

# 12 • Gases and Their Properties

## PRACTICE TEST

- A pressure of 745 mmHg corresponds to \_\_\_\_ kPa.
  - 55.89 kPa
  - 0.980 kPa
  - 99.3 kPa
  - 745 kPa
- Liquid nitrogen has a boiling point of  $-196\text{ }^{\circ}\text{C}$  this corresponds to...
  - $-469\text{ K}$
  - $77\text{ K}$
  - $153\text{ K}$
  - $469\text{ K}$
- $1.20\text{ atm}$  is the same pressure as:
  - $1.2\text{ mmHg}$
  - $760\text{ mmHg}$
  - $912\text{ mmHg}$
  - $850\text{ mmHg}$
  - $358\text{ mmHg}$
- For an ideal gas, which pair of variables are inversely proportional to each other (if all other factors remain constant)?
  - P, V
  - P, T
  - V, T
  - n, P
- A real gas would act most ideal at
  - $1.0\text{ atm}$  and  $273\text{ K}$
  - $10\text{ atm}$  and  $546\text{ K}$
  - $10\text{ atm}$  and  $273\text{ K}$
  - $0.5\text{ atm}$  and  $546\text{ K}$
  - $0.5\text{ atm}$  and  $273\text{ K}$
- One mole of hydrogen,  $\text{H}_2$ , occupies  $61.2\text{ L}$  at
  - $100\text{ }^{\circ}\text{C}$  and  $1.00\text{ atm}$
  - $200\text{ }^{\circ}\text{C}$  and  $1.00\text{ atm}$
  - $0\text{ }^{\circ}\text{C}$  and  $0.500\text{ atm}$
  - $50\text{ }^{\circ}\text{C}$  and  $0.500\text{ atm}$
  - $100\text{ }^{\circ}\text{C}$  and  $.500\text{ atm}$
- A  $31.0\text{ mL}$  sample of gas is collected at a temperature of  $37\text{ }^{\circ}\text{C}$  and pressure of  $720\text{ mmHg}$ . What is its volume at  $17\text{ }^{\circ}\text{C}$  and  $580\text{ mmHg}$ .
  - $23\text{ mL}$
  - $27\text{ mL}$
  - $36\text{ mL}$
  - $41\text{ mL}$
  - $58\text{ mL}$
- The coldest possible temperature of a gas is:
  - $0\text{ }^{\circ}\text{C}$
  - $273\text{ K}$
  - $-273\text{ K}$
  - $-273\text{ }^{\circ}\text{C}$
- The pressure of  $4.0\text{ L}$  of an ideal gas in a flexible container is decreased to one-third of its original pressure and its absolute temperature is decreased by one-half. The volume then is
  - $1.0\text{ L}$
  - $4.0\text{ L}$
  - $6.0\text{ L}$
  - $8.0\text{ L}$
  - $24\text{ L}$
- A given mass of gas in a rigid container is heated from  $100\text{ }^{\circ}\text{C}$  to  $300\text{ }^{\circ}\text{C}$ . Which of the following best describes what will happen to the pressure of the gas? The pressure will...
  - decrease by a factor of three.
  - increase by a factor of three.
  - increase by a factor less than three.
  - decrease by a factor greater than three.
- What is the pressure exerted by some nitrogen gas collected in a tube filled with water on a day when the room temperature is  $18.0\text{ }^{\circ}\text{C}$  and the room pressure is  $750.0\text{ mmHg}$ ? [The partial pressure of water at  $18\text{ }^{\circ}\text{C}$  is  $15.5\text{ mmHg}$ .]
  - $15.5\text{ mmHg}$
  - $750.0\text{ mmHg}$
  - $734.5\text{ mmHg}$
  - $760.0\text{ mmHg}$
  - $732.0\text{ mmHg}$

