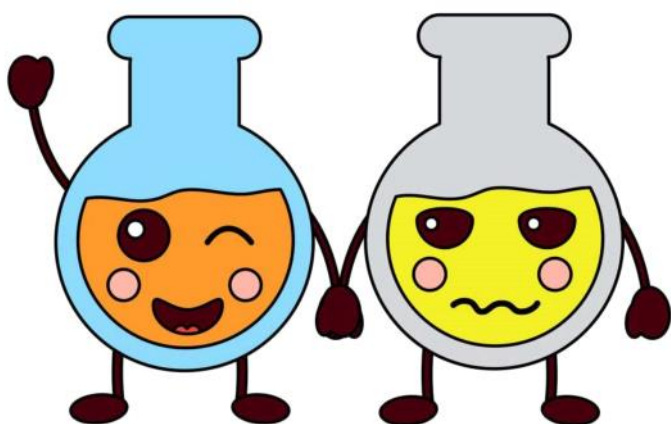


**Unit 2: Chemistry (Books 5-7)**

**"Practice Test"**

**Science 9**



Name: \_\_\_\_\_

*Key*

Date: \_\_\_\_\_

**Vocabulary:** Referring to your notes, define each of the following vocabulary terms in a complete sentence.

|                      |  |
|----------------------|--|
| 1. atom              | The particle that makes up an element  |
| 2. coefficient       | The big number in front of an atom or compound   |
| 3. compound          | A substance containing more than 1 element   |
| 4. covalent compound | A compound formed between two non-metals (share electrons)   |
| 5. element           | One kind of atom   |
| 6. ion               | A charged atom (gained or lost electrons)<br><div style="display: flex; justify-content: center; gap: 20px;"> <span>↑</span> <span>↑</span> </div> <div style="display: flex; justify-content: center; gap: 20px;"> <span>-</span> <span>+</span> </div> |
| 7. ionic compound    | A compound formed between a metal and a non-metal (transfer electrons)   |
| 8. molecule          | A particle containing more than one atom   |
| 9. polyatomic ions   | A covalent compound with a charge  |
| 10. polyvalent metal | A metal that can have more than 1 charge   |
| 11. roman numerals   | Numbers represented by letters<br>(I, II, III, IV, V, VI, VII, VIII, IX, X)  |
| 12. subscript        | A number that is dropped down after a symbol   |
| 13. univalent metal  | A metal with only 1 charge   |

# The atom and the subatomic particles

1. Use the following vocabulary words to label the diagram.

| Vocabulary        |                     |
|-------------------|---------------------|
| common ion charge | symbol              |
| other ion charge  | atomic number       |
| name              | average atomic mass |

|                                |   |    |    |           |    |          |  |      |  |                              |
|--------------------------------|---|----|----|-----------|----|----------|--|------|--|------------------------------|
| (a) <u>atomic number</u>       | <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;">22</td> <td style="text-align: center;">4+</td> </tr> <tr> <td style="text-align: center;"><b>Ti</b></td> <td style="text-align: center;">3+</td> </tr> <tr> <td colspan="2" style="text-align: center;">Titanium</td> </tr> <tr> <td colspan="2" style="text-align: center;">47.9</td> </tr> </table> | 22 | 4+ | <b>Ti</b> | 3+ | Titanium |  | 47.9 |  | (e) <u>common ion charge</u> |
| 22                             |   | 4+ |    |           |    |          |  |      |  |                              |
| <b>Ti</b>                      |   | 3+ |    |           |    |          |  |      |  |                              |
| Titanium                       |   |    |    |           |    |          |  |      |  |                              |
| 47.9                           |   |    |    |           |    |          |  |      |  |                              |
| (b) <u>symbol</u>              | (f) <u>other ion charge</u>   |    |    |           |    |          |  |      |  |                              |
| (c) <u>name</u>                |   |    |    |           |    |          |  |      |  |                              |
| (d) <u>average atomic mass</u> |   |    |    |           |    |          |  |      |  |                              |

