Gases

Test bank chapter (5)

Choose the most correct answer

1. A sample of oxygen occupies 47.2 liters under a pressure of 1240 torr at 25°C. What volume would it occupy at 25°C if the pressure were decreased to 730 torr?

a) 27.8 L
b) 29.3 L
c) 32.3 L
d) **80.2 L**

2. Under conditions of fixed temperature and amount of gas, Boyle's law requires that

I. $P_1V_1 = P_2V_2$
II. PV = constant
III. $P_1/P_2 = V_2/V_1$

a) I only
b) II only
c) III only
d) I, II, and III

3. The volume of a sample of nitrogen is 6.00 liters at 35°C and 740 torr. What volume will it occupy at STP?

a) 6.59 L
b) 5.46 L
c) 6.95 L
d) **5.18 L**

4. The density of chlorine gas at STP, in grams per liter, is approximately:

a) 6.2
b) **3.2**
c) 3.9
d) 4.5

Explanation: d = molar mass × p/ RT = 70 × 1/ 0.082× 273 = 3.17 g/L

5. What pressure (in atm) would be exerted by 76 g of fluorine gas in a 1.50 liter vessel at -37°C?

a) 26 atm
b) 4.1 atm
c) 19,600 atm
d) 84 atm

6. What is the density of ammonia gas at 2.00 atm pressure and a temperature of 25.0°C?

a) 0.720 g/L
b) 0.980 g/L
c) **1.39 g/L**
d) 16.6 g/L

7. Convert 2.0 atm to mmHg

a) 150 mmHg
b) 0.27 mmHg
c) 150 mmHg
d) 1520 mmHg

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8. A container with volume 71.9 mL contains water vapor at a pressure of 10.4 atm and a temperature of 465ºC. How many grams of the gas are in the container?

a) 0.421 g
b) **0.222 g**
c) 0.183 g
d) 0.129 g

Explanation: n = PV/RT = 0.0719× 10.4 = 0.0821 × (465 +273) = 0.012 mole

Mass = n × **molar mass** = 0.012 × 18 = 0.222 g

9. What is the molar mass of a pure gaseous compound having a density of 4.95 g/L at -35 ºC and 1020 torr?

a) 24 g/mole
b) 11 g/mole
c) **72 g/mole**
d) 120 g/mole

10. A 0.580 g sample of a compound containing only carbon and hydrogen contains 0.480 g of carbon and 0.100 g of hydrogen. At STP, 33.6 mL of the gas has a mass of 0.087 g. What is the molecular (true) formula for the compound?

a) CH_3
b) C_2H_6
c) C_2H_5
d) **C_4H_{10}**

11. Gas occupy 6L at 37^{0}C what will be its volume when its temperature is doubled?

a) 12 L
b) 6L
c) 3.2 L
d) 2L

12. A mixture of 90.0 grams of CH_4 and 10.0 grams of argon has a pressure of 250 torr under conditions of constant temperature and volume. The partial pressure of CH_4 in torr is:

(a) 143
(b) 100
(c) 10.7
(d) 239

Explanation: from Dalton law >>> $P_{CH4} = X_{CH4} P_{total}$, n_{CH4} = 90/ 16 =5.625 mole , n_{Ar} = 10/39.95 = 0.250 mole $X_{CH4} = n_{CH4} / n_{CH4} + n_{Ar}$ = 5.625 / 5.625 + 0.250 = 0.96 >>>> P_{CH4} = 0.96 ×250 = 239.3 torr

13. What pressure (in atm) would be exerted by a mixture of 1.4 g of nitrogen gas and 4.8 g of oxygen gas in a 200 mL container at 57ºC?

a) 4.7
b) 34
c) 47
d) 27

Explanation: P = n_{total} RT/V , n_{N2} = 1.4/ 2×14 = 0.05 mole , n_{O2} = 4.8/2×16 = 0.15 mole

P = (0.05 +0.15) 0.0821×(57+273) /0.2 = 27 atm

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14. A sample of hydrogen gas collected by displacement of water occupied 30.0 mL at 24°C and pressure 736 torr. What volume would the hydrogen occupy if it were dry and at STP? The vapor pressure of water at 24.0°C is 22.4 torr.

