**Faculty Submitting**: Allison Kelly

**Specify here whether “Pre” or “End” of Unit and the Unit #:** End Unit 9

Notes from the author:

* I don’t know that we should use all of these in one assignment but I figured the more we have in the bank we can switch them out or group them if they become compromised.
* \*\*Difficult problem; maybe should included a link to a “guided solution” or “video solution”
* Should we link to the portion in the textbook for each of these problems? Like a hyperlink that says “Learn More About This”

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| --- | --- |
| LO: Sketch and interpret phase diagrams – normal boiling point, critical point, triple point | |
| **Unit 9\_ Question 1 \*\*** | **Canvas Question Type:** Formula |
|  | **Question Text:**  A piece of ice sitting on a hot sidewalk on a hot summer day will eventually melt and then evaporate. If the ice weighs [mass] g, how much energy would be required (in kJ) to melt the ice and vaporize the ice cube?   |  |  | | --- | --- | | T°M | 0.00 °C | | T°B | 100.0 °C | | Specific heat of liquid water (cliquid) | 4.184 J/g °C | | Enthalpy of Fusion (ΔHfus) | 6.02 kJ/mol | | Enthalpy of Vaporization (ΔHvap) | 40.7 kJ/mol | |
|  | Formula: (mass/18.015\*6.02)+(mass/18.015\*40.7)+(mass\*4.184\*100/1000)  Mass: 30-50 g, 1 decimal place |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-3-phase-transitions#CNX_Chem_10_03_HeatCurve> |
| **Unit 9\_ Question 2** | **Canvas Question Type:** Formula |
|  | **Question Text**: The enthalpy of fusion (ΔHfus) for aluminum is 8.66 kJ/mol. How much energy (in kJ) is released when [mass] kg of liquid aluminum solidifies?  Note: Although heat "released" is symbolically negative, please insert a positive value below for the heat. |
|  | Formula:(mass\*1000/26.981\*8.66)  Mass: 0.5-3.5, 2 decimal places |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-3-phase-transitions#CNX_Chem_10_03_Evap> |
| **Unit 9\_ Question 3** | **Canvas Question Type:** Formula |
|  | A common technique for forming metal electrodes on electronic devices is evaporation in a vacuum. In this technique the metal is melted in a heat resistant boat and then vaporized, eventually landing onto the desired surface. How much energy in Joules is required to vaporize [mass] g of liquid gold? The enthalpy of vaporization (ΔHvap) for gold is 310.9 kJ/mol. |
|  | Formula: mass/196.966\*310.9\*1000  Mass: 2-6, 2 decimal places |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-3-phase-transitions#CNX_Chem_10_03_Evap> |
| **Unit 9\_ Question 4** | **Canvas Question Type:** Numeric Answer **Question GROUP** |
| **4a** | The following graph indicates the vapor pressure of a liquid as a function of temperature.  What is the **normal boiling point** of this liquid? (Do NOT include units in the answer box)    ALT TEXT: The figure represents a graph with an upward curving line. The x axis is Temperature in degrees C from 100 to 300. The y axis is Pressure in Torr from 600 to 900. There is a horizontal dashed line at approximately 760 torr, which appears to intersect with the curving line at 240 torr. |
|  | Answer: 239-245 |
| **4b** | The following graph indicates the vapor pressure of a liquid as a function of temperature.  What is the **normal boiling point** of this liquid? (Do NOT include units in the answer box)    ALT TEXT: The figure represents a graph with an upward curving line. The x axis is Temperature in degrees C from 300 to 600. The y axis is Pressure in Torr from 600 to 900. There is a horizontal dashed line at approximately 760 torr, which appears to intersect with the curving line at 510 torr. |
|  | Answer: 509-515 |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-3-phase-transitions#CNX_Chem_10_03_VapPress2> |
| **Unit 9\_ Question 5** | **Canvas Question Type:** Numeric Answer **Question GROUP** |
