

Name: _____

Key

Unit 9 Practice Test

D 1) An assumption of the kinetic theory of gases is that the particles of a gas have

- A) strong attraction for each other and an insignificant volume
- B) strong attraction for each other and a significant volume
- C) little attraction for each other and a significant volume
- D) little attraction for each other and an insignificant volume

C 2) A gas occupies a volume of 30 milliliters at 273 K. If the temperature is increased to 364 K while the pressure remains constant, what will be the volume of the gas?

- A) 60 mL
- B) 30 mL
- C) 40 mL
- D) 20 mL

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{30}{273} = \frac{x}{364}$$

$$x = 40 \text{ mL}$$

D 3) When a sample of a gas is heated at constant pressure, the average kinetic energy of its molecules

- A) decreases, and the volume of the gas increases
- B) increases, and the volume of the gas decreases
- C) decreases, and the volume of the gas decreases
- D) increases, and the volume of the gas increases

↑ temp, ↑ average KE, ↑ volume

C 4) The pressure on 200. milliliters of a gas at constant temperature is changed from 50.65 kPa to 101.3 kPa. What is the new volume of the gas?

- A) 200. mL
- B) 400. mL
- C) 100. mL
- D) 800. mL

Direct relationship

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$P_1 V_1 = P_2 V_2$$

$$50.65(200) = (101.3)(x)$$

$$x = 100. \text{ mL}$$

B 5) One reason that a real gas deviates from an ideal gas is that the molecules of the real gas have

- A) a straight-line motion
- B) forces of attraction for each other
- C) no net loss of energy on collision
- D) a negligible volume

B 6) A sample of gas A was stored in a container at a temperature of 50°C and a pressure of 0.50 atmosphere. Compared to a sample of gas B at STP, gas A had a

- A) lower temperature and a lower pressure
- B) higher temperature and a lower pressure
- C) higher temperature and a higher pressure
- D) lower temperature and a higher pressure

↓
0°C,
1 atm

A 7) Which gas will most closely resemble an ideal gas at STP?

- A) H₂
- B) SO₂
- C) NH₃
- D) Cl₂

lighter gases behave more like ideal gases

C 8) Which change must result in an increase in the average kinetic energy of the molecules of a sample of N₂(g)?

- A) The volume changes from 1 liter to 2 liters.
- B) The density changes from 2.0 g/l to 2.5 g/l.
- C) The temperature changes from 20°C to 30°C.
- D) The pressure changes from 0.5 atmosphere to 1 atmosphere.

↑ temp.

$$P_1 V_1 = P_2 V_2 \text{ (inverse)}$$

- A 9) As the pressure on a sample of a gas increases at constant temperature, the volume of the gas
 (A) decreases B) remains the same C) increases

- C 10) At STP, 44.8 liters of CO_2 contains the same number of particles as
 A) 1.00 mole of He $\frac{44.8}{22.4} = 2.0 \text{ mol}$ (C) 2.00 moles of Ne
 B) 4.00 moles of N_2 22.4 D) 0.500 mole of H_2

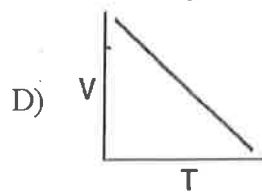
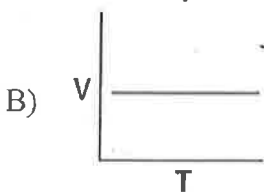
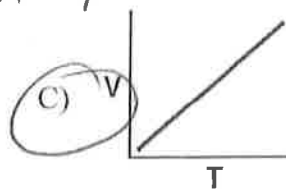
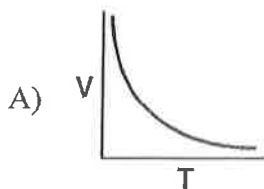
- A 11) What volume will a 300.-milliliter sample of a gas at STP occupy when the pressure is doubled at constant temperature?
 (A) 150. mL $\frac{300}{2} = 150$ $P_1 V_1 = P_2 V_2$ C) 300. mL pressure is doubled, volume is halved.
 B) 450. mL * inverse D) 600. mL

- B 12) A cylinder is filled with 2.0 moles of nitrogen, 3.0 moles of argon, and 5.0 moles of helium. If the gas mixture is at STP, what is the partial pressure of the argon?
 (A) 50.7 kPa $\frac{3}{10}(101.3 \text{ kPa}) =$ C) 20.3 kPa
 B) 30.4 kPa D) 101.3 kPa

