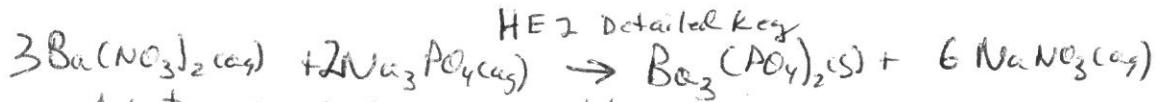


Form
A/B
C/N



Nat and NO₃ are spectator ions.
CHEMISTRY 102 HOUR EXAM II Fall 2019
 $3\text{Ba}^{2+} + 2\text{PO}_4^{3-} \rightarrow \text{Ba}_3(\text{PO}_4)_2(\text{s})$ is Page 1
the net ionic equation.

For the next two questions, consider the reaction between 150.0 mL of 0.300 M Ba(NO₃)₂ with 120.0 mL of 0.300 M Na₃PO₄. Assume the reaction has 100% yield.

$$0.1500\text{L}(0.300\text{mol}) = 0.0450 \text{ moles Ba}(\text{NO}_3)_2 = 0.0450 \text{ moles Ba}^{2+} + 0.090 \text{ mol NO}_3^-$$

1. Which ions are present in solution after the reaction has gone to completion?

$$0.1200\text{L}(0.300\text{mol}) = 0.036 \text{ mol Na}_3\text{PO}_4 = 0.036 \text{ mol PO}_4^{3-} + 0.108 \text{ mol Na}^+$$

a) There are no ions in solution after completion.

Let Ba²⁺ and PO₄³⁻ react:

b) Ba²⁺, NO₃⁻, Na⁺, and PO₄³⁻ ions are all present after completion.

c) Only Ba²⁺, NO₃⁻, and Na⁺ ions present after completion.

d) Only NO₃⁻ and Na⁺ ions are present after completion.

e) Only NO₃⁻, Na⁺, and PO₄³⁻ ions are present after completion.

Ba²⁺ is limiting and 0.0150 mol of Ba₃(PO₄)₂(s) forms.

PO₄³⁻ ions are in excess. Also present will be the

How many moles of precipitate form after the reaction has gone to completion?

Na⁺ and NO₃⁻ spectator ions.

a) 0.0450 mol

b) 0.0300 mol

c) 0.0360 mol

d) 0.0150 mol

e) 0.0180 mol

2/14 3. 12/24

- Consider a substance that has a high vapor pressure. Which of the following is **not** characteristic of a substance with a high vapor pressure?

A substance with weak intermolecular forces will have a high vapor pressure. Also a substance at a high temperature can have a high vapor pressure. Ionic forces are the strongest, so ionic compounds have very low vapor pressures.

T b) The temperature of the substance is relatively high.

T c) The substance is a small, nonpolar covalent compound. will have weak intermolecular forces (only small LD forces).

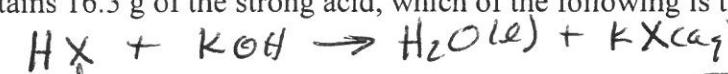
T d) The substance has a relatively small value for the enthalpy of vaporization (ΔH_{vap}).

If has small ΔH_{vap} , has weak intermolecular forces.

4/16 4. 13/25

- Consider a strong acid solution. When lead nitrate is added to some of the strong acid solution, a precipitate forms. In a second experiment, 50.0 mL of the strong acid solution requires 201.5 mL of 1.00 M KOH for complete reaction. If the 50.0 mL of strong acid solution contains 16.3 g of the strong acid, which of the following is the identity of the strong acid?

acid



Note: all answers are monoprotic acids, so assume unknown is monoprotic.

a) HF

b) HCl

c) HBr

$$\text{moles HX} = 0.2015\text{L} \left(\frac{1.00 \text{ mol KOH}}{\text{1 mol HX}} \right) \left(\frac{1 \text{ mol HX}}{1 \text{ mol KOH}} \right) = 0.2015 \text{ mol HX}$$

d) HI

e) HNO₃

$$\text{molar mass HX} = \frac{16.3 \text{ g HX}}{0.2015 \text{ mol HX}} = 80.9 \text{ g/mol}$$

HBr has a molar mass of 80.9 g/mol.

