Mr. Bracken
AP Chemistry

Name BRACKEN KEY
Period ____

Multiple-Choice Review: Gases

1. This is the most plentiful gas in the earth's atmosphere.
   (a) H_2
   (b) He
   (c) O_2
   (d) N_2
   (e) CO_2

D

NOT FROM NOTES

OUR ATMOSPHERE = 80% N_2
20% O_2

2. A one-mole sample of this gas occupying 1 Liter will have the greatest density.
   (a) H_2
   (b) He
   (c) O_2
   (d) N_2
   (e) CO_2

E

LARGEST FWt

3. At a given temperature, this gas will have the greatest rate of effusion.
   (a) H_2
   (b) He
   (c) O_2
   (d) N_2
   (e) CO_2

A

SMALLEST FWt

4. The temperature of a sample of an ideal gas confined in a 2.0 Liter container was raised from 27°C to 77°C. If the initial pressure of the gas was 1200 mmHg, what was the final pressure of the gas?
   (a) 300 mmHg
   (b) 600 mmHg
   (c) 1400 mmHg
   (d) 2400 mmHg
   (e) 3600 mmHg

C

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$ $\quad \frac{1200}{300} = \frac{P_2}{350}$

5. A sealed container contains 0.20 moles of oxygen gas and 0.10 moles of hydrogen gas. If the temperature is 25°C throughout the container, which of the following is true?
   (a) The partial pressures of the two gases are the same.
   (b) The average kinetic energies of the two gases are the same.
   (c) The molecular masses of the two gases are the same.
   (d) The total masses of the two gases are the same.
   (e) The average molecular speeds of the two gases are the same.

B

@ same temp so average K.E. is the same.

6. A gas sample contains 0.1 mole of oxygen and 0.4 moles of nitrogen. If the sample is at standard temperature and pressure, what is the partial pressure due to nitrogen?

(a) 0.1 atm
(b) 0.2 atm
(c) 0.5 atm
(d) 0.8 atm
(e) 1.0 atm

D

$\frac{.4}{.1+.4} = \frac{.4}{.5} = .8$ mole fraction that is N_2

$(.8)(1.00\ atm) = .8\ atm$

since STP

7. A mixture of gases contains 1.5 moles of oxygen, 3.0 moles of nitrogen, and 0.5 moles of water vapor. If the total pressure is 700 mmHg, what is the partial pressure of the nitrogen gas?

(a) 70 mmHg
(b) 210 mmHg
(c) 280 mmHg
(d) 350 mmHg
(e) 420 mmHg

E

$\left(\frac{3.0}{5.0}\right)(700) = 420\ mmHg$

8. A mixture of helium and neon gases has a total pressure of 1.2 atm. If the mixture contains twice as many moles of helium as neon, what is the partial pressure due to neon?

(a) 0.2 atm
(b) 0.3 atm
(c) 0.4 atm
(d) 0.8 atm
(e) 0.9 atm

C

moles helium = $2x$
moles neon = x

$\left(\frac{x}{3x}\right)(1.2) =$

9. Nitrogen gas was collected over water at 25°C. If the vapor pressure of water at 25°C is 23 mmHg and the total pressure in the container is measured to be 781 mmHg, what is the partial pressure of the nitrogen gas?

(a) 23 mmHg
(b) 46 mmHg
(c) 551 mmHg
(d) 735 mmHg
(e) 758 mmHg

E

$781 - 23 = 758\ mmHg$

collecting gas over water

10. When 4.0 moles of oxygen are confined in a 24-Liter vessel at 176°C, the pressure is 6.0 atm. If the oxygen is allowed to expand isothermally (temp remains constant) until it occupies 36 Liters, what will be the new pressure?

(a) 2 atm
(b) 3 atm
(c) 4 atm
(d) 8 atm
(e) 9 atm

C

$P_1V_1 = P_2V_2$

$(6.0)(24) = (P_2)(36)$

$P_2 = 4\ atm$

11. A gas sample is confined in a 5-Liter container. Which of the following will occur if the temperature of the container is increased?

I. The kinetic energy of the gas will increase. ✓
II. The pressure of the gas will increase. ✓
III. The density of the gas will increase. NO

C
(a) **I** only
(b) **II** only
(c) **I** and **II** only
(d) **I** and **III** only
(e) **I**, **II**, and **III**

12. A 22.0 gram sample of an unknown gas occupies 11.2 Liters at standard temperature and pressure. Which of the following could be the identity of the gas?

A
(a) CO_2
(b) SO_3
(c) O_2
(d) N_2
(e) He

STP Conditions
1 mole = 22.4 Liters

moles gas @ STP = $\frac{11.2}{22.4}$ = .5 moles

.5 = $\frac{22.0}{FWt}$

FWt = 44

13. A gaseous mixture at a constant temperature contains O_2, CO_2, and He. Which of the following lists the three gases in order of increasing average molecular speed?

