Science 10 - Year End Review

Biology

1. **P.L.O.** - distinguish between abiotic and biotic factors in a given scenario.

   Identify 4 biotic factors and 4 abiotic factors in the following picture.

   ![Diagram](image)

   **Biotic** = tree, goose, rabbit and fish.

   **Abiotic** = temperature, light, water, soil.

2. **P.L.O.** - describe the connection between abiotic and biotic elements within an ecosystem.

   Describe 2 different relationships between biotic and abiotic conditions in the diagram below.

   ![Diagram](image)

   a.) Aquatic plants make their own food using energy from the sun through the process of photosynthesis.

   b.) The aquatic plants also produce oxygen as a result of photosynthesis. (1 Point)
3.)

![Biome Graph]

a.) Looking at the graph shown above, which biome has the greatest average annual precipitation and temperature?
   Tropical rainforest.

b.) Looking at the graph shown above, which biome ranges in temperature between -18°C and -8°C and receives about 20 cm of rain a year?
   Tundra.

4.) P.L.O. - conduct experiments that investigate the effects of altering biotic and abiotic factors.

Use the following graphs and information to answer the next three questions.

![Population Growth Graphs]

a.) Describe the differences seen in all three graphs shown above.
   Each population prospers when it is alone, as seen in graphs I and II. When the two populations are forced to interact, competition results and Paramecium aurelia wins over Paramecium caudatum.

b.) What evidence suggests that the two populations shown above affect each other?
   There is a decline in the population size of Paramecium caudatum when Paramecium aurelia is present (as shown by comparing graph II and graph III).

c.) What is the most likely explanation for the growth curve of Paramecium caudatum in Graph III shown above?
   Fewer resources (e.g., food) are available due to competition between the two species.
5.) P.L.O. - explain relationships within food chains, food webs and food pyramids, including producers, consumers, predators, decomposers and symbiosis.

P.L.O. - describe how bioaccumulation can occur and what impact bioaccumulation has.

P.L.O. - compare how bioaccumulation affects consumers at different levels of the food chain.

![Food Pyramid Diagram]

a.) In the above diagram, which level will contain the most consumer biomass? Why?

The primary consumers will have the most consumer biomass as this level of the pyramid has the most energy for consumers and so can support the most life. As well, the subsequent levels all rely on this level so each level higher has less biomass.

b.) If plants start with 100% of the energy in the system, how much energy will reach the level the snakes occupy?

1% as only 10% of the previous levels energy makes it to the next level up the food pyramid.

c.) Which level of the above pyramid will have the highest levels of toxins and why?

The highest order consumer (eagles), have the highest level because toxins increase in concentration as each level of a pyramid eats the toxins from the organisms at a lower level.

d.) What is the word used to describe this increase in toxins?

Biomagnification.

e.) What is the difference between bioaccumulation and biomagnifications?

Bioaccumulation is the increase in toxins in an ecosystems organisms. Biomagnification is the increase in concentration of toxins as you progress up a food chain.

f.) What are decomposers and why do they have such a crucial role in a food web?

Decomposers are organisms that break down dead material to release the nutrients back into the soil.
6.) The food web shown below shows some of the relationships that exist between organisms in an ecosystem.

![Food Web Diagram]

a) Identify a secondary consumer from the food web.

Bear, red-tailed hawk, or possibly the grouse.

b) Describe the complete path of energy from the Sun to that secondary consumer.

The sun's energy is absorbed by plants and converted into sugars. The plant is then eaten by a primary consumer (deer) and the energy is used to power this organism (90% being lost as heat) and finally the remaining energy is transferred to the secondary consumer (bear) when he eats the deer.

c) Explain why decomposers are necessary in this food web.

Decomposers are needed to break down dead organisms to return their nutrients to the soil and atmosphere.

d) A pesticide was sprayed in the environment where these organisms live. Explain why several years later, the red-tailed hawk population would contain higher pesticide levels than any other herbivores would contain.

The pesticide would slowly be taken into plants from the soil. As primary consumers eat these plants the pesticide would be transferred into the consumers and biomagnifications would occur. As the pesticide moved up the food chain to the red-tailed hawk, it would continue to biomagnify as it went up each level of the food chain.

7.) P.L.O. - track the path of carbon, nitrogen, and phosphorus through an ecosystem.

a.) Explain how the carbon cycle is cyclical in nature.

