Practice Celebration for Gas Chemistry 2025 ANSWERS

1. A helium balloon is filled to a volume of 78.5 liters, at 2.50 atm, and the gas temperature is 295 K. If the balloon cools to 252 K, and the volume drops to 64.0 Liters. What is the new pressure in this balloon?

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \qquad \frac{(2.50\text{ atm})(78.5\text{ L})}{295\text{ K}} = \frac{(P_2)(64.0\text{ L})}{252\text{ K}} \qquad 49{,}455 = 18800\,(P_2)$$

$$P_2 = 2.63\text{ atm}$$

2. At constant temperature a sample of carbon dioxide gas is at 100. liters and 125 kPa. If the pressure is tripled, what is the new volume of CO_2?

$$P_1V_1 = P_2V_2 \qquad (125\text{ kPa})(100.\text{ L}) = (375\text{ kPa})(V_2) \qquad V_2 = 33.3\text{ Liters}$$

3. At constant pressure, a sample of CH_4 gas is at 250. liters and 273 K, is heated up to 373 K, what is the new volume of methane?

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \qquad \frac{(250.\text{ L})}{273\text{ K}} = \frac{(V_2)}{373\text{K}} \qquad 93250 = (273)(V_2)$$

$$V_2 = 342\text{ Liters}$$

4. At constant volume, a sample of O_2 is at 2.25 atm and 295 K. If the O_2 is cooled to 268 K, what is the new pressure of this gas?

$$\frac{P_1}{T_1} = \frac{P_2}{T_2} \qquad \frac{(2.25\text{ atm})}{295\text{ K}} = \frac{(P_2)}{268\text{ K}} \qquad (295)(P_2) = 603$$

$$P_2 = 2.04\text{ atm}$$

5. Convert 125 kPa to mm of Hg.

$$\frac{125\text{ kPa}}{1} \times \frac{760\text{ mm Hg}}{101.3\text{ kPa}} = 938\text{ mm Hg}$$

6. Convert 25.0 psi into atmospheres.

$$\frac{25.0\text{ psi}}{1} \times \frac{1\text{ atm}}{14.7\text{ psi}} = 1.70\text{ atm}$$

7. Convert 945 mm Hg into kPa.

$$\frac{945\text{ mm Hg}}{1} \times \frac{101.3\text{ kPa}}{760\text{ mm Hg}} = 126\text{ kPa}$$

8. Convert 0.975 atm into pounds per square inch.

$$\frac{0.975\text{ atm}}{1} \times \frac{14.7\text{ psi}}{1\text{ atm}} = 14.3\text{ psi}$$

9 Avogadro's Hypothesis	Equal volumes of different gases, at the same temperature & pressure, have the same number of moles, and the same number of particles.

10. The Kinetic Molecular Theory, or the KMT

Gas particles are in random, constant, straight line motion.

This is 100% true, real gases (and ideal gases) follow this exactly. Atoms and molecules of gas only move in straight lines, very fast. When they bump into walls, or each other, they careen off in new straight lines.

Gas particles are separated from each other by vast distances from each other, relative to their actual sizes.

This is 100% true, real gases (and ideal gases) follow this exactly.
Atoms and molecules are very, very small compared to the amount of space they live in.

Gas particles act as small hard spheres.

This is not true for real gases, but real gases act as if this is true. Real gases have real shapes, especially the multiatom molecules. Acting as spheres means that gas molecules are unlikely to turn into liquids, and gases generally do not turn into liquids. But real gases do have shapes; usually these shapes have little impact as to gases turning into liquids.

Gas particles (atoms or molecules) have no attraction, or repulsion, for each other.

This is fully untrue. The amount of attraction between the particles is very small. The amount of repulsion is also real and also very small. Over time this constant attraction and repulsion should render the gases slower and slower, ultimately letting all gases turn into liquids. But, the small loss of energy caused by attractions and repulsions is easily made up by the Sun providing energy to the Earth each day (or heat in buildings, etc.)

Gas particles have collisions that are ELASTIC.

Elastic means that ALL kinetic energy is transferred to other gas particles on all collisions. This is untrue. Every collision causes a very small loss of energy, as heat mostly (sound? too small for our ears for sure) Over time this loss of energy should render the gases slower and slower, ultimately letting all gases turn into liquids. But, the small loss of energy caused collisions is easily made up by the Sun providing energy to the Earth each day (or heat in buildings, etc.)

Ideal gases can be compressed indefinitely but they remain gases.

Real gases are made up of particles that have a real volume or size. It's crazy small but never quite zero. When compressed, gases can squeeze together into liquids, but ideal gases (which are fake) can theoretically stay gases at a zero volume.

The average Kinetic Energy is directly proportional to the Kelvin Temperature of a gas.

This is 100% true, real gases (and ideal gases) are directly impacted by the temperature.
Temperature and Kinetic Energy are directly proportional. When gases get hotter, the particles move faster. When gases get colder, the particles move slower.