2. Examine the periodic table for the element below and complete the blanks.

|         |   |
|---------|---|
| 35      | - |
| Br      |   |
| Bromine |   |
| 79.9    |   |

- |                                    |   |
|------------------------------------|---|
| (a) atomic number <u>35</u>        | (b) average atomic mass <u>79.9</u>               |
| (c) ion charge <u>-1</u>           | (d) number of protons <u>35</u>                   |
| (e) name of element <u>Bromine</u> | (f) number of neutrons <u>80-35 = 45 neutrons</u> |

3. Complete the following table for the different atoms and ions. The first two rows have been completed to help you.

| Element Name | Atomic Number | Ion Charge | Number of Protons | Number of Electrons | Number of Neutrons |
|--------------|---------------|------------|-------------------|---------------------|--------------------|
| potassium    | 19            | 1+         | 19                | 18                  | 20                 |
| phosphorus   | 15            | 0          | 15                | 15                  | 16                 |
| lithium      | 3             | 0          | 3                 | 3                   | 4                  |
| calcium      | 20            | 2+         | 20                | 18                  | 20                 |
| nitrogen     | 7             | 3-         | 7                 | 10                  | 7                  |
| boron        | 5             | 0          | 5                 | 5                   | 6                  |
| argon        | 18            | 0          | 18                | 18                  | 18                 |
| aluminium    | 13            | +3         | 13                | 10                  | 14                 |
| chlorine     | 17            | 0          | 17                | 17                  | 19                 |
| sodium       | 11            | +1         | 11                | 10                  | 12                 |

# Bohr diagrams of Ions (+/-)

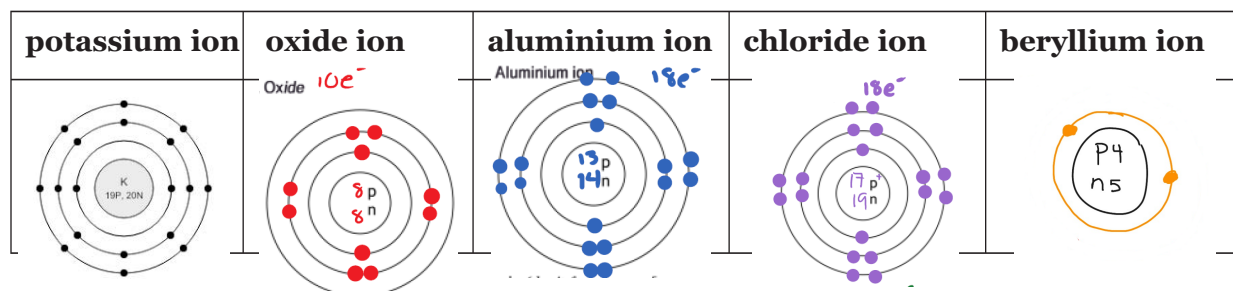
1. Define the following terms:

- (a) Bohr diagram a diagram which shows the electron energy shells, and how many electrons are in each shell
- (b) stable octet refers to a valence shell that is full, usually this is 8 valence electrons (unless it is the first shell which only holds 2 electrons max)
- (c) valence shell the outermost shell of an atom or ion
- (d) valence electrons the electrons that are in the outermost shell only

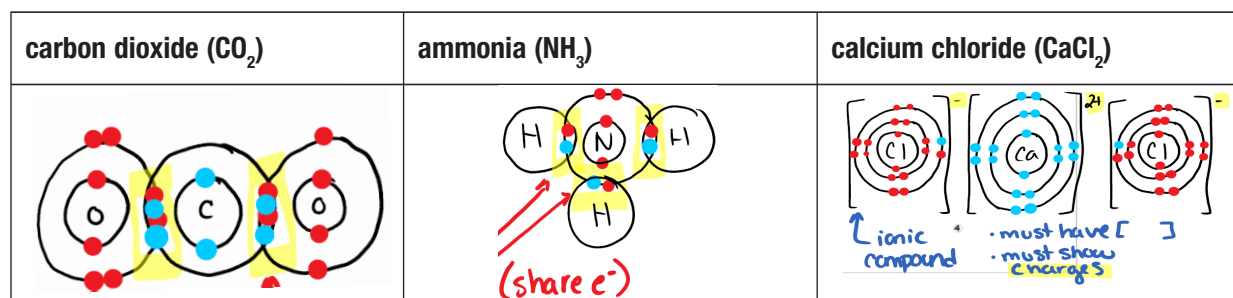
2. Complete the following table.