Form
~~AB~~
~~CD~~

CHEMISTRY 102
 HOUR EXAM II

HCl is a polar compound so has dipole forces as well as London dispersion (LD) forces.
 Fall 2019
 Ar is a nonpolar substance so Page 2
 Only has London dispersion forces. Since Ar

5/11
 22/18

5. Which of the following statements best explains why HCl has a higher boiling point than Ar?
 and HCl have about the same molar mass, Ar and HCl will have similar strength LD forces.
- HCl and Ar have similar strength London dispersion forces, but HCl has additional dipole forces that Ar does not possess.
 - HCl and Ar have similar strength London dispersion forces, but HCl has additional ionic forces that Ar does not possess.
 - HCl and Ar have similar strength London dispersion forces, but HCl has additional hydrogen bonding forces that Ar does not possess.
 - HCl has stronger London dispersion forces than Ar.
 - HCl is a strong electrolyte but Ar is not.

$$\text{Original moles } K^+ = \frac{0.1000 \text{ L}}{0.875 \text{ mol } K_2CO_3} \times \frac{2 \text{ mol } K^+}{1 \text{ mol } K_2CO_3} = 0.175 \text{ mol } K^+$$

6/2
 23/19

6. Consider 100.0 mL of a 0.875 M K_2CO_3 solution sitting in an uncovered beaker. Some water from the solution evaporates. After several days, you determine the K^+ concentration in the remaining solution to be 2.334 M. What volume of water evaporated from the original solution?

Only water was removed, so moles of K^+ did not change.

$$\begin{array}{lll} \text{a) } 100.0 \text{ mL} & \text{b) } 80.0 \text{ mL} & \text{c) } 75.0 \text{ mL} \\ \text{moles } K^+ \text{ initially} = \text{moles } K^+ \text{ after evaporation. Let } x = \\ \text{d) } 25.0 \text{ mL} & \text{e) } 10.0 \text{ mL} & \text{Volume of final solution (in L)} \end{array}$$

$$0.175 \text{ mol } K^+ = x \left(\frac{2.334 \text{ mol } K^+}{L} \right), \text{ solving: } x = 0.0750 \text{ L}$$

water evaporated = $100.0 \text{ mL}_{\text{initial}} - 75.0 \text{ mL}_{\text{final}} = 25.0 \text{ mL } H_2O$
 Consider the reaction of 4.60 g of sodium metal with excess oxygen to form Na_2O (molar mass = 61.98 g/mol). The actual yield of the reaction is 5.88 g of Na_2O . What is the percent yield of the reaction? $2 Na(s) + \frac{1}{2} O_2(g) \rightarrow Na_2O(s)$

$$\begin{array}{lll} \text{a) } 94.8\% & \text{b) } 63.8\% & \text{c) } 47.4\% \\ \text{theoretical yield} = 4.60 \text{ g } Na \left(\frac{1 \text{ mol } Na}{22.99 \text{ g}} \right) \left(\frac{1 \text{ mol } Na_2O}{2 \text{ mol } Na} \right) \left(\frac{61.98 \text{ g}}{1 \text{ mol } Na_2O} \right) = 6.20 \text{ g } Na_2O \\ \text{d) } 86.4\% & \text{e) } 73.8\% & \end{array}$$

$$\text{% yield} = \frac{\text{actual}}{\text{theoretical}} \times 100 = \frac{5.88 \text{ g}}{6.20 \text{ g}} \times 100 = 94.8\%$$

7/3
 24/20

7. Consider the reaction of 4.60 g of sodium metal with excess oxygen to form Na_2O (molar mass = 61.98 g/mol). The actual yield of the reaction is 5.88 g of Na_2O . What is the percent yield of the reaction? $2 Na(s) + \frac{1}{2} O_2(g) \rightarrow Na_2O(s)$
- 0 (none)
 - 1
 - 2
 - 3
 - 4 (A precipitate will form in all four beakers).

No reaction will occur between $Ba(NO_3)_2$ and NH_4Cl and $Ba(NO_3)_2$ and $RbOH$. So two precipitates will form ($BaSO_4(s)$ and $BaCO_3(s)$).

8/4
 25/21

Form
A/B
C/D

CHEMISTRY 102
HOUR EXAM II

Between HCl, HBr, and HI, the boiling increases steadily as the molar mass increase. So HI has a higher bp than HBr, while HCl has a bp lower than that of HBr.

