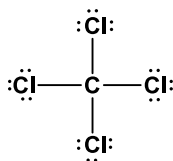


Sample Exam 3 – Chapters 8, 9, 10

Show ALL work for FULL credit!!

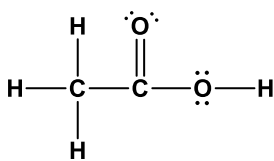
1. Which of the following substances crystallizes as a molecular solid?

- NaCl
- CO₂
- Au
- K₂CO₃
- CaO

2. Circle **ALL** of the IMF's present for each of the following substances:

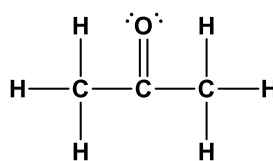
A.

LDF DDF HBF



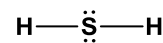
B.

LDF DDF HBF



C.

LDF DDF HBF



D.

LDF DDF HBF

3. Which of the following properties indicates the presence of *weak* intermolecular forces in a liquid?

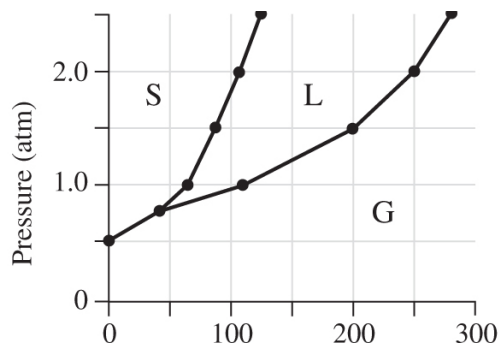
- a high boiling point
- a high vapor pressure
- a high viscosity
- a high surface tension

4. Which of the following should have the highest boiling point at a given temperature?

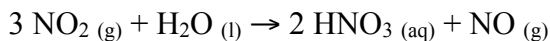
- methane, CH₄
- carbon tetrafluoride, CF₄
- carbon tetrachloride, CCl₄
- carbon tetrabromide, CBr₄
- carbon tetraiodide, CI₄

5. Refer to the phase diagram provided to answer the following questions:

- What is the normal boiling point for this substance? _____
- What is the physical state for this substance at 1.5 atm and 150°C? _____
- Circle the vaporization curve on the phase diagram below.

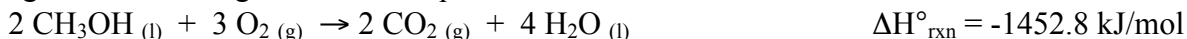


6. Calculate the heat of reaction, ΔH° , for the reaction:

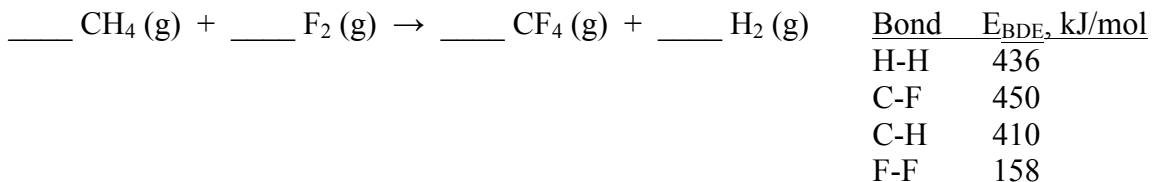


Substance:	$\text{NO}_2(\text{g})$	$\text{H}_2\text{O} (\text{l})$	$\text{HNO}_3 (\text{aq})$	$\text{NO} (\text{g})$
$\Delta H^\circ_f(\text{kJ/mol})$	33.2	-285.5	-119.0	91.3

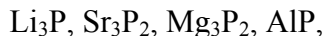
7. Determine the amount of heat released when 26.9 mL methanol, CH_3OH (density = 0.792 g/mL), reacts according to the following combustion equation:



8. Use the given average bond dissociation energies to estimate ΔH for the reaction of methane, $\text{CH}_4 (\text{g})$, with fluorine:



9. List the following ionic compounds in order of **increasing** lattice energy:



Lowest LE _____ > _____ > _____ > _____ > Highest LE

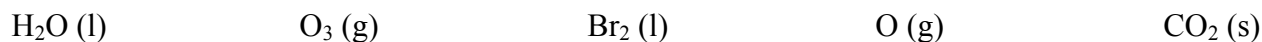
10. Which of the following equations represents a heat of formation equation?

- $\text{C} (\text{s}) + \text{O}_2 (\text{g}) \rightarrow \text{CO}_2 (\text{g})$
- $2 \text{Au} (\text{s}) + 3 \text{Cl}_2 (\text{g}) \rightarrow 2 \text{AuCl}_3 (\text{s})$
- $\text{Cl} (\text{g}) + \text{Na} (\text{s}) \rightarrow \text{NaCl} (\text{s})$
- $\text{CaO} (\text{s}) + \text{CO}_2 (\text{g}) \rightarrow \text{CaCO}_3 (\text{s})$

11. What type of bond typically has the highest bond enthalpy value?

- single
- double
- triple
- all three have the same value for bond enthalpy

12. Which of the following has a standard enthalpy of a formation value (ΔH°_f) of zero?



13. Which ionic compound is the most stable?
 a. CaO b. K₂O c. SrO d. Rb₂O
14. When bonds are broken in a chemical reaction, this process is considered _____.
 a. exothermic b. endothermic
15. Find ΔH for **BaCO₃ (s) → BaO (s) + CO₂ (g)**
 given $2 \text{ Ba (s)} + \text{O}_2 \text{ (g)} \rightarrow 2 \text{ BaO (s)}$ $\Delta H = -1107.0 \text{ kJ}$
 $\text{Ba (s)} + \text{CO}_2 \text{ (g)} + \frac{1}{2} \text{ O}_2 \text{ (g)} \rightarrow \text{BaCO}_3 \text{ (g)}$ $\Delta H = -822.5 \text{ kJ}$
16. Which one of the following is **not** used to describe the condition of a gas?
 a. number of moles b. polarity c. temperature d. volume
17. Boyle's Law states that pressure is
 a. directly related to volume
 b. inversely related to volume
 c. directly related to temperature
 d. inversely related to temperature
18. A basketball is inflated to a pressure of 1.50 atm in a 20.0°C garage. What is the pressure of the basketball outside where the temperature is -5.0°C? (Assume V and n are constant)
 a. 1.37 atm b. 1.42 atm c. 1.58 atm d. 1.64 atm
19. Which of the following would have a density of 1.21 g/L at 280.15°C and 0.993 atm?
 a. Ar b. N₂ c. Ne d. O₂
20. What is the total pressure in a 3.00 L container containing 0.310 moles of N₂ and 0.250 mole of O₂ at 303 K?
 a. 4.64 atm b. 4.55×10^{-4} atm c. 0.215 atm d. 1.00 atm
21. Which of the following gases has the **highest** average speed at 400K?
 a. CO₂ b. N₂O₄ c. F₂ d. SF₆
22. A process by which gas molecules escape through a tiny hole in a membrane into a vacuum without collisions is called
 a. Boyle's law. b. diffusion. c. sublimation. d. effusion.
23. Of the following statements, which describes properties of an ideal gas?
 a. Gases are highly compressible.
 b. There are relatively large distances between gas molecules in a container.
 c. Gases form homogeneous mixtures and do not react with other gas molecules.
 d. All of the above.
24. The specific capacity heat of copper is 0.385 J/(g°C). If 34.2 g of copper, initially at 25°C, absorbs 4.689 kJ, what will be the final temperature of the copper?
 a. 356 °C b. 381 °C c. 25.4 °C d. 27.8 °C
25. What mass of chlorine gas occupies a 4.50L container at 55.6°C and 887 torr?

26. What volume of hydrogen gas is produced when 6.75 g of aluminum is placed in excess 4.0 M HCl at 33.8 °C and 956.4 torr according to the equation $2\text{Al}(s) + 6\text{HCl}(aq) \rightarrow 3\text{H}_2(g) + 2\text{AlCl}_3(aq)$?
27. How much heat is absorbed when 30.00 g of C (s) reacts in the presence of excess SO₂ (g) to produce CS₂ (l) and CO (g) according to the following chemical equation?
 $5\text{C}(s) + 2\text{SO}_2(g) \rightarrow \text{CS}_2(l) + 4\text{CO}(g) \quad \Delta H^\circ = +239.9\text{ kJ}$
28. Which of the following would exhibit dipole-dipole forces as the strongest force between molecules?
a. HCN b. CCl₄ c. CH₃OH d. C₆H₆
29. Which of the following will have the lowest boiling point?
a. CH₃CH₂CH₂NH₂ b. CH₃CH₂CH₂SH c. CH₃CH₂CH₂OH
30. Solid carbon dioxide, CO₂ (s), is what type of crystalline solid?
a. molecular b. ionic c. metallic
31. What type of intermolecular force, IMF, would be present between molecules in a sample of Br₂ (l)?
a. LDF b. DDF c. HBF d. Ion-Dipole Forces
32. What is the strongest IMF present between like molecules in a sample of H₂S (l)?
a. LDF b. DDF c. HBF d. Ion-Dipole Forces
33. What type of bond is present between atoms in a sample of CO₂?
a. nonpolar covalent b. polar covalent c. LDF d. James
34. Hexane, C₆H₁₂, is an organic molecule found in gasoline. Circle the property of liquids that would have a relatively high value for hexane.
a. vapor pressure b. surface tension c. boiling point d. viscosity
35. Which molecule will have the highest boiling point?
a. I₂ b. Br₂ c. Cl₂ d. F₂
36. Select the correct molecule with the lowest surface tension.
a. CH₃CH₂CH₂Cl b. CH₃CH₂CH₂NH₂ c. CH₃CH₂CH₂CH₃
37. Select the molecule that has HBF as it's strongest IMF between like molecules.
a. CH₃CH₂CH₂SH b. CH₃CH₂CH₂OH c. CH₃CH₂OCH₂CH₃
38. What is the strongest force present between like particles in a sample of liquid mercury, Hg (l)?
a. London Dispersion Forces
b. Ionic Bonds
c. Covalent Bonds
d. Metallic Bonds