| Atom/ion      | Atomic Number | Number of Protons | Number of Electrons | Number of Neutrons | Number of Electron Shells | Charge |
|---------------|---------------|-------------------|---------------------|--------------------|---------------------------|--------|
| neon atom     | 10            | 10                | 10                  | $20 - 10 = 10$     | 2                         | 0      |
| fluorine atom | 9             | 9                 | 9                   | $19 - 9 = 10$      | 2                         | 0      |
| fluorine ion  | 9             | 9                 | 10                  | $19 - 9 = 10$      | 2                         | -1     |
| sodium atom   | 11            | 11                | 11                  | $23 - 11 = 12$     | 3                         | 0      |
| sodium ion    | 11            | 11                | 10                  | $23 - 11 = 12$     | 3                         | +1     |

3. Use the table above to draw the Bohr model diagram for each of the following atoms and ions.



4. Draw the Bohr model diagram for each of the following compounds.



## Names and formulas of compounds

Match each Chemical Name on the left with the correct Chemical Formula on the right.

| Chemical Name                     | Chemical Formula               |
|-----------------------------------|--------------------------------|
| 1. <u>F</u> tin(II) chlorate      | A. $\text{SnCl}$               |
| 2. <u>C</u> sulphur dichloride    | B. $\text{S}_2\text{Cl}$       |
| 3. <u>I</u> strontium perchlorate | C. $\text{SnCl}$               |
|                                   | D. $\text{SnClO}$              |
|                                   | E. $\text{Sn}(\text{ClO})_2$   |
|                                   | F. $\text{Sn}(\text{ClO})_2$   |
|                                   | G. $\text{Sn}(\text{ClO})_2$   |
|                                   | H. $\text{Sr}(\text{ClO})_2$   |
|                                   | I. $\text{Sr}(\text{ClO}_4)_2$ |

4. Which of the following is a covalent compound?  
**A.  $\text{SrO}$**  C.  $\text{SnO}_2$  **metal**  
**B.  $\text{SeO}_2$**  D.  $\text{Se}_2\text{O}_7$  **non-metal**
5. In which of the following do covalent bonds hold the atoms together?  
**A. silver**  
**B. calcium carbonate**  
**C. silicon tetrafluoride** **2 non-metals**  
**D. magnesium bromide**
6. What is the total number of atoms that make up iodine pentachloride?  
**A. 2** C. 5  
**B. 4** **D. 6**  
*1 = I }  
 5 = Cl } 6*
7. Which of the following occurs when carbon forms a compound with oxygen?  
**A. oxygen and carbon share electrons** ✓  
**B. both oxygen and carbon lose electrons** ✗  
**C. oxygen gains electrons, while carbon loses electrons** ✗  
**D. carbon gains electrons, while oxygen loses electrons** ✗

8. In the chemical reaction  $\text{CuO} + \text{CO}_2 \rightarrow \text{CuCO}_3$ , which of the following are ionic compounds?

|        |                 |          |
|--------|-----------------|----------|
| I. ✗   | $\text{CO}_2$   | covalent |
| II. ✓  | $\text{CuO}$    | ionic    |
| III. ✓ | $\text{CuCO}_3$ | ionic    |

- A. I and II only C. II and III only  
 B. I and III only D. I, II, and III

9. Which of the following is the formula for the compound formed by ammonium and dichromate?

- A.  $\text{NH}_4\text{Cr}_2\text{O}_7$   
 B.  $(\text{NH}_4)_2\text{CrO}_4$   
 C.  $\text{NH}_4(\text{Cr}_2\text{O}_7)$   
**D.  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$**