| **5a** | The following graph indicates the vapor pressure of a liquid as a function of temperature.  What is the boiling point of this liquid on the top of a mountain at roughly 1600 feet of elevation where the atmospheric pressure is 650 torr? (Do NOT include units in the answer box)    ALT TEXT: The figure represents a graph with an upward curving line. The x axis is Temperature in degrees C from 100 to 300. The y axis is Pressure in Torr from 600 to 900. There is a horizontal dashed line at approximately 760 torr, which appears to intersect with the curving line at 240 torr. |
|  | Answer : 160  Margin: +/- 1 |
| **5b** | The following graph indicates the vapor pressure of a liquid as a function of temperature.  What is the boiling point of this liquid on the top of a mountain at roughly 1600 feet of elevation where the atmospheric pressure is 650 torr? (Do NOT include units in the answer box)    ALT TEXT: The figure represents a graph with an upward curving line. The x axis is Temperature in degrees C from 300 to 600. The y axis is Pressure in Torr from 600 to 900. There is a horizontal dashed line at approximately 760 torr, which appears to intersect with the curving line at 510 torr. |
|  | Answer: 390  Margin +/- 1 |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-3-phase-transitions#CNX_Chem_10_03_VapPress2> |
| **Unit 9\_ Question 6** | **Canvas Question Type: Multiple Drop Downs** |
|  | Label the sections on the following heating curve    ALT TEXT: The figure shows a general heating curve. The y axis is labelled temperature, with Tm and Tb indicated. The x axis is labelled heat added. Each segment is labelled. The segment labelled 1 is increasing with a positive slope. The second segment is a plateau at Tm on the y axis. The third segment is increasing with a positive slope. The fourth segment is a plateau at Tb. The fifth segment is increasing with a positive slope.   1. [DropOne] 2. [DropTwo] 3. [DropThree] 4. [DropFour] 5. [DropFive]   DropOne  Correct: Increasing Temperature  Wrong:  Decreasing Temperature Melting Freezing Vaporization Condensation  DropTwo  Correct: Melting  Wrong:  Decreasing Temperature Increasing Temperature Freezing Vaporization Condensation  DropThree  Correct: Increasing Temperature  Wrong:  Decreasing Temperature Melting Freezing Vaporization Condensation  DropFour  Correct: Vaporization  Wrong:  Increasing Temperature Decreasing Temperature Melting Freezing Condensation  DropFive  Correct: Increasing Temperature  Wrong:  Decreasing Temperature Melting Freezing Vaporization Condensation |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-3-phase-transitions#CNX_Chem_10_03_HeatCurve> |
| **Unit 9\_ Question 7** | **Canvas Question Type: Multiple Choice**  **QUESTION GROUP** |
| **7a** | On the following phase diagram, Point A is \_\_\_\_\_\_\_\_.    ALT TEXT: The figure shows a general Y shaped phase diagram. The y axis is pressure in atm. The x axis is temperature in K. The point where all three lines converged is labelled A. The point to the upper right end of the Y is labelled B.  Correct Answer: triple point  Wrong Answers: critical point normal boiling point normal melting point |
| **7b** | On the following phase diagram, Point B is \_\_\_\_\_\_\_\_.    ALT TEXT: The figure shows a general Y shaped phase diagram. The y axis is pressure in atm. The x axis is temperature in K. The point where all three lines converged is labelled A. The point to the upper right end of the Y is labelled B.  Correct Answer: critical point  Wrong Answers: triple point normal boiling point normal melting point |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-4-phase-diagrams> |
| **Unit 9\_ Question 8** | **Canvas Question Type: Matching** |
|  | ALT TEXT: The figure represents a general Y shaped phase diagram. The x axis is labelled Temperature in kelvin. The y axis is labelled pressure in atm. The segment of the diagram at low temperatures and mid to high pressure is labelled A. The segment of the diagram at mid temperatures and high pressures is labelled B. The segment of the diagram at high temperatures and low pressures is labelled C.    ALT TEXT: The figure shows three boxes. The left box is labelled Phase 1 and shows circles spread throughout the box randomly. The middle box is labelled Phase 2 and shows circles arranged uniformly at the bottom of the box. The right box is labelled Phase 3 and shows circles arranged overlapping each other at the bottom of the box.  Match the phases pictured with the area in the phase diagram that they represent  Phase 1 – C  Phase 2 – A  Phase 3 – B |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-4-phase-diagrams> |
