Name _____ Chemistry ___/___/___

SOL Questions – Chapter 10

Each of the following questions below appeared on an SOL Chemistry Exam. Put the answer on the GREEN side of the scantron.

1. _____ A student wants to study the effects of volume on gas pressure. During his experiment he recorded the data to the right. How could he now study the effects of temperature on gas pressure?

Trial	Volume	Pressure	Temperature
1	100 mL	250 mmHg	298 K
2	300 mL	83 mmHg	298 K
3	500 mL	50 mmHg	298 K

a. Vary the temperature and volume of the gas.
b. Vary the volume of the gas only.
c. Vary the pressure and temperature of the gas.
d. Vary the temperature but keep the gas volume constant.

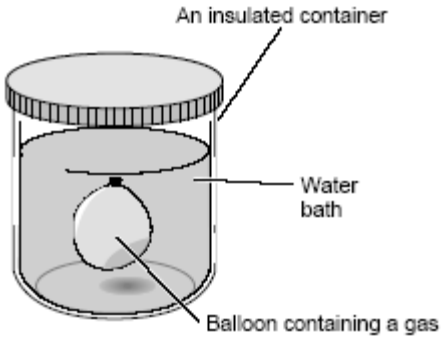
2. _____ A sample of nitrogen gas is collected over water at 20°C. The vapor pressure of water at 20°C is 18 mmHg. What is the partial pressure of the nitrogen if the total pressure is 765 mmHg?
a. 18 mmHg b. 747 mmHg c. 765 mmHg d. 783 mmHg

3. _____ A gas has a volume of 50.0 cm^3 at a temperature of -73°C. What volume would the gas occupy at a temperature of -123°C if the pressure stays constant?
a. 3.75 cm^3 b. 5.0 cm^3 c. 37.5 cm^3 d. 50.0 cm^3

4. _____ $\text{Ideal Gas Law constant} = 8.31 \frac{dm^3 \cdot kPa}{K \cdot mol}$

How many moles of CO_2 are there in a 50.0 dm^3 sample of the gas at a pressure of 100.0 kPa and a temperature of 50.0°C?
a. 1.20 moles b. 1.86 moles c. 2.0 moles d. 12.0 moles

5. _____ One way to increase the volume of the gas in the balloon in the diagram below is to –
a. cool the gas and the balloon only
b. increase the temperature of the water
c. push the balloon farther down into the water bath
d. seal the top of the water bath



6. _____ One of the main assumptions of the kinetic molecular theory of gases is that the particles of an ideal gas –
a. must be single atoms instead of molecules
b. are in constant motion
c. must be maintained at very high pressures
d. must be highly chemically reactive

7. _____ The average kinetic energy of a sample of water molecules is –
a. increased as the temperature is decreased b. increased as the temperature is increased
c. unaffected by temperature changes d. always equal to zero

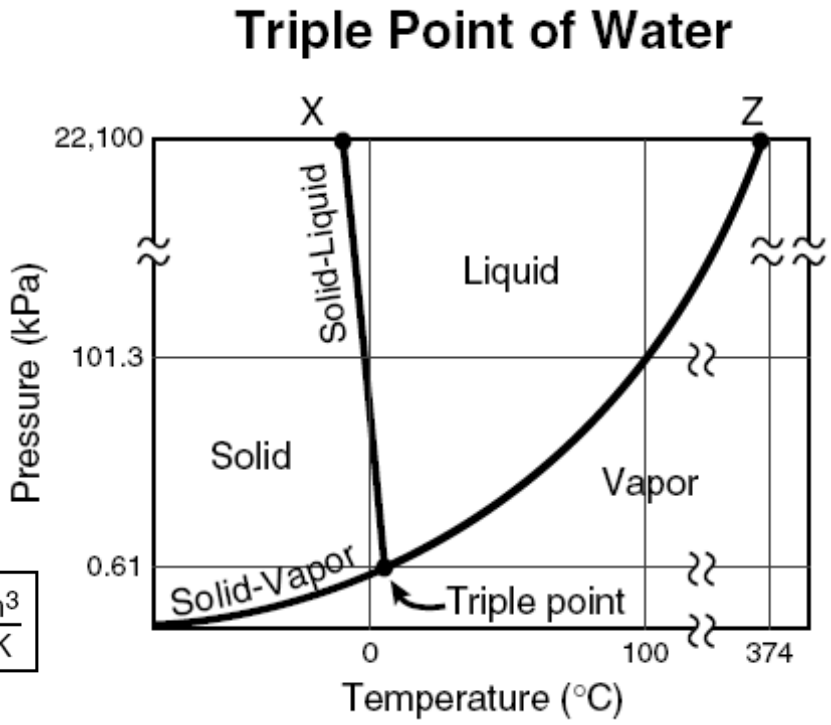
8. _____ If the pressure exerted on a confined gas is doubled, then the volume of the gas –
a. increased four times b. decreases by one-fourth c. is doubled d. is halved