10. In which of the following compounds does manganese have the highest ion charge?

- A.  $\text{MnO}_3$   **$\text{Mn}^{6+}$**  C.  $\text{MnSO}_3$   **$\text{Mn}^{2+}$**   
 B.  $\text{MnBr}_2$   **$\text{Mn}^{2+}$**  D.  $\text{Mn}(\text{OH})_2$   **$\text{Mn}^{2+}$**

11. In which of the following compounds is the ion charge on copper the same?

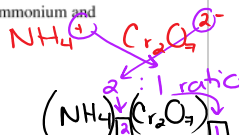
|      |                  |                  |
|------|------------------|------------------|
| I.   | $\text{Cu}^{+1}$ | $\text{Cu}^{+1}$ |
| II.  | $\text{Cu}^{+2}$ | $\text{Cu}^{+2}$ |
| III. | $\text{Cu}^{+2}$ | $\text{Cu}^{+2}$ |

- A. I and II only C. II and III only  
 B. I and III only D. I, II, and III

12. In the name arsenic(III) chloride, what does the Roman numeral reveal about arsenic?

- A. it has an ion charge of 3-  
**B. it has an ion charge of 3+**  
 C. it has gained three electrons  
 D. it can form three positive ions

*metal*  
*non-metal*



*Mn<sup>2+</sup> or 3+ or 4+ or 6+ it is multivalent, so need to solve.*

*A. Mn<sup>6+</sup> we know O<sup>2-</sup> always  
 3:1 5:2 reverse simplification*

*B. Mn<sup>2+</sup> Br<sup>-1</sup> matches ✓  
 2:1*

*C. Mn<sup>2+</sup> we know SO<sub>3</sub><sup>2-</sup> always  
 2:1:1 reverse simplification*

*D. Mn<sup>4+</sup> we know OH<sup>-</sup> always matches ✓  
 4:1*

## Chemical names and formulas of covalent compounds

1. What is a covalent compound? A compound consisting of 2 non-metals; a compound that involves the sharing of electrons
2. What type of bond is formed in a covalent compound?  
A covalent bond
3. What is used in naming covalent compounds?  
Prefixes: 1=mono 2=di 3=tri 4=tetra 5=penta 6=hexa 7=hepta 8=octa 9=nona 10=deca
4. Write the chemical formula for each of the following compounds.

|                         |                         |                            |                                   |
|-------------------------|-------------------------|----------------------------|-----------------------------------|
| (a) silicon dioxide     | <u>SiO<sub>2</sub></u>  | (i) dinitrogen pentoxide   | <u>N<sub>2</sub>O<sub>5</sub></u> |
| (b) chlorine dioxide    | <u>ClO<sub>2</sub></u>  | (j) dinitrogen monoxide    | <u>N<sub>2</sub>O</u>             |
| (c) tellurium dioxide   | <u>TeO<sub>2</sub></u>  | (k) arsenic tetrabromide   | <u>AsBr<sub>4</sub></u>           |
| (d) selenium trioxide   | <u>SeO<sub>2</sub></u>  | (l) arsenic pentachloride  | <u>AsCl<sub>5</sub></u>           |
| (e) carbon disulphide   | <u>CS<sub>2</sub></u>   | (m) disulphide pentoxide   | <u>S<sub>2</sub>O<sub>5</sub></u> |
| (f) arsenic trichloride | <u>AsCl<sub>3</sub></u> | (n) sulphur monochloride   | <u>SCl</u>                        |
| (g) chlorine heptoxide  | <u>ClO<sub>7</sub></u>  | (o) phosphorus trichloride | <u>PCl<sub>3</sub></u>            |
| (h) selenium difluoride | <u>SeF<sub>2</sub></u>  | (p) diphosphorus pentoxide | <u>P<sub>2</sub>O<sub>5</sub></u> |

## COVALENT COMPOUNDS CROSSWORD PUZZLE

5. Complete the following crossword puzzle. (use the word list provided to help!)  
Given the chemical formula, **what is the name for the covalent compound?**

