Full Name: February 22, 2023

0.1 In a storage area where the temperature has reached 300K, the pressure of oxygen gas in a 15 L steel cylinder is 1 atm. Calculate the volume if the pressure is reduced to 0.5 atm.

0.2 A sample of a gas at 400K and 12 atm is cooled in the same container to 200K. Calculate the new pressure.

0.3 A sample of Ne in a closed, expandable container, has a volume of 3L at 40°C. Calculate the new volume if the container is cooled to 25°C.

0.4 A closed H_2 sample has a volume of 5 L and a pressure of 1 atm. What is the new pressure if the volume is decreased to 2L with no change in temperature and the amount of gas.

0.5 Complete the following statement: if the temperature of a gas increases, at fixed volume and moles, its pressure....

0.6 Complete the following statement: if the pressure of a gas increases, at fixed temperature and moles, its volume....

0.7 Convert the following properties: (a) A pressure value of 900 mmHg into torr (b) A temperature value of 400K into °C

0.8 Convert the following properties: (a) A pressure value of 2 atm into mmHg (b) A pressure value of 3000 Pa into atm (c) A temperature value of 25°C into K

0.9 Dinitrogen oxide, used in dentistry, is an anesthetic also called laughing gas. What is the pressure in atm of 0.35 moles of N_2O at 22°C in a 5L container?

0.10 A gas contained in a 3L tank has a pressure of 5 atm at a temperature of 400 K. Calculate the number of moles in the tank.

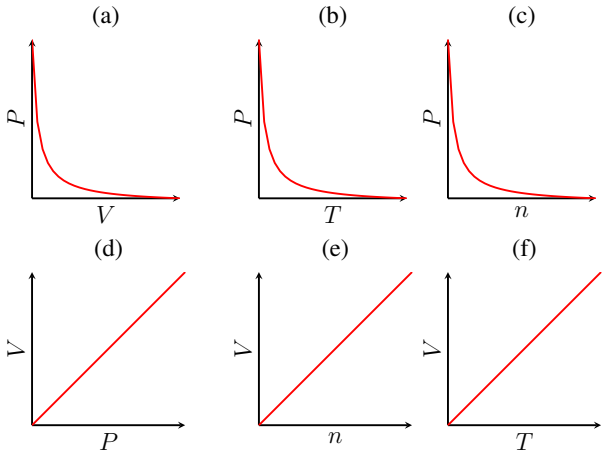
0.11 A 3 grams sample of Ar at 40°C is placed in a 3L container. Calculate the pressure inside the container.

0.12 A 4 moles sample of gas at 400K has a pressure of 10 atm. Calculate the volume of the sample.

0.13 What is the molar mass of a gas if a 3.16 g sample at 0.75 atm and 45°C occupies a volume of 2L.

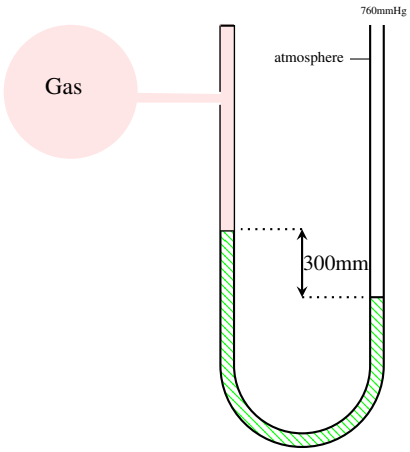
0.14 Eighteen grams of a gas in a 11L container at 400K exert a pressure of 3 atm. Calculate the molar mass of the gas.

0.15 Indicate what plot (or plots) bellow best represent the following gas laws: (a) Boyle's law (b) Charle's law (c) Avogadro's law



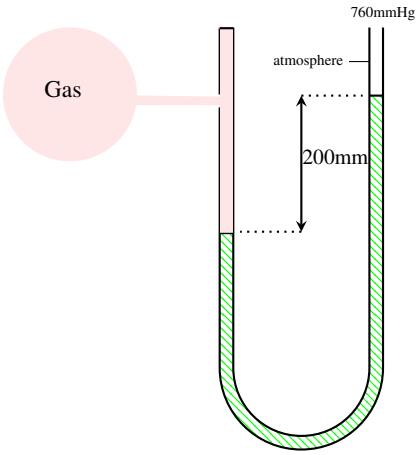
0.16 Answer the following questions: (a) Calculate the volume of a 4 moles of Ar at STP conditions. (b) Calculate the volume of a 4 moles of Ne at STP conditions. (c) Calculate the moles of gas in 3L of Ar at STP conditions. (d) Calculate the volume of 64 g of O2 gas at STP (273K, 1atm)

0.17 An open-tube manometer is used to measure the pressure of a given gas. When there is no gas in the container, the mercury levels are equal in both sides of the u-tube.