- A 13) A flask containing molecules of gas A and a separate flask containing the molecules of gas B are both at the same temperature. Gases A and B must have equal
 (A) average kinetic energies C) masses
 B) volumes D) pressures

- D 14) What pressure, in atmospheres, is equal to 152 kPa?
 A) 1.00 B) 2.00 $\frac{152 \text{ kPa}}{101.3 \text{ kPa}} = 1.50 \text{ atm}$ (D) 1.50
 C) 0.670

- C 15) At constant pressure, which graph shows the correct relationship between the volume of a gas (V) and its absolute temperature (T)? \Rightarrow direct relationship



$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

- A 16) A sample of a gas occupies 6.00 liters at a temperature of 200. K. If the pressure remains constant and the temperature is raised to 600. K, the volume of the gas sample would be
 (A) 18.0 L $\frac{6}{200} = \frac{x}{600}$ B) 3.00 L C) 2.00 L D) 12.0 L

- B 17) At constant temperature, the pressure on 8.0 liters of a gas is increased from 1 atmosphere to 4 atmospheres. What will be the new volume of the gas?
 A) 32 L (B) 2.0 L C) 1.0 L D) 4.0 L

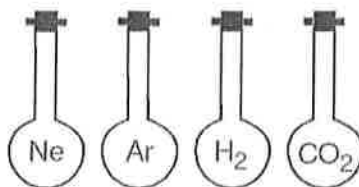
$$P_1 V_1 = P_2 V_2$$

$$1.0(8.0) = (4.0)(x)$$

B 18) When 7.00 moles of gas A and 3.00 moles of gas B are combined, the total pressure exerted by the gas mixture is 1.0 atm. What is the partial pressure exerted by gas A in this mixture?

- A) 1.0 atm $\frac{7}{10}(1.0) = 0.70 \text{ atm}$ C) 0.10 atm
B) 0.70 atm D) 0.30 atm

D 19) The diagrams below represent four 500-milliliter flasks. Each flask contains the gas represented by its symbol. All gas samples are at STP.



same V, T, P =
same # of molecules.

Each flask contains the same number of

- A) atoms, but different numbers of molecules
 B) atoms and molecules
 C) atoms, only
D) molecules, only

A 20) At the same temperature and pressure, which gas will diffuse through air at the fastest rate?

- A) He 4.0 g/mol B) CH₄ 16.0 g/mol C) CO₂ 44.0 g/mol D) CO 28.0 g/mol

lightest gas.

C 21) As the pressure on a liquid is changed from 100 kPa to 120 kPa, the temperature at which the liquid will boil

- A) remains the same B) decreases C) increases

D 22) What is the normal boiling point of propanone? Table H

- A) 78°C B) 67°C C) 100°C D) 56°C

A 23) According to the *Vapor Pressure of Four Liquids* chemistry reference table, if the pressure on the surface of water in the liquid state is 47.0 kPa, the water will boil at

- A) 80°C B) 35°C C) 95°C D) 60°C

24) A gas sample has a volume of 25.0 milliliters at a temperature of 75.0°C and 1.00 atmosphere of pressure. What will be the final temperature of the gas (in degrees Kelvin) if the volume increases to 50.0 milliliters and the pressure remains constant? [Write the correct formula. Show all work. Indicate the correct answer with an appropriate unit.]

$$V_1 = 25.0 \quad V_2 = 50.0 \quad \frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \frac{(25.0)}{348} = \frac{50.0}{x}$$

$$T_1 = 75.0 + 273 = 348 \text{ K} \quad T_2 = x$$

$$\boxed{x = 696 \text{ K}}$$

25) A sample of gas occupies 15.0 liters at 4.00 atmospheres and 300. K. What is the new volume of the gas if pressure is decreased to 2.00 atmosphere and temperature is increased to 400. K? [Write the correct formula. Show all work. Indicate the correct answer with an appropriate unit.]

$$P_1 = 4.00 \text{ atm} \quad P_2 = 2.00 \text{ atm}$$

$$V_1 = 15.0 \text{ L} \quad V_2 = x$$

$$T_1 = 300. \text{ K} \quad T_2 = 400 \text{ K}$$

$$\frac{(4.00)(15.0)}{300.} = \frac{2.00(x)}{400.}$$

$$\boxed{x = 40.0 \text{ L}}$$

26) A 1.0 liter helium balloon (originally at 101.3 kPa and 25°C) is released and rises up into the sky. What will be the volume of the balloon at the higher altitude where the temperature is 15°C and atmospheric pressure is 81.3 kPa? [Write the correct formula. Show all work. Indicate the correct answer with an appropriate unit.]