**COVALENT COMPOUNDS**

- | ACROSS       | DOWN         |
|--------------|--------------|
| 1. $S_2Cl_2$ | 1. $P_2O_3$  |
| 3. $PBr_3$   | 2. $As_2O_5$ |
| 5. $SIF_4$   | 4. $SiCl_4$  |
| 7. $Cl_2O_7$ | 6. $ICl_3$   |
| 9. $ClF_3$   | 8. $NO$      |
| 11. $N_2O_3$ | 9. $CS_2$    |
| 14. $TeBr_2$ | 10. $TeO_3$  |
| 15. $ClO$    | 12. $BO$     |
| 16. $AsO_3$  | 13. $NO_2$   |

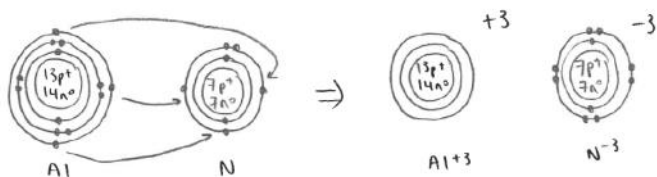
- Word List**
- Arsenic trioxide
  - Boron monoxide
  - Carbon disulphide
  - Chlorine monoxide
  - Diarsenic pentoxide
  - Dichlorine heptoxide
  - Dinitrogen trioxide
  - Disulphur dichloride
  - Iodine trichloride
  - Nitrogen dioxide
  - Nitrogen monoxide
  - Phosphorus
  - tribromide Silicon
  - tetrafluoride Sulphur
  - tetrachloride
  - Tellurium dibromide
  - Tellurium trioxide

**Knowledge:** Answer each of the following questions. Make sure to use complete sentences, where applicable. It should be clear from your answer what the question was!

1. Count the total number of atoms in the following compounds.

|   |           |
|---|-----------|
| 1. NaOH   | <u>3</u>  |
| 2. 4 HNO <sub>3</sub>   | <u>24</u> |
| 3. MgCl <sub>2</sub>  | <u>3</u>  |
| 4. 4 Li <sub>2</sub> O  | <u>12</u> |
| 5. 2 NaOH   | <u>8</u>  |
| 6. Li <sub>2</sub> SO <sub>4</sub>                                  | <u>7</u>  |
| 7. 3 H <sub>2</sub> O   | <u>9</u>  |
| 8. NaC <sub>2</sub> H <sub>3</sub> O <sub>2</sub>                   | <u>8</u>  |
| 9. 3 Al <sub>2</sub> O <sub>3</sub>                                 | <u>15</u> |
| 10. NH <sub>4</sub> Cl  | <u>6</u>  |
| 11. 5 ZnSO <sub>4</sub>   | <u>30</u> |
| 12. 7 C <sub>2</sub> S <sub>2</sub>                                 | <u>28</u> |
| 13. 2 Sr <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>               | <u>21</u> |
| 14. 4 Al(OH) <sub>3</sub>   | <u>28</u> |
| 15. Ca (C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ) <sub>2</sub> | <u>10</u> |
| 16. 4 Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>               | <u>56</u> |
| 17. 2 (NH <sub>4</sub> ) <sub>3</sub> PO <sub>4</sub>               | <u>40</u> |
| 18. 4 Mg(OH) <sub>2</sub>   | <u>20</u> |

2. Draw the Bohr diagram for the ionic compound aluminum nitride.



8



3. Distinguish between an element and a compound.

- Element is formed by particles of a single kind of atom
- Compound is formed by particles containing two or more elements combined together.

4. Distinguish between a compound and a molecule.

- Compound refers to a particle containing more than 1 element
- Molecule refers to a particle containing more than 1 atom (more general).