Fall 2019
Page 3

9/17
1/14

9. Consider the following four substances: HF can form ff-bonding, so it has the highest bp.



Cl₂ and HBr have similar molar mass, so have similar strength London dispersion forces, but HBr is

- a) 0 (none) b) 1 c) 2 d) 3
e) 4 (All of the substances have a higher boiling point than HBr.)

polar so HBr has additional ~~dipole~~ dipole forces so HBr has a higher bp than Cl₂. So HF and HI will have a higher bp than HBr. the others shouldn't.

10/18
2/15

10. Air bags are activated when a severe impact causes a steel ball to compress a spring and electronically ignite a detonator cap. This causes sodium azide (NaN₃) to decompose explosively according to the following equation:



$$n_{\text{N}_2} = \frac{PV}{RT} = \frac{1.00 \text{ atm}(70.0 \text{ L})}{0.08206(273 \text{ K})}$$

What mass of NaN₃(s) must be reacted to inflate an air bag to 70.0 L at STP assuming 100% yield?

$$3.125 \text{ mol-N}_2 \left(\frac{2 \text{ mol NaN}_3}{3 \text{ mol N}_2} \right) \left(\frac{65.02 \text{ g}}{1 \text{ mol NaN}_3} \right) = 135 \text{ g NaN}_3$$

a) 203 g

e) 135 g

b) 43.8 g

c) 75.0 g

d) 304 g

11/19
3/16

11. Which of the following net ionic equations will **not** occur?

- OK a) Ag⁺(aq) + Cl⁻(aq) → AgCl(s) OK
OK b) Hg₂²⁺(aq) + SO₄²⁻(aq) → Hg₂SO₄(s)
OK c) Fe²⁺(aq) + OH⁻(aq) → Fe(OH)₂(s)
OK d) Mn²⁺(aq) + CrO₄²⁻(aq) → MnCrO₄(s)
WRONG e) Co²⁺(aq) + I⁻(aq) → CoI₂(s)

does not form

Apply solubility rules to see if predicted precipitate will form.
All are fine except for CoI₂(s). This compound will not form as told by Rule 3 of the solubility rules

12/20
4/17

12. A sample of gas containing 0.50 moles of Kr at 25°C exerts a pressure 0.75 atm. More Kr gas is added to the rigid container and the temperature is increased to 50.°C. The resulting pressure is 2.5 atm. How many moles of Kr were **added** to the rigid container?

- a) 0.83 moles b) 0.33 moles c) 1.5 moles

- d) 1.0 mole

- e) 0.50 moles

$$\frac{P_1 V_1}{n_1 T_1} = \frac{P_2 V_2}{n_2 T_2}, V_1 = V_2, n_2 = n_1 \left(\frac{P_2}{P_1} \right) \left(\frac{T_2}{T_1} \right) = 0.50 \text{ mol} \left(\frac{2.5 \text{ atm}}{0.75 \text{ atm}} \right) \left(\frac{323 \text{ K}}{298 \text{ K}} \right) = 1.54 \text{ mol}$$

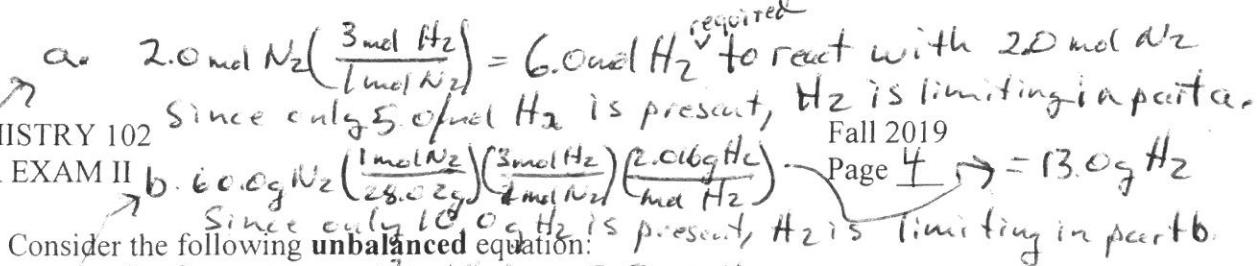
$$\text{moles Kr added} = 1.54 - 0.50 = 1.04 \quad \boxed{1.0 \text{ mol added}}$$