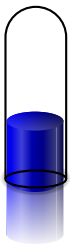
(a) Would the gas pressure be lower or higher than the atmospheric pressure? (b) Calculate the gas pressure in MPa. (c) Calculate the gas pressure in Torr.

0.18 An open-tube manometer is used to measure the pressure of a given gas. When there is no gas in the container, the mercury levels are equal in both sides of the u-tube.



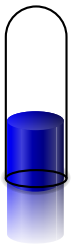
(a) Would the gas pressure be lower or higher than the atmospheric pressure? (b) Calculate the gas pressure in MPa. (c) Calculate the gas pressure in Torr.

0.19 A barometer is a device used to measure the atmospheric pressure. It is made of a glass tube filled with a liquid, inverted on a dish of the same liquid. When inverting the tube, liquid will remain on the tube. The filled height of the column is proportional to the pressure. The liquid used is normally mercury with density 13593 kg/m^3.



(a) Given that the height of the column is 750mm, calculate the atmospheric pressure in MPa. (b) What are the benefits of building a barometer with a lighter liquid than mercury?

0.20 A barometer is a device used to measure the atmospheric pressure. It is made of a glass tube filled with a liquid, inverted on a dish of the same liquid. When inverting the tube, liquid will remain on the tube. The filled height of the column is proportional to the pressure. The liquid used is normally mercury with density 13593 kg/m^3.



(a) Calculate the atmospheric pressure in atm if you use a barometer containing a liquid of density 1000 kg/m^3 and the liquid height is 9cm. (b) What are the drawbacks of building a barometer with a lighter liquid than mercury?

0.21 An anesthetic consist of a mixture of cyclopropane gas and oxygen gas. If the mixture has a total pressure of 2 atm and the partial pressure of cyclopropane is 0.5atm, what is the partial pressure of O2?

0.22 A tank contains Ne gas at 700 mmHg, Ar at 2 atm, and Kr at 700 torr. What is the total pressure of the mixture in atm?

0.23 The atmospheric pressure on a hot day is 790 mmHg. Given that the air is made of 78% of nitrogen and 22% of oxygen, calculate the partial pressure of each gas in the air.

0.24 The atmospheric pressure on a hot day is 780 mmHg. Given that the air is made of 78% of nitrogen and 22% of oxygen, calculate the partial pressure of each gas in the air.

0.25 For the following reaction, calculate the unknown x at STP conditions:

$$\underset{5\text{L}}{C_3H_8(g) + 5O_2(g)} \longrightarrow \underset{\text{x L}}{3CO_2(g) + 4\,H_2O_{(l)}}$$

0.26 Phosphorus reacts with oxygen gas to produce tetraphosphorus decaoxide according to the following equation:

$$\underset{2\text{L}}{P_4(s) + 5O_2(g)} \longrightarrow \underset{\text{x mol}}{P_4O_{10}(g)}$$

Calculate the number of moles of phosphorus that react with 2L of oxygen at STP conditions.

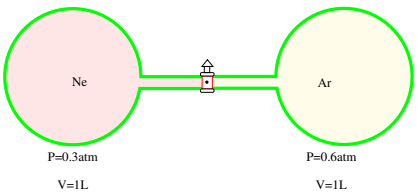
0.27 For the following reaction, calculate the unknown x at STP conditions:

$$\underset{\text{6moles}}{5C_3H_8(g)} + 5O_2(g) \longrightarrow \underset{\text{x L}}{3CO_2(g)} + 4\,H_2O_{(l)}$$