5. For each of the following pairs of substances, identify whether the compound they form will be ionic or covalent:

1. potassium and sulphur           Ionic
2. lithium and chlorine           Ionic
3. oxygen and fluorine           Covalent
4. sulphur and bromine           Covalent
5. copper and perchlorate           Ionic

6. For each of the following compounds, identify whether they are ionic or covalent:

1. AlP           Ionic
2. CO<sub>2</sub>           Covalent
3. FeCO<sub>3</sub>           Ionic
4. Fe<sub>2</sub>O<sub>3</sub>           Ionic
5. CrCl<sub>3</sub>           Ionic
6. Na<sub>3</sub>PO<sub>4</sub>           Ionic
7. SO<sub>3</sub>           Covalent
8. NO           Covalent

7. Write the chemical names of each of the following IONIC compounds.

(be sure to pay close attention in case the ions are MULTIVALENT or POLYATOMIC)

Do any working out to the side...

|  |                        |
|--|------------------------|
| 1. CaS   | calcium sulphide       |
| 2. Cs <sub>2</sub> O                               | cesium oxide           |
| 3. FeCO <sub>3</sub>                               | iron (II) carbonate    |
| 4. CrCl <sub>2</sub>                               | chromium (II) chloride |
| 5. Mg <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub> | magnesium phosphate    |
| 6. Au <sub>2</sub> O <sub>3</sub>                  | gold (III) oxide       |
| 7. CaS   | calcium sulphide       |
| 8. (NH <sub>4</sub> ) <sub>3</sub> PO <sub>3</sub> | ammonium phosphate     |
| 9. FeCl <sub>2</sub>                               | iron (II) chloride     |
| 10. KCl  | potassium chloride     |
| 11. Na <sub>2</sub> S                              | sodium sulphide        |
| 12. AlCl <sub>3</sub>                              | aluminum chloride      |
| 13. BaO  | barium oxide           |
| 14. Ag <sub>2</sub> S                              | silver sulphide        |
| 15. Al <sub>2</sub> O <sub>3</sub>                 | aluminum oxide         |
| 16. LiF  | lithium fluoride       |
| 17. ZnF <sub>2</sub>                               | zinc fluoride          |
| 18. MgBr <sub>2</sub>                              | magnesium bromide      |
| 19. CaS  | calcium sulphide       |
| 20. Li <sub>2</sub> O                              | lithium oxide          |
| 21. ZnI <sub>2</sub>                               | zinc iodide            |
| 22. BaBr <sub>2</sub>                              | barium bromide         |
| 23. MgS  | magnesium sulphide     |
| 24. AgCl   | silver chloride        |
| 25. FeO  | iron (II) oxide        |
| 26. SnS <sub>2</sub>                               | tin (IV) sulphide      |

|                             |                                |
|-----------------------------|--------------------------------|
| 27. $\text{Cr}_2\text{S}_3$ | <u>chromium (III) sulphide</u> |
| 28. $\text{SnF}_2$          | <u>tin (II) fluoride</u>       |
| 29. $\text{CuCl}$           | <u>copper (I) chloride</u>     |
| 30. $\text{MnO}_2$          | <u>manganese (IV) oxide</u>    |
| 31. $\text{HgBr}$           | <u>mercury (I) bromide</u>     |
| 32. $\text{CrCl}_3$         | <u>chromium (III) chloride</u> |
| 33. $\text{PbS}$            | <u>lead (II) sulphide</u>      |
| 34. $\text{CuF}_2$          | <u>copper (II) fluoride</u>    |
| 35. $\text{NiS}$            | <u>nickel (II) sulphide</u>    |
| 36. $\text{PbCl}_4$         | <u>lead (IV) chloride</u>      |
| 37. $\text{CrO}$            | <u>chromium (II) oxide</u>     |
| 38. $\text{Hg}_3\text{N}_2$ | <u>mercury (II) nitride</u>    |
| 39. $\text{Sn}_3\text{P}_4$ | <u>tin (IV) phosphide</u>      |

8. Write the chemical formulas of each of the following compounds.

SHOW YOUR  
WORK HERE!