Carbon enters the soil when living organisms defecate or die. This carbon is taken up into plants which are eaten by consumers. Both plants and animals respire into the air releasing carbon dioxide into the air. Plants take in this carbon dioxide and fix it into sugars which are then eaten by consumers who will die and return the carbon to the soil.
b.) How in nitrogen “fixed” into the soil for plant uptake?
   Nitrogen-fixing bacteria convert \( \text{N}_2 \) into \( \text{NH}_4^+ \) which is a form plants can take into their bodies.
   Rhizobium is a common bacteria found in root nodules that does this.

c.) Phosphorus and nitrogen are very important nutrients for plants. Farmers fertilize their soils with nitrogen and phosphorus. How is this bad for organisms living in bodies of water?
   The nitrogen and phosphorus leached into the soil and run-off caused the excess fertilizer to move down into lakes and ponds. These extra nutrients caused increased algal growth which stripped the water of needed oxygen and blocked sun light from reaching lower levels of the water. The results are death in plants and animal species.

d.) What is the most common way phosphorus enters the soil?
   Weathering breaking down rocks containing phosphorus releasing it to the soil.

8.) Use the following climatograph to answer question 6.

   ![Climatograph]

   a.) What biome fits with the above climatic graph?
      Temperate deciduous.

   b.) State one adaptation found in a plant and an animal found in this biome.
      Birds may migrate to warmer areas or mammals may hibernate.
      Trees may shed leaves to minimize water loss and breakage of limbs from snow weight. Bark will also be thick to minimize moisture loss.

   c.) Would permafrost occur in this biome? Why?
      No, the biome is temperate deciduous and is not cold enough.

9.) P.L.O. - identify the factors that determine what type of biome exists in various geographical locations.
 List the four main factors that determine what type of biome exists in an area and what influence each of these factors has.

   1.) Temperature and precipitation - Temperature and precipitation (which includes rainfall, snow, mist, and fog) are two of the most important abiotic factors that influence the characteristics of biomes
and the distribution of biomes on Earth. The slugs, ferns, and mosses would not survive in a hot, dry desert biome.

2.) **Latitude** - The sun strikes the earth differently depending where in the world you live. Areas near the equator are struck more directly by the sun's rays and so are hotter. Areas that are North or South of equator get progressively cooler due to the aspect of the earth (tilt of the earth's axis).

3.) **Elevation** - the height above sea level that the land is. As one gets higher the temperature decreases and the causes the air to hold less moisture. This leads to rain occurring on windward side of mountains (Why the coast is so wet) and dry desert like conditions on the leeward side (this is why the Okanagan is so warm and dry!!!).

4.) **Ocean Currents** - Warm water currents cause warm, wet climates on land and cold water currents cause cool, dry climates on land.

10.) What is a pioneer species and give an example of one?

   A pioneer species is a plant species that moves into an area that has no organisms and changes the conditions to allow other organisms to move in and survive. Ex. - Lichen or mosses.

   b.) Why are pioneer species important?

   See above.

11.) **P.L.O.** - **identify the effects of changing abiotic factors- such as climate change, water contamination, soil degradation, deforestation- on living things within an ecosystem.**

   Increasing human populations have expanded into ecosystems, resulting in the destruction of habitats. When habitats are destroyed, they no longer support the plant and animal species that once lived there. Habitat loss is an environmental problem.

   a) Name two human activities that cause habitat loss.

   The human activities could include any two of the following: urbanization or urban development, clear-cutting large areas of forest, deforestation, road construction, agriculture, industry, and forestry. (2 Points)

   b) What are two ways in which the destruction of habitats affects plants and animals?

   The two ways in which destruction of habitats affects plants and animals could include any of the following: reduces the number of plants and animals living in an ecosystem, reduces biodiversity, causes plants and animals to become endangered species, reduces the availability of food sources, affects wildlife movement, and affects plant and animal reproduction. (2 Points)
c) Name two ways to prevent further habitat loss or lessen the impact of habitat loss.

Two ways to prevent further habitat loss or lessen the impact of habitat loss could include any of the following: replant logged forests with native tree species, implement sustainable land use approaches, redevelop industrial areas or buildings, implement less harmful road-building practices, use forest management practices that allow more trees to remain uncut, and provide productive grazing lands. (2 Points)

12.) P.L.O. - identify substances that can bioaccumulate.

