Chapter 6 Answers

Practice Examples

1a. $760.\,\text{mmHg}$

1b. $1.13\ \text{g/cm}^3$

2a. $756.0\ \text{mmHg}$

2b. $93\,\text{mm}$ glycerol

3a. 139 torr

3b. 1.35 kg. It is not necessary to add a mass with the same cross sectional area.

4a. $24.4\ \text{L}\ NH_3$

4b. $464\,\text{K}$

5a. $2.11\,\text{mol}\,\text{He}$

5b. 5.59×10^{14} molecules N_2

6a. $2.11\,\text{mL}$

6b. $0.378\ \text{g}\ O_2$

7a. $86.4\,\text{g/mol}$

7b. $30.0\ \text{g/mol}$. This answer is in good agreement with the molar mass of NO.

8a. $0.162\,\text{g/L}$. When compared to the density of air under the same conditions (1.16 g/L, based on the "average molar mass of air"=28.8g/mol) the density of He is only about one seventh as much. Thus, helium is less dense ("lighter") than air.

8b. $32.0\ \text{g/mol}$

9a. $35.6\ \text{g}\ NaN_3$

9b. $0.619\,\text{g}$ Na(l)

10a. $1.25\ \text{L}\ O_2\,(\text{g})$

10b. $150.\ \text{L}\ NH_3$

11a. $13\,\text{atm}$

11b. $5.5\,\text{atm}$

12a. $0.0348\,\text{atm}\,H_2O(g)$, $2.47\,\text{atm}\,CO_2(g)$.

12b. N_2 = 584 mmHg, O_2 pressure = 157 mmHg, CO_2 = 0.27 mmHg, Ar = 7.0 mmHg.

13a. $0.00278\,\text{mol}\,HCl$

13b. 0.382 L

14a. NH_3 (g), $661\,\text{m/s}$.

14b. $76.75\,\text{K}$

15a. 2.1×10^{-4} mol O_2

15b. 28.2 s

16a. 1.90×10^{2} g/mol

16b. 52.3 s

17a. $Cl_2(g)$

17b. $Cl_2(g)$

Integrative Example

A. C_3H_4. There are three possible Lewis structures.

B. $C_4H_9NO_3$

Exercises

1a. 0.968 atm

1b. 0.766 atm

1c. 1.17 atm

1d. 2.22 atm

3. 11.4 m benzene

5. 710 mm Hg

7. 1.03 kg cm^{-2}

9a. 52.8 L

9b. 7.27 L

11. 225 K

13. 50.6 atm

15. 255 K

17. 0.132 g Ar

19a. 41.3 mg PH_3

19b. 7.32×10^{20} molecules

21. At the higher elevation of the mountains, the atmospheric pressure is lower than at the beach. However, the bag is virtually leak proof; no gas escapes. Thus, the gas inside the bag expands in the lower pressure until the bag is filled to near bursting.

23. 4.30 L

25. 4.89 g

27. 5.32×10^4 mL

29. 702 g Kr

31. 2.1×10^{-11} Pa

33a. 24.4 $L \cdot mol^{-1}$

33b. 31.3 $L \cdot mol^{-1}$

35. 103 g/mol

37. SF_4

39. 55.8 g/mol. The formula is C_4H_8.

41. 15.56 L/mol

43a. 1.18 g/L air

43b. The density of CO_2 is 1.80 g/L CO_2. Since this density is greater than that of air, the balloon will not rise in air.

45. P_4

47. 378 L O_2

49. 3.1×10^7 L SO_2

51. 10.9% $KClO_3$

53. 73.7 L H_2

55. 5.59 L gas

57. 2.06×10^3 g Ne

59. The answer is (d).

61a. 842 mmHg

61b. $P_{\text{benzene}} = 89.5$ mmHg, $P_{\text{Ar}} = 752$ mmHg.

63. Situation (b) best represents the resulting mixture, as the volume has increased by 50%.

65. 4.0 atm

67. 2.37 L H_2(g)

69. 751 mmHg

71. 17.9%

73. 326 m/s

75. 7.83 g/mol or 7.83 u.

77. 1.51×10^3 K

79. 6.17×10^{-21} J/molecule

81. 0.00473 mol NO_2

83a. 1.07

83b. 1.05

83c. 0.978

83d. 1.004

85. 9.80 h

87a. $P_{\text{ideal}} = 15.3\,\text{atm}$, $P_{\text{vdw}} = 14.1\,\text{atm}$, P_{ideal} is off by 1.2 atm or +8.5%.

87b. $P_{\text{ideal}} = 19.4\,\text{atm}$, $P_{\text{vdw}} = 18.3_5$ atm, P_{ideal} is off by 1.0 atm or +5.5%.

87c. $P_{\text{ideal}} = 27.6\,\text{atm}$, $P_{\text{vdw}} = 26.8\,\text{atm}$, P_{ideal} is off by 0.8 atm or +3.0%.

89. 3.95×10^{7} pm^3 / He atom

Integrative and Advanced Exercises

94. Flask 2 n =0.391, Flask 1 n = 0.609.

97. 2.25 atm

98. 542 L

99. 0.39 atm

101. 153 mmHg

102. 19.9% He

105. 23 L

108. 2.070×10^{4} L

109. 31 mmHg

111a. 3.42% H_2O by volume

111b. 3.42% by number

111c. 1.95 % H_2O by mass

112a. 0.40 g/L

112b. 2.9 atm

114. $\chi_{O_3} = 8.046\times10^{-4}$

115. 19°C

118a. 482 m/s

118b. $F_u = 1.92\times10^{-3}$

119. 13.6 km

121a. $$0 = V^3 - n\left(\frac{RT + bP}{P}\right)V^2 + \left(\frac{n^2a}{P}\right)V - \frac{n^3ab}{P} = 0$$

121b. 7.37 L

Feature Problems

126. The atomic mass of X is 16 u which corresponds to the element oxygen. The number of atoms of X (oxygen) in each compound is : Nitryl Fluoride = 2 atoms of O, Nitrosyl Fluoride = 1 atom of O, Thionyl Fluoride = 1 atom of O, Sulfuryl Fluoride = 2 atoms of O.

127a. The $N_2(g)$ extracted from liquid air has some Ar(g) mixed in.

127b. Because of the presence of Ar(g) [39.95 g/mol], the $N_2(g)$ [28.01 g/mol] from liquid air will have a greater density than $N_2(g)$ from nitrogen compounds.

127c. Magnesium will react with molecular nitrogen but not with Ar. Thus, magnesium reacts with all the nitrogen in the mixture, but leaves the relatively inert Ar(g) unreacted.

127d. The densities differ by 0.50%.

129. Just over 30 km.

Self-Assessment Exercises

133. The answer is (d).

134. The answer is (c).

135. 546 K

136. The answer is (d).

137. The answer is (b).

138. The answer is (a).

139a. False

139b. True

139c. False

139d. True

139e. False

140. The answer is (c).

141. The answer is (a).

142. The answer is (b).

143. 1.3 L of CO remain.

145. The answer is (c).

146a. Ne has higher *a* and *b* values.

146b. C_3H_8 has higher *a* and *b* values.

146c. Cl_2 has higher *a* and *b* values.

147. The height, h is inversely proportional to D. That is, the larger the diameter of the tube, the shorter the height of the liquid.

148. C_4H_{10}

149. For every single mark representing CO_2, we need 2060 marks for N_2, 553 marks for O_2, and 25 for Ar.