

Unit 7 Practice Problems (with answers at end)

To gain that which is worth having, it may be necessary to lose everything else.
--Bernadette Devlin

Critical Phenomena

1. What is meant by the critical temperature of a gas?
2. The magnitude of the critical temperature is a measure of what characteristic of molecules?

Boyle's Law

3. A gas occupies a volume of 75.0 mL when the pressure is 50.65 kPa. What volume will the gas occupy at 151.9 kPa?
4. The gas in a eudiometer has a volume of 80.0 mL at 98.6 kPa. What is its volume at standard pressure?

Charles' Law

5. A gas occupies 500 mL (to the nearest mL) at a temperature of -23°C . What will its volume be at 23°C ?

Combined gas laws

6. A gas collected when the pressure is 107 kPa and the temperature is 27°C has a volume of 500 mL (to the nearest mL). What will the volume of the same amount of gas be at -3.0°C and 99 kPa?

Ideal gas law

[the value of R for units of L and kPa is 8.31]

7. What volume would be occupied by 3.0 moles of nitrogen gas under a pressure of 12156 kPa at 50°C (to the nearest 1 $^{\circ}\text{C}$)?
8. How many moles of a gas will occupy 900 mL (to the nearest mL) at a pressure of 599.8 kPa and -73°C ?

9. What would be the volume occupied by 7.31 g of carbon dioxide at 107 kPa and 27°C ?

10. What is the molar mass of a gas, 350 mL of which (to the nearest mL) has a mass of 1.069 g at 40°C and 104.63 kPa?

Dalton's Law of Partial Pressures

11. A gas collected over water at 25°C has a volume of 60 mL (to the nearest mL). The total pressure of the wet gas is 99 kPa. What is the partial pressure of the dry gas? (table, p. 143)

Gas Stoichiometry

12. Chlorine gas (Cl_2) can be produced by reacting manganese(IV) oxide and hydrochloric acid. The other products are manganese(II) chloride and water. How many grams of MnO_2 are required to produce 1.00 L of chlorine gas at 110 kPa (to the nearest 1 kPa) and 29°C ?

13. When heated, calcium carbonate decomposes to form a gas and a solid. How many grams of calcium carbonate must be decomposed to produce 4.0 L of the gas at STP? What is the gas?

14. Na reacts with water to produce hydrogen gas and sodium hydroxide. How many Litres of hydrogen at STP can be produced by 2.30 g of Na?

Answers:

1. the temperature beyond which no amount of pressure will condense the gas
2. the strength of intermolecular forces
3. 25.0 mL
4. 77.9 mL
5. 592 mL
6. 490 mL
7. 0.66 L
8. 0.325 mol
9. 3.87 L
10. 75.8 g/mol
11. 96 kPa or 719 mmHg
12. 3.81 g
13. 18 g, CO_2
14. 1.12 L