Form
A/B
C/D

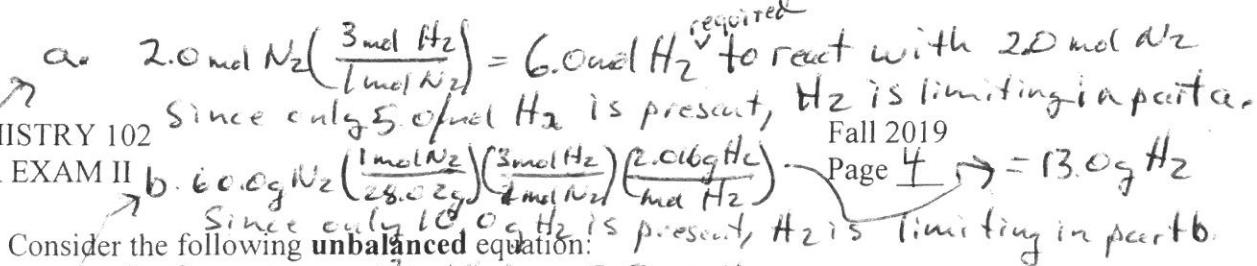
CHEMISTRY 102

HOUR EXAM II

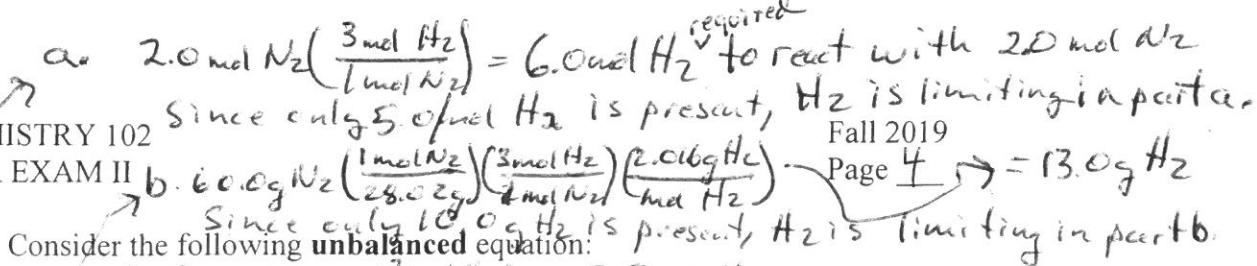
13.



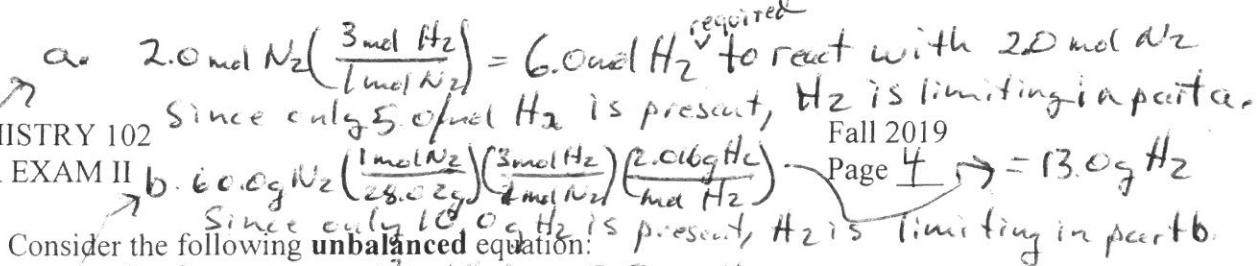
13.



13.



13.



a) Reacting 2.0 moles of N_2 with 5.0 moles of H_2 .

b) Reacting 60.0 g of N_2 with 10.0 g H_2 .

c) Reacting 3.0 moles of N_2 with 3.0 moles of H_2 .

d) Reacting 250.0 g of N_2 with 60.0 g of H_2 .

Since we have 60.0 g H_2 present, N_2 is limiting in part d.

e) Nitrogen is limiting in at least two of the above cases (a-d).

$$\text{mass H in } 100.00 \text{ g compound} = 100.00 - 56.79 \text{ g C} - 28.37 \text{ g O} - 8.28 \text{ g N} = 6.56 \text{ g H}$$

14.