| **Unit 9\_ Question 9** | **Canvas Question Type: Multiple Drop Downs** |
|  | Given the following phase diagram:    ALT TEXT: The figure shows a phase diagram with a general Y shape. The y axis is in pressure, atm from 1 to 2 in 0.1 increments. The x axis is in temperature K from 100 to 300. The point where all three lines converge seems to be between 1.2 and 1.3 atm and 140 and 160 K. The top of the left line sits between 120 and 140 K and 2 atm. The top of the right line is between 280 and 300 K at 2 atm  What phase transition occurs in each of the following cases.  Increasing temperature from 120 K to 180 K at 1.5 atm. [DropOne]  Increasing pressure from 1.4 atm to 1.9 atm at 140 K [DropTwo]  Decreasing temperature from 160 K to 120 K at 1.1 atm [DropThree]  Increasing pressure from 1.3 atm to 1.6 atm at 240 K [DropFour]  **DropOne**  Correct Answer: Melting  Wrong Answers: Freezing Vaporization Condensation Sublimation Deposition  **DropTwo**  Correct Answer: Melting  Wrong Answers: Freezing Vaporization Condensation Sublimation Deposition  **DropThree**  Correct Answer: Deposition  Wrong Answers: Freezing Vaporization Condensation Sublimation Melting  **DropFour**  Correct Answer: Condensation  Wrong Answers: Freezing Vaporization Melting Sublimation Deposition |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-4-phase-diagrams> |
| *LO: Identify molecular/ion interactions based upon structures – hydrogen bonding, dipole-dipole and London Dispersion Forces* | |
| **Unit 9\_ Question 10** | **Canvas Question Type: Multiple Answers** |
|  | Select all of the IMFs that the following molecule experiences.  SF6  Correct Answers: London Dispersion Forces  Wrong Answers:  Dipole-dipole Hydrogen Bonding Ion-Dipole |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-1-intermolecular-forces> |
| **Unit 9\_ Question 11** | **Canvas Question Type: Multiple Answers** |
|  | Select all of the IMFs that the following molecule experiences.  C8H16  Correct Answers: London Dispersion Forces  Wrong Answers:  Dipole-dipole Hydrogen Bonding Ion-Dipole |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-1-intermolecular-forces> |
| **Unit 9\_ Question 12** | **Canvas Question Type: Multiple Answers** |
|  | Select all of the IMFs that the following molecule experiences.    ALT TEXT: The figure illustrates a formula with the following structure: A chain of three carbon atoms, the leftmost carbon has three single bonds to H. The second carbon has a single bond to H and a single bond to a Nitrogen (which has two H atoms bonded). The third carbon has a double bond to oxygen and a single bond to an O H group.  Correct Answers: London Dispersion Forces Dipole-dipole Hydrogen Bonding  Wrong Answers:  Ion-Dipole |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-1-intermolecular-forces> |
| **Unit 9\_ Question 13** | **Canvas Question Type: Multiple Choice** |
|  | Which of the following molecules is most likely to be a gas at room temperature?  Correct Answer: C3H8  Wrong Answers:  C3H7OH C5H12 C5H11OH |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-1-intermolecular-forces> |
| **Unit 9\_ Question 14** | **Canvas Question Type: Matching** |
|  | Rank the following molecules from lowest viscosity to highest viscosity  Lowest Viscosity   1. C4H8 2. C3H7NH2 3. C8H17OH   Highest Viscosity |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-1-intermolecular-forces> |
| **Unit 9\_ Question 15** | **Canvas Question Type: Multiple Choice** |