a) 32.4 mL
b) 21.6 mL
c) 36.8 mL
d) 25.9 mL

Explanation: from Dalton law >>> $P_{H2} = P_{total} - P_{H2O}$, $P_{H2} = 736 - 22.4 = 713.6$ torr

n = PV /RT >>>>> n =(713.6/760) × 0.03/ 0.0821× (24+273) = 0.00115 mle

at STP >>>>> V = nRT/P = 0.00115× 0.0821×273 /1 = 0.026 L × 1000 = 25.89 mL

15. Ammonia burns in oxygen gas to form nitric oxide (NO) and water vapor. How many volumes of NO are obtained from one volume of ammonia at the same temperature and pressure?

$$4\ NH_3\ (g) + 5\ O_2\ (g) \rightarrow 4NO\ (g) + 6\ H_2O\ (g)$$

a) One
b) Two
c) Three
d) Four

16. The pressure of 6.0 L of an ideal gas in a flexible container is decreased to one-third of its original value, and its absolute temperature is decreased by one-half. What is the final volume of the gas?

a) 9.0 L
b) 6.0 L
c) 4.0 L
d) 1 L

Explanation: let V_1= 6 & V_2 = ? , T_1= T & T_2 = ½ T , P_1= P & P_2 = 1/3 P

From combined gas law **$P_1V_1 /T_1 = P_2V_2/T_2$**>>>>> $\frac{P\times 6}{T} = \frac{(\frac{1}{3})P\times V2}{(\frac{1}{2})T}$ >>> $V2 = \frac{P\times 6\times T\times 3}{T\times 2\times P}$

17. Gas A is at 30°C and gas B is at 20°C. Both gases are at 1atmosphere. What is the ratio of the volume of 1 mole gas A to 1 mole of gas B

a) 606:303
b) 3 : 2
c) 2 : 3
d) 303 :293

Explanation: $\frac{V_A}{T_A} = \frac{V_B}{T_B}$ >>>>> $\frac{V_A}{30+273} = \frac{V_B}{20+273}$ >>>>> $\frac{V_A}{303} = \frac{V_B}{293}$

18. The sample of argon occupies 50L at standard temperature. Assuming constant pressure, what volume with the gas occupy if the temperature is doubled.

a) 25L
b) 50L
c) 100L
d) 100 mL

19. What total gas volume (in liters) at 520ºC and 880 torr would result from the decomposition of 33 g of potassium bicarbonate according to the equation:

$$2KHCO_3(s) \longrightarrow K_2CO_3(s) + CO_2(g) + H_2O(g)$$

(a) 56 L
(b) 37 L
(c) 10 L
(d) 19 L

20. Calculate the weight of $KClO_3$ that would be required to produce 29.5 L of oxygen measured at 127ºC and 760 torr.

$$2KClO_3(s) \longrightarrow 2KCl(s) + 3O_2(g)$$

(a) **73.5 g**
(b) 12.2 g
(c) 14.6 g
(d) 24.4 g

21. The ideal gas law predicts that the molar volume (volume of one mole) of gas equals:
(a) mRT/PV
(b) (MM)P/RT
(c) $1/2ms^{-2}$
(d) RT/P

22. For a gas, which pair of variables are inversely proportional to each other (if all other conditions remain constant)?
a) P, V
b) V, T
c) n, V
d) n, P

23. Convert 562 mmHg to atm
a) 0.739 atm
b) 4.27×10^5 atm
c) 1.05 atm
d) 0.562 atm

24. What is the volume of one mole of an ideal gas at STP?
a) 24.5 L
b) **22.4 L**
c) 1.0 L
d) 10.0 L

25. What are standard temperature and pressure (STP)?
a) 0 °C, 1 torr
b) 25 °C, 1 torr
c) 0 °C, 1 atm
d) 25 °C, 1 atm

26. What is the unit of mole fraction
a) mol
b) mol^{-1}
c) unitless
d) mol^2

27. Refer to Dalton's law of partial pressures explain what mole fraction is
   a) The number of moles of one component
   b) The ratio of the number of moles of one component to the number of moles of all components present.
   c) The number of moles of one component divided by 100
   d) The ratio of the number of moles of all components present to the number of moles of one component.

28. Write the ideal gas equation. Give the units for each term in the equation
   a) $PV = nRT$; P in torr, V in L, n in mol, R in Latm/Kmol, T in °C.
   b) $PV = nRT$; P in torr, V in L, n in mol, R in Latm/Kmol, T in K.
   c) (c) $PV = nRT$; P in atm, V in L, n in mol, R in Latm/Kmol, T in K.
   d) $PV = nRT$; P in atm, V in L, n in mol, R in Latm/Kmol, T in °C .

