Gases practice problems

1) What unit of temperature is always used in gas law calculations? 1) _____

A) Terms such as "hot" or "pretty hot" or "somewhat cold" usually work just fine.
B) Any temperature unit - it doesn't matter as long as we're consistent.
C) Celsius or Kelvin but not Farenheit
D) Celsius
E) Kelvin

2) A gas can be compressed much more than a liquid or solid because 2) _____

A) gas particles move faster when the temperature increases.
B) a gas is composed of smaller particles.
C) gas molecules are more flexible.
D) gas particles can become smaller as pressure increases.
E) the particles of a gas are very far apart.

3) A tank contains helium gas at 1.50 atm. What is the pressure of the gas in mm Hg? 3) _____

4) At constant temperature, a sample of helium at 768 torr was compressed from 4.96 L to 2.34 L. What was the new pressure of the gas? 4) _____

5) The temperature of a 565.02 mL sample of gas increases from 25.0°C to 75.0°C. What is the final volume of the sample of gas, if the pressure in the container is kept constant? 5) _____

6) A gas at 2498 torr pressure was stored in a gas cylinder during the winter at 5.0°C. During the summer, the temperature in the storage area reached 40.0°C. What was the pressure in the gas tank then? 6) _____

7) A sample of argon at 295°C and 50.0 atm pressure is cooled in the same container to a temperature of 0°C. What is the new pressure? 7) _____

8) A sample of nitrogen gas had a volume of 500.00 mL, a pressure in its closed container of 748 torr, and a temperature of 25°C. What was the new volume of the gas when the temperature was changed to 59°C and the new pressure was 759 torr? 8) _____

9) A 10.0 liter balloon was taken from a temperature of 25.0°C and a pressure of 769 torr and placed in a freezer at a temperature of -15.0°C with the same pressure. What was the new volume? 9) _____

10) 1.96 g of nitrogen gas has a volume of 275 mL at 7.90 °C. What is its pressure? 10) _____

11) 0.987 g of ethane gas has a volume of 52.9 $in.^3$ at 1.56 atm. What is its temperature? 11) _____

12) A rigid cylinder that contains 25.0 liters of air at 22°C and 6.25 atm pressure was placed in an oven at a temperature of 100.°C. What is the new pressure? 12) _____
A) 7.90 atm B) 550. atm C) 34.4 atm D) 28.4 atm E) 4.94 atm

13) At STP, temperature and pressure have the values of 13) _____
A) 0 K and 1 atm.
B) 273 K and 760 mm Hg.
C) 273 K and 1 mm Hg.
D) 760 K and 273 atm.
E) 0 K and 760 mm Hg.

14) How many grams of neon occupy a volume of 14.3 L at STP? 14) _____

15) At STP conditions, 11.0 g of SO_2 has a volume of _____. 15) _____

16) How many grams of chlorine gas are present in a 150.0 liter cylinder of chlorine at a pressure of 1.00 atm and 0 °C? 16) _____

17) What is the density of carbon dioxide at STP? 17) _____

18) Assuming ideal gas behavior, which of the following gases would have the lowest density at standard temperature and pressure? 18) _____

A) Kr B) N_2 C) CF_2Cl_2 D) SF_6 E) CO_2

19) Subtracting the vapor pressure of water from the total pressure of a gas collected over water is an example of the application of: 19) _____

A) Ideal gas law
B) Graham's Law
C) Avogadro's law
D) Vapor subtractionation
E) Dalton's Law

20) A 50.0 g gas sample is 20.0% gas A, 30.0% gas B, and 50.0% gas C, by moles. What are the partial pressures of each gas at STP? 20) _____

21) A 50.0 g gas sample is 20.0% He, 30.0% Ne, and 50.0% Ar, by mass. What are the partial pressures of each gas at STP? 21) _____

22) A gas sample of unknown amount is 20.0% He, 30.0% Ne, and 50.0% Ar, by mass. What are the partial pressures of each gas at STP? 22) _____

23) The fact that a balloon filled with helium will leak more slowly than one filled with hydrogen can be explained by citing: 23) _____

A) Ideal gas law
B) Dalton's Law
C) Avogardro's law
D) The balloon hypothesis
E) Graham's Law

24) What is the ratio of the diffusion rates of Cl_2 and O_2? 24) _____

25) Under conditions for which chlorine gas has an effusion rate of 2.4×10^{-6} mol sec^{-1}, what would be the effusion rate for bromine gas, in mol/sec? 25) _____

26) A sample of $N_2(g)$ effuses through a tiny hole in 19.0 s. How long would it take for a sample of $N_2O_2(g)$ to effuse under the same conditions? 26) _____