$$P_1 = 101.3 \text{ kPa} \quad P_2 = 81.3 \text{ kPa}$$

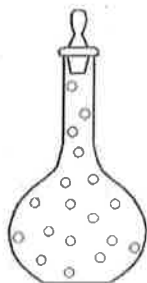
$$V_1 = 1.0 \text{ L} \quad V_2 = X$$

$$T_1 = 298 \text{ K} \quad T_2 = 288 \text{ K}$$

$$\frac{101.3 (1.0)}{298} = \frac{81.3 (x)}{288}$$

$$x = 1.2 \text{ L}$$

27) The particle diagram below represents a sample of a gas sealed in a 1.0 liter flask. The sample was heated gently and the gas pressure was measured over a range of temperatures as reported in the data table.



Temperature (K)	Pressure (kPa)
300	101.3
310	104.7
320	108.1
330	111.4

(a) State the relationship between the temperature and pressure of the gas when the volume remains constant. As temperature increases, pressure increases.

(b) Explain the increase in pressure of the sample at higher temperatures in terms of kinetic energy and collisions of the gas particles. As kinetic energy increases, the number of collisions increases, thus increasing the pressure.

(c) Predict the gas pressure at 340 K. [Write the correct formula. Show all work. Indicate the correct answer with an appropriate unit.]

$$P_1 = 101.3 \quad P_2 = X$$

$$T_1 = 300 \quad T_2 = 340$$

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$\frac{101.3}{300} = \frac{X}{340}$$

1 sig fig

$$X = 1 \times 10^2 \text{ kPa}$$

28) A gas that behaves exactly as predicted by the kinetic theory of gases is called an ideal gas. The behavior of real gases deviates slightly from the kinetic theory.

State two reasons why real gases are *not* ideal.

The gas particles of real gases:

- 1) do have volume
- 2) do have attractions b/w one another
- 3) have collisions that are inelastic.

Review - GASES

Key

Name: _____ 4

A 1) A 200-milliliter sample of a gas has a pressure of 1 atmosphere. If the volume of the gas is decreased to 50 milliliters at constant temperature, the new pressure of the gas will be inverse relationship $V \downarrow 4 \quad P \uparrow 4$
 A) 4 atm B) 3 atm C) 1 atm D) 2 atm

B 2) At constant temperature, the pressure on 8.0 liters of a gas is increased from 1 atmosphere to 4 atmospheres. What will be the new volume of the gas? $P \uparrow \times 4$
 A) 1.0 l B) 2.0 l C) 32 l D) 4.0 l

C 3) A 100. milliliter sample of a gas at a pressure of 380. torr is reduced to 190. torr at constant temperature. What is the new volume of the gas? decreases by factor of 2
 A) 50.0 ml B) 290. ml C) 200. ml D) 90.0 ml

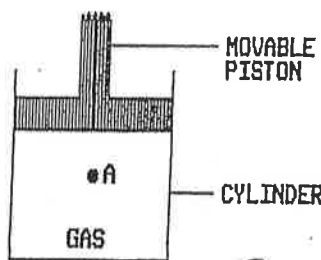
A 4) As the temperature of a sample of an ideal gas increases at constant pressure, the volume occupied by the sample
 A) increases direct relationship B) remains the same C) decreases

B 5) The volume of a sample of hydrogen gas at STP is 1.00 liter. As the temperature decreases, pressure remaining constant, the volume of the sample direct
 A) increases B) decreases C) remains the same

C 6) The pressure on 200. milliliters of a gas at constant temperature is changed from 380. torr to 760. torr. The new volume of the gas is $\times 2$
 A) 800. ml B) 400. ml C) 100. ml D) 200. ml

C 7) As the pressure on a sample of a gas increases at constant temperature, the volume of the gas
 A) increases inverse B) remains the same C) decreases

C 8) The diagram represents a gas confined in a cylinder fitted with a movable piston. As the piston moves toward point A at constant temperature, which relationship involving pressure (P) and volume (V) is correct?