E
(a) O_2, CO_2, He
(b) O_2, He, CO_2
(c) He, CO_2, O_2
(d) He, O_2, CO_2
(e) CO_2, O_2, He

O_2 = 32
CO_2 = 44
He = 4

CO_2 O_2 He
slowest Fastest

14. Which of the following conditions would be most likely to cause the ideal gas law to fail?

I. High pressure **II.** High temperature **III.** Large container volume

A
(a) **I** only
(b) **II** only
(c) **I** and **II** only
(d) **I** and **III** only
(e) **II** and **III** only

Notes #3

15. Which of the following expressions is equal to the density of helium gas at STP?

D
(a) $\frac{1}{22.4}$ g/L (b) $\frac{2}{22.4}$ g/L (c) $\frac{1}{4}$ g/L

(d) $\frac{4}{22.4}$ g/L (e) $\frac{4}{4}$ g/L

$\frac{FWt\ He}{22.4}$

16. An ideal gas is contained in a 5.0 Liter chamber at a temperature of 37°C. If the gas exerts a pressure of 2.0 atm on the walls of the chamber, which of the following expressions is equal to the number of moles of the gas? The gas constant, R, is 0.08 (L·atm)/(mol·K).

$PV = nRT$

$(2.0)(5.0) = n(.08)(310)$

E

(a) $\frac{(2.0)(5.0)}{(0.08)(37)}$ moles

(b) $\frac{(2.0)(0.08)}{(5.0)(37)}$ moles

(c) $\frac{(2.0)(0.08)}{(5.0)(310)}$ moles

(d) $\frac{(2.0)(310)}{(0.08)(5.0)}$ moles

(e) $\frac{(2.0)(5.0)}{(0.08)(310)}$ moles

$\frac{(2.0)(5.0)}{(.08)(310)} = n$

17. A gaseous mixture of oxygen and nitrogen is maintained at a constant temperature. Which of the following MUST be true regarding these two gases?

A

(a) Their average kinetic energies will be the same. ✓
(b) Their average molecular speeds will be the same.
(c) Their partial pressures will be the same.
(d) Their total masses will be the same.
(e) Their densities will be the same.

18. Nitrogen gas was collected over water at a temperature of 40°C and the pressure of the sample was measured to be 796 mmHg. If the vapor pressure of the water at 40°C is 55 mmHg, what is the partial pressure of the nitrogen gas?

B

(a) 55 mmHg
(b) 741 mmHg
(c) 756 mmHg
(d) 796 mmHg
(e) 851 mmHg

$796 - 55 = 741$ mmHg

Collecting gases over water

19. A balloon occupies a volume of 1.0 Liter when it contains 0.16 grams of helium at 37°C and 1 atm pressure. If helium is added to the balloon until it contains 0.80 grams while the pressure and temperature are kept constant, what will be the new volume of the balloon?

E

(a) 0.50 Liter
(b) 1.0 Liter
(c) 2.0 Liters
(d) 4.0 Liters
(e) 5.0 Liters

.16 grams = 1.0 Liter

.80 grams = 5.0 Liters

5x's as much so 5x's the volume

Could also use ideal gas law to solve for volume when .80 grams helium used.

20. An ideal gas fills a balloon at a temperature of 27°C and 1 atm pressure. By what factor will the volume of the balloon change if the gas is heated to 127°C?

(a) $\frac{27}{127}$ (b) $\frac{3}{4}$ (c) $\frac{4}{3}$

(d) $\frac{2}{1}$ (e) $\frac{127}{27}$

C

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

set $V_1 = 1$

$\frac{1}{300} = \frac{V_2}{400}$

$V_2 = \frac{4}{3}$

21. A gas sample with a mass of 10 grams occupies 6.0 Liters and exerts a pressure of 2.0 atm at a temperature of 26°C. Which of the following expressions is equal to the formula weight of the gas? The gas constant, R, is 0.08 (L·atm)/(mol·K).

(a) $\frac{(10)(0.08)(299)}{(2.0)(6.0)}$ (b) $\frac{(299)(0.08)}{(10)(2.0)(6.0)}$

(c) $\frac{(2.0)(6.0)(299)}{(10)(0.08)}$ (d) $\frac{(10)(2.0)(6.0)}{(299)(0.08)}$

(e) $\frac{(2.0)(6.0)}{(10)(299)(0.08)}$

A

$PV = nRT$

$PV = \left(\frac{\text{mass}}{\text{FWt}}\right)RT$

$FWt = \frac{(\text{mass})(R)(T)}{PV}$

$FWt = \frac{(10)(.08)(299)}{(2.0)(6.0)}$

22. Which of the following assumptions is (are) valid based on the kinetic molecular theory?

I. Gas molecules have negligible volume. ✓
II. Gas molecules exert no attractive forces on each other. ✓
III. The temperature of a gas is directly proportional to its average kinetic energy. ✓

E

(a) **I** only
(b) **III** only
(c) **I** and **III** only
(d) **II** and **III** only
(e) **I, II,** and **III**

23. What volume will 2.50 moles of N_2 occupy at 45°C and 1.50 atm of pressure?

(a) 43.5 L
(b) 6.08 L
(c) 0.0233 L
(d) 56.00 L
(e) 14.9 L

A

$PV = nRT$

$(1.50)(V) = (2.50)(.0821)(318)$

$V = 43.5$ Liters

24. How many moles of helium are needed to fill a balloon that has a volume of 6.45 Liters and a pressure of 800 mmHg at a temperature of 24°C? Assume ideal gas behavior.

