Academic Integrity Pledge:
In keeping with Creighton University’s ideals and with the Academic Integrity Code adopted by the College of Arts and Sciences, I pledge that this work is my own and that I have neither given nor received inappropriate assistance in preparing it.
Signature:

Instructions: Show all work whenever a calculation is required! You will receive credit for how you worked each problem as well as for the correct answer. If you need more space, you may use the back of your periodic table — Write: “See PT” in box. BOX YOUR ANSWERS! Write legibly.

Chapter 3. Formulas, Equations and Moles

1. (3 pts each) Balance the equations with the smallest whole number coefficients.

$$\text{S}_8 + \text{O}_2 \rightarrow \text{SO}_3$$

$$\text{NH}_4\text{NO}_3 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$$

$$\text{NH}_3 + \text{O}_2 \rightarrow \text{NO} + \text{H}_2\text{O}$$

$$\text{C}_4\text{H}_10 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$$

$$\text{SiCl}_4 + \text{H}_2\text{O} \rightarrow \text{SiO}_2 + \text{HCl}$$

2. (3 pts each) What is the molar mass of
   (a) triboron trinitride?

   (b) chromium(III) nitrate?

   (c) sodium sulfate monohydrate?

3. (a) (5 pts) How many moles of $\text{(NH}_4\text{)}_3\text{PO}_4$ are in a 550 g sample of the substance? (MM = 149 g/mol)

   (b) (4 pts) How many moles of ammonium cations are in the sample in 3(a)?

   (c) (4 pts) How many hydrogen atoms are in the sample in 3(a)? [Given: $N_A = 6.02 \times 10^{23}$]

4. In class you observed the following reaction:
   $$\text{Fe}_2\text{O}_3 + 3 \text{H}_2 \rightarrow 2 \text{Fe} + 3 \text{H}_2\text{O}$$

   (a) (4 pts) How many moles of hydrogen would be required to react with 4.65 mol of iron(III) oxide?

   (b) (4 pts) What is the theoretical yield of iron in moles if 4.65 mol iron(III) oxide were reacted with excess hydrogen?

   (c) (4 pts) What is the theoretical yield of water in grams if 4.65 mol iron(III) oxide were reacted with excess hydrogen?
5. (5 pts) Calcium carbonate can be made from the reaction given in the box below. How many moles of calcium carbonate would you expect from the reaction of 150 g calcium chloride (MM = 111 g/mol) with 160 g sodium carbonate (MM = 106 g/mol)?

\[
\text{CaCl}_2 + \text{Na}_2\text{CO}_3 \rightarrow \text{CaCO}_3 + 2 \text{NaCl}
\]

(2 pts) Circle the limiting reagent: \text{CaCl}_2 or \text{Na}_2\text{CO}_3

6. (5 pts) Determine the limiting reagent in the following reaction if 35 mol NO, 28 mol \text{O}_2 and 19 mol \text{H}_2\text{O} were used in the reaction.

\[
4 \text{NO} + 3 \text{O}_2 + 2 \text{H}_2\text{O} \rightarrow 4 \text{HNO}_3
\]

The limiting reagent is: \text{NO} \quad \text{O}_2 \quad \text{H}_2\text{O} \quad \text{HNO}_3

7. (5 pts) In the following reaction, 7.2 moles of \text{NaN}_3 produced 255 g \text{N}_2. What is the percent yield?

\[
2 \text{NaN}_3 \rightarrow 3 \text{N}_2 + 2 \text{Na}
\]

8. Hydrocarbons are a broad class of compounds that contain only carbon (C = 12.01) and hydrogen (H = 1.008) and have the formula \( C_xH_y \).

(a) (5 pts) If a certain hydrocarbon contains 85.63% C and 14.37% H, what is its empirical formula?

(b) (5 pts) Which of the following could be the actual molecular formula? There may be more than one.

\[
\begin{align*}
\text{C}_2\text{H}_4 & \quad \text{C}_2\text{H}_6 & \quad \text{C}_3\text{H}_6 & \quad \text{C}_3\text{H}_8 & \quad \text{C}_5\text{H}_{10}
\end{align*}
\]

9. (6 pts) The mineral stephanite contains only silver (Ag = 107.87), antimony (Sb = 121.76) and sulfur (S = 32.064). If stephanite contains 68.33% silver and 15.43% antimony, what is the empirical formula for this mineral?

10. (5 pts) Choose the correct name for each of these compounds.