9. _____ A sample of oxygen gas is collected over water at 22°C and 98.67 kPa pressure. If the partial pressure of the water is 2.67 kPa, the partial pressure of oxygen gas is –
a. 93.33 kPa b. 96.00 kPa c. 98.66 kPa d. 101.33 kPa

10. _____ A sample of hydrogen gas is collected over water at 25°C. The vapor pressure of water at 25°C is 23.8 mmHg. If the total pressure is 523.8 mmHg, what is the partial pressure of the hydrogen?
a. 23.8 mmHg b. 47.6 mmHg c. 500.0 mmHg d. 523.8 mmHg

11. _____ According to the graph to the right, what happens at the triple point of water?

a. Only ice and liquid water exist in equilibrium.
b. Water exists only as a solid.
c. Water exists only as a gas.
d. Ice, water vapor, and liquid water exist in equilibrium.



12. _____ According to the graph to the right, at a temperature of 100°C and a pressure of 0.61 kPa what state is water in?

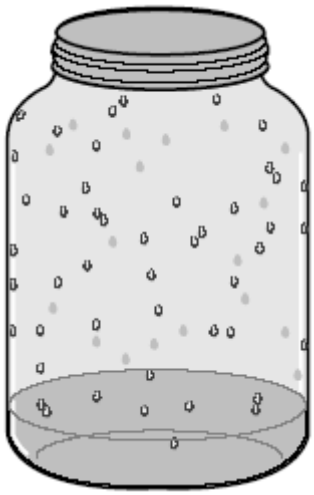
a. solid b. liquid
c. gas d. solid, liquid and gas

13. _____

$$R = 8.31 \frac{kPa \bullet dm^3}{moles \bullet K}$$

A gas cylinder with a volume of 3.00 dm^3 contains 8.00 moles of oxygen gas at a temperature of 50.0 K. What is the pressure inside the cylinder?

a. 504 kPa b. 1110 kPa
c. 2220 kPa d. 3320 kPa



14. _____ A tank contains N_2 at 1.0 atm and O_2 at 2.0 atm. Helium is added to this tank until the total pressure is 6.0 atm. What is the partial pressure of the helium?

a. 4.0 atm b. 3.0 atm
c. 2.0 atm d. 1.0 atm

15. _____ A heated liquid placed in a closed container will vaporize until –

a. the boundary between liquid and vapor disappears
b. all the liquid molecules become vapor molecules
c. the vapor pressure is greater than the atmospheric pressure
d. the number of liquid molecules vaporizing equals the number of vapor molecules condensing

16. _____ Which of the following liquids would exhibit the highest vapor pressure at 25°C?

a. water, boiling point = 100°C b. glycerine, boiling point = 290°C
c. ether, boiling point = 34.6°C d. ethyl alcohol, boiling point = 78.3°C

17. _____

$$R = 8.31 \frac{kPa \bullet dm^3}{moles \bullet K}$$

A gas cylinder is filled with 4.00 moles of oxygen gas at 300.0 K. The piston is compressed to yield a pressure of 400.0 kPa. What is the volume inside the cylinder?