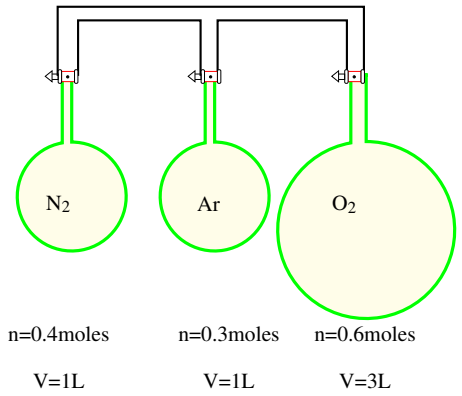
0.28 For the following reaction, calculate the unknown x at STP conditions:

$$\underset{\text{3L}}{5C_3H_8(g)} + 5O_2(g) \longrightarrow \underset{\text{x L}}{3CO_2(g)} + 4\,H_2O_{(l)}$$

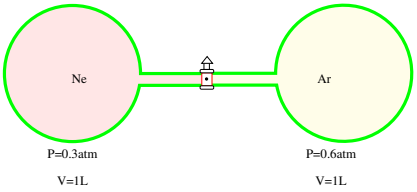
0.29 Consider the set up presented below at fixed temperature, where the connecting tubes have negligible volume. Calculate the partial pressure of each gas after the connection between the flasks is open.



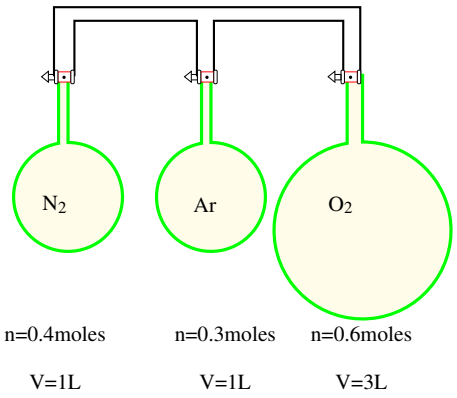
0.30 Consider the set up below with three different gases in three different closed containers at 300K. Assuming that the connecting tubes have zero volume, once the flasks are connected, calculate: (a) The partial pressure of each gas in the mixture (b) The total gas pressure



0.31 Consider the set up presented below, where the connecting tubes have negligible volume. Calculate the partial pressure of each gas after the connection between the flasks is open.



0.32 Consider the set up below with three different gases in three different closed containers at 300K. Assuming that the connecting tubes have zero volume, once the flasks are connected, calculate: (a) The partial pressure of each gas in the mixture (b) The total gas pressure



0.33 Calculate the pressure p in atm exerted by 2 moles of methane (CH_4) in a 0.5L container at 300K. (a) Using the ideal gas law p^{ideal} (b) Using the real gas law p^{real}, given $a = 2.283$ atm $\cdot$ L^2/mol^2 and $b = 0.04278$L/mol (c) Calculate the percent error in the ideal gas law using $\left|p^{ideal} - p^{real}\right|/p^{real} \times 100$.

0.34 What is the pressure in atm of 1 mol of He at 600K in a 1L container: (a) Using the ideal gas law (b) Using the real gas law given $a = 0.0342$atm $\cdot$ L^2/mol^2 and $b = 0.0237$L/mol

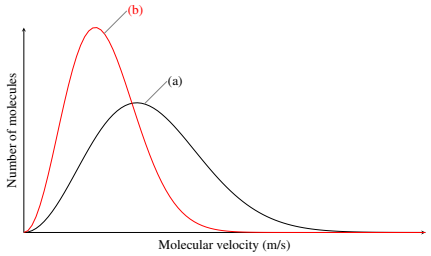
0.35 Without consulting the values of the Van der walls constant b indicate which of the gases of the following pair would exhibit a larger b value: (a) C_2H_6 or CH_4 (b) H_2 or CH_4

0.36 Use the Van der walls constant a to compare which of the gases exhibit stronger intermolecular interactions between its particles for the following pair of gases: (a) Ar or Ne (b) CO or NO

0.37 Order the following molecules in increasing order of root-mean square velocity: Ne, CO_2, H_2O, CH_4.

0.38 What is the rms speed of O_2 at STP?.

0.39 For the velocity distribution curved below: (a) The plots represent the distribution of velocity of two gases Ne or Ar at STP conditions in a fixed volume. What line represents each gas? (b) The plots represent the distribution of velocity of a gas at two different temperatures 300K and 500K at fixed pressure and volume conditions. What line represents each each temperature?



