1. The density of water at 20 °C is 0.998 g·cm^{-3}. What height would the column of liquid be in a water barometer when the atmospheric pressure corresponds to 760 mm of mercury?

2. In a petroleum refinery, a 750. L container containing ethylene gas at 1.00 bar was compressed isothermally to 5.00 bar. What was the final volume of the container?

3. A helium weather balloon was filled at −20. °C and at a certain pressure to a volume of 2.5 × 104 L with 1.2 × 103 mol He. What is the molar volume of helium under those conditions?

4. Air is a source of reactants for many chemical processes. To determine the amount of air required for these reactions, it is helpful to know the partial pressures of the components. A particular sample of dry air of total mass 1.00 g consists almost entirely of 0.760 g of nitrogen and 0.240 g of oxygen. Calculate the partial pressures of these gases when the total pressure is 0.87 atm.

5. Divers exploring a shipwreck and wishing to avoid the narcosis associated with breathing nitrogen under high pressure switch to a neon-oxygen gas mixture containing 141.2 g of oxygen and 335.0 g of neon. The pressure in the gas tanks is 50.0 atm. What is the partial pressure of oxygen in the tanks?

6. A weather balloon is filled with helium gas at 20. °C and 1.00 atm. The volume of the balloon is 250. L. When the balloon rises to a layer of air where the temperature is −30. °C, it has expanded to 800. L. What is the pressure of the atmosphere at that point?

7. Calculate the volume occupied by 2.0 g of helium at 25 °C and 1.0 atm.

8. The volatile organic compound geraniol, a component of oil of roses, is used in perfumery. The density of the vapor at 260. °C and 103 Torr is 0.480 g·L−1. What is the molar mass of geraniol?

9. The Codex Ebers, an Egyptian medical papyrus, describes the use of garlic as an antiseptic. Chemists today have verified that the oxide of diallyl disulfide (the volatile compound responsible for garlic odor) is a powerful antibacterial agent. At 177 °C and 200. Torr, a sample of diallyl disulfide vapor has a density of 1.04 g·L−1. What is the molar mass of diallyl disulfide?

10. The carbon dioxide generated by the personnel in the artificial atmosphere of submarines and spacecraft must be removed from the air and the oxygen recovered. Submarine design teams have investigated the use of potassium superoxide, KO_2, as an air purifier because this compound reacts with carbon dioxide and releases oxygen. Calculate the mass of KO_2 needed to react with 50. L of carbon dioxide at 25 °C and 1.0 atm.

11. Estimate the root mean square speed of CH_4 molecules at 25 °C.

12. A cylinder of volume 2.00 L contains 1.00 mol He(g) at 30 °C.
Which process does more work on the surroundings: allowing the gas to expand isothermally to 4.00 L against a constant external pressure of 1.00 atm, or allowing it to expand reversibly and isothermally to the same final volume?

Quick answers

1) 10.3 m
2) 150 L
3) 20.83 L/mol
4) 0.68 atm and 0.19 atm
5) 10.5 atm O_2
6) 0.259 atm
7) 12 L
8) 155 g/mol
9) 146 g/mol
10) 290 g KO_2
11) 681 m/s
12) a) -203 J b) -1750 J