

A.(64) Circle the best response. Record answers on the attached answer sheet.

1. Which is NOT a unit for expressing pressure?

- a) Pascal b) lb/cm^3 c) torr d) mm Hg e) atmosphere

2. Which statement below is NOT true about gases, according to the kinetic-molecular theory?

- a) Average kinetic energy for all gases is the same at the same conditions.
b) Gas molecules have relatively little attraction for each other.
c) Collisions between gas molecules are almost perfectly elastic.
d) Gas molecules themselves are large compared to the distance between them.

3. Which statement best uses the kinetic molecular theory to explain the inverse relationship between the pressure and volume of a gas at constant temperature?

- a) As the volume of a gas decreases, the gas molecules slow down and collide with the wall less often causing a smaller force.
b) As the volume of a gas decreases, the gas molecules speed up and collide with the walls with a greater force.
c) As the volume of a gas decreases, the gas molecules collide with the wall more often causing a greater force.
d) As the volume of a gas increases, the gas molecules collide with the wall more often causing a greater force.

4. If equal masses of O_2 (molar mass=32) and HBr (molar mass = 81) are in separate containers of equal volume and temperature, which of the following statements is true?

- a) The average kinetic energy of the HBr molecules is greater than that of the oxygen molecules.
b) There are more HBr molecules than oxygen molecules.
c) The pressure in the oxygen container is greater than that in the HBr container.
d) The pressure in each container is the same.
e) The HBr molecules are moving faster than the oxygen molecules.

5. At constant temperature, what pressure would be required to compress 2210 liters of nitrogen gas at 1.0 atmosphere into a 25.0 liter tank?

- a) 104 atmospheres b) 126 atmospheres c) 88.4 atmospheres d) 78.0 atmospheres

6. A sample of oxygen gas is collected at 24°C and 735 mm Hg. If the initial volume of the oxygen were 235 mL, which expression below will best recalculate the volume to standard conditions?

- a) $(235)(273)(735) / [(297)(760)]$ b) $(235)(297)(735) / [(273)(760)]$
c) $(235)(273)(760) / [(297)(735)]$ d) $(235)(297)(760) / [(273)(735)]$

7. If 2.00 g of a gas at 20.0°C in a fixed volume of 10.0 L is heated to 40.0°C , the pressure of the gas

- a) would increase by 40/20. b) would increase by 313/293.
c) would stay the same. d) would decrease by 293/313.
e. would decrease by 20/40.

8. Given a container with 3.00 grams of Xenon and a temperature of -73°C . If exactly one third of the gas was released, what would the temperature have to be in order for the volume and pressure to

remain constant?

- a) 27.0 °C b) -139.7 °C c) -109.5 °C d) -48.7 °C

9. What is the density of SO₃ (molar mass = 80) at standard temperature and pressure?

- a) 80/22.4 g/mL b) 80/22.4 g/L c) 22.4/80 g/L d) 22.4/80 g/mL

10. A sample of hydrogen gas (161 mL) is collected over water by the reaction of hydrochloric acid on zinc metal. The hydrogen (and water) temperature is 21 °C and the barometric pressure is 751.7 mm Hg. (The partial pressure of water at 21 °C is 18.7 torr.) Using Dalton's Law to determine the partial pressure of the hydrogen and the ideal gas equation, approximately how many moles of hydrogen were collected?

- a) 0.00928 moles b) 0.0136 moles c) 0.0112 moles d) 0.00644 moles

11. Hydrogen gas and oxygen gas are placed into separate but equal containers with identical outlet valves and at equal temperatures and pressures. What would be the relative **effusion times** for the hydrogen (molar mass = 2) to oxygen (molar mass = 32)?

- a) 1 to 4 b) 4 to 1 c) 2 to 32 d) 16 to 1 e) 1 to 1

12. Given: $2\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$. If 0.898 liters of carbon dioxide are produced in the reaction above, how many liters of oxygen were consumed at the same temperature and pressure?

- a) 2.14 liters b) 2.58 liters c) 1.57 liters d) 1.76 liters

13. When air is dissolved in water, the type of attraction between the two would be designated as:

- a) dipole-dipole b) dipole-induced dipole c) ion-dipole d) induced dipole-induced dipole.

14. When alcohol(CH₃CH₂OH) is dissolved in water, the type of attraction would be designated as:

- a) dipole-dipole b) dipole-induced dipole c) ion-dipole d) induced dipole-induced dipole.

15. "Hydrogen bonding" is most likely found in a) H₂S b) CH₄ c) NH₃ d) H₂.

16. Which has the highest vapor pressure at the same T? a) water b) CH₃CH₃ c) Fe d) Na₂SO₄

17. Which pure liquid would have the lowest vapor pressure? The one with the:

- a) highest boiling point b) least hydrogen bonding c) lowest surface tension d) least polarity.

18. The triple point of CO₂ is: a) dependent on the pressure. b) dependent on the T.

- c) the same as the sublimation point. d) above 1 atm.

19. In a phase diagram, which state would most commonly appear at relatively high T and low P?

- a) gas b) liquid c) solid

20. Which has the strongest dispersion forces? a) F₂ b) Cl₂ c) Br₂ d) I₂

21. In the dissolution of KBr in water, the attractive forces involved would be called:

- a) dipole-dipole b) dipole-induced dipole c) ion-dipole d) induced dipole-induced dipole.