0.40 Which of the following statements is assumed by the kinetic molecular theory of gases: (a) gas particles interact with each other (b) gas particles have large sizes (c) particles move slowly (d) gas particles move randomly

0.41 For the following reaction, calculate the unknown x at STP conditions:

$$\underset{5\text{L}}{C_3H_8(g)} + 5O_2(g) \longrightarrow \underset{\text{x L}}{3CO_2(g)} + 4\,H_2O_{(l)}$$

0.42 Phosphorus reacts with oxygen gas to produce tetraphosphorus decaoxide according to the following equation:

$$\underset{2\text{L}}{P_4(s)} + 5O_2(g) \longrightarrow \underset{\text{x mol}}{P_4O_{10}(g)}$$

Calculate the number of moles of phosphorus that react with 2L of oxygen at STP conditions.

0.43 For the following reaction, calculate the unknown x at STP conditions:

$$\underset{6\text{moles}}{5C_3H_8(g)} + 5O_2(g) \longrightarrow \underset{\text{x L}}{3CO_2(g)} + 4\,H_2O_{(l)}$$

0.44 For the following reaction, calculate the unknown x at STP conditions:

$$\underset{3\text{L}}{5C_3H_8(g)} + 5O_2(g) \longrightarrow \underset{\text{x L}}{3CO_2(g)} + 4\,H_2O_{(l)}$$

Answersv. 68 **0.1** 30L **0.2** 6 atm **0.3** 2.8 L **0.4** 2.5L **0.5** increases **0.6** decreases **0.7** (a) 7×10^5 torr (b) 121°C **0.8** (a) 1520 mmHg (b) 2.96×10^{-3} atm (c) 298K **0.9** 1.7atm **0.10** 0.45 moles **0.11** 0.64 atm **0.12** 13.12 L **0.13** 21 g/mol **0.14** 18 g/mol **0.15** (a) (a) (b) (f) (c) (e) **0.16** (a) 89.6L (b) 89.6L (c) 0.13mol (d) 44.7L **0.17** (a) lower (b) 0.14MPa (c) 460mmHg **0.18** (a) higher (b) 0.127MPa (c) 960mmHg **0.19** (a) Given that the height of the column is 750mm, calculate the atmospheric pressure in MPa. (b) What are the benefits of building a barometer with a lighter liquid than mercury? **0.20** (a) Calculate the atmospheric pressure in atm if you use a barometer containing a liquid of density 1000 kg/m^3 and the liquid height is 9cm. (b) What are the drawbacks of building a barometer with a lighter liquid than mercury? **0.21** 1.5atm **0.22** 1402torr **0.23** N_2 616 mmHg, O_2 174 mmHg **0.24** N_2 608 mmHg, O_2 171.6 mmHg **0.25** 3L **0.26** 0.017 mol **0.27** 80.64L **0.28** 1.8L **0.29** p_{Ne}=0.15atm, p_{Ar}=0.3atm

0.30 (a) $p_{\mathrm{N_2}}$=1.97atm, p_{Ar}=1.48atm,$p_{\mathrm{O_2}}$=2.95atm (b) 6.40 atm **0.31** p_{Ne}=0.15atm, p_{Ar}=0.3atm **0.32** (a) $p_{\mathrm{N_2}}$=1.97atm, p_{Ar}=1.48atm,$p_{\mathrm{O_2}}$=2.95atm (b) 6.40 atm **0.33** (a) 98.4 atm (b) 82.1 atm (c) 17% **0.34** (a) 49.2 atm (b) 50.36 atm **0.35** (a) C_2H_6 (b) CH_4 **0.36** (a) Ar (b) CO **0.37** $v_{rms}^{\mathrm{Ne}} < v_{rms}^{\mathrm{CH_4}} < v_{rms}^{\mathrm{H_2O}} < v_{rms}^{\mathrm{CO_2}}$ **0.38** 481.9 m/s **0.39** (a) b is Ne and a is Ar (b) b is 500K and a is 300K **0.40** gas particles move randomly **0.41** 3L **0.42** 0.017 mol **0.43** 80.64L **0.44** 1.8L