MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) The thermal decomposition of potassium chlorate can be used to produce oxygen in the laboratory.

\[ 2\text{KClO}_3(\text{s}) \rightarrow 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g}) \]

What volume (L) of \( \text{O}_2 \) gas at 25°C and 1.00 atm pressure is produced by the decomposition of 7.5 g of KClO\(_3\)?

A) 11 \hspace{1cm} B) 3.7 \hspace{1cm} C) 4.5 \hspace{1cm} D) 2.2 \hspace{1cm} E) 7.5

Page Ref: Sec. 10.3

2) The kinetic-molecular theory predicts that pressure rises as the temperature of a gas increases because

A) the gas molecules collide less frequently with the wall
B) the average kinetic energy of the gas molecules decreases
C) the gas molecules collide more frequently with the wall
D) the gas molecules collide more energetically with the wall
E) both the gas molecules collide more frequently with the wall and the gas molecules collide more energetically with the wall

Page Ref: Sec. 10.7

3) A sample of He gas (2.0 mmol) effused through a pinhole in 53 s. The same amount of an unknown gas, under the same conditions, effused through the pinhole in 248 s. The molecular mass of the unknown gas is \( \underline{\hspace{2cm}} \) g/mol.

A) 19 \hspace{1cm} B) 0.19 \hspace{1cm} C) 3.80 \hspace{1cm} D) 5.5 \hspace{1cm} E) 88

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4) At a temperature of \( \underline{\hspace{2cm}} ^\circ\text{C} \), 0.444 mol of CO gas occupies 11.8 L at 889 torr.

A) 32 \hspace{1cm} B) 73 \hspace{1cm} C) 106 \hspace{1cm} D) 379 \hspace{1cm} E) 14

Page Ref: Sec. 10.4

5) The molecular weight of a gas that has a density of 6.70 g/L at STP is \( \underline{\hspace{2cm}} \) g/mol.

A) 73.0 \hspace{1cm} B) 0.296 \hspace{1cm} C) 150 \hspace{1cm} D) 96 \hspace{1cm} E) 3.35

Page Ref: Sec. 10.5

6) The reaction of 50 mL of Cl\(_2\) gas with 50 mL of CH\(_4\) gas via the equation:

\[ \text{Cl}_2(g) + \text{CH}_4(g) \rightarrow \text{HCl}(g) + \text{CH}_3\text{Cl}(g) \]

will produce a total of \( \underline{\hspace{2cm}} \) mL of products if pressure and temperature are kept constant.

A) 50 \hspace{1cm} B) 150 \hspace{1cm} C) 250 \hspace{1cm} D) 100 \hspace{1cm} E) 200

Page Ref: Sec. 10.6
7. The density of ammonia gas in a 4.32 L container at 837 torr and 45°C is ______ g/L.
   A) 3.86  B) 0.717  C) 0.194  D) 4.22 x 10⁻²  E) 0.432
   Page Ref: Sec. 10.3
   Topic:

8. Using the van der Waals equation, the pressure in a 22.4 L vessel containing 1.00 mol of neon gas at 100°C is ______ atm. (a = 0.211 L²·atm/mol², b = 0.0171 L/mol)
   A) 1.21  B) 0.367  C) 1.99  D) L.37  E) 0.730
   Page Ref: Sec. 10.9
   Topic:

9. The density of air at STP is 1.283 g/L. Which of the following cannot be used to fill a balloon that will float in air at STP?
   A) NO  B) CH₄  C) Ne  D) NH₃  E) HE
   Page Ref: Sec. 10.5
   Topic:

10. Of the following, ________ is a valid statement of Charles’ law.
    A) \( \frac{V}{T} \) constant
    B) \( \frac{P}{V} \) constant
    C) \( V = constant \times P \)
    D) \( V = constant \times T \)
    E) \(TV = constant \)
    Page Ref: Sec. 10.6
    Topic:

11. The amount of gas that occupies 60.82 L at 31°C and 367 mmHg is ______ mol.
    A) 0.138  B) 0.894  C) 0.650  D) 0.120  E) 1.6
    Page Ref: Sec. 10.4
    Topic:

