#  KEY

# Chemistry: *Mixed Review*

Solve each of the following problems, being sure to show your work and include all proper units.

1. Use the ideal gas law PV = nRT, to derive Boyle’s law and Charles’s law.

 If n, R and T are constant: PV = nRT If n, R and P are constant: V/T = nRP

 PV = constant V/T = constant

 P1V1 = P2V2 (Boyle’s Law) V1/T1 = V2/T2 (Charles’s Law)

2. A container holds 265 mL of chlorine gas, Cl2. Assuming that the gas sample is at STP, what is its mass?

 V = 265 mL (0.265 L) PV = nRT

 T = 273 K

 P = 1 atm

 n = ? mol

 R = 0.0821 L.atm / mol.K

3. Suppose that 3.11 mol of carbon dioxide is at a pressure of 0.820 atm and a temperature of 39oC. What is the volume of the sample, in liters?

 n = 3.11 mol CO2 PV = nRT

 P = 0.820 atm

 T = 39oC + 273 = 312 K

 V = ? L

 R = 0.0821 L.atm / mol.K

4. Compare the rates of diffusion of carbon monoxide, CO, and sulfur trioxide, SO3.

 CO = carbon monoxide SO3 = sulfur trioxide

 m1 = 28 g m2 = 80 g

 *v*1 = ? *v*2 = ?

 CO diffuses 1.69x faster than SO3 (or SO3 is 0.59x slower)

5. A gas sample that has a mass of 0.993 g occupies 0.570 L. Given the temperature is 281 K and the pressure is 1.44 atm, what is the molar mass of the gas?

 P = 1.44 atm PV = nRT

 V = 0.570 L

 n = ? mol

 R = 0.0821 L.atm / mol.K

 T = 281 K

Answers: 1. 2. **0.84 g Cl2** 3. **97.1L** 4. **CO is 1.69x faster** 5. **28 g/mol**

6. The density of a gas is 3.07 g/L at STP. Calculate the gas’s molar mass.

 P = 1 atm

 V = ? L

 T = 273 K

 n = ? mol

 R = 0.0821

 D = 3.07 g/L

Density is an intensive property.

Assume mass = 1.0 g

7. How many moles of helium gas would it take to fill a gas balloon with a volume of 1000. cm3 when the temperature is 32oC and the atmospheric pressure is 752 mm Hg?

 P = 752 mm Hg PV = nRT

 V = 1 L

 n = ? mol

 R = 0.0821 L.atm / mol.K

 T = 32oC + 273 = 305 K

8. A gas sample is collected at 16oC and 0.982 atm. If the sample has a mass of 7.40 g and a volume of 3.96 L, find the volume of the gas at STP and the molar mass.

 P1 = 0.982 atm

 V1 = 3.96 L

 T1 = 16oC + 273 = 289 K

 P2 = 1 atm

 V2 = ? L PV = nRT

 T2 = 273 K

9. An unknown gas effuses at 0.850 times the effusion rate of nitrogen dioxide, NO2. Estimate the molar mass of the unknown gas.

 Unknown Gas Nitrogen dioxide, NO2

 m1 = ? g m2 = 46 g

 *v*1 = 0.850 *v*2 = 1



10. What will be the pressure if we open:

* 1. just valve A? **0.75 atm**
	2. just valve C? **0.5 atm**
	3. any two valves? **0.5 atm**

Use Boyle’s law:

 (a) 1.5 atm of gas divided in 2 spheres = 0.75 atm

 (b) 1.0 atm of gas divided in 2 spheres = 0.5 atm

 (c) 1.5 atm of gas divided in 3 spheres = 0.5 atm

Answers: 6. **68.8 g/mol** 7. **0.0395 mol** 8. **3.67 L & 45 g/mol** 9. **63.7 g/mol**