**Problem Set #5 Unit 8 Gases (GRADED HOMEWORK)  
Chemistry 3A Fall 2025 (Secs 43957 & 43958)**

SHOW YOUR WORK, YOUR CALCULATIONS, not just the result. This is PART of the grading. Be careful of precision (significant digits, decimal places). All the information to is in the Chap 8 Content lecture slides. Point value is given in question.

**How to do this homework?** Easiest is to print out and do by hand (neatly please: work it out on scratch paper first). If you can do this online in PDF or DOCX as I did, that’s fine too.  
A RUBRIC is provided for this homework assignment in the Canvas description

1. A gas at 1.00 atm in a volume of 100.0 L is compressed to 5.000 L volume. What is the pressure in the smaller volume?

Boyle’s Law calculation: *P*1*V*1 = *P*2*V*2  🡪 *P*2 = *P*1*V*1 / *V*2

*P*2 = (1.00 atm × 100.0 L) / (5.000 L) = 20.0 atm

2. 10.0 mol argon (Ar) at 400 K in a volume of 5.00 L will have a pressure of how many atmospheres (atm)?

This is a straightforward ideal gas law problem: *PV = nRT*, and we solve for pressure *P*.

*V* = 5.00 L, *n* = 10.0 mol, *T* = 400 K. We need a value in atmospheres, so the correct R constant must have units of liters (L), Kelvin (K) [it must always be Kelvin, and moles (mol) [it will always be mol].

3. Helium (He) in a balloon of 2.00 L volume on a cold (10°C) day is brought into a room at room temperature (25°C) and the balloon expands. What is the new volume?

This is a change of volume with change in temperature relationship. Looks like Charles Law. The temperature needs converting to K before solving:

4. From problem #3, the mass of helium is 10.00 g. What is the pressure of the gas at the initial conditions of 10°C?

In the previous problem, there was a volume (V) and a temperature (T). A pressure (P) is being asked for. One thing is missing: the moles (n) to solve it using the ideal gas law equation PV = nRT. An amount is given, but is it the ***n*** value? The units of ***n*** must be in **moles**, but the mass is in **grams (g)**.

How can a mass in grams be related to an amount in moles? The **molar mass** of the substance. All molar masses, with units in **grams per mole (g/mol)**, whether pure atoms or compounds/molecules can be related to the values in the Periodic Table. In this case, it is one value in the Periodic Table: the molar mass of pure noble gas helium. From the table it is **4.003** **g/mol**

Now solve it:

5. A gas at a temperature of 100°C has a pressure of 1.0 atm. The temperature is brought way down to –20°C. What is the pressure now?

This describes a pressure (*P*) and temperature (*T*) of a gas at one (initial) condition, then wants to know the pressure (*P*) at a different temperature (*T*). This is about the Gay-Lussac Law.

6. 50.0 g of potassium chlorate is heated in a 20.0 L sealed container, and produces diatomic oxygen (O2) according to the reaction below. If the temperature after reaction is at 25°C, what is the pressure in the flask? Use any units for the pressure you want.

The question is about solving a pressure (P). Determine what is given:

• 50.0 g KClO3 solid  
• volume (V) = 2.0 L  
° temperature (T) = 25°C  
Since this is about gases, and oxygen (O2) is mentioned, then the pressure of oxygen is wanted. From the reaction, O2 will be generated from the solid KClO3. The theoretical amount of O2 will be the stoichiometric reaction of 2 mol KClO3 to make 3 mol of O2.  
So it is necessary to compute the molar mass of KClO3 from the molar masses of the elements in the Table: 39.10 g/mol K × 1 + 35.45 g/mol Cl × 1 + 16.00 g/mol O × 3 = 48.00 g/mol = 122.55 g/mol KClO3. Computing moles of O2 to be produced:

Now ***n*** is obtained and everything is ready for the PV = nRT equation