|  | For which of the following pairings is the substance with the higher melting point listed first   1. NH3 and CH4 2. CH4 and C2H4 3. CH3CH2CH2NH2 and CH3CH2CH2CH3   Correct Answer: I and III  Wrong Answer: I and II I, II and III II and III I only II only III only |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-1-intermolecular-forces> |
| **Unit 9\_ Question 16** | **Canvas Question Type: Multiple Drop Down** |
|  | Identify whether the following processes involve intramolecular or intermolecular forces  Wine ferments in an barrel [DropOne] Sugar dissolves when stirred into coffee [DropTwo] Dropping bleach on a shirt removes the color [DropThree] Yeast in warm water forms bubbles [DropFour] The windshield fogs up in winter [DropFive]  **DropOne**  Correct Answer: intramolecular Wrong Answer: intermolecular  **DropTwo**  Correct Answer: intermolecular Wrong Answer: intramolecular  **DropThree**  Correct Answer: intramolecular Wrong Answer: intermolecular  **DropFour**  Correct Answer: intramolecular Wrong Answer: intermolecular  **DropFive**  Correct Answer: intermolecular Wrong Answer: intramolecular |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-1-intermolecular-forces> |
| **Unit 9\_ Question 17** | **Canvas Question Type: Multiple Choice** |
|  | Consider the following statements:  “Molecule A has a higher surface tension than Molecule B.” “Molecule C has a higher vapor pressure than Molecule B.”  Which molecule will have the lowest melting point?  Correct Answer: Molecule C  Wrong Answers:  Molecule A Molecule B Not enough information to tell |
| Read More | <https://openstax.org/books/chemistry-2e/pages/10-1-intermolecular-forces> |
| *LO: Prepare solutions and calculate solution concentration using molarity, molality, weight percent, mole fraction* | |
| **Unit 9\_ Question 18** | **Canvas Question Type: Formula Answer** |
|  | What is the molality of a solution when [mass] g of KMnO4 is dissolved in [vol] mL of water (assume the density of water is 0.999 g/mL? |
|  | Answer: (mass/158.034)/(vol\*0.999/1000)  mass: 60-80, one decimal place vol: 500-900, zero decimal places |
| Read More |  |
| **Unit 9\_ Question 19** | **Canvas Question Type: Formula Answer** |
|  | What is the mole fraction of solute when [moleth] mols of ethanol is added to [molsw] mols of water? |
|  | Answer: moleth/(moleth+molsw)  moleth: 0.5-2.5, two decimal place molesw: 3-10, one decimal place |
| Read More | <https://openstax.org/books/chemistry-2e/pages/11-4-colligative-properties> |
| **Unit 9\_ Question 20 \*\*** | **Canvas Question Type: Formula Answer** |
|  | What is the molality of an aqueous solution of glucose, C6H12O6, that is [molar] M? Assume the density of the solution is [density] g/mL |
|  | molar/(((density\*1000)-(Molar\*180.156))/1000) |
| Read More | <https://openstax.org/books/chemistry-2e/pages/11-4-colligative-properties> |
| **Unit 9\_ Question 21 \*\*** | **Canvas Question Type: Formula Answer** |
|  | A given cup of coffee contains [conc] g/mL of caffeine (C8H10N4O2). What is the mole fraction of caffeine in a cup of coffee? (The density of water is 0.983g/mL at 60 °C) |
|  | (conc/194.19)/(conc/194.19+1.00\*0.983/18.015)  Conc: 0.338-0.422; 3 decimal places |
| Read More | <https://openstax.org/books/chemistry-2e/pages/11-4-colligative-properties> |
| **Unit 9\_ Question 22** | **Canvas Question Type: Formula Answer** |
|  | In lab, your spectrophotometer has a maximum detection limit of [A] M. The solution you want to measure has a concentration of [B] M, so you measure out [vol] mL and dilute it to [volb] mL. What is the final concentration of your solution? |
|  | Answer: B\*vol/volb  A: 1.0-1.5, one decimal B: 2-4, one decimal vol: 25-50, one decimal volb: 150-500, one decimal |
| Read More | <https://openstax.org/books/chemistry-2e/pages/3-3-molarity> |
| **Unit 9\_ Question 23** | **Canvas Question Type: Formula Answer** |
|  | What is the mass percent of sugar in a beverage if [massj] g of the drink contains [mass] g of sugar? |
|  | mass/(massj)\*100  massj: 450-650, one decimal  mass: 20-40, one decimal |
| Read More | <https://openstax.org/books/chemistry-2e/pages/3-4-other-units-for-solution-concentrations> |