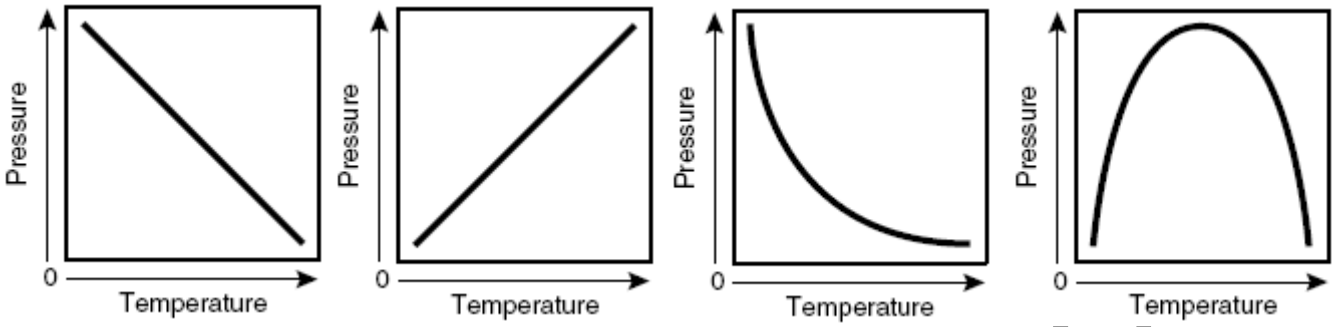
a. 3.19 dm^3 b. 6.25 dm^3 c. 24.9 dm^3 d. 31.5 dm^3

18. _____ What is the density of carbon dioxide at STP?

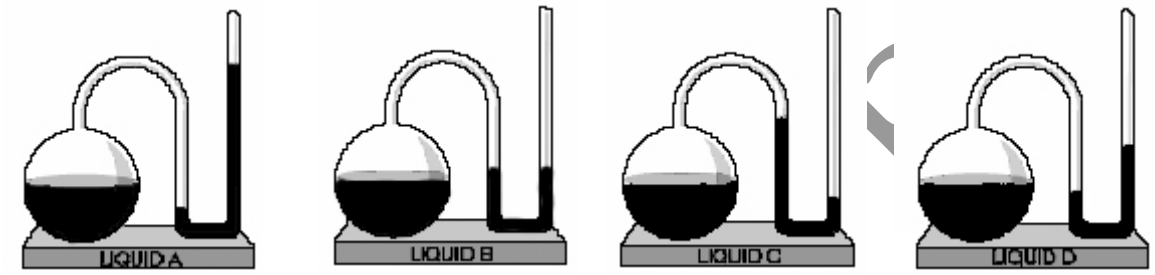
a. 1.96 g/L b. 22.0 g/L c. 46.0 g/L d. 5.09×10^1 g/L

19. _____ At a constant volume, the pressure of a gas will increase as the temperature increases. Which of the following graphics shows that relationship?

a. b. c. d.



20. _____ Equal quantities of different liquids are placed in closed manometers at 20°C. Which liquid has the highest vapor pressure?



21. _____ What mass of nitrogen gas is needed to have 5.70 dm^3 at 113.2 kPa and -10 °C?

$$R = 8.31 \frac{kPa \cdot dm^3}{moles \cdot K}$$

a. 0.295 grams b. 8.27 grams
c. 29.9 grams d. 1.07 grams

22. _____ If you heat up a closed tank of helium, what would happen to the pressure inside the tank?

a. increase b. decrease c. remain constant d. not enough information

23. _____ A balloon has a volume of 7.00 liters at a pressure of 740 mm Hg. If the temperature remains constant, at what pressure will the volume decrease to 2.00 liters?

a. 749 mm Hg b. 52.9 mm Hg c. 2590 mm Hg d. 211 mm Hg

24. _____ A container contains helium, neon, argon and krypton. Calculate the total pressure if P_{neon} = 90. kPa, P_{argon} = 20. kPa, $P_{krypton}$ = 50. kPa & P_{helium} = 10. kPa.

a. 170 kPa b. 10 kPa c. 160 kPa d. 30 kPa

25. _____ Water can be made to boil *above* its normal boiling point of 100°C by —

a. decreasing the air pressure b. increasing the air pressure
c. increasing the heat being applied d. decreasing the volume of the container

26. _____ Which of the following could cause a gaseous substance to liquify?

a. An increase in pressure b. An increase in volume
c. An increase in temperature d. A decrease in number of moles

27. _____ According to Charles' law, the volume of a fixed amount of gas is directly proportional to —

a. isoelectric mixture b. vapor concentration c. barometric pressure d. Kelvin temperature