22. The normal boiling point of chloroform (CHCl₃) is 61.2 °C. At a pressure of 1.1 atm, the boiling

point would be expected to be:

- a) $<61.2\text{ }^{\circ}\text{C}$ b) $>61.2\text{ }^{\circ}\text{C}$ c) $61.2\text{ }^{\circ}\text{C}$ d) $< \text{ or } >$ than $61.2\text{ }^{\circ}\text{C}$ depending on the volume.

23. Which statement(s) is(are) true about water?

- A. Water will normally boil at $100\text{ }^{\circ}\text{C}$ in a UWP laboratory.
B. Ice will melt below $0\text{ }^{\circ}\text{C}$ when pressure is applied to it.
C. Water will form spherical droplets in free fall because of its high surface tension.
D. The triple point of water is near 1 atm and $0\text{ }^{\circ}\text{C}$.
a) A, B, C, D b) A, B, C, c) B, C, D d) B, C e. A, D

24. If one wanted to increase the concentration of CO_2 in a soda, one could:

- a) increase the pressure of CO_2 above the water.
b) increase the temperature.
c) pressurize the container with air.
d) open the system to the atmosphere.

25. Aqueous solutions A and B are prepared with two different nonvolatile solutes. Solution A has a lower vapor pressure than solution B. Which of the following statements is true?

- a) The osmotic pressure of solution A is lower than that of solution B.
b) The freezing point of solution A is be higher than that of solution B.
c) The boiling point of solution A is lower than that of solution B.
d) None of these statements is true.

26. If a dehydrated patient in hospital was treated with an aqueous solution intravenously, but the solution was made too concentrated, the red blood cells would:

- a) swell b) shrink c) not be affected d) swell or shrink depending on the temperature.

27. Which aqueous solution has the lowest freezing point?

- a) $0.15\text{ M Fe}(\text{NO}_3)_3$ b) 0.30 M NaOH c) 0.25 M MgBr_2 d) $0.5\text{ M HC}_2\text{H}_3\text{O}_2$

28. When salt is spread on an icy sidewalk, the ice melts and the surroundings:

- a) get colder b) get warmer c. don't change in temperature.

29. Given the reaction, $\text{Cl}_2(\text{g}) + 2\text{NO}(\text{g}) \rightleftharpoons 2\text{NOCl}(\text{g})$. At $300\text{ }^{\circ}\text{C}$, 0.600 atm of Cl_2 is mixed with 1.40 atm of NO . At equilibrium, 0.650 atm of NOCl is present. What is the K for the reaction at $300\text{ }^{\circ}\text{C}$?
a) 0.359 b) 0.605 c) 1.65 d. 2.73

30 You would predict the partition coefficient of I_2 in a water-benzene(C_6H_6) system to be:

- a) < 1 b) > 1 c) equal to 1

31. "Synthesis gas" made from a reaction of methane with water:

- A. is a good source for hydrogen gas which is used for the production of ammonia.
B. can be used to make methanol (CH_3OH).
C. is the same as "water gas"

Which statement(s) is(are) true? a) A, B b) B, C c) A, C d) C

32. The saturation of hemoglobin with oxygen in blood depends on:

- A. the partial pressure of oxygen in the surroundings.
- B. a process called positive cooperativity.
- C. speed with which the blood flows.

Which statement(s) is(are) true? a) A, C b) B, C c) A, B d) C

B.(12)

1. An organic pollutant with a molar mass of 169 is found in a lake to be at a concentration of 37 ppb. How many moles of the pollutant are in 100 mL of water?

_____ moles

2. An aqueous solution of phosphoric acid (98 g/mole) is 20.0% phosphoric acid by mass.

a. What is the mole fraction of this solution? _____

b. What is the molality of the solution? _____

3. A solution is composed of 67.00 % ethanol (C_2H_5OH , 46 g/mole) and 33.00% water by mass. The solution has a density of 0.8554 g/mL. What is the molarity of **water** in the solution?

_____ M

C.(24) Consider the reaction, $2H_2(g) + O_2(g) \rightleftharpoons 2H_2O(g)$. K_p at $25^\circ C = 5 \times 10^{41}$

The reaction is exothermic.

1.(2) What is value for the K_p for the reverse reaction at $25^\circ C$? _____

2.(2) The partial pressure of $H_2(g)$ in equilibrium with $H_2O(g)$ at $25^\circ C$ is:(very small, very large, about the same as $P(\text{water})$). Choose one.

3.(12) Consider the reaction at equilibrium. What effect would a(n):

a. increase in T have on the mole fraction of water 8 9 no change

b. decrease in volume have on K_p ? 8 9 no change

c. decrease in T have on K_p ? 8 9 no change

d. decrease in volume have on $P(O_2)$? 8 9 no change

e. addition of $H_2(g)$ have on $P(O_2)$? 8 9 no change

f. addition of a catalyst have on $P(O_2)$? 8 9 no change

4. (8) At temperature T, the above reaction has a K_p of 12.0. $H_2O(g)$, $H_2(g)$ and $O_2(g)$ were placed into a container and their initial partial pressures were 0.10, 2.0 and 1.0 atm respectively at temperature T.

a.(3) Is this system at equilibrium? If not which direction will the reaction go?

b.(5) Assume that x atm of $O_2(g)$ are formed under these conditions. Express the equilibrium partial pressures of all three substances in terms of x and **set up** the problem to solve for x .

Do not work solve the quadratic.

$$P(H_2O) \text{ _____ } P(H_2) \text{ _____ } P(O_2) \text{ _____ } K_p = 12 =$$