12. As the average kinetic energy of the molecules of a sample increases, the temperature of the sample
- decreases
  - increases
  - remains the same
13. If a gas that is confined in a rigid container is heated, the pressure of the gas will...
- increase
  - decrease
  - remain the same
14. A mixture of gases at 810 kPa pressure contains:
- 3.0 moles of oxygen gas,
  - 2.0 moles of helium gas, and
  - 4.0 moles of carbon dioxide gas.
- What is the partial pressure of helium gas,  $P_{\text{He}}$ .
- 405 kPa
  - 1620 kPa
  - 810 kPa
  - 81.0 kPa
  - 180 kPa
15. If a gas has a pressure of 2.0 atm, which one of the following equations will express its pressure after...
- the number of moles has been increased to three times the original amount,
  - the absolute temperature (K) has been reduced to half, and
  - the volume has been tripled?
- $P_2 = 2.0 \text{ atm} \times \frac{1}{3} \times \frac{2}{1} \times \frac{4}{1}$
  - $P_2 = 2.0 \text{ atm} \times \frac{3}{1} \times \frac{1}{2} \times \frac{1}{3}$
  - $P_2 = 2.0 \text{ atm} \times \frac{3}{1} \times \frac{2}{1} \times \frac{1}{3}$
  - $P_2 = 2.0 \text{ atm} \times \frac{1}{3} \times \frac{1}{4} \times \frac{3}{1}$
16. A sample of gas occupies 30.0 L at 0.800 atm and 298 K. How many moles of gas are in the sample?
- 22.4
  - 0.981
  - 1.02
  - 2.23
  - none of these
17. When ammonium nitrite undergoes decomposition, only gases are produced according to the equation:
- $$\text{NH}_4\text{NO}_2(\text{s}) \rightarrow \text{N}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$$
- What is the total volume of gases produced at 819K and 1.00 atm pressure when 128 g of ammonium nitrite undergoes the above decomposition reaction?
- \_\_\_\_\_
18. At STP, it was found that 1.12 L of a gas had a mass of 2.78 g. Its molar mass is
- 2.78 g/mol
  - 27.8 g/mol
  - 55.6 g/mol
  - 111 g/mol
19. A mixture of gases, nitrogen, oxygen, and carbon dioxide at 27 °C and 0.50 atmospheres pressure occupied a volume of 492 mL. How many moles of gas are there in this sample?
- 0.010
  - 1/9
  - 7.6
  - 10
20. At a given temperature, gaseous ammonia molecules ( $\text{NH}_3$ ) have a velocity that is \_\_\_\_\_ gaseous sulfur dioxide molecules ( $\text{SO}_2$ ).
- greater than
  - less than
  - equal to
  - more inf. needed
21. The ratio of the average velocities of  $\text{SO}_2(\text{g})$  to  $\text{CH}_4(\text{g})$  at 300 K is
- 1:4
  - 1:2
  - 4:1
  - 2:1
22. A sealed flask contains 1 molecule of hydrogen for every 3 molecules of helium at 20 °C. If the total pressure is 400 kPa, the partial pressure of the hydrogen is...
- 100 kPa
  - 200 kPa
  - 300 kPa
  - 400 kPa

23. A given mass of a gas occupies 5.00 L at 65 °C and 480 mmHg. What is the volume of the gas at 630 mmHg and 85 °C?
- a)  $5.00 \times \frac{65}{85} \times \frac{480}{630}$
- b)  $5.00 \times \frac{338}{358} \times \frac{480}{630}$
- c)  $5.00 \times \frac{358}{338} \times \frac{480}{630}$
- d)  $5.00 \times \frac{358}{338} \times \frac{630}{480}$
- e)  $5.00 \times \frac{338}{358} \times \frac{630}{480}$
24. Which statement best explains why a confined gas exerts pressure?
- a) the molecules are in random motion
- b) the molecules travel in straight lines
- c) the molecules attract each other
- d) the molecules collide with the container walls
25. CH<sub>4</sub> gas and O<sub>2</sub> gas are together in a container. Which statement correctly describes the **velocities** of the two molecules.
- a) The two molecules have the **same** average velocity.
- b) The CH<sub>4</sub> is moving **twice** as fast as the O<sub>2</sub>.
- c) The CH<sub>4</sub> is moving **faster**, but **not twice as fast** as the O<sub>2</sub>.
- d) The O<sub>2</sub> is moving **faster** than the CH<sub>4</sub>.

## 9 • Properties of Gases

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### TEST ANSWERS

Please use **CAPITAL** letters:

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

7. \_\_\_\_\_

8. \_\_\_\_\_

9. \_\_\_\_\_

10. \_\_\_\_\_

11. \_\_\_\_\_

12. \_\_\_\_\_

13. \_\_\_\_\_

14. \_\_\_\_\_

15. \_\_\_\_\_

16. \_\_\_\_\_

17. \_\_\_\_\_

18. \_\_\_\_\_

19. \_\_\_\_\_

20. \_\_\_\_\_

21. \_\_\_\_\_

22. \_\_\_\_\_

23. \_\_\_\_\_

24. \_\_\_\_\_

25. \_\_\_\_\_

#### Useful Information

STP = 0°C = 273 K and

1 atm = 760 torr = 760 mmHg

= 101.3 kPa = 14.7 psi

= 14.7  $\frac{\text{lb}}{\text{in}^2}$

Ideal Gas Constant, R

= 62.4  $\frac{\text{L} \cdot \text{mmHg}}{\text{mol} \cdot \text{K}}$

= 0.0821  $\frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$

= 8.31  $\frac{\text{L} \cdot \text{kPa}}{\text{mol} \cdot \text{K}}$