**Day 2: Kinetic Theory and Properties of Gases**

1. What pressure, in kilopascals and in atmospheres, does a gas exert at 385 mm Hg?
2. A cylinder of oxygen gas is cooled from 300 K (27°C) to 150 K (-123°C). By what factor does the average kinetic energy of the oxygen molecules in the cylinder decrease?
3. Which of these statements are characteristic of matter in the gaseous state?
	1. Gases fill their containers completely.
	2. Gases exert pressure.
	3. Gases have mass.
	4. The pressure of a gas is independent of the temperature.
	5. Gases are compressible.
4. What is significant about the temperature absolute zero? Describe the motion of molecules at this temperature.

**Day 3: The Nature of Liquids and Solids**



**Figure 13.9: Vapor Pressure vs. Temperature**

On the graph, the intersection of a curve with the 101.3 kPa line indicates the boiling point of that substance at standard pressure.

1. **Read Graphs**: What is the boiling point of chloroform at 101.3 kPa? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. **Read Graphs**: What is the vapor pressure of ethanol at 40°C? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. **Predict**: What would atmospheric pressure need to be for ethanoic acid to boil at 80°C?
4. In terms of kinetic energy, explain how a molecule of a liquid evaporates.
5. Why does the boiling point of a liquid vary with atmospheric pressure?
6. Why does a solid have a definite shape and volume while liquids and gases do not?

**Day 4: Changes of State**

The phase diagram of water shows the relationship among pressure, temperature, and the physical states of water. Note that the scale of the axes is not linear.

* 1. **Read graphs**: At the triple point of water, what are the values of temperature and pressure?
	2. **Identify**: What states of matter are present at the triple point of water?
	3. **Analyze**: Assuming standard pressure, at what temperature is there an equilibrium between water vapor and liquid water? Between liquid water and ice?

**Figure 13.18: Phase Diagram of Water**

* + 1. **Analyze**: What state(s) does water exist in given the following conditions:
1. 0.01°C and 101.3 kPa: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. 100°C and 0.611 kPa: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Using Figure 13.18, estimate the boiling point of water at a pressure of 50 kPa.
4. What does the triple point on a phase diagram describe?
5. Explain why a liquid stays at a constant temperature while it is boiling.

**Day 6: Properties of Gases and Gas Laws**

1. List three factors that can affect gas pressure.
2. How does a decrease in temperature affect the pressure of a contained gas?
3. Nitrous oxide (N2O) is used as an anesthetic. The pressure of 2.50 L of N2O changes from 105 kPa to 40.5 kPa. If the temperature does not change, what will the new volume be?
4. A gas with a volume of 4.00 L at a pressure of 205 kPa is allowed to expand to a volume of 12.0 L. What is the pressure in the container if the temperature remains constant?

**Day 7: Gas Laws, day 2**

1. Exactly 5.00 L of air at -50.0°C is warmed to 100.0°C. What is the new volume if he pressure remains constant?
2. The pressure in a car tire is 198 kPa at 27°C. After a long drive, the pressure is 225 kPa. What is the temperature of the air in the tire? Assume that the volume is constant.
3. A gas at 155 kPa and 25°C has an initial volume of 1.00 L. The pressure of the gas increases to 605 kPa as the temperature is raised to 125°C. What is the new volume?
4. A 5.00 L air sample has a pressure of 107 kPa at a temperature of -50.0°C. If the temperature is raised to 102°C and the volume expands to 7.00 L, what will the new pressure be?

**Day 8: Ideal Gases**

1. When the temperature of a rigid hollow sphere containing 685 L of helium gas is held to 621 K, the pressure of the gas is 1.89x103 kPa. How many moles of helium does the sphere contain?
2. What pressure will be exerted by 0.450 mol of a gas at 25°C if it is contained in a 0.650-L vessel?
3. A child’s lungs can hold 2.20 L. How many grams of air do her lungs hold at a pressure of 102 kPa and a body temperature of 37°C? Use a molar mass of 29 g for hot air, which is about 20% O2 and 80% N2.
4. Under what conditions do real gases deviate most from ideal behavior?

**Day 10: Gases: Mixtures and Movements**

1. A gas mixture containing oxygen, nitrogen, and carbon dioxide has a total pressure of 32.9 kPa. If $P\_{O\_{2}}$­= 6.6 kPa and $P\_{N\_{2}}$=23.0 kPa, what is $P\_{CO\_{2}}$?
2. Determine the total pressure of a gas mixture that contains oxygen, nitrogen, and helium. The partial pressure are $P\_{O\_{2}}$­= 20.0 kPa, $P\_{N\_{2}}$=46.7 kPa and $P\_{He}$=26.7 kPa.
3. Calculate the ratio of the velocity of hydrogen molecules to the velocity of carbon dioxide molecules at the same temperature.
4. Explain why the rates of diffusion of nitrogen gas and carbon monoxide are almost identical at the same temperature.