- A) $P/V = k$ B) $P - V = k$ C) $P \times V = k$ D) $P + V = k$

B 9) At constant pressure, 50. milliliters (ml) of a gas at 20. °C is heated to 30. °C. The new volume of the gas in milliliters (ml) is equal to $\frac{V_1}{T_1} = \frac{V_2}{T_2}$
 $\frac{50.}{293} = \frac{x}{303}$
 $293x = 50(303)$
 $x = \frac{50 \times 303}{293}$
 A) $50. \times \frac{20.}{30.}$ B) $50. \times \frac{303}{293}$ C) $50. \times \frac{30.}{20.}$ D) $50. \times \frac{293}{303}$

C 10) A sample of oxygen gas has a volume of 150. milliliters at 300 K. If the pressure of the sample is held constant and the temperature is raised to 600 K, the new volume of the sample will be $\times 2$
 A) 75.0 mL B) 150. mL C) 300. mL D) 600 mL

C 11) The volume of 50.0 milliliters of an ideal gas at STP increases to 100. milliliters. If the pressure remains constant, the new temperature must be 273×2 V and T → direct
 A) 100. K B) 273 K C) 546 K D) 0 K

B 12) If the pressure on a given mass of gas in a closed system is increased and the temperature remains constant, the volume of the gas will $P_1 V_1 = P_2 V_2$
 A) increase B) decrease C) remain the same

(Dalton, Graham, Avogadro, KMT)

Name: _____

3) 1) What is the total pressure exerted by a mixture containing two gases if the partial pressure of one gas is 70 kPa and the partial pressure of the other gas is 30 kPa?

- 1) 40 kPa 2) 70 kPa 3) 100 kPa 4) 30 kPa
- Handwritten: $70 + 30 = 100 \text{ kPa}$*

3) 2) A gas volume that contains an equal number of hydrogen and oxygen molecules has a pressure of 0.6 atmosphere. The partial pressure due to the oxygen molecules is

- 1) 0.2 atm 2) 0.6 atm 3) 0.3 atm 4) 0.1 atm
- Handwritten: $\frac{0.6}{2} = 0.3 \text{ atm}$*

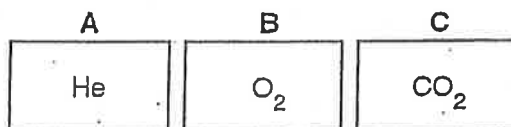
4) 3) A 300.-milliliter container that is filled with 100. milliliters of oxygen and 200. milliliters of hydrogen has a total pressure of 90.0 kPa. What is the partial pressure of the oxygen?

- 1) 100. kPa 2) 200. kPa 3) 60.0 kPa 4) 30.0 kPa
- Handwritten: $\frac{1}{3}(90.0) = 30.0 \text{ kPa}$*

1) 4) A 1-liter flask contains two gases at a total pressure of 3.0 atmospheres. If the partial pressure of one of the gases is 0.5 atmosphere, then the partial pressure of the other gas must be

- 1) 2.5 atm 2) 0.50 atm 3) 1.0 atm 4) 1.5 atm
- Handwritten: $3.0 - 0.5 = 2.5$*

2) 5) The diagrams below represent three 1-liter containers of gas, A, B, and C. Each container is at STP.



Which of the following statements correctly compares the number of molecules in the containers?

- 1) Container A has the greatest number of molecules.
 2) All three containers have the same number of molecules.
 3) Container C has the greatest number of molecules.
 4) Container B has the greatest number of molecules.

2) 6) Samples of SO₂(g) and N₂(g) contain equal numbers of molecules. If the gases are at STP, the samples have

- 1) the same density 2) equal volumes 3) equal numbers of atoms 4) the same molecular mass

2) 7) The table below shows the temperature, pressure, and volume of five samples.

Sample	Substance	Temperature (K)	Pressure (atm)	Volume (L)
A	He	273	1	22.4
B	O ₂	273	1	22.4
C	Ne	273	2	22.4
D	N ₂	546	2	44.8
E	Ar	546	2	44.8

Which sample contains the same number of molecules as sample A?

- 1) E 2) B 3) C 4) D

2) 8) Which gas would have the slowest rate of diffusion when all of the gases are held at the same temperature and pressure?

- 1) N₂ 2) CO₂ 3) NO 4) O₂
- Handwritten: "heaviest" under CO₂*

1) 9) Which gas would diffuse most rapidly under the same conditions of temperature and pressure?

- 1) gas A, molecular mass = 4 2) gas B, molecular mass = 16 3) gas D, molecular mass = 49 4) gas C, molecular mass = 20
- Handwritten: "lightest" under gas A*