<table>
<thead>
<tr>
<th>SO(_3)</th>
<th>sulfur(IV) oxide</th>
<th>sulfur(III) oxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrBr(_2)</td>
<td>chromium(II) bromide</td>
<td>chromium bromide</td>
</tr>
<tr>
<td>Ca(NO(_3))(_2)</td>
<td>calcium nitrate</td>
<td>calcium nitrate</td>
</tr>
<tr>
<td>S(_4)O(_6)</td>
<td>sulfur(IV) oxide(VI)</td>
<td>disulphite</td>
</tr>
<tr>
<td>V(_2)O(_5)</td>
<td>vanadium(V) oxide</td>
<td>vanadium oxide</td>
</tr>
</tbody>
</table>

11. (6 pts) Print the name for each of the following compounds.

| KBr | MgSO\(_4\) | SCl\(_2\) | FeCO\(_3\) | IF\(_5\) | Ca(C\(_2\)H\(_3\)O\(_2\))\(_2\) |

12. (5 pts) Print the name for each of these acids.

| HBr | HClO\(_2\) | H\(_2\)SO\(_4\) | H\(_2\)SO\(_3\) | HBrO\(_4\) |

Sign the Academic Integrity pledge and print your name here:

Your exam score (100 possible): _______

Determine your grade:

\[A+ \geq 95; A \geq 90; B+ \geq 85; B \geq 80; C+ \geq 75; C \geq 70; D \geq 60\]
Answers

Chapter 3. Formulas, Equations and Moles

1. Balance the equations with the smallest whole number coefficients.

\[
\begin{align*}
1 \text{ S}_8 & + \ 12 \text{ O}_2 \rightarrow 8 \text{ SO}_3 \\
1 \text{ NH}_4\text{NO}_3 & \rightarrow 1 \text{ N}_2\text{O} + 2 \text{ H}_2\text{O} \\
4 \text{ NH}_3 & + 5 \text{ O}_2 \rightarrow 4 \text{ NO} + 6 \text{ H}_2\text{O} \\
2 \text{ C}_4\text{H}_{10} & + 13 \text{ O}_2 \rightarrow 8 \text{ CO}_2 + 10 \text{ H}_2\text{O} \\
1 \text{ SiCl}_4 & + 2 \text{ H}_2\text{O} \rightarrow 1 \text{ SiO}_2 + 4 \text{ HCl}
\end{align*}
\]

2. (a) tribor on trinitride, MM = 74.4 g/mol 
(b) chromium(III) nitrate, MM = 238.0 g/mol 
(c) sodium sulfate monohydrate, MM = 160.0 g/mol

3. (a) 3.69 mol (NH\textsubscript{4})\textsubscript{3}PO\textsubscript{4} 
(b) 11.07 mol NH\textsubscript{4}\textsuperscript{+} 
(c) 2.67 \times 10^{25} \text{ hydrogen atoms}

4. (a) 13.95 mol H\textsubscript{2} 
(b) 9.3 mol Fe 
(c) 251 g H\textsubscript{2}O

5. 1.35 mol CaCO\textsubscript{3} ; limiting reagent is CaCl\textsubscript{2}

6. NO

7. 84.3%

8. (a) CH\textsubscript{2}
(b) C\textsubscript{2}H\textsubscript{4} C\textsubscript{3}H\textsubscript{6} C\textsubscript{5}H\textsubscript{10}

9. Ag\textsubscript{5}SbS\textsubscript{4}

Chapter 2. Nomenclature

10. (5 pts) Choose the correct name for each of these compounds.
SO\textsubscript{4} sulfur trioxide
CrBr\textsubscript{2} chromium(II) bromide
Ca(NO\textsubscript{3})\textsubscript{2} calcium nitrate
S\textsubscript{4}O\textsubscript{6} tetrasulfur hexoxide
V\textsubscript{2}O\textsubscript{5} vanadium(V) oxide

11. (6 pts) Print the name for each of the following compounds.
KBr potassium bromide 
MgSO\textsubscript{4} magnesium sulfate
SCl\textsubscript{2} sulfur dichloride
FeCO\textsubscript{3} iron(III) carbonate
IF\textsubscript{5} iodine pentafluoride
Ca(C\textsubscript{2}H\textsubscript{3}O\textsubscript{2})\textsubscript{2} calcium acetate

12. (5 pts) Print the name for each of these acids.
HBr hydrobromic acid
<table>
<thead>
<tr>
<th>Formula</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>HClO₂</td>
<td>chlorous acid</td>
</tr>
<tr>
<td>H₂SO₄</td>
<td>sulfuric acid</td>
</tr>
<tr>
<td>H₂SO₃</td>
<td>sulfurous acid</td>
</tr>
<tr>
<td>HBrO₄</td>
<td>perbromic acid</td>
</tr>
</tbody>
</table>