(a) 0.288 moles
(b) 214 moles
(c) 0.278 moles
(d) 2650 moles
(e) 0.255 moles

C

$PV = nRT$

$(1.05)(6.45) = n(.0821)(297)$

$P = \frac{800}{760} = 1.05$ atm

25. If ideal gas behavior is assumed, what is the density of neon at STP?

(a) 1.11 g/L
(b) 448 g/L
(c) 0.009 g/L
(d) 0.901 g/L
(e) 1.25 g/L

D

1 mole Ne = 20.2 grams
1 mole Ne = 22.4 Liters @ STP

Density $= \frac{20.2}{22.4} = .90$ g/Liter

26. A sample of CO gas has a pressure of 58 mmHg and a volume of 155 mL. When the CO gas is quantitatively transferred to a 1.00 Liter flask, the pressure of the gas will be

(a) 374 mmHg
(b) 8990 mmHg
(c) 111 mmHg
(d) 8.99 mmHg
(e) 2.67 mmHg

D

$P_1V_1 = P_2V_2$

$(58)(.155) = (P_2)(1.00)$

$P_2 = 8.99$ mm Hg

need to keep your units consistent for Volume !

27. What will be the total pressure in a 2.50 Liter flask at 25°C if it contains 0.016 moles of CO_2 gas and 0.035 moles of CH_4 gas?

(a) 31.4 mm Hg
(b) 380 mmHg
(c) 0.041 mmHg
(d) 935 mmHg
(e) 1.23 atm

B

TOTAL MOLES of GAS = .016 + .035 = .051 moles gas

$PV = nRT$

$P(2.50) = (.051)(.0821)(298)$

$P = .499$ atm

$.499 = \frac{x}{760}$ $x = 380$

28. The kinetic molecular theory predicts that at a given temperature

(a) all gas molecules have the same kinetic energy NO (Average k.E. is the same)
(b) all gas molecules have the same average velocity NO
(c) only real gas molecules collide with each other NO
(d) on the average, heavier molecules move more slowly YES
(e) elastic collisions result in the loss of energy NO

D

29. Ideal gases

(a) have no volume POINT MASSES ONLY
(b) have no mass
(c) have no attractive forces between them YES
(d) have a combination of (a) and (c)
(e) have a combination of (a) and (b)

D

30. Under which conditions will a real gas behave most like an ideal gas?
(a) high pressure and high temperature
(b) low pressure and low temperature
(c) low volume and high temperature
(d) low pressure and high temperature
(e) high pressure and low temperature

D

SEE NOTES #3

31. Compared to ideal gases, real gases tend to have
(a) larger volumes ✓
(b) greater kinetic energies
(c) lower average kinetic energies
(d) lower pressures ✓
(e) both (a) and (d)

E

32. A gas has a density, at STP, of 3.48 g/L. What is the most reasonable formula for this compound?
(a) C_2H_6
(b) HF
(c) CCl_4
(d) C_6H_6
(e) CO_2

D

3.48
× 22.4
77.95 grams in 1 mole sample of gas
look for molecule w/ similar fmt

33. A gas in a 1.50 Liter container has a pressure of 245 mmHg. When the gas is transferred completely to a 350 mL container at the same temperature, the pressure will be
(a) 1.05 mmHg
(b) 1.05 atm
(c) 2.14 mmHg
(d) 1050 mmHg
(e) 0.00095 atm

D

$P_1V_1 = P_2V_2$
$(245)(1.50) = (P_2)(.350)$
1050 mmHg = P_2

Must Keep Volume units consistent

34. What volume of hydrogen gas, at STP, will be produced from a 0.100 gram sample of magnesium when reacted with an excess of HCl?

$$Mg + 2\,HCl \rightarrow MgCl_2 + H_2$$

(a) 92.1 mL
(b) 46.1 mL
(c) 184 mL
(d) 9.2 mL
(e) 4.6 L

A

$\frac{.100}{24}$ = .0042 moles Mg ← .0042 moles H_2 produced

$.0042 = \frac{x}{22.4}$

$x = .094$ Liters H_2
94 mL closest to 92.1 mL

DUE TO ROUNDING DIFFERENCES W/ FMT OF Mg