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Charles law questions and answers

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Practice merit scholarships assessment test, online learning charles law quiz questions for competitive exams in chemistry majors for colleges that offer certificate programs. MCQ: In defining Charle's law the quantity which remains constant is volume pressure temperature forces MCQ: In defining Charle's law the volume is directly proportional to temperature pressure moles atoms MCQ: Charle's law defines the value of 'k' as MCQ: Charle's law was given by Dutch scientist French scientist Polish scientist American scientist MCQ: Between temperature and volume of gas Charle's law determines qualitative relationship quantitative relationship non-polar relationship correlation Notes: I used: $V_1 / T_1 = V_2 / T_2$ to set up the solution for the first few. Sometimes, you will see the symbolic equation in cross-multiplied form: $V_1T_2 = V_2T_1$ I set up some solutions toward the end using various permutations of the cross-multiplied form. In all the problems below, the pressure and the amount of gas are held constant. Problem #1: Calculate the decrease in temperature (in Celsius) when 2.00 L at 21.0 °C is compressed to 1.00 L. Solution: $(2.00\text{ L}) / 294.0\text{ K} = (1.00\text{ L}) / (x)$ cross multiply to get: $2x = 293\text{ x} = 147.0\text{ K}$ Converting 147.0 K to Celsius, we find -126.0 °C, for a total decrease of 147.0 °C, from 21.0 °C to -126.0 °C. Problem #2: 600.0 mL of air is at 20.0 °C. What is the volume at 60.0 °C? Solution: $(600.0\text{ mL}) / (293.0) = (x) / (333.0\text{ K})$ x = 682 mL Problem #3: A gas occupies 900.0 mL at a temperature of 27.0 °C. What is the volume at 132.0 °C? Solution: $(900.0\text{ mL}) / (300.0\text{ K}) = (x) / (405.0\text{ K})$ x = 1215 mL Problem #4: What change in volume results if 60.0 mL of gas is cooled from 33.0 °C to 5.00 °C? Solution: $(60.0\text{ mL}) / (306.0\text{ K}) = (x) / (278.00\text{ K})$ Cross multiply to get: $306x = 16680\text{ x} = 54.5\text{ mL}$ The volume decreases by 5.5 mL. Problem #5: Given 300.0 mL of a gas at 17.0 °C. What is its volume at 10.0 °C? Solution: In cross-multiplied form, it is this: $V_1T_2 = V_2T_1$ $V_2 = (V_1T_2) / T_1$ $1\text{ x} = [(300.0\text{ mL}) (283.0\text{ K})] / 290.0\text{ K}$ Problem #6: A gas occupies 1.00 L at standard temperature. What is the volume at 333.0 °C? Solution: In cross-multiplied form, it is this: $V_1T_2 = V_2T_1$ $V_2 = (V_1) [T_2 / T_1]$ $x = (1.00\text{ L}) [(606.0\text{ K}) / (273.0\text{ K})]$ x = 2.22 L Problem #7: At 27.00 °C a gas has a volume of 6.00 L. What will the volume be at 150.0 °C? Solution: Two different set-ups: $(6.00\text{ L}) / (300.0\text{ K}) = (x) / (423.0\text{ K})$ or $(6.00\text{ L}) (423.0\text{ K}) = (x) (300.0\text{ K})$ Same answer: x = 8.46 L Problem #8: At 225.0 °C a gas has a volume of 400.0 mL. What is the volume of this gas at 127.0 °C? Solution: From #6: $V_2 = (V_1) [T_2 / T_1]$ $x = (400.0\text{ mL}) [(400.0\text{ K}) / (498.0\text{ K})]$ x = 321 mL Here's the "traditional" way: $(400.0\text{ mL}) / (498.0\text{ K}) = (x) / (400.0\text{ K})$ Problem #9: At 210.0 °C a gas has a volume of 8.00 L. What is the volume of this gas at -23.0 °C? Solution: $(8.00\text{ L}) / (483.0\text{ K}) = (x) / (250.0\text{ K})$ Note how you can have a negative Celsius temperature, but not a negative Kelvin temperature. Problem #10: When the volume of a gas is changed from ____ mL to 852 mL, the temperature will change from 315 °C to 452 °C. What is the starting volume? Solution: Write Charles Law and substitute values in: $V_1 / T_1 = V_2 / T_2$ $x / 588\text{ K} = 852\text{ mL} / 725\text{ K}$ $(x) (725\text{ K}) = (852\text{ mL}) (588\text{ K})$ x = 691 mL Note the large °C values, trying to get you to forget to add 273. Remember, only Kelvin temperatures are allowed in the calculations. Bonus Problem: An open "empty" 2 L plastic pop container, which has an actual inside volume of 2.05 L, is removed from a refrigerator at 5 °C and allowed to warm up to 21 °C. What volume of air measured at 21 °C, will leave the container as it warms? Solution: $2.05\text{ L} / 278\text{ K} = V_2 / 294\text{ K}$ Calculate V2. The volume that "escapes" is V2 minus 2.05 L Usually, a Charles' Law problem asks for what the volume is at the end (the V2 in this question) or at the start, before some temperature change. This question asks you for the difference between V1 and V2. It's not hard to solve, it's just that it doesn't get asked very often in a Charles' Law setting. This set of Basic Chemical Engineering Multiple Choice Questions & Answers (MCQs) focuses on "Ideal Gas Law". 