Skills Worksheet

Math Skills

Boyle's Law

After you study each sample problem and solution, work out the practice problems on a separate sheet of paper. Write your answers in the spaces provided.

PROBLEM

To make an air horn, 1.50 L of air at 101 kPa are compressed into a can with a volume of 0.462 L. Assuming a constant temperature, what is the pressure on the compressed air?

SOLUTION

Step 1: **List the given and unknown values.**

Given: $V_1 = 1.50$ L

$P_1 = 101$ kPa

$V_2 = 0.462$ L

Unknown: P_2

Step 2: **Write the equation for Boyle's law, then rearrange the equation to isolate the value you want to find.**

$$P_1V_1 = P_2V_2$$
$$P_2 = \frac{P_1V_1}{V_2}$$

Step 3: **Substitute the known values into the equation, and solve.**

$$P_2 = \frac{(101 \text{ kPa})(1.50 \text{ L})}{(0.462 \text{ L})}$$
$$P_2 = 328 \text{ kPa}$$

PRACTICE

1. A science class puts a balloon containing 1.25 L of air at 101 kPa into a bell jar. Using an air pump, the class removes some of the air in the jar, causing the balloon to expand to a volume of 2.25 L. Assuming a constant temperature, what is the new pressure inside the jar?

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2. A small balloon is inflated with helium at 102 kPa to a volume of 2.12 L. According to the balloon's manufacturer, if the balloon is stretched to a volume of 4.25 L, the balloon will pop. If the balloon were released, at what pressure would the balloon pop? Assume constant temperature throughout.

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| Math Skills *continued*

3. An oxygen supplier wants to reduce the volume of her oxygen tanks. She plans to take the oxygen in her 155 L tanks and store it in 95.5 L tanks. If the oxygen in the old tanks has a pressure of 8.27×10^3 kPa, what will the new pressure be after the oxygen is compressed? Assume a constant temperature throughout.

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4. A blocked bicycle pump contains 0.682 L of air at 99.3 kPa. If the handle is pressed down, decreasing the volume of the inside air to 0.151 L, what is the pressure inside the pump? Assume that the temperature of the air does not change.

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PROBLEM

A balloon is filled with air at a pressure of 105 kPa. Then the pressure around the balloon is increased to 205 kPa. If the balloon originally had a volume of 4.11 L, what is the new volume of the balloon? Assume constant temperature throughout.

SOLUTION

Step 1: List the given and unknown values.

$$\text{Given:} \quad V_1 = 4.11 \text{ L}$$
$$P_1 = 105 \text{ kPa}$$
$$P_2 = 205 \text{ kPa}$$
$$\text{Unknown:} \quad V_2$$

Step 2: Write the equation for Boyle's law, then rearrange the equation to isolate the value you want to find.

$$P_1V_1 = P_2V_2$$
$$V_2 = \frac{P_1V_1}{P_2}$$

Step 3: Substitute the known values into the equation, and solve.

$$V_2 = \frac{(105 \text{ kPa})(4.11 \text{ L})}{205 \text{ kPa}}$$
$$V_2 = 2.11 \text{ L}$$

PRACTICE

5. An oxygen tank holds 355 L of oxygen at 8.23×10^3 kPa. What volume would the same amount of oxygen take up if the pressure were reduced to 4.11×10^3 kPa ? Assume that the temperature remains the same.

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Math Skills *continued*

6. A machine produces 599 L of hydrogen at 101 kPa each day. If each day's supply of hydrogen were kept at a pressure of 366 kPa, what would be the volume of the hydrogen? Assume that temperature is constant throughout.

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7. A diver's tank holds 15.1 L of air at a pressure of 1.53×10^4 kPa. If the air was released underwater at a pressure of 6.11×10^2 kPa, what would the volume of the released air be? Assume that temperature remains constant throughout.

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8. A plastic food storage bag is sealed with 0.213 L of air inside at a pressure of 99.2 kPa. The bag is loaded onto a plane, where the pressure is decreased to 80.5 kPa. What is the size of the air in the bag after the pressure is decreased, if the temperature of the air remains the same?

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MIXED PRACTICE

9. A balloon is filled with helium in an airplane, where the air pressure is 81 kPa. The filled balloon has a volume of 4.2 L. When the plane lands, the cabin is depressurized to the outside air pressure, which is 94 kPa. If the temperature of the balloon remains the same, what is the new volume of the balloon?

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10. A small helium tank claims to be able to fill 30 balloons to a volume of 3.15 L at a pressure of 101 kPa. How many liters of helium will the tank be able to produce at a pressure of 94.2 kPa? Assume that the temperature of the tank remains the same throughout.

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11. A scuba diver carries a small balloon of air deep underwater. If the balloon has a volume of 2.11 L at the surface, where the pressure is 102 kPa, what will the pressure be when the balloon has shrunk to a size of 0.581 L? Assume that the balloon's temperature remains the same throughout its descent.

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12. A medical supply company stores oxygen in a 200.5 L tank at a pressure of 9,585 kPa. If the company transfers all of the oxygen to a 350.8 L tank, what will the pressure be inside the tank, if the temperature stays the same?

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13. At a sewage treatment plant, methane is gathered for energy use. If 75 L of methane is produced at 94 kPa, how many liters would be produced at 100 kPa? Assume temperature remains constant throughout.

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