2.79 Describe a major contribution to science made by each of the following scientists:
(b) Thomson  **Measured charge to mass ratio of the electrons (e/m); proposed plum pudding model.**
(c) Millikan  **Measured charge of electron in the oil drop experiment, therefore allowing calculation of the mass of the electron.**
(d) Rutherford  **Gold foil experiment showed that atoms are mostly empty space with dense, positive center.**

2.21 (a) Define atomic number and mass number.
**Atomic number represents the # of protons in an atom.**
**Atomic mass number is the sum total of protons and neutrons in an atom.**

(b) Which of these can vary without changing the identity of the element?
**Atomic mass # varies with neutron count, but the identity of the atom remains the same.**

2.27 Write the correct symbol, with both superscript and subscript, for each of the following. Use the list of elements inside the front cover as needed:
(a) the isotope of platinum that contains 118 neutrons  \[ ^{196}_{78} \text{Pt} \]
(b) the isotope of krypton with mass number 84  \[ ^{84}_{36} \text{Kr} \]
(c) the isotope of arsenic with mass number 75  \[ ^{75}_{33} \text{As} \]
(d) the isotope of magnesium that has an equal number of protons and neutrons  \[ ^{24}_{12} \text{Mg} \]

2.49 Fill in the gaps in the following table:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>(^{59}\text{Co}^{3+})</th>
<th>(^{80}\text{Se}^{2-})</th>
<th>(^{192}\text{Os}^{2+})</th>
<th>(^{200}\text{Hg}^{2+})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protons</td>
<td>27</td>
<td>34</td>
<td>76</td>
<td>80</td>
</tr>
<tr>
<td>Neutrons</td>
<td>32</td>
<td>46</td>
<td>116</td>
<td>120</td>
</tr>
<tr>
<td>Electrons</td>
<td>24</td>
<td>36</td>
<td>74</td>
<td>78</td>
</tr>
<tr>
<td>Net charge</td>
<td>3+</td>
<td>2-</td>
<td>2+</td>
<td>2+</td>
</tr>
</tbody>
</table>
2.31 Only two isotopes of copper occur naturally, \(^{63}\)Cu (atomic mass = 62.9296 amu; abundance 69.17\%) and \(^{65}\)Cu (atomic mass = 64.9278 amu; abundance 30.83\%). Calculate the atomic weight (average atomic mass) of copper.

\[
\text{Atomic Weight of Copper} = 62.9296 \times 0.6917 + 64.9278 \times 0.3083
\]

MIXED OPERATIONS

\[
= 63.54564506 \text{ round to } 2 \text{ dp (last math is addition)}
\]

\[
= 63.55 \text{ amu for copper}
\]

2.53 Using the periodic table to guide you, predict the chemical formula and name of the compound formed by the following elements:

(a) Ga and F \quad \text{GaF}_3 \quad \text{gallium(III) fluoride}

(b) Li and H \quad \text{LiH} \quad \text{lithium hydride}

(c) Al and I \quad \text{AlI}_3 \quad \text{aluminum iodide}

(d) K and S \quad \text{K}_2\text{S} \quad \text{potassium sulfide}

2.63 Give the names and charges of the cation and anion in each of the following compounds:

(a) \text{CaO} \quad 	ext{calcium cation} +2 \quad \text{oxide anion} -2

(b) \text{Na}_2\text{SO}_4 \quad \text{sodium cation} +1 \quad \text{sulfate anion} -2

(c) \text{KClO}_4 \quad \text{potassium cation} +1 \quad \text{perchlorate anion} -1

(d) \text{Fe(NO}_3\text{)}_2 \quad \text{iron cation} +2 \quad \text{nitrte anion} -1

(e) \text{Cr(OH)}_3 \quad \text{chromium cation} +3 \quad \text{hydroxide anion} -1

2.65 Name the following ionic compounds:

(a) \text{MgO} \quad \text{magnesium oxide}

(b) \text{AlCl}_3 \quad \text{aluminum chloride}

(c) \text{Li}_3\text{PO}_4 \quad \text{lithium phosphate}

(d) \text{Ba(ClO}_4\text{)}_2 \quad \text{barium perchlorate}

(e) \text{Cu(NO}_3\text{)}_2 \quad \text{copper(II) nitrate}

(f) \text{Fe(OH)}_2 \quad \text{iron(II) hydroxide}

(g) \text{Ca(C}_2\text{H}_3\text{O}_2\text{)}_2 \quad \text{calcium acetate}

(h) \text{Cr}_2(\text{CO}_3\text{)}_3 \quad \text{chromium(III) carbonate}

(i) \text{K}_2\text{CrO}_4 \quad \text{potassium chromate}

(j) \text{(NH}_4\text{)}_2\text{SO}_4 \quad \text{ammonium sulfate}

2.67 Write the chemical formulas for the following compounds:

(a) aluminum hydroxide \quad \text{Al(OH)}_3

(b) potassium sulfate \quad \text{K}_2\text{SO}_4

(c) copper(I) oxide \quad \text{Cu}_2\text{O}

(d) zinc nitrate \quad \text{Zn(NO}_3\text{)}_2

(f) iron(III) carbonate \quad \text{Fe}_2(\text{CO}_3\text{)}_3
2.98 Name each of the following oxides. Assuming that the compounds are ionic, what charge is associated with the metallic element in each case?
(a) NiO nickel(II) oxide +2
(b) MnO₂ manganese(IV) oxide +4
(c) Cr₂O₃ chromium(III) oxide +3
(d) MoO₃ molybdenum(VI) oxide +6

2.71 Give the name or chemical formula, as appropriate, for each of the following binary molecular substances:
(a) SF₆ sulfur hexafluoride
(b) IF₅ iodine pentafluoride
(c) XeO₃ xenon trioxide
(d) dinitrogen tetroxide N₂O₄
(e) hydrogen cyanide HCN (note: CN⁻ not on study list)
(f) tetraphosphorus hexasulfide P₄S₆

2.73 Write the chemical formula for each substance mentioned in the following word descriptions (use the front inside cover to find the symbols for the elements you don't know).
(a) Zinc carbonate can be heated to form zinc oxide and carbon dioxide.
   ZnCO₃ ZnO CO₂
(b) On treatment with hydrofluoric acid, silicon dioxide forms silicon tetrafluoride and water.
   HF SiO₂ SiF₄ H₂O
(c) Sulfur dioxide reacts with water to form sulfurous acid.
   SO₂ H₂O H₂SO₃

2.104 Many ions and compounds have very similar names, and there is great potential for confusing them. Write the correct chemical formulas to distinguish between
(c) aluminum nitride and aluminum nitrite AlN Al(NO₂)₃
(e) ammonia and ammonium ion NH₃ NH₄⁺