27) Determine the volume of O_2 (at STP) formed when 50.0 g of $KClO_3$ decomposes according to the following reaction. The molar mass for $KClO_3$ is 122.55 g/mol. 27) _____

$$2\ KClO_3(s) \rightarrow 2\ KCl(s) + 3\ O_2(g)$$

28) Determine the volume of SO_2 formed at STP from the reaction of 96.7 g of FeS_2 and 55.0 L of O_2 (initially at 398 K and 1.20 atm). 28) _____

$$4\ FeS_2(s) + 11\ O_2(g) \rightarrow 2\ Fe_2O_3(s) + 8\ SO_2(g)$$

29) Determine the percent yield if 21.8 g of K_2CO_3 is produced from reacting 27.9 g KO_2 with 29.0 L of CO_2 (at STP). The molar mass of KO_2 = 71.10 g/mol and K_2CO_3 = 138.21 g/mol. 29) _____

$$4\ KO_2(s) + 2\ CO_2(g) \rightarrow 2\ K_2CO_3(s) + 3\ O_2(g)$$

30) The following reaction is used to generate hydrogen gas in the laboratory. If 243 mL of gas is collected at 298 K and has a total pressure of 745 mm Hg, what mass of hydrogen is produced? A possibly useful table of water vapor pressures is provided below. 30) _____

$$Mg(s) + 2\ HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

T (°C)	P (mm Hg)
25	23.78

31) The following reaction generates hydrogen gas. If 408.0 mL of gas is collected over water at 20.0 °C and has a pressure of 767.4 mm Hg, what mass of zinc metal dissolved? An extensive table of water vapor pressures at different temperatures is provided. 31) _____

$$Zn(s) + 2\ HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$$

T (°C)	P (mm Hg)
20	17.55

32) A 31.4 mL sample of nitrogen gas was collected over water at 23.7 °C and a barometric pressure of 706 mmHg. What mass of nitrogen was collected? (Vapor pressure of water at 23.7 °C is 22 mmHg). 32) _____

33) A gas mixture contains CO, Ar and H_2. What is the total pressure of the mixture, if the mole fraction of H_2 is 0.35 and the pressure of H_2 is 0.58 atm? 33) _____

34) Calculate the height in meters of a column of liquid glycerol (density =1.26 g/cm^3) required to exert the same pressure as 760 mmHg (d = 13.60 g/cm^3). 34) _____

35) Calculate the height of a column of liquid glycerol (d = 1.26 g/cm^3), in meters, required to exert the same pressure as 4.91 m of water. 35) _____

36) According to the kinetic-molecular theory of gases: 36) _____
A) all gas particles move at the exact same speed at a given temperature
B) all collisions cause particles to lose kinetic energy
C) gaseous particles are in constant, circular motion
D) the average kinetic energy of a particle is independent of the temperature
E) the average kinetic energy of a particle is directly proportional to the kelvin temperature

37) The kinetic energy of a gas particle: 37) _____
A) depends only on the speed of the particle
B) depends only on the mass of the particle
C) is the same for all particles at constant temperature
D) is distributed over a wide range at a given temperature

38) Which of the following assumptions is NOT from the kinetic molecular theory of gases? 38) _____
A) gas particles occupy a negligible amount of the total gas volume
B) the average kinetic energy of the gas particles is directly proportional to the Kelvin temperature
C) inter-particular forces are negligible
D) collisions between gas particles and gas particles with the container walls are perfectly elastic
E) individual gas particles are never collide with each other

39) If 0.50 moles of hydrogen gas and 1.0 mole of helium gas are compared at standard temperature and pressure, the two gases will: 39) _____
A) have equal mass
B) have equal rates of diffusion and effusion
C) occupy equal volumes
D) have equal average molecular velocities
E) have equal average molecular kinetic energies

40) If a liter of CO_2 is compared to a liter of H_2 at 25 °C and 1 atm, then: 40) _____

A) the CO_2 and H_2 molecules will have the same average speed
B) the average kinetic energy of the CO_2 molecules is greater than that of the H_2 molecules
C) there are more H_2 molecules than CO_2 molecules
D) the mass of one liter of CO_2 equals the mass of one liter of H_2
E) the CO_2 molecules have a slower average speed than the H_2 molecules

41) At 27 °C and 750 torr, both a 16 g sample of methane gas (CH_4) and a 16 g sample of oxygen gas will have the same: 41) _____

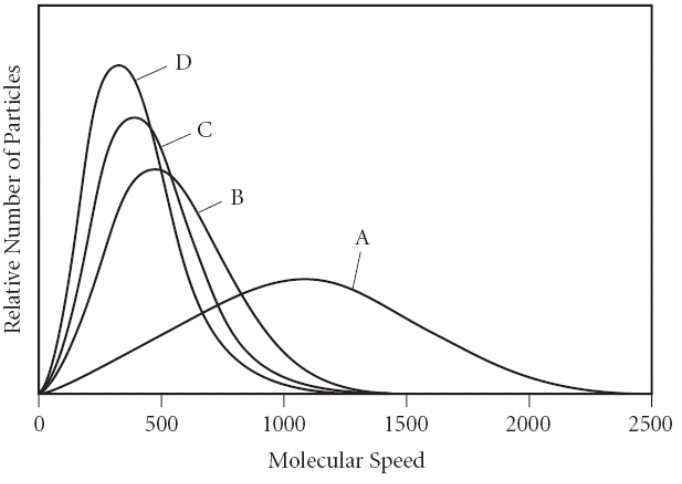
A) volume
B) effusion rates
C) number of gaseous particles
D) average molecular velocities
E) average kinetic energies

42) Which of the following samples will have the greatest average speed at 273 K? 42) _____

A) Ne
B) Cl_2
C) CH_4
D) C_2H_4
E) All of these samples will have the same average speed.