The compound adrenaline contains 56.79% C, 28.37% O, and 8.28% N by mass, with hydrogen the remaining element in the compound. What is the empirical formula of adrenaline?

$$56.79 \text{ g C} \left(\frac{1 \text{ mol C}}{12.01 \text{ g}} \right) = 4.729 \text{ mol C} / 0.591 \text{ mol H} = 8 \text{ mol C}$$

$$6.56 \text{ g H} \left(\frac{1 \text{ mol H}}{1.008 \text{ g}} \right) = 6.508 \text{ mol H} / 0.591 \text{ mol} = 11 \text{ mol H}$$

$$28.37 \text{ g O} \left(\frac{1 \text{ mol O}}{16.00 \text{ g}} \right) = 1.773 \text{ mol O} / 0.591 = 3 \text{ mol O}$$

$$8.28 \text{ g N} \left(\frac{1 \text{ mol N}}{14.01 \text{ g}} \right) = 0.591 \text{ mol N} / 0.591 = 1 \text{ mol N}$$

15.

Consider the following four substances:

C-C, C-H bonds nonpolar
 $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$, so this compound is nonpolar

Ar, nonpolar

$\text{CH}_3\text{-O-CH}_3$, polar

$\text{CH}_3\text{-O-CH}_3$ is polar, so has additional dipole forces.

How many of these four substances only exhibit London dispersion forces (LDF)?

Nonpolar compounds only exhibit LDF. All of the

a) 0 (none) b) 1 c) 2 d) 3

Compounds are nonpolar except for $\text{CH}_3\text{-O-CH}_3$. This compound has polar C-O bonds which add together to make the $\text{CH}_3\text{-O-CH}_3$ molecule polar.

e) 4 (All four of these substances only exhibit London dispersion forces.)

16.

Some argon gas is collected over water. The wet gas occupies 2.0 L at 60.°C and 783 torr. If the 2.0 L of wet gas contains 0.0144 moles of water, what is the partial pressure

$$\text{Ar in the 2.0 L of wet gas at } 60.^\circ\text{C? } P_{\text{Ar}} = \frac{0.0144 \text{ mol H}_2\text{O} (0.08206)(333 \text{ K})}{2.0 \text{ L}} = 0.1967 \text{ atm}$$

a) 633 torr b) 150. torr c) 715 torr

d) 762 torr e) 300. torr

$$P_{\text{H}_2\text{O}} = 0.1967 \text{ atm} \left(\frac{760 \text{ torr}}{1 \text{ atm}} \right) = 149.53 \text{ torr}$$

$$P_{\text{TOT}} = P_{\text{Ar}} + P_{\text{H}_2\text{O}}, P_{\text{Ar}} = P_{\text{TOT}} - P_{\text{H}_2\text{O}} = 783 - 149.53 = 633 \text{ torr}$$

Form
A/B

Let $H_x A$ = Glutamic acid, where $x=1$ (mono protic acid) or $x=2$ (diprotic acid) or $x=3$ (triprotic acid).

CHEMISTRY 102 HOUR EXAM II Fall 2019
Page 5

17/21
5/5

$$\text{moles } OH^- = 0.017 \text{ mol} \left(\frac{0.100 \text{ mol } Ca(OH)_2}{1 \text{ mol } Ca(OH)_2} \right) \left(\frac{2 \text{ mol } OH^-}{1 \text{ mol } Ca(OH)_2} \right) = 0.00340 \text{ mol } OH^-$$

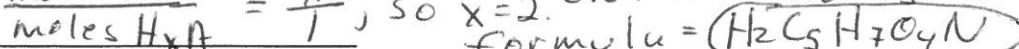
Glutamic acid, one of the 20 naturally occurring amino acids, has a molecular formula of $C_5H_9O_4N$. A 0.250 g-sample of glutamic acid (molar mass = 147.1 g/mol) dissolved in 75.0 mL of solution requires 17.0 mL of 0.100 M $Ca(OH)_2$ to react completely with all of the acid. Which of the following is the best formula for glutamic acid?

$$\text{moles glutamic acid} = 0.250 \text{ g} \left(\frac{1 \text{ mol}}{147.1 \text{ g}} \right) = 0.00170 \text{ mol glutamic acid}$$

