Unit 10: Gases Practice Exam

Matching

Match each item with the correct statement below.

a. kinetic molecular theory
b. atmospheric pressure
c. absolute zero
d. barometer
e. kinetic energy

____ 1. All matter consists of tiny particles that are in constant motion.
____ 2. The energy an object has due to its motion
____ 3. A device used to measure atmospheric pressure
____ 4. The pressure resulting from the collision of atoms and molecules with objects
____ 5. The point where all motion stops

Match each item with the correct statement below.

a. Boyle's law
b. Charles's law
c. Combined Gas law
d. Avogadro's law
e. Gay-Lussac's law
f. Ideal Gas law

____ 6. $P_1V_1 = P_2V_2$
____ 7. $\frac{V_1}{n_1} = \frac{V_2}{n_2}$
____ 8. $\frac{P_1}{T_1} = \frac{P_2}{T_2}$
____ 9. $PV = nRT$
____ 10. $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
____ 11. $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 12. According to the kinetic theory, collisions between molecules in a gas ____.
a. are perfectly elastic
b. are inelastic
c. never occur
d. cause a loss of total kinetic energy

____ 13. Which of the following statements is part of the kinetic theory?
a. The particles of a gas move in random paths.
b. The particles in a gas move rapidly.
c. The particles in a gas are relatively far apart.
d. all of the above

____ 14. Which of the following statements is NOT true, according to the kinetic theory?
a. There is no attraction between particles of a gas.

b. Only particles of matter in the gaseous state are in constant motion.
c. The particles of a gas collide with each other and with other objects.
d. All of the statements are true.

____ 15. Particles in a gas are best described as ____.
a. slow-moving, kinetic, hard spheres
b. spheres that are in fixed positions when trapped in a container
c. small, hard spheres with insignificant volumes
d. hard spheres influenced by repulsive forces from other spheres

____ 16. What instrument is normally used to measure atmospheric pressure?
a. thermometer
b. barometer
c. vacuum
d. manometer

____ 17. What is a unit of pressure?
a. mm Hg
b. atm
c. torr
d. kPa
e. all of the above

____ 18. What is one atmosphere of pressure in kilopascals?
a. 0 kPa
b. 760 kPa
c. 101.3 kPa
d. 1 kPa

____ 19. Standard conditions when working with gases are defined as ____.
a. 0 K and 1 atm
b. 0 K and 1 kPa
c. 0°C and 1 atm
d. 0°C and 1 kPa

____ 20. What causes gas pressure in a container such as a helium balloon?
a. the walls of the container
b. the vacuum maintained in the container
c. the simultaneous collisions of fast-moving particles in the container
d. atmospheric pressure acting on the outside walls of the container

____ 21. The pressure of a gas in a container is 152 mm Hg. This is equivalent to ____.
a. 0.2 atm
b. 2 atm
c. 0.3 atm
d. 0.4 atm

____ 22. The temperature at which the motion of particles theoretically ceases is ____.
a. –273 K
b. 0 K
c. 0°C
d. 273°C

____ 23. What happens to the average kinetic energy of the particles in a sample of matter as the temperature of the sample is increased?
a. The average kinetic energy decreases.
b. The average kinetic energy increases.
c. The average kinetic energy does not change.
d. The change in average kinetic energy cannot be determined.

____ 24. With which temperature scale is temperature directly proportional to average kinetic energy?
a. Celsius
b. Fahrenheit
c. Kelvin
d. centigrade

____ 25. When a gas is heated, ____.
a. all of the absorbed energy is converted to kinetic energy
b. some of the absorbed energy is converted to potential energy, and some is converted to kinetic energy
c. all of the absorbed energy is converted to potential energy

d. none of the energy is converted to kinetic energy

____ 26. How does the gas propellant move when an aerosol can is used?
a. from a region of high pressure to a region of lower pressure
b. from a region of high pressure to a region of equally high pressure
c. from a region of low pressure to a region of higher pressure
d. from a region of low pressure to a region of equally low pressure

____ 27. If the volume of a container of gas is reduced, what will happen to the pressure inside the container?
a. The pressure will increase.
b. The pressure will not change.
c. The pressure will decrease.
d. The pressure depends on the type of gas.

____ 28. If a balloon is squeezed, what happens to the pressure of the gas inside the balloon?
a. It increases.
b. It stays the same.
c. It decreases.
d. The pressure depends on the type of gas in the balloon.

____ 29. What happens to the pressure of a gas inside a container if the temperature of the gas decreases?
a. The pressure increases.
b. The pressure does not change.
c. The pressure decreases.
d. The pressure cannot be predicted.

____ 30. The volume of a gas is doubled while the temperature is held constant. How does the gas pressure change?
a. It is reduced by one half.
b. It does not change.
c. It is doubled.
d. It varies depending on the type of gas.

