

## Combined Gas Law Worksheet

- 1) If I initially have 4.0 L of a gas at a pressure of 1.1 atm, what will the volume be if I increase the pressure to 3.4 atm?
- 2) A toy balloon has an internal pressure of 1.05 atm and a volume of 5.0 L. If the temperature where the balloon is released is 20° C, what will happen to the volume when the balloon rises to an altitude where the pressure is 0.65 atm and the temperature is -15° C?
- 3) A small research submarine with a volume of  $1.2 \times 10^5$  L has an internal pressure of 1.0 atm and an internal temperature of 15° C. If the submarine descends to a depth where the pressure is 150 atm and the temperature is 3° C, what will the volume of the gas inside be if the hull of the submarine breaks?
- 4) People who are angry sometimes say that they feel as if they'll explode. If a calm person with a lung capacity of 3.5 liters and a body temperature of 36° C gets angry, what will the volume of the person's lungs be if their temperature rises to 39° C. Based on this, do you think it's likely they will explode?

- 5) A bag of potato chips is packaged at sea level (1.00 atm) and has a volume of 315 mL. If this bag of chips is transported to Denver (0.775 atm), what will the new volume of the bag be?
  
- 6) A Los Angeles class nuclear submarine has an internal volume of eleven million liters at a pressure of 1.250 atm. If a crewman were to open one of the hatches to the outside ocean while it was underwater (pressure = 15.75 atm), what would be the new volume of the air inside the submarine?
  
- 7) A child has a toy balloon with a volume of 1.80 liters. The temperature of the balloon when it was filled was 20° C and the pressure was 1.00 atm. If the child were to let go of the balloon and it rose 3 kilometers into the sky where the pressure is 0.667 atm and the temperature is -10° C, what would the new volume of the balloon be?
  
- 8) A commercial airliner has an internal pressure of 1.00 atm and temperature of 25° C at takeoff. If the temperature of the airliner drops to 17° C during the flight, what is the new cabin pressure?
  
- 9) If divers rise too quickly from a deep dive, they get a condition called “the bends” which is caused by the expansion of very small nitrogen bubbles in the blood due to decreased pressure. If the initial volume of the bubbles in a diver’s blood is 15 mL and the initial pressure is 12.75 atm, what is the volume of the bubbles when the diver has surfaced to 1.00 atm pressure?

## **Combined Gas Law Worksheet - Solutions**

- 1) If I initially have 4.0 L of a gas at a pressure of 1.1 atm, what will the volume be if I increase the pressure to 3.4 atm?

$$(1.1 \text{ atm})(4.0 \text{ L}) = (3.4 \text{ atm})(x \text{ L})$$

$$x = 1.29 \text{ L}$$

- 2) A toy balloon has an internal pressure of 1.05 atm and a volume of 5.0 L. If the temperature where the balloon is released is 20° C, what will happen to the volume when the balloon rises to an altitude where the pressure is 0.65 atm and the temperature is -15° C?

$$(1.05 \text{ atm})(5.0 \text{ L})/(293 \text{ K}) = (0.65 \text{ atm})(x \text{ L})/(258 \text{ K})$$

$$x = 7.11 \text{ L}$$

- 3) A small research submarine with a volume of  $1.2 \times 10^5$  L has an internal pressure of 1.0 atm and an internal temperature of 15° C. If the submarine descends to a depth where the pressure is 150 atm and the temperature is 3° C, what will the volume of the gas inside be if the hull of the submarine breaks?

$$(1.0 \text{ atm})(1.2 \times 10^5 \text{ L})/(288 \text{ K}) = (150 \text{ atm})(x \text{ L})/(276 \text{ K})$$

$$x = 767 \text{ L}$$

- 4) People who are angry sometimes say that they feel as if they'll explode. If a calm person with a lung capacity of 3.5 liters and a body temperature of 36° C gets angry, what will the volume of the person's lungs be if their temperature rises to 39° C. Based on this, do you think it's likely they will explode?

$$(3.5 \text{ L})/(309 \text{ K}) = (x \text{ L})/(312 \text{ K})$$

$$x = 3.53 \text{ L}$$

**It seems unlikely that this very small increase in lung volume would cause somebody to explode, though you never know.**

- 5) A bag of potato chips is packaged at sea level (1.00 atm) and has a volume of 315 mL. If this bag of chips is transported to Denver (0.775 atm), what will the new volume of the bag be?

**406 mL**

- 6) A Los Angeles class nuclear submarine has an internal volume of eleven million liters at a pressure of 1.250 atm. If a crewman were to open one of the hatches to the outside ocean while it was underwater (pressure = 15.75 atm), what would be the new volume of the air inside the submarine?

**873,000 L**

- 7) A child has a toy balloon with a volume of 1.80 liters. The temperature of the balloon when it was filled was 20° C and the pressure was 1.00 atm. If the child were to let go of the balloon and it rose 3 kilometers into the sky where the pressure is 0.667 atm and the temperature is -10° C, what would the new volume of the balloon be?

**2.42 L**

- 8) A commercial airliner has an internal pressure of 1.00 atm and temperature of 25° C at takeoff. If the temperature of the airliner drops to 17° C during the flight, what is the new cabin pressure?

**0.973 atm**

- 9) If divers rise too quickly from a deep dive, they get a condition called “the bends” which is caused by the expansion of very small nitrogen bubbles in the blood due to decreased pressure. If the initial volume of the bubbles in a diver’s blood is 15 mL and the initial pressure is 12.75 atm, what is the volume of the bubbles when the diver has surfaced to 1.00 atm pressure?

**191 mL**