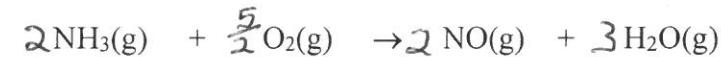
- a) $HC_5H_8O_4N$ b) $H_2C_5H_7O_4N$ c) $H_3C_5H_6O_4N$

$$\frac{\text{mol } OH^-}{\text{mol glutamic acid}} = \frac{0.00340}{0.00170} = 2 \text{, From balanced equation,}$$

$$\frac{\text{moles } OH^-}{\text{moles } H_x A} = \frac{X}{1}, \text{ so } X=2. \text{ Glutamic acid is a diprotic acid.}$$



For the next two questions, consider the reaction between 20.00 g of $NH_3(g)$ and 45.00 g of $O_2(g)$ by the following unbalanced equation:



Molar mass: 17.03 32.00 30.01 18.02 g/mol

$$\text{If } NH_3 \text{ limiting: } 20.0 \text{ g } NH_3 \left(\frac{1 \text{ mol } NH_3}{17.03 \text{ g}} \right) \left(\frac{2 \text{ mol } NO}{2 \text{ mol } NH_3} \right) \left(\frac{30.01 \text{ g}}{1 \text{ mol } NO} \right) = 35.24 \text{ g } NO \text{ produced}$$

18/22
6/6

18. What mass of $NO(g)$ can form assuming 100% yield?

If O_2 limiting:

$$\text{a) } 30.41 \text{ g} \quad \text{b) } 33.76 \text{ g} \quad \text{c) } 35.24 \text{ g} \quad \text{d) } 42.37 \text{ g} \quad \text{e) } 49.83 \text{ g}$$
$$45.00 \text{ g } O_2 \left(\frac{1 \text{ mol } O_2}{32.00 \text{ g}} \right) \left(\frac{2 \text{ mol } NO}{2.5 \text{ mol } O_2} \right) \left(\frac{30.01 \text{ g}}{1 \text{ mol } NO} \right) = \boxed{33.76 \text{ g } NO \text{ produced}}$$

Since O_2 reacted produces smallest amount of product, O_2 is limiting and 33.76 g NO can form.

19/23
7/7

19. What mass of excess reactant remains after the reaction has gone to completion?

$$\text{mass } NH_3 \text{ reacted} = 45.00 \text{ g } O_2 \left(\frac{1 \text{ mol } O_2}{32.00 \text{ g}} \right) \left(\frac{2 \text{ mol } NH_3}{2.5 \text{ mol } O_2} \right) \left(\frac{17.03 \text{ g}}{1 \text{ mol } NH_3} \right) = 19.16 \text{ g } NH_3 \text{ reacted}$$

$$\text{excess } NH_3 = 20.00 \text{ g } NH_3 \text{ initially} - 19.16 \text{ g } NH_3 \text{ reacted} = \boxed{0.84 \text{ g } NH_3 \text{ in excess}}$$

20. Calcium phosphate is an insoluble ionic compound. What is the mass percent of calcium in calcium phosphate?

$$3(40.08) + 2(30.97) + 8(16.00) = 310.18 \text{ g/mol} (= \text{molar mass } Ca_3(PO_4)_2)$$

- a) 21.96% b) 29.68% c) 38.76%

$$\text{mass \% Ca} = \frac{\text{mass } Ca \times 100}{\text{mass } Ca_3(PO_4)_2 \times 100} = \frac{3(40.08)}{310.18} \times 100 = \boxed{38.76 \% Ca}$$

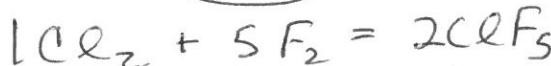
At constant T + P, $V = n$. So balanced equation gives mole

21/25
9/9

21. At STP, 1.0 L of $Cl_2(g)$ reacts completely with 5.0 L of $F_2(g)$ to produce $ClF_5(g)$. What volume of $ClF_5(g)$ is produced in this reaction at STP?

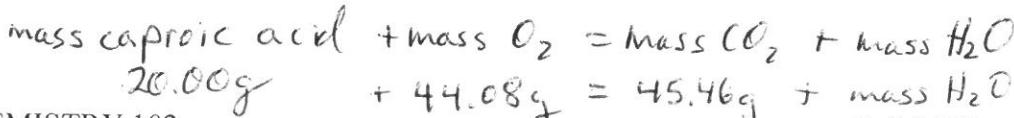
ratios, but will also give volume ratios.

- a) 1.0 L b) 2.0 L c) 3.0 L d) 5.0 L e) 6.0 L



From balanced reaction, 1L of Cl_2 reacts with every 5L of F_2 to produce $\boxed{2L}$ of ClF_5 .