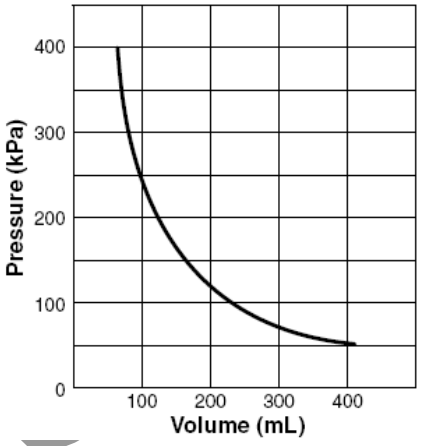
28. _____ Industrial deep-sea divers must breathe a mixture of helium and oxygen to prevent a disorienting condition known as nitrogen narcosis. If a diver's tank is filled with a helium-oxygen mixture to a pressure of 170 atmospheres and the partial pressure of helium is 110 atmospheres, the partial pressure of the oxygen is —

a. 60 atm b. 110 atm c. 140 atm d. 280 atm

29. _____ A sample of nitrogen occupies 10.0 liters at 25°C and 98.7 kPa. What would be the volume at 20°C and 102.7 kPa?

a. 7.87 L b. 9.45 L c. 10.2 L d. 10.6 L

30. _____ The graph to the right shows the pressure of an ideal gas as a function of its volume. According to the graph, increasing the volume from 100 mL to 150 mL —

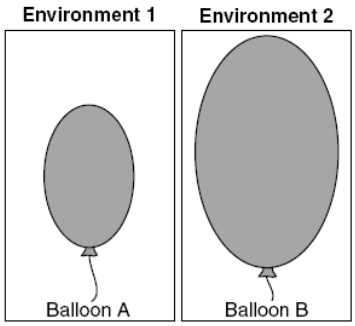


a. decreases the pressure by 80 kPa
b. decreases the pressure by 160 kPa
c. increases the pressure by 80 kPa
d. increases the pressure by 160 kPa

31. _____ The total pressure of an O_2-Ar-He gas mixture is 755 mmHg. If the partial pressure of Ar is 174 mmHg and the partial pressure of He is 389 mmHg, then the partial pressure of O_2 is —

a. 192 mmHg b. 282 mmHg
c. 366 mmHg d. 563 mmHg

32. _____ Each balloon to the right was filled with an identical number of moles of gas. Which of the following *best* explains why balloon B is larger than balloon A?

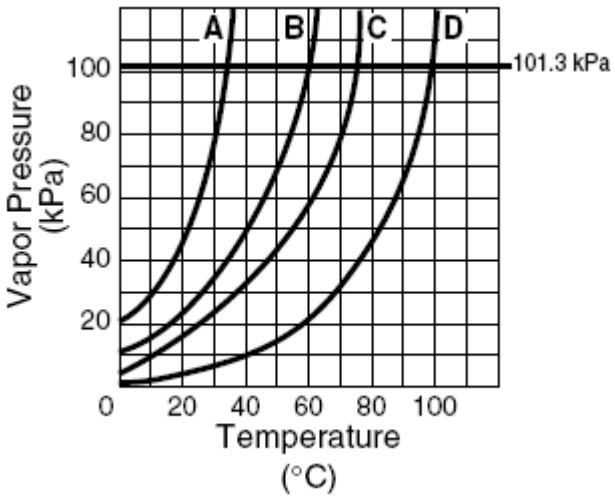


a. The gas in balloon A is under less pressure.
b. The gas in balloon A is warmer.
c. The gas in balloon B is under more pressure.
d. The gas in balloon B is warmer.

33. _____ According to Boyle's law, the relationship between the pressure and volume of a gas at constant temperature is —

a. numerically equivalent b. inversely proportional
c. positively correlated d. totally unrelated

34. _____ Line D in the graph to the right represents water. If the atmospheric pressure in a flask is lowered to 70 kPa, water would boil at what temperature?



a. 32°C b. 70°C
c. 92°C d. 100°C

35. _____ Standard atmospheric pressure is 101.3 kPa. According to the graph to the right, which of these four liquids boils at the lowest temperature?

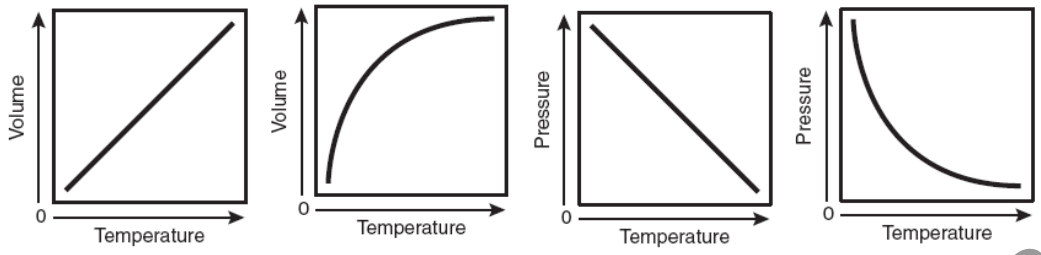
a. A b. B c. C d. D

36. _____ Charles' Law states that if a given quantity of gas is held at a constant pressure, then its volume is directly proportional to the absolute temperature. This law explains why —

a. the pressure of a gas increases when volume decreases
b. a gas-filled balloon expands when it is heated
c. solids require heat in order to change into gases
d. some gases only react with each other at high temperatures