12. If one was told that their blood pressure was 130/80, their systolic pressure was ______.
    A) 130 Pa  B) 80 mmHg  C) 130 mmHg  D) 80 psi  E) 80 Pa
    Page Ref: Sec. 10.2
    Topic:

13. Which one of the following is not true about the unit pascal (Pa)?
    A) 1 atm = 101,325 kPa
    B) 1 Pa = 100 torr
    C) The Pa is the SI unit for force
    D) 1 Pa = 1 N/m²
    E) The Pa is the SI unit for pressure
    Page Ref: Sec. 10.2
    Topic:

14. If 50.75 g of a gas occupies 10.0 L at STP, 129.5 g of the gas will occupy ______ L at STP.
    A) 5.08  B) 3.92  C) 12.9  D) 35.5  E) 50.8
    Page Ref: Sec. 10.5
    Topic:
15) A sample of a gas (5.0 mol) at 1.0 atm is expanded at constant temperature from 10 L to 15 L. The final pressure is ______ atm.
   A) 7.5  B) 1.5  C) 0.67  D) 3.3  E) 15
   Page Ref: Sec. 10.3
   Topic:  

16) In ideal gas equation calculations, expressing pressure in Pascals (Pa), necessitates the use of the gas constant, R, equal to ______.
   A) 8.314 J mol⁻¹K⁻¹
   B) 6.236 L atm mol⁻¹K⁻¹
   C) 1.87 cal mol⁻¹K⁻¹
   D) 0.08206 atm L mol⁻¹K⁻¹
   E) none of the above
   Page Ref: Sec. 10.2, 10.3
   Topic:  

17) Which noble gas is expected to show the largest deviations from the ideal gas behavior?
   A) xenon  B) helium  C) krypton  D) argon  E) neon
   Page Ref: Sec. 10.9
   Topic:  

18) At 333 K, which of the pairs of gases below would have the most nearly identical rates of effusion?
   A) N₂ and O₂
   B) CO and N₂
   C) N₂O and NO₂
   D) NO₂ and N₂O₄
   E) CO and CO₂
   Page Ref: Sec. 19.8
   Topic:  

19) The National Weather Service routinely supplies atmospheric pressure data to help pilots set their altimeters. The units the NWS uses for atmospheric pressure are inches of mercury. A barometric pressure of 30.51 inches of mercury corresponds to ______ kPa.
   A) 103.3  B) 775  C) 765  D) 1.020  E) 16.01
   Page Ref: Sec. 10.2
   Topic:  

20) A fixed amount of gas at 25°C occupies a volume of 10.0 L, when the pressure is 629 torr. Use Charles’s law to calculate the volume (L) the gas will occupy when the temperature is increased to 121°C while maintaining the pressure at 629 torr.
   A) 7.56  B) 13.2  C) 10.9  D) 2.07  E) 48.4
   Page Ref: Sec. 10.3
   Topic:  

21) SO₂ (5.0 g) and CO₂ (5.0 g) were placed in a 750 mL container at 50°C. The partial pressure of CO₂ in the container was ______ atm.
   A) 4.02  B) 6.78  C) 0.192  D) 2.7%  E) 1.60
   Page Ref: Sec. 10.6
   Topic:  
22) A fixed amount of gas at 25.0°C occupies a volume of 10.0 L. When the pressure is 667 torr. Use Boyle's law to calculate the pressure (torr) when the volume is reduced to 7.88 L at a constant temperature of 25.0°C.

A) 1.11 B) 846 C) 5.26 x 10^4 D) 0.118 E) 526

Page Ref: Sec. 10.3
Topic: 

23) A flask contains a mixture of He and Ne at a total pressure of 2.6 atm. There are 2.0 mol of He and 5.0 mol of Ne in the flask. The partial pressure of He is ______ atm.

A) 1.04 B) 9.1 C) 0.74 D) 1.86 E) 6.5

Page Ref: Sec. 10.6
Topic: 

24) A sample of oxygen gas was found to effuse at a rate equal to two times that of an unknown gas. The molecular weight of the unknown gas is ______ g/mol.