1. Which of the following term does not involve in ideal gas law? a) Pressure b) Volume c) Temperature d) Time View answerAnswer: d Explanation: Ideal gas law is $PV = nRT$, which does not involve time. 2. What is the shape of a P-T curve for ideal gas? a) Straight line b) Parabolic c) Hyperbolic d) Ellipse View answerAnswer: a Explanation: P-T curve is a straight line for ideal gas. 3. What is the shape of a V-T curve for ideal gas? a) Straight line b) Parabolic c) Hyperbolic d) Ellipse View answerAnswer: a Explanation: V-T curve is straight line for ideal gas. 4. What is the shape of a P-V curve for an ideal gas? a) Straight line b) Parabolic c) Hyperbolic d) Ellipse View answerAnswer: c Explanation: P-V curve is hyperbolic for an ideal gas. 5. Which of the following is not true about ideal gas molecules? a) They have negligible size b) They do not have attractive forces c) They do not apply pressure d) They move in random motion View answerAnswer: c Explanation: Ideal gas molecules apply pressure to the walls of a container. 6. What is the pressure of a 5 liter/mole ideal gas at temperature 27oC? a) 2.5 atm b) 3.8 atm c) 4.4 atm d) 5.3 atm View answerAnswer: d Explanation: $PV = nRT$, => $P*5 = 0.0821*300$, => $P = 5.3\text{ atm}$. 7. What is the Temperature of a 2 liter/mole ideal gas with pressure 10 atm? a) 243.6 K b) 268.4 K c) 289.1 K d) 313.5 K View answerAnswer: a Explanation: $PV = nRT$, => $10*2 = 0.0821*T$, => $T = 243.6\text{ K}$. 8. First of the two ideal gases has twice molar volume as much as the second at same temperature, what is the ratio of their pressures? a) 4:1 b) 1:4 c) 2:1 d) 1:2 View answerAnswer: d Explanation: $P_1V_1 = n_1RT_1$, $P_2V_2 = n_2RT_2$ dividing both the equations, => $P_1:P_2 = 1:2$. 9. 88 grams of CO2 at 27oC is applying 5 atm pressure, what is the volume occupied by it? a) 5.6 liter b) 7.9 liter c) 9.8 liter d) 12.2 liter View answerAnswer: c Explanation: $n = 88/44 = 2$, $PV = nRT$, => $5*V = 2*0.0821*300$, => $V = 9.8\text{ liter}$. 10. What is the density of O2 at 27oC with pressure 1 atm? a) 1.1 g/L b) 1.3 g/L c) 1.5 g/L d) 1.7 g/L View answerAnswer: b Explanation: Molecular wt. of O2= 44 g, $PV = nRT$, => $PV = (m/M)RT$, => $d = PM/RT = (1*32)/(0.0821*300) = 1.3\text{ g/L}$. 11. What is the molecular mass of an ideal gas with pressure 1 atm, and density 10 g/L at temperature 27oC? a) 84.5 g b) 135.1 g c) 186.8 g d) 246.3 g View answerAnswer: d Explanation: $M = dRT/P = 10*0.0821*300/1 = 246.3\text{ g}$. 12. What is the specific gravity of CO2 at 27oC and pressure 1 atm with respect to air of with density 1 g/L? a) 1.23 b) 1.55 c) 1.78 d) 1.96 View answerAnswer: c Explanation: Density of CO2 = $PM/RT = 1*44/(0.0821*300) = 1.78\text{ g/L}$, => Specific gravity = $1.78/1 = 1.78$. 13. What is the specific gravity of CO at 27oC and pressure 5 atm with respect to air (molecular wt. = 29 g) at 27oC and pressure 10 atm? a) 0.48 b) 0.56 c) 0.64 d) 0.72 View answerAnswer: a Explanation: Density of CO = $5*28/(0.0821*300) = 5.68\text{ g/L}$, density of air = $10*29/(0.0821*300) = 11.77\text{ g/L}$, => specific gravity = $5.68/11.77 = 0.48$. 14. What is the compressibility factor for an ideal gas? a) 1 b) 2 c) 3 d) Depends on the gas View answerAnswer: a Explanation: Compressibility of an ideal gas is always 1. 15. Which of the following is not the unit of R? a) Atm.liter/K.mole b) Pa.m3/K c) N.Kg.m3/K.d mole d) None of the mentioned View answerAnswer: c Explanation: N.Kg.m/K.mole is the unit of R. Sanfoundry Global Education & Learning Series – Basic Chemical Engineering. To practice all areas of Basic Chemical Engineering, here is complete set of 1000+ Multiple Choice Questions and Answers. 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