____ 31. Boyle's law states that ____.
a. the volume of a gas varies inversely with pressure
b. the volume of a gas varies directly with pressure
c. the temperature of a gas varies inversely with pressure
d. the temperature of a gas varies directly with pressure

____ 32. Charles's law states that ____.
a. the pressure of a gas is inversely proportional to its temperature in kelvins
b. the volume of a gas is directly proportional to its temperature in kelvins
c. the pressure of a gas is directly proportional to its temperature in kelvins
d. the volume of a gas is inversely proportional to its temperature in kelvins

____ 33. If a balloon is heated, what happens to the volume of the air in the balloon if the pressure is constant?
a. It increases.
b. It stays the same.
c. It decreases.
d. The change cannot be predicted.

____ 34. As the temperature of a fixed volume of a gas increases, the pressure will ____.
a. vary inversely
b. decrease
c. not change
d. increase

____ 35. A gas occupies a volume of 2.4 L at 14.1 kPa. What volume will the gas occupy at 84.6 kPa?
a. 497 L
b. 2.5 L
c. 14 L
d. 0.40 L

____ 36. A sample of gas occupies 17 mL at –112°C. What volume does the sample occupy at 70°C?
a. 10.6 mL
b. 27 mL
c. 36mL
d. 8.0mL

Short Answer

37. What is a pressure of 0.520 atm equal to in mm of Hg?
38. What is a pressure of 622 mm Hg equal to in atm?
39. What is a pressure of 35.6 mm Hg equal to in torr?
40. Convert 25°C to K.
41. Convert 0K to °C.
42. The volume of a gas is 0.250 L at 340.0 kPa pressure. What will the volume be when the pressure is reduced to 50.0 kPa, assuming the temperature remains constant?
43. A balloon filled with helium has a volume of 30.0 L at a pressure of 100 kPa and a temperature of 15.0°C. What will the volume of the balloon be if the temperature is increased to 80.0°C and the pressure remains constant?
44. A gas has a volume of 0.590 L at a temperature of –55.0°C. What volume will the gas occupy at 30.0°C?
45. A rigid container of O_2 has a pressure of 340 kPa at a temperature of 713 K. What is the pressure at 273 K?
46. A 10-g mass of krypton occupies 15.0 L at a pressure of 210 kPa. Find the volume of the krypton when the pressure is increased to 790 kPa.
47. A gas has a pressure of 710 kPa at 227°C. What will its pressure be at 27°C, if the volume does not change?
48. A gas occupies a volume of 0.140 L at 35.0°C and 97 kPa. What is the volume of the gas at STP?
49. How many moles of N_2 are in a flask with a volume of 250 mL at a pressure of 300.0 kPa and a temperature of 300.0 K?
50. What is the pressure exerted by 32 g of O_2 in a 22.0-L container at 30.0°C?

Essay

51. Name the basic assumptions that the kinetic theory makes about gases.
52. How does the air pressure in a balloon change when the balloon is squeezed? Explain why this change occurs using gas laws.
53. How does the pressure of an enclosed gas in a rigid container change when the gas is heated? Explain why this change occurs using gas laws.

Unit 10: Gases Practice Exam
Answer Section

MATCHING

1. ANS: A REF: p. 385
2. ANS: E REF: p. 385
3. ANS: D REF: p. 386
4. ANS: B REF: p. 386
5. ANS: C

6. ANS: A REF: p. 418
7. ANS: D REF: p. 420
8. ANS: E REF: p. 422
9. ANS: F REF: p. 426
10. ANS: C REF: p. 432
11. ANS: B REF: p. 435

MULTIPLE CHOICE

12. ANS: A REF: p. 385
13. ANS: D REF: p. 385
14. ANS: B REF: p. 385
15. ANS: C REF: p. 385
16. ANS: B REF: p. 386
17. ANS: E REF: p. 387
18. ANS: C REF: p. 387
19. ANS: C REF: p. 387
20. ANS: C REF: p. 386
21. ANS: A REF: p. 387
22. ANS: B REF: p. 389
23. ANS: B REF: p. 388
24. ANS: C REF: p. 389
25. ANS: B REF: p. 388
26. ANS: A REF: p. 416
27. ANS: A REF: p. 416
28. ANS: A REF: p. 416
29. ANS: C REF: p. 417
30. ANS: A REF: p. 418
31. ANS: A REF: p. 418
32. ANS: B REF: p. 420
33. ANS: A REF: p. 420
34. ANS: D REF: p. 422
35. ANS: D REF: p. 419