A) 8.0 B) 16 C) 128 D) 8 E) 64

Page Ref: Sec. 10.8
Topic: 

25) The volume of a sample of gas (2.49 g) was 752 mL at 1.98 atm and 62°C. The gas is ______.

A) NO₂ B) SO₂ C) SO₃ D) NH₃ E) Ne

Page Ref: Sec. 10.5
Topic: 

26) Gaseous mixtures ______.

A) are all heterogeneous B) can only contain molecules C) are all homogeneous D) can only contain isolated atoms E) must contain both isolated atoms and molecules

Page Ref: Sec. 10.1
Topic: 

27) Molecular compounds of low molecular weight tend to be gases at room temperature. Which of the following is most likely not a gas at room temperature?

A) HCl B) CH₄ C) LiCl D) H₂ E) Cl₂

Page Ref: Sec. 10.1
Topic: 

28) The root-mean-square speed of CO at 113°C is ______ m/s.

A) 317 B) 58.3 C) 31.5 D) 586 E) 993

Page Ref: Sec. 10.8
Topic: 

29) Using the van der Waals equation, the pressure in a 22.4 L vessel containing 1.50 mol of chlorine gas at 0°C is ______ atm. \( (a = 6.49 \text{ LI}^2\text{atm/mol}^2, \ b = 0.0562 \text{L/mol}) \)

A) 0.676 B) 0.993 C) 1.48 D) 1.91 E) 1.50

Page Ref: Sec. 10.9
Topic: 

30) Zinc reacts with aqueous sulfuric acid to form hydrogen gas:

\[ \text{Zn (s)} + \text{H}_2\text{SO}_4 \text{(aq)} \rightarrow \text{ZnSO}_4 \text{(aq)} + \text{H}_2 \text{(g)} \]

In an experiment, 201 mL of wet H\textsubscript{2} is collected over water at 27°C and a barometric pressure of 733 torr. The vapor pressure of water at 27°C is 26.74 torr. The partial pressure of hydrogen in this experiment is ______ atm.

A) 0.929  B) 1.00  C) 0.964  D) 760  E) 706

Page Ref: Sec. 10.6
Topic:

31) The density of ________ is 0.900 g/L at STP.

A) CH\textsubscript{4}  B) NO  C) Ne  D) CO  E) N\textsubscript{2}

Page Ref: Sec. 10.5
Topic:

32) The volume occupied by 1.5 mol of gas at 35°C and 2.0 atm pressure is ________ L.

A) 2.2  B) 0.026  C) 0.053  D) 19  E) 38

Page Ref: Sec. 10.4
Topic:

33) According to the kinetic-molecular theory, molecules of different gases at the same temperature always have the same ________.

A) volume  B) pressure  C) molecular mass  D) average density  E) average kinetic energy

Page Ref: Sec. 10.7
Topic:

34) A gas vessel is attached to an open-end manometer containing a nonvolatile liquid of density 0.791 g/mL as shown below.

The difference in heights of the liquid in the two sides of the manometer is 43.4 cm when the atmospheric pressure is 765 mmHg. Given that the density of mercury is 13.6 g/mL, the pressure of the enclosed gas is ________ atm.

A) 0.960  B) 0.990  C) 0.993  D) 1.03  E) 0.987

Page Ref: Sec. 10.2
Topic:
35) The density of \( \text{NgO} \) at 1.33 atm and 45.2°C is _________ g/L.
A) 0.388    B) 9.99    C) 1.76    D) 2.58    E) 18.2

36) Arrange the following gases in order of increasing average molecular speed at 25°C.