Form
AIB
CD



CHEMISTRY 102

HOUR EXAM II $\text{mass H}_2\text{O} = 20.00 + 44.08 - 45.46 = 18.62\text{ g}$

Fall 2019

Page 6

22. Caproic acid has an odor that is often associated with dirty socks; it is composed of C, H, and O. A 20.00 g-sample of caproic acid reacts with 44.08 g of O₂ to produce 45.46 g of CO₂ and some H₂O. What is the mass percent of hydrogen in caproic acid? Hint: Mass is conserved in a chemical reaction.

$$\text{mass \% H} = (2.083\text{ g H} / 20.00\text{ g caproic acid}) \times 100 \approx 10.45\%$$

a) 7.25% H

(b) 10.4% H

c) 3.36% H

d) 5.21% H

$$\text{mass C in caproic acid} = 45.46\text{ g CO}_2 \left(\frac{1\text{ mol CO}_2}{44.08\text{ g}} \right) \left(\frac{1\text{ mol C}}{1\text{ mol CO}_2} \right) \left(\frac{12.01\text{ g}}{1\text{ mol C}} \right) = 12.41\text{ g C}$$

e) 4.73% H

$$\text{mass O in caproic acid} = 20.00\text{ g} - 2.083\text{ g H} - 12.41\text{ g C} = 5.51\text{ g O}$$

23. Caproic acid has an odor that is often associated with dirty socks; it is composed of C, H, and O. A 20.00 g-sample of caproic acid reacts with 44.08 g of O₂ to produce 45.46 g of CO₂ and some H₂O. What is the empirical formula of caproic acid? Hint: Mass is conserved in a chemical reaction.

$$12.41\text{ g C} \left(\frac{1\text{ mol C}}{12.01\text{ g}} \right) = 1.033\text{ mol C} / 0.344 = 3\text{ mol C}$$

a) C₂H₄O

b) C₄H₂O

c) C₂H₆O₃ empirical formula

$$2.083\text{ g H} \left(\frac{1\text{ mol H}}{1.008\text{ g}} \right) = 2.066\text{ mol H} / 0.344 = 6\text{ mol H}$$

d) C₃H₆O

e) C₂H₃O₂

$$5.51\text{ g O} \left(\frac{1\text{ mol O}}{16.00\text{ g}} \right) = 0.344\text{ mol O} / 0.344 = 1\text{ mol O}$$

(C₃H₆O) is the

24. Consider the following four statements (I-IV) regarding real gases:

True I. Gases behave most ideally at high temperatures and low pressures.

True II. Real gas molecules have a volume and do exert intermolecular forces.

True III. In the van der Waals gas equation, a term is added to the measured pressure to correct for the intermolecular forces exerted by a real gas.

True IV. In the van der Waals gas equation, the "b" constant in the equation helps correct for the volume taken up by the gas particles themselves.

$$(P + \frac{an^2}{V^2})(V - nb) = nRT$$

How many of the above four statements (I-IV) is/are true? Hint: refer to the van der Waals gas equation on the constants page. All statements are true.

a) 0 (none)

b) 1

c) 2

d) 3

e) 4 [All of the statements (I-IV) are true].

25. Which of the following 1.0 M solutions is the worst conductor of electricity?

Soluble ionic compd
a) SrCl₂

Strong electrolyte

Soluble ionic compd
d) NH₄NO₃

Strong electrolyte

weak acid

b) HF

weak electrolyte

e) CuSO₄

soluble ionic compd

strong electrolyte

covalent compound, not an acid

c) CH₃OH

non electrolyte

The solution with no ions is the worst conductor of electricity.
This will be the solution of CH₃OH, a nonelectrolyte.

Form

A/B
C/DCHEMISTRY 102
HOUR EXAM II

$$\frac{\text{rate CH}_4}{\text{rate O}_2} = \sqrt{\frac{M_{O_2}}{M_{CH_4}}} = \sqrt{\frac{32}{16}} = \sqrt{2} = 1.41$$

Fall 2019

$$\text{rate O}_2 = \frac{0.32 \text{ moles O}_2}{10 \text{ mins}} \quad \text{rate CH}_4 = \frac{x \text{ mol}}{10 \text{ mins}}$$

Let $x = \text{mol CH}_4 \text{ that effuses}$

26 | 26 26.