29. What is the difference between a gas and a vapor?
   a) A gas is a substance normally in the gaseous state at normal atmospheric conditions (25C, 1 atm); a vapor is the gaseous form of any substance that is a liquid or a solid at normal temperatures and pressures.
   b) A gas is the gaseous form of any substance; a vapor refers to a gas over a water surface.
   c) A gas is a substance normally in the gaseous state at normal atmospheric conditions (25C, 1 atm); a vapor is a gas over a water surface.
   d) A gas and a vapor are two interchangeable nomenclatures; they are identical.

30. What volume is occupied by 19.6 g of methane (CH_4) at 27°C and 1.59 atm?
   a) 1.71 L
   b) **18.9 L**
   c) 27.7 L
   d) 302 L

31. A 4.37 gram sample of a certain diatomic gas occupies a volume of 3.00 L at 1.00 atm and a temperature of 45°C. Identify this gas.
   a) F_2
   b) N_2
   c) H_2
   d) O_2

Explanation: MM = mRT/ PV >>>> MM = 4.37 × 0.0821× (45+273) /1×3 = 37.77/2 = 18.88 g/mole~ F_2

32. A sample of hydrogen gas was collected over water at 21°C and 685 mmHg. The volume of the container was 7.80 L. Calculate the mass of $H_2(g)$ collected. (Vapor pressure of water = 18.6 mmHg at 21°C.)
   a) 0.283 g
   b) **0.571 g**
   c) 0.589 g
   d) 7.14 g

33.Which of the following is/are characteristic(s) of gases?

   a) High compressibility
   b) Relatively large distances between molecules
   c) Formation of homogeneous mixtures regardless of the nature of gases
   d) High compressibility, relatively large distances between molecules AND formation of homogeneous mixtures regardless of the nature of gases

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34. A small bubble rises from the bottom of a lake, where the temperature and pressure are 4°C and 3.0 atm, to the water's surface, where the temperature is 25°C and the pressure is 0.95 atm. Calculate the final volume of the bubble if its initial volume was 2.1 mL.

a) 0.72 mL
b) 6.2 mL
c) 41.4 mL
d) 7.1 mL

35. Calculate the mass, in grams, of 2.74 L of CO gas measured at 33°C and 945 mmHg.

a) 0.263 g
b) 2.46 g
c) 3.80 g
d) 35.2 g

36. Which of the following gases will have the greatest density at the same specified temperature and pressure?

a) H_2
b) $CClF_3$
c) CO_2
d) C_2H_6

37. Determine the molar mass of chloroform gas if a sample weighing 0.389 g is collected in a flask with a volume of 102 cm^3 at 97°C. The pressure of the chloroform is 728 mmHg.

a) 187 g/mol
b) 121 g/mol
c) 112 g/mol
d) 31.6 g/mol

38. What is the molar mass of Freon-11 gas if its density is 6.13 g/L at STP?

a) 0.274 g/mol
b) 3.64 g/mol
c) 78.2 g/mol
d) 137 g/mol

40. A mixture of three gases has a total pressure of 1,380 mmHg at 298 K. The mixture is analyzed and is found to contain 1.27 mol CO_2, 3.04 mol CO, and 1.50 mol Ar. What is the partial pressure of Ar?

a) 0.258 atm
b) 301 mmHg
c) 356 mmHg
d) 5,345 mmHg

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41. A sample of hydrogen gas was collected over water at 21°C and 685 mmHg. The volume of the container was 7.80 L. Calculate the mass of H_2(g) collected. (Vapor pressure of water = 18.6 mmHg at 21°C.)

a) 0.283 g
b) 0.572 g
c) 0.589 g
d) 7.14 g

42. A 0.271 g sample of an unknown vapor occupies 294 mL at 140°C and 847 mmHg. The empirical formula of the compound is CH_2. What is the molecular formula of the compound?

a) CH_2
b) C_2H_4
c) C_3H_6
d) C_4H_8

43. How many liters of chlorine gas at 25°C and 0.950 atm can be produced by the reaction of 12.0 g of MnO_2? $MnO_2(s) + 4HCl(aq) \rightarrow MnCl_2(aq) + 2H_2O(l) + Cl_2(g)$

a) 5.36×10^{-3} L
b) 0.138 L
c) 0.282 L
d) 3.55 L