\( \text{He, CO}_2, \text{ CO}_2, \text{ N}_2 \)

A) \( \text{CO}_2 < \text{ N}_2 < \text{ O}_2 < \text{ He} \)
B) \( \text{He} < \text{ N}_2 < \text{ O}_2 < \text{ CO}_2 \)
C) \( \text{CO}_2 < \text{ O}_2 < \text{ N}_2 < \text{ He} \)
D) \( \text{CO}_2 < \text{ He} < \text{ N}_2 < \text{ O}_2 \)
E) \( \text{He} < \text{ O}_2 < \text{ N}_2 < \text{ CO}_2 \)

37) The molecular weight of a gas that has a density of 5.75 g/L at STP is ________ g/mol.
A) 578    B) 141    C) 129    D) 3.90    E) 1.73 \times 10^{-3}

38) A balloon originally had a volume of 4.39 L at 44°C and a pressure of 729 torr. The balloon must be cooled to ________°C to reduce its volume to 3.78 L at constant pressure.
A) 0    B) 546    C) 273    D) 38    E) 72.9

39) What volume (mL) of sulfur dioxide can be produced by the complete reaction of 3.82 g of calcium sulfite with excess \( \text{HCl(aq)} \), when the final \( \text{SO}_2 \) pressure is 827 torr at 44°C?
A) 578    B) 761    C) 1.39 \times 10^{-4}    D) 0.106    E) 1.00 \times 10^{-3}

40) A sample of an ideal gas (3.00 L) in a closed container at 25.0°C and 76.0 torr is heated to 300°C. The pressure of the gas at this temperature is ________ torr.
A) 39.5    B) 146    C) 2.53 \times 10^{-2}    D) 912    E) 76.5

41) An open-end manometer filled with a liquid with a density of ________ g/mL will exhibit the smallest height difference for a given pressure.
A) 2.29    B) 0.0918    C) 16.2    D) 0.00234    E) 13.6

42) The density of chlorine (\( \text{Cl}_2 \)) gas at 25°C and 60. kPa is ________ g/L.
A) 4.9    B) 1.7    C) 20    D) 0.58    E) 0.96
43) The density of nitric oxide (NO) gas at 1.21 atm and 54.1°C is ______ g/L. 
A) 0.740  B) 8.2  C) 1.35  D) 0.0451  E) 0.273
Page Ref: Sec. 10.5
Topic:

44) How much faster does $^{235}$UF$_6$ effuse than $^{238}$UF$_6$?
A) 1.013 times as fast  B) 1.009 times as fast  
C) 1.018 times as fast  D) 1.006 times as fast  
E) 1.004 times as fast
Page Ref: Sec. 10.8
Topic:

45) At STP, the ratio of the root-mean-square speed of CO$_2$ to that of SO$_2$ is _______. 
A) 1.000  B) 1.207  C) 2.119  D) 1.456  E) 2.001
Page Ref: Sec. 10.8
Topic:

46) A vessel contained N$_2$, Ar, He, and Ne. The total pressure in the vessel was 987 torr. The partial pressures of nitrogen, argon, and helium were 44, 486, and 218 torr, respectively. The partial pressure of neon in the vessel was _______ torr. 
A) 760  B) 521  C) 42.4  D) 19.4  E) 239
Page Ref: Sec. 10.6
Topic:

47) Sodium hydride reacts with excess water to produce aqueous sodium hydroxide and hydrogen gas:
$$\text{NaH(s)} + \text{H}_2\text{O(l)} \rightarrow \text{NaOH(aq)} + \text{H}_2(g)$$
A sample of NaH weighing ______ g will produce 982 mL of gas at 28°C and 765 torr, when the hydrogen is collected over water. The vapor pressure of water at this temperature is 28 torr. 
A) 0.960  B) 2.93  C) 0.925  D) 925  E) 0.0388
Page Ref: Sec. 10.6
Topic:

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question

48) Explain how conversion of uranium to UF$_6$, allowed separation of $^{235}$U and $^{238}$U. 
Page Ref: Sec. 10.8
Topic:

49) Calculate the rms speed of methane molecules at 45°C. 
Page Ref: Sec. 10.8
Topic:

50) What is the partial pressure of neon in a 4.00 L vessel that contains 0.836 mol of chloroform, 0.184 mol of ethane, and 0.755 mol of neon at a total pressure of 928 mmHg? 
Page Ref: Sec. 10.6
Topic: