

Name: _____

Date: _____

1) Solder (Pb-Sn) is an alloy, aluminum oxide (Al_2O_3) is an ionic solid, and iodine (I_2) is a molecular solid. How can you tell this information from the formulas of the substances?

2) What are intermolecular forces? How are these forces different than chemical bonds (intramolecular forces)?

3) Which types of intermolecular forces are the strongest? Which ones are the weakest?

4) What is the strongest intermolecular force that can exist between molecules that have covalent bonding within them?

5) Using the formulas of the following substances, determine the strongest force (intramolecular or intermolecular) that is holding the substance together.

| | |
|-------------------|------------------------|
| White gold, Au-Ni | Ammonia, NH_3 |
|-------------------|------------------------|

| | |
|--|--------------------------------|
| Phosphorus trichloride, PCl_3 | Lithium fluoride, LiF |
| Octane, C_8H_{18} | Helium gas, He |
| Carbon monoxide, CO | Hydrofluoric acid, HF |

6) Use intermolecular forces and numbers of electrons to explain why methane (CH_4) is a gas at room temperature but octane (C_8H_{18}) is a liquid.

7) Explain why most metals bend when struck but most ionic solids shatter.

11) Predict the type of solid (covalent network, molecular solid, ionic crystal, or metallic crystal).

| | |
|------------------|-------------------|
| Cu | Diamond, C |
| CuO | NI ₃ |
| H ₂ O | CaCl ₂ |

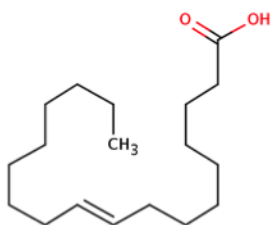
12) What is surface tension? How can surface tension be disrupted?

13) Explain why water forms a meniscus when placed into a glass cylinder.

14) Which liquid has a higher viscosity at room temperature, water or honey?

15) Compare the viscosity of molasses at room temperature (20 °C) and after it is placed in a microwave (120 °C).

16) Below is the structural formula for oleic acid, which is the primary component of olive oil. What about this molecule makes the viscosity of olive oil so high? (Hint: Each corner is a C atom!)



17) Using intermolecular forces, explain why oil and water do not mix. Then, explain what can be added to allow the two substances to mix more easily.

18) What are the three states of matter that exist under normal conditions? Which phase has the most energy, and which phase has the least energy?

19) Use kinetic-molecular theory to explain the compressibility and expansion of gases.

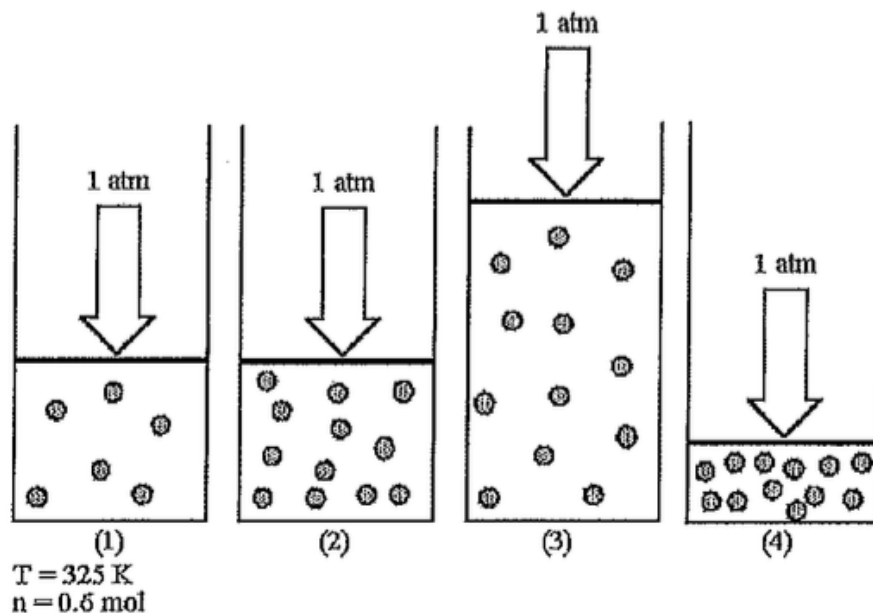
20) How are the postulates of kinetic molecular theory different for gases compared to solids and liquids?

21) Relate the properties of diffusion and density to gases.

22) How is the effusion of a gas related to its molar mass?

23) Calculate the ratio of the effusion rate of krypton to neon.

24) Consider the following image of a piston moving up and down. For which images is the density of the gas the highest?



25) What is the molar mass of a gas that effuses 3 times slower than helium (He)?

26) Which of the following gases would effuse the most rapidly? Which one will effuse the slowest? How do you know?

ammonia, helium, oxygen, carbon monoxide

27) What is the partial pressure water vapor in an air sample when the total pressure is 1.00 atm, the partial pressure of nitrogen is 0.79 atm, the partial pressure of oxygen is 0.20 atm, and the partial pressure of all of the other gases in air is 0.0044 atm?

28) What is the total gas pressure in a sealed flask that contains oxygen at a partial pressure of 0.41 atm and water vapor at a partial pressure of 0.58 atm?

29) The pressure on top of Mt. Everest is usually about 33.6 kPa. Convert this pressure to atmospheres. How does this pressure compare with atmospheric pressure at sea level?