37. _____ Which graph shows the relationship between temperature and volume as described in Charles' Law?

a. b. c. d.



38. _____ According to the kinetic-molecular theory of gases, molecules of an ideal gas —

a. travel in curved lines of motion
b. undergo elastic collisions
c. are separated by small distances
d. have strong forces between them

Partial Pressures of Gases in Air

Gas	Partial Pressure (mm Hg)
Ar	7.10
CO_2	?
N_2	593.44
O_2	159.20
Others	0.02

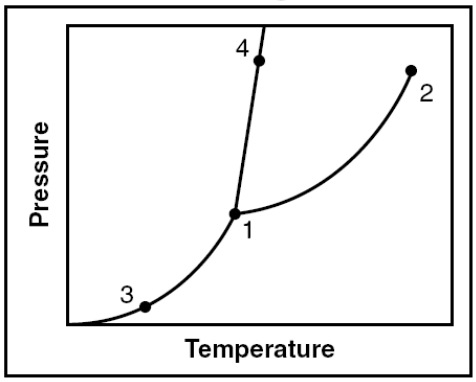
39. _____ The partial pressures of the gases that comprise air are shown in the table. If the total atmospheric pressure is 760.00 mm Hg, what is the partial pressure of CO_2?

a. 0.03 mm Hg
b. 0.24 mm Hg
c. 7.36 mm Hg
d. 759.76 mm Hg

40. _____ A mixture of gases with a pressure of 800.0 mm Hg contains 60% nitrogen and 40% oxygen by volume. What is the partial pressure of oxygen in this mixture?

a. 140.0 mm Hg
b. 320.0 mm Hg
c. 373.0 mm Hg
d. 480.0 mm Hg

Phase Diagram



41. _____ The graph shows the phase diagram of a substance. At which point on the diagram do the solid, liquid, and gas phases coexist simultaneously?

a. 1
b. 2
c. 3
d. 4

42. _____ The composition of dry air is approximately 78% nitrogen, 21% oxygen, and 1% other gases. What is the partial pressure of nitrogen at standard atmospheric pressure (101.3 kPa)?

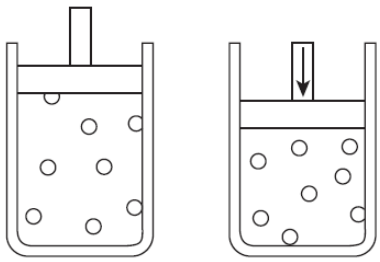
a. 21.0 kPa
b. 79.0 kPa
c. 101.3 kPa
d. 760.0 kPa

43. _____ A gas has a volume of 100.0 mL at a pressure of 600.0 mm Hg. If the temperature is held constant, what is the volume of the gas at a pressure of 800.0 mm Hg?

a. 33.33 mL b. 66.67 mL c. 75.00 mL d. 133.0 mL

44. _____ A sample of a gas is in a cylinder as shown. If the temperature is kept constant and the piston moves down to decrease the volume, the pressure increases because the gas particles —

a. expand
b. lose velocity within the container
c. become smaller
d. collide more frequently with the container



45. _____ In a mixture of oxygen and nitrogen gas, 80.0 percent of the total gas pressure is exerted by the nitrogen. If the total pressure is 2.0 atm, what pressure does the oxygen exert?

a. 0.20 atm b. 0.40 atm c. 0.80 atm d. 1.6 atm

46. _____ The table shows the measurements of the volume and the pressure of a portion of a gas at constant temperature. After graphing, the data reveals that the volume is —

a. inversely proportional to pressure
b. directly proportional to pressure
c. inversely proportional to pressure squared
d. directly proportional to pressure squared

Volume (m^3)	Pressure (kPa)
0.3	498
0.4	409
0.5	247
0.8	203
1.0	150