|                          |  |
|--------------------------|--|
| 1. zinc oxide            | <u><math>\text{ZnO}</math></u>                 |
| 2. aluminum fluoride     | <u><math>\text{AlF}_3</math></u>               |
| 3. potassium bromide     | <u><math>\text{KBr}</math></u>                 |
| 4. calcium oxide         | <u><math>\text{CaO}</math></u>                 |
| 5. iron (II) fluoride    | <u><math>\text{FeF}_2</math></u>               |
| 6. tin (IV) oxide        | <u><math>\text{SnO}_2</math></u>               |
| 7. sodium sulphate       | <u><math>\text{Na}_2\text{SO}_4</math></u>     |
| 8. strontium hydroxide   | <u><math>\text{Sr}(\text{OH})_2</math></u>     |
| 9. nickel (III) chlorate | <u><math>\text{Ni}(\text{ClO}_3)_2</math></u>  |
| 10. iron (III) sulphite  | <u><math>\text{Fe}_2(\text{SO}_3)_3</math></u> |
| 11. zinc bromide         | <u><math>\text{ZnBr}_2</math></u>              |
| 12. calcium fluoride     | <u><math>\text{CaF}_2</math></u>               |

|                              |                                    |
|------------------------------|------------------------------------|
| 13. silver sulfide           | <u>Ag<sub>2</sub>S</u>             |
| 14. lithium sulfide          | <u>Li<sub>2</sub>S</u>             |
| 15. potassium sulfide        | <u>K<sub>2</sub>S</u>              |
| 16. magnesium oxide          | <u>MgO</u>                         |
| 17. magnesium phosphide      | <u>Mg<sub>3</sub>P<sub>2</sub></u> |
| 18. sodium nitride           | <u>Na<sub>3</sub>N</u>             |
| 19. silver fluoride          | <u>AgF</u>                         |
| 20. barium nitride           | <u>Ba<sub>3</sub>N<sub>2</sub></u> |
| 21. copper (II) chloride     | <u>CuCl<sub>2</sub></u>            |
| 22. iron (III) oxide         | <u>Fe<sub>2</sub>O<sub>3</sub></u> |
| 23. manganese (II) nitride   | <u>Mn<sub>3</sub>N<sub>2</sub></u> |
| 24. lead (IV) bromide        | <u>PbBr<sub>4</sub></u>            |
| 25. tin (IV) sulfide         | <u>SnS<sub>2</sub></u>             |
| 26. manganese (IV) phosphide | <u>Mn<sub>3</sub>P<sub>4</sub></u> |
| 27. iron (II) oxide          | <u>FeO</u>                         |
| 28. lead (IV) sulfide        | <u>PbS<sub>2</sub></u>             |
| 29. mercury (II) sulfide     | <u>HgS</u>                         |
| 30. copper (II) nitride      | <u>Cu<sub>3</sub>N<sub>2</sub></u> |

9. The compound H<sub>2</sub>O<sub>2</sub> is separated and produces hydrogen gas and oxygen gas as a result. What do you expect will be the ratio of the two gases produced?

They will be produced in a ratio of  
2 hydrogen : 1 oxygen

- H<sub>2</sub>O  
 10. Water is separated and produces hydrogen gas and oxygen gas as a result. What do you expect will be the ratio of the two gases produced?

They will be produced in a ratio of  
2 hydrogen : 1 oxygen

11. Determine the ratio of atoms of each element in the compound ammonium monohydrogen phosphate:  $(\text{NH}_4)_2\text{HPO}_4$

The ratio is 2N : 9H : 1P : 4O

12. Explain the importance of the Roman numerals in the names of the three compounds: manganese (IV) nitride, manganese (III) nitride and manganese (II) nitride. In your answer include the total number of atoms in each compound.

manganese (IV) nitride  $\Rightarrow \text{Mn}_3\text{N}_4$  (TOTAL = 7)

manganese (III) nitride  $\Rightarrow \text{Mn}_2\text{N}$  (TOTAL = 3)

manganese (II) nitride  $\Rightarrow \text{Mn}_3\text{N}_2$  (TOTAL = 5)

$\hookrightarrow$  Totally changes the compound

13. Knowing that barium and oxygen react in a one to one ratio, in what ratio will radium and oxygen react? In your answer include to concepts of chemical families and valence electrons.

Same ratio as barium and oxygen (1:1)

$\hookrightarrow$  Ba is in the same group / family as Ra, so

radium will react similarly to barium as

it has the same number of valence electrons