1. It is desired to market oxygen in small cylinders having volumes of 0.5 cu ft and each containing 1.0 lb of oxygen. If the cylinders may be subjected to a maximum temperature of 120°F, calculate the pressure of which they must be designed, assuming the applicability of the ideal-gas law.

2. Calculate the number of cubic feet of hydrogen sulfide, measured at a temperature of 50°C and pressure of 29.5 in Hg, which may be produced from 7 lb of iron sulfide (FeS).

3. An automobile tire is inflated to a gage pressure of 35 psi at a temperature of 0°F. Calculate the maximum temperature to which the tire may be heated without the gage pressure exceeding 50 psi. (Assume that the volume of the tire does not change.)

4. Calculate the densities in pound per cubic foot at standard conditions and the specific gravities of the following gases:

   (a) ethane, (b) sulfur dioxide, (c) hydrogen sulfide, (d) chlorine.

5. The gas acetylene is produced according to the following reaction by treating calcium carbide with water:

$$CaC_2 + 2H_2O = C_2H_2 + Ca(OH)_2$$

   Calculate the number of hours of service that can be derived from 1.0 lb of carbide in an acetylene lamp burning 2 cu ft of gas per hour at a temperature of 75°F and a pressure of 743 mm Hg.

6. A natural gas has the following composition by volume:

CH_4	94.1%
C_2H_6	3.0
N_2	2.9

	100.0%

   This gas is piped form the well at a temperature of 80°F and absolute pressure of 50 psi. It may be assumed that the ideal-gas law is applicable. Calculate:

   (a) Partial pressure of the nitrogen.

   (b) Pure-component volume of nitrogen per 100 cu ft of gas.

(c) Density of mixture in pounds per cubic foot ant existing conditions.

7. A gas mixture contains 0.274 lb-mole of HCl, 0.337 lb-mole of nitrogen, and0.089 lb-mole of oxygen. Calculate:

   (a) The volume occupied by this mixture and

   (b) Its density in pounds per cubic foot at a pressure of 40 psi and a temperature of 30°C.

8. A chimney gas has the following composition by volume:

CO_2	9.5%
CO	0.2
O_2	9.6
N_2	80.7

	100.0%

   Using the ideal-gas law, calculate:

   (a) Its composition by weight.

   (b) Volume occupied by 1.0 lb of the gas at 80°F and 29.5 in. Hg pressure.

   (c) Density of the gas in pounds per cubic foot at the conditions of part b.

   (d) Specific gravity of the mixture.

9. By electrolyzing a mixed brine a mixture of gases is obtained at the cathode having the following composition by weight:

Cl_2	67%
Br_2	28
O_2	5

	100%

   Using the ideal-gas law, calculated:

   (a) Composition of the gas by volume.

(b) Density of the mixture in grams per liter at 25°C and 740 mm of Hg pressure.

(c) Specific gravity of the mixture.

10. A mixture of ammonia and air at a pressure of 730 mm Hg and temperature of 30°C contains 5.1% NH_3 by volume. The gas is passed at a rate of 100 cu ft per min through an absorption tower in which only ammonia is removed. The gases leave the tower at pressure of 725 m Hg, a temperature of 20°C, and contain 0.05% NH_3 by volume. Using the ideal-gas law, calculate:

(a) Rate of flow of gas leaving the tower in cubic feet per minute.

(b) (weight of ammonia absorbed in the tower per minute.

11. A producer gas has the following composition by volume:

CO	23%
CO_2	4.4
O_2	2.6
N_2	70.0

	100%

(a) Calculate the cubic feet of gas, at 70°F and 750 mm Hg pressure, per pound of carbon present.

(b) Calculate the volume of air, at the conditions of part a, required of the combustion of 100 cu ft of the gas at the same conditions if it is desired that the total oxygen present before combustion shall be 20% in excess of that theoretically required.

(c) Calculate the percentage composition by volume of the gases leaving the burner of part b, assuming complete combustion.

(d) Calculate the volume of the gases leaving the combustion in parts b and c at a temperature of 600°F and a pressure of 750 mm Hg per 100 cu ft of gas burned.