Over a ten minute period, 0.32 moles of oxygen gas effuses from a container. How many moles of methane (CH_4) gas will effuse from the same container in 10 minutes?

- a) 0.64 moles b) 0.32 moles c) 0.23 moles d) 0.16 moles e) 0.45 mol

$$\frac{x \text{ mol CH}_4}{10 \text{ mins}} = 1.41, \quad (x = 0.45 \text{ mol } CH_4 \text{ will effuse in 10 minutes})$$

27 | 27 27.

Which of the following gas samples (a-d) has the same average kinetic energy as nitrogen gas at 232 K? Any other gas at 232 K will have the same average kinetic energy ($KE_{ave} = \frac{3}{2}RT$).

- a) $O_2(g)$ at 200 K b) $Ar(g)$ at -41°C c) $Ne(g)$ at 41°C d) $CO_2(g)$ at 200 K
 $-41^\circ C \Rightarrow 273 - 41 = 232 K$

- e) None of these gases have the same average kinetic energy as $N_2(g)$ at 232 K.

$Ar(g)$ at -41°C (232 K) has the same average KE as N_2 at 232 K.

The higher the temp the faster the average velocity. The smaller the gas particle, the Which of the following gas samples has the fastest average velocity?

- a) $O_2(g)$ at 200 K b) $Ar(g)$ at -41°C c) $Ne(g)$ at 41°C
 $44 g/mol$ $32 g/mol$ $20 g/mol$
d) $CO_2(g)$ at 200 K e) $N_2(g)$ at 232 K

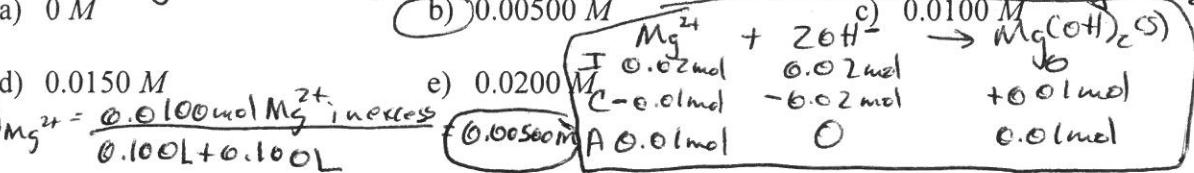
$Ne(g)$ has the smallest molar mass, with all gases at the same

$Ne(g)$ sample is also at temp., Ne would have fastest average velocity. The $Ne(g)$ sample is also at the highest temp. So Ne

Consider the reaction between 100.0 mL of 0.200 M KOH and 100.0 mL of 0.200 M $Mg(NO_3)_2$. Calculate the concentration of Mg^{2+} ions in solution after the reaction has gone to completion. $0.100 L \left(\frac{0.200 \text{ mol}}{L} \right) = 0.0200 \text{ mol KOH} + 0.0200 \text{ mol } Mg(NO_3)_2$

Let Mg^{2+} (0.02 moles) react with OH^- (0.02 moles) to form $Mg(OH)_2(s)$.

- a) 0 M



$$M_{Mg^{2+}} = \frac{0.0100 \text{ mol } Mg^{2+}}{0.100 \text{ L} + 0.100 \text{ L}}$$

30 | 30 30. Consider two steel containers with the same volume and at the same temperature. You have 25 g of $Ar(g)$ in one of the tanks producing a pressure of 1.0 atm. In the other tank, you have 20. g of a gas which produces a pressure of 2.0 atm. Which of the following could be the gas in the second container?

At constant $V + T$, $P \propto n$. So 2.0 atm container must have twice as many moles of gas as the 1.0 atm container.

- a) CH_4

$$mol Ar = 25 \text{ g Ar} \left(\frac{1 \text{ mol Ar}}{39.95 \text{ g}} \right) = 0.626 \text{ mol Ar}$$

- d) O_2

$$Must have 2(0.626) = 1.25 \text{ mol in } 2.0 \text{ atm container.}$$

$$\text{molar mass} = \frac{20. \text{ g}}{1.25 \text{ mol}}$$

$\text{This is } CH_4.$

31. My answers for this Chemistry 102 exam should be graded with the answer sheet associated with:

- a) Form A b) Form B c) Form C d) Form D e) Form E