30) A hammer is designed to drive nails into a surface as well as carefully remove nails without damaging the same surface. Compare and contrast the two sides of a hammer and relate these observations to pressure.

31) Why are the collisions of gas particles according to kinetic molecular theory considered to be perfectly elastic?

32) What is kinetic energy versus other types of energy? How does the average kinetic energy of particles change with temperature?

33) What are the six (6) possible phase changes that can occur between states of matter? Which ones are exothermic and which ones are endothermic?

34) Why are some cooking instructions for boiling water different for higher and lower elevations?

35) The melting point of a substance is the temperature at which it changes from a solid to a liquid. What must be overcome in order for a solid to completely melt?

36) Substance A is a gas at room temperature while substance B is a solid at room temperature. Compare the intermolecular forces that are holding the substances together if they are both molecular.

37) What is the vapor pressure of a substance? How does the vapor pressure of a substance relate to its boiling point?

38) Is the boiling point of a substance always at the same temperature? Why or why not?

39) What is the boiling point of a substance defined as?

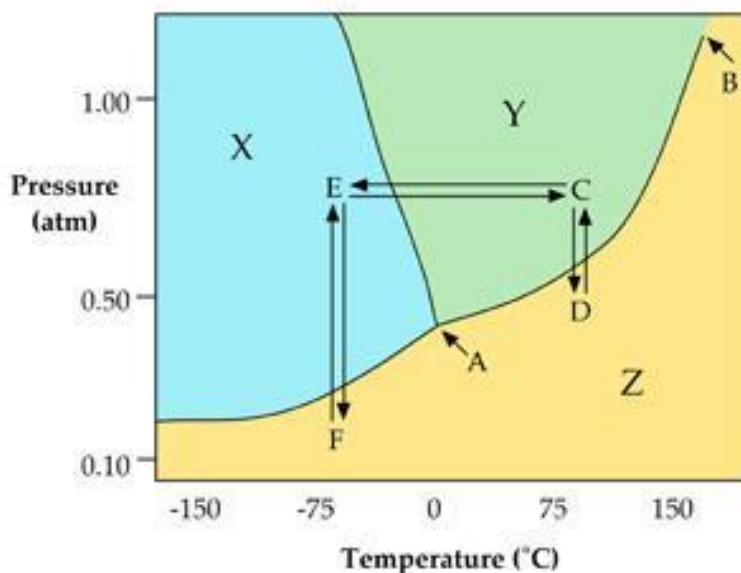
40) How is the process of “boiling” different than the process of “evaporating” at a microscopic level?

41) Substances such as iodine (I_2) and carbon dioxide (CO_2) exist as solids that sublime quite easily from the solid phase to the gaseous phase. Using intermolecular forces, explain why this happens.

42) Examine the following substances. Determine which one has the lowest boiling point and the highest boiling point out of the set.

| | |
|------------------------|-----------------------|
| CH_4, C_2H_6, C_3H_8 | CH_3OH, CH_4, CH_2O |
| W-C alloy, HF, SO_2 | H_2O, CH_4, HCl |

43) Use the phase diagram below to answer the following questions.



a) If substance C has its temperature lowered until it is substance E, what has occurred?

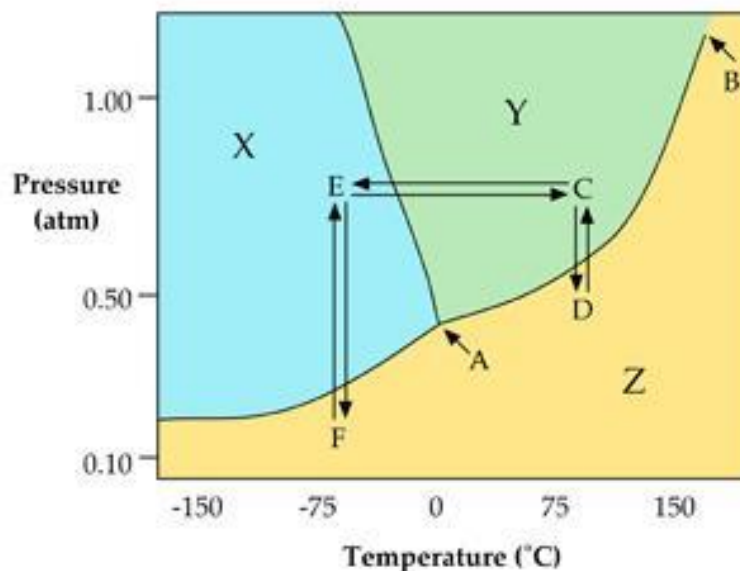
b) What is the significance of point A?

c) Substance D is held at a constant temperature, but the pressure is increased to substance C. What has occurred?

d) What state of matter is this substance in region Z?

e) What is the significance of the temperature and pressure at point B?

f) A substance at the pressure and temperature of F is held at a constant temperature while its pressure is increased. What will happen?



g) A substance has a pressure of 0.75 atm and a temperature of 50 °C. The temperature is increased until the substance is at 150 °C while the pressure remains constant. What will happen to the substance?

h) A substance at a pressure of 0.50 atm and a temperature of -100 °C. The temperature is held constant, but the pressure is reduced to 0.10 atm. What will happen?