Boyle's law solutions

Science, Chemistry



Boyle's Law - Solutions 1) If I have 5. 6 liters of gas in a piston at a pressure of 1. 5 atm and compress the gas until its volume is 4. 8 L, what will the new pressure inside the piston be? P1V1 = P2V2 (1.5 atm)(5.6 L) = (x)(4.8 L) x= 1.8 atm 2) I have added 15 L of air to a balloon at sea level (1.0 atm). If I take the balloon with me to Denver, where the air pressure is 0.85 atm, what will the new volume of the balloon be? P1V1 = P2V2 (1. 0 atm)(15 L) = (0.85 atm)(x) x = 18 L 3) I've got a car with an internal volume of 12, 000 L. If I drive my car into the river and it implodes, what will be the volume of the gas when the pressure goes from 1. 0 atm to 1. 4 atm? P1V1 = P2V2 (1. 0 atm)(12, 000 L) = (1. 4 atm)(x) x = 8600 L Charles's Law — Solutions 1) If I have 45 liters of helium in a balloon at 250 C and increase the temperature of the balloon to 550 C, what will the new volume of the balloon be? [pic] 2) Calcium carbonate decomposes at 12000 C to form carbon dioxide and calcium oxide. If 25 liters of carbon dioxide are collected at 12000 C, what will the volume of this gas be after it cools to 250 C? [pic] 3) I have 130 liters of gas in a piston at a temperature of 2500 C. If I cool the gas until the volume decreases to 85 liters, what will temperature of the gas be? [pic] 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 atm)(4.0 L) = (3.4 atm)(x L) x = 1.29 L 2) A toy balloonhas an internal pressure of 1.05 atm and a volume of 5.0 L. If the temperature where the balloon is released is 200 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 -150 C? (1. 05 atm)(5. 0 L)/(293 K) = (0. 65 atm)(x L)/(258 K) x = 7. 11 L 3) A small research submarine with a volume of 1. 2 x

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105 L has an internal pressure of 1. 0 atm and an internal temperature of 150 C. If the submarine descends to a depth where the pressure is 150 atm and the temperature is 30 C, what will the volume of the gas inside be if the hull of the submarine breaks? $(1.0 \text{ atm})(1.2 \times 105 \text{ L})/(288 \text{ K}) = (150 \text{ atm})(x \text{ L})$ L)/(276 K) x = 767 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 360 C gets angry, what will the volume of the person's lungs be if their temperature rises to 390 C. Based on this, do you think it's likely they will explode? (3.5 L)/(309 K) = (x L)/(312 K) x = 3.53 L lt seemsunlikely that this very small increase in lung volume would cause somebody to explode, though you never know. Ideal Gas Law Practice Worksheet Solve the following problems using the ideal gas law: 1) How many moles of gas does it take to occupy 120 liters at a pressure of 2. 3 atmospheres and a temperature of 340 K? 2) If I have a 50 liter container that holds 45 moles of gas at a temperature of 2000 C, what is the pressure inside the container? 3) It is not safe to put aerosol canisters in a campfire, because the pressure inside the canisters gets very high and they can explode. If I have a 1. 0 liter canister that holds 2 moles of gas, and the campfire temperature is 14000 C, what is the pressure inside the canister? 4) How many moles of gas are in a 30 liter scuba canister if the temperature of the canister is 300 K and the pressure is 200 atmospheres? 5) I have a balloon that can hold 100 liters of air. If I blow up this balloon with 3 moles of oxygen gas at a pressure of 1 atmosphere, what is the temperature of the balloon? Solutions to the Ideal gas law practice worksheet: The ideal gas law states that PV= nRT, where P is the pressure of a gas, V is the volume of the gas, n is the number of moles

of gas present, R is the ideal gas constant, and T is the temperature of the gas in Kelvins. Common mistakes: - Students express T in degrees celsius, rather than Kelvins. This can cause huge problems, especially when the temperature is below freezing. - Students use the wrong value of R. You need to make sure that you have the right value of R for the units you're using. In this worksheet, R = 0.08206 L. atm/mol. K — some teachers prefer using units of KPa rather than atmospheres, resulting in huge errors if the wrong R is used. 1) 9. 89 moles 2) 34. 9 atm 3) 274. 5 atm 4) 243. 7 moles 5) 406. 2 K (133. 20 C — a very hot day to blow up balloons!)