor pressure below are true? Select all that apply.

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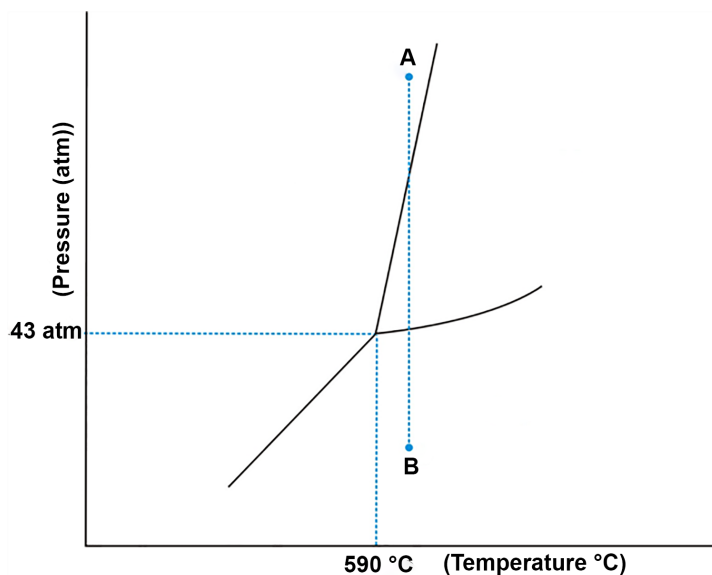
- A. Water in a 150 mL container volume with a diameter of 12 cm evaporates faster and therefore has a higher vapor pressure than water in a container with a volume of 75 mL and a diameter of 5.5 cm
- B. The stronger the intermolecular forces between the molecules of a liquid the lower the vapor pressure
- C. An increase in temperature of a liquid increases its vapor pressure
- D. Normal melting point is the temperature at which the vapor pressure of a liquid is 760 torr or 1 atm.
- E. All the above statements are true.

15. A liquid has an enthalpy of vaporization of 30.8 kJ/mol. At 273 K it has a vapor pressure of 102 mmHg. What is the normal boiling point of this liquid? (1mm Hg = 1 Torr)

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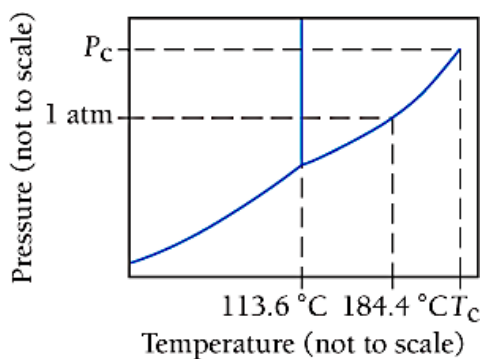
- A. 273 K
- B. 320 K
- C. 292 K
- D. 238 K
- E. 257 K

16. Using the phase diagram for phosphorous below, which of the following statements is correct? Select all that apply. Insert letters without spaces or commas, example: **ABCD**.



- A. The critical pressure and temperature of phosphorous is at 43 atm and 590 °C respectively
- B. The triple point of phosphorous is at 43 atm and 590 °C
- C. Phosphorous changes from solid to liquid to gas as you follow along the line AB
- D. Phosphorous changes from liquid to gas to solid as you follow along the line AB
- E. Phosphorous exists as a gas if it is heated at 22 atm and 750 °C

17. Using the phase diagram for iodine below, answer the following questions:



- A. What is the normal boiling point for iodine?

B. What is the normal melting point for iodine?

C. Which state is present at 186 °C and 1.0 atm?