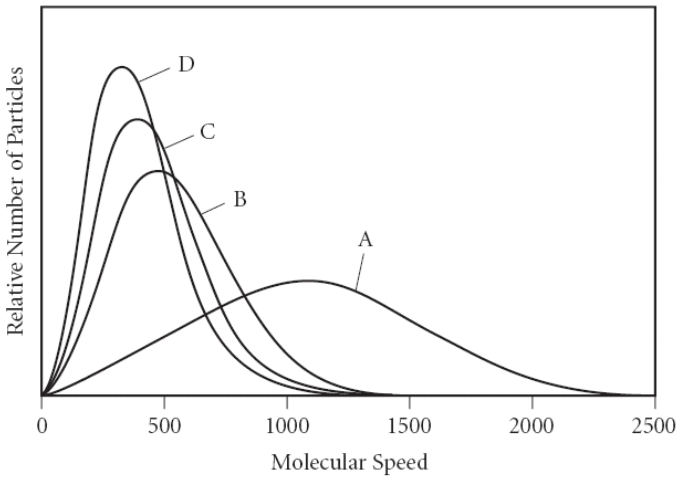
43) Calculate v_{rms} , $\bar{v}$, and v_p for H_2 molecules at 30 °C. 43) _____

44) Which of the gases in the graph below has the largest molar mass (assume same temperature and pressure)? 44) _____



A) A
B) B
C) C
D) D
E) All have same molar mass.

45) Which of the gases in the graph below has the lowest density at STP. 45) _____



A) A
B) B
C) C
D) D
E) All of the gases have the same density at STP.

46) Gases tend to behave ideally at: 46) _____
A) high temperature and high pressure
B) low temperature and high pressure
C) high temperature and low pressure
D) low temperature and low pressure
E) gases always behave ideally

47) In which of the following cases is the gas most likely to behave as an ideal gas? 47) _____
A) H_2O at 375 K, 0.99 atm
B) Ne at 648K, 0.75 atm
C) He at 37.5 K, 9.9 atm
D) SF_6 at 235 K, 0.75 atm
E) CH_4 at 310K, 7.5 atm

48) The volume correction term in the van der Waals equation is present because: 48) _____
A) molecules occupy volume
B) barometers are inaccurate
C) molecules attract each other
D) molecules are diatomic
E) molecules repel each other

49) The measured P of a van der Waals gas compared to an ideal gas is: 49) _____
A) higher, because of the intermolecular forces
B) higher, because the molecules repel each other
C) lower, because of the intermolecular forces
D) lower, because the gases expand
E) higher, because the molecules occupy space

Use the Van der Waal equation for the problems that follow:

$$\left(P + \frac{an^2}{V^2}\right)((V - nb)) = nRT$$

50) A cylinder of nitrogen contains 2.50 kg of the gas with a volume of 21.2 liters at 25°C. What is the pressure of the gas in the cylinder? 50) _____

for nitrogen, a = 1.370 L^2atm/mol^2; b = 0.0387 L/mol

51) A 1.00 mol sample of neon gas at 0°C has a pressure of 45.00 atmosphere. What would the observed volume be for this gas using the van der Waals equation? 51) _____

for neon, a = 0.208 L^2atm/mol^2; b = 0.0167 L/mol

52) Two flasks (flask A and flask B) are connected by a tube with a closed stopcock. Flask A is 1.50 L and contains N_2 gas at a pressure of 3.45 atm and flask B is evacuated using a vacuum pump. If the stopcock is opened the pressure in flask A is reduced to 1.67 atm. What is the volume of flask B? 52) _____

TRUE FALSE. Write T or F.

53) A gaseous mixture consists of 50.0% O_2, 25.0% N_2, and 25.0% Cl_2, by moles. At standard temperature and pressure, the partial pressure of Cl_2 is 0.25 atm. 53) _____

54) A gaseous mixture consists of 50.0% O_2, 25.0% N_2, and 25.0% Cl_2, by mass. At standard temperature and pressure, the partial pressure of Cl_2 is 0.25 atm. 54) _____

55) If someone opens up a perfume bottle at one end of a room, people at the other end of the room will soon smell the perfume. This process is an example of effusion. 55) _____

56) Hydrogen gas will diffuse 4.5 times faster than nitrogen gas. 56) _____

57) The higher the temperature, the lower the average kinetic energy of the sample. 57) _____

58) According to the kinetic-molecular theory of gases, all particles in the gas have the same kinetic energy at a given temperature. 58) _____

59) According to the kinetic-molecular theory of gases, all particles in the gas have the same average kinetic energy at a given temperature. 59) _____

60) Especially at higher pressures, a gas will occupy a larger volume than predicted by the ideal gas law. 60) _____

61) Especially at lower temperatures, a gas will have a lower pressure than predicted by the ideal gas law. 61) _____