36. ANS: C REF: p. 421

SHORT ANSWER

37. ANS:

$0.520 \text{ atm} \times \frac{760 mmHg}{1 atm} = 395 \text{ mm Hg}$

REF: p. 387

38. ANS:

$622 \text{ mm Hg} \times \frac{1 atm}{760 mmHg} = 0.818 \text{ atm}$

REF: p. 387

39. ANS:

$35.6 \text{ mm Hg} \times \frac{760 torr}{760 mmHg} = 35.6 \text{ torr}$

REF: p. 387

40. ANS:

$K = 25^{o}C + 273 = 298 K$

REF: p. 389

41. ANS:

$^{o}C = 0K - 273 = -273^{o}C$

REF: p. 392

42. ANS:

Rearrange Boyle's Law: $P_1V_1 = P_2V_2 \Rightarrow V_2 = V_1 \times \frac{P_1}{P_2} = 0.250 \text{ L} \times \frac{340.0 \text{ kPa}}{50.0 \text{ kPa}} = 1.700 \text{ L}$

REF: p. 419

43. ANS:

Rearrange Charles's Law: $\frac{V_1}{T_1} = \frac{V_2}{T_2} \Rightarrow V_2 = V_1 \times \frac{T_2}{T_1} = 30.0 \text{ L} \times \frac{353 \text{ K}}{288 \text{ K}} = 34.3 \text{ L}$

REF: p. 421

44. ANS:

$T_1 = -55^{o}C + 273 = 218 K$

$T_2 = 30.0^{o}C + 273 = 303 K$

Rearrange Charles's Law: $\frac{V_1}{T_1} = \frac{V_2}{T_2} \Rightarrow V_2 = V_1 \times \frac{T_2}{T_1} = 0.590 \text{ L} \times \frac{303 \text{ K}}{218 \text{ K}} = 0.820 \text{ L}$

REF: p. 421

45. ANS:

Rearrange Gay-Lussac's Law: $\frac{P_1}{T_1} = \frac{P_2}{T_2} \Rightarrow P_2 = P_1 \times \frac{T_2}{T_1} = 340 \text{ kPa} \times \frac{273 \text{ K}}{713 \text{ K}} = 140 \text{ kPa}$

REF: p. 421

46. ANS:

$P_1 \times V_1 = P_2 \times V_2$

$210 \text{ kPa} \times 15.0 \text{ L} = 790 \text{ kPa} \times V_2$

$\frac{210 \text{ kPa} \times 15.0 \text{ L}}{790 \text{ kPa}} = V_2$

$V_2 = 4.0 \text{ L}$

REF: p. 419

47. ANS:

227°C + 273 = 500 K 27°C + 273 = 300 K

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$; $\frac{710 \text{ kPa}}{500 \text{ K}} = \frac{P_2}{300 \text{ K}} \Rightarrow 710 \text{ kPa} \times \frac{300 \text{ K}}{500 \text{ K}} = P_2$

$P_2 = 470 \text{ kPa}$

REF: p. 421

48. ANS:

$T_1 = 35.0°\text{C} + 273 = 308 \text{ K}$

$T_2 = 0.0°\text{C} + 273 = 273 \text{ K}$

Rearrange Combined Gas Law: $V_2 = P_1 \times V_1 \times \frac{T_2}{T_1 \times P_2}$

$V_2 = 97 \text{ kPa} \times 0.140 \text{ L} \times \frac{273 \text{ K}}{308 \text{ K} \times 101 \text{ kPa}} = 0.120 \text{ L}$

REF: p. 424

49. ANS:

$300.0 \text{ kPa x } \frac{1atm}{101.3kPa} = 2.96 \text{ atm}$

PV = nRT

$n = \frac{PV}{RT} = \frac{2.96\text{atm} \times 0.25 \text{ L}}{0.0821 \frac{\text{atm} \cdot L}{\text{mol} \cdot K} \times 300.0 \text{ K}} = 0.030 \text{ mol}$

REF: p. 427

50. ANS:

$32 \text{ g } O_2 \times \frac{1 \text{ mol } O_2}{32 \text{ g } O_2} = 1 \text{ mol } O_2$

$$P = \frac{nRT}{V} = \frac{1.0\ \text{mol} \times 0.0821\ \frac{\text{atm} \cdot L}{\text{mol} \cdot K} \times 303\ \text{K}}{22.0\ \text{L}} = 1.13\ \text{atm}$$

REF: p. 427

ESSAY

51. ANS:
The kinetic theory is based upon the following assumptions: A gas is composed of tiny particles with an insignificant volume. Gas particles are in constant random motion. All collisions between gas particles are perfectly elastic.

REF: p. 385

52. ANS:
This is an application of Boyle's Law. As volume decreases, pressure increases. The air pressure increases. Squeezing reduces the enclosed volume of the balloon without changing the number of particles in the balloon. Consequently, the number of collisions between the particles and the balloon increases.

REF: p. 416

53. ANS:
This is an application of Gay-Lussac's Law. As temperature increases, pressure increases as well. The pressure increases when the gas is heated because increasing the temperature of the gas increases the average kinetic energy of the particles in the gas. With an increase in average kinetic energy, there will be an increase in the number of collisions between the particles and the container walls. In addition, because the particles are moving faster, on average, the collisions will occur with greater force. Both factors, the increased frequency of collision and the increased force of the collisions, contribute to the increase in pressure.

REF: p. 417