List three chemicals that bioaccumulate.

PCBs, DDT, and heavy metals such as lead, cadmium, and mercury.

13.) P.L.O. - explain how populations are kept in balance by natural selection, proliferation, predation, ecological succession, climax community, extinction, and adaptive radiation.

a.) Describe what natural selection means.

Natural selection is the process by which weaker animals are preyed upon or outcompeted causing their death and removal from the ecosystem.

b.) What is ecological succession?

Ecological succession is the process by which an ecosystem will change over time from being uninhabited to more and more complex species and a wider range of species. The succession stops at a climax community (dominated by top species and everything is in balance).

c.) Using the above diagram, what are the pioneer species?

Lichens and mosses.

d.) What do the white spruce, balsam fir, and paper birch represent in the diagram shown above?

Climax community.

e.) In which biome would the sequence of plant communities shown above most likely be found?

Boreal forest biome.
14.) P.L.O. - describe the impact of natural disasters on ecosystems, including drought, fire, flooding, temperature change, tsunamis, infestations, and volcanic eruption.

Complete the following table:

<table>
<thead>
<tr>
<th>Natural Event Cause</th>
<th>Description</th>
<th>Possible Impact on Ecosystem</th>
</tr>
</thead>
</table>
| Tsunami             | - huge, rapidly moving ocean wave | - washes away/destroys plants and animals  
- destroys habitats  
- disrupts food webs  
- changes composition of soil with salt water brought onto land |
| Drought             | - water is scarce for animals and plants  
- very dry conditions | - causes animals and plants to die  
- triggers crop failures and livestock deaths  
- destroys habitat |
| Flooding            | - excess water that occurs in coastal areas, rivers, and lakes | - affects the spread of diseases  
- triggers soil pollution  
- causes soil erosion |

15.) P.L.O. - describe using examples how foreign species can affect an ecosystem.

<table>
<thead>
<tr>
<th>Introduced Invasive Species</th>
<th>Impact on the Ecosystem</th>
</tr>
</thead>
</table>
| Eurasian milfoil            | - form dense mats at lake surfaces, cutting off sunlight to the organisms below  
- interfere with recreational activities |
| Norway rat                  | - feed on almost any food source  
- can cause a decline in ground-nesting sea birds  
- have a high reproduction rate |
| American bullfrog           | - breed rapidly  
- have taken over habitats  
- eat native frogs that are now endangered  
- attack ducks and small mammals |
| European starling           | - caused a decline in the yellow-billed cuckoo, western bluebird, and band-tailed pigeon  
- outcompete native birds for nesting sites and food  
- devastate food crops and grain crops  
- are a fast-growing species |
16.) P.L.O. - give examples of how traditional ecological knowledge can effect biodiversity.
   Name one practice performed by aboriginals that benefited biodiversity.
   Burning of forests and grasslands to return nutrient to the soil.

17.) P.L.O. - describe situations in which disease, pollution, habitat destruction and exploitation of resources effect ecosystems.
   Give one example of disease, pollution, habitat destruction and overexploitation or resources that has effected an ecosystem.
   **Disease** - By decreasing cod populations from over fishing (exploitation) the population was decreased to a level where genetic diversity was lost and the remaining cod were more prone to disease.
   **Pollution** - DDT exposure to bald eagles built up to high levels and resulted in minimal young survival as the DDT weakened the egg causing embryo deaths.
   **Habitat destruction** - deforestation with minimal to no replanting.
   **Exploitation** - Hunting the plains buffalo to near extinction changed the brush content of the plains and caused other predators numbers to decline.

**Chemistry**

1.) P.L.O. - be comfortable using the periodic table to; distinguish between metals and non-metals.
   Name two metals and two non-metals and describe the general area that metals and non-metals are found on the periodic table.
   - **Metals** _____ Sodium (Na) _____ and _____ Iron (Fe) _____
   - **Non-metals** _____ Oxygen (O) _____ and _____ Iodine (I) _____
   Metals are found to the left of the "steps" of the periodic table and non-metals are found to the right of the "steps".

2.) P.L.O. - classify the reactivity of an element.
   a.) What is the most reactive element on the periodic table (think most dangerous gas)?
      Fluorine gas.
   b.) Describe the general trend that occurs on the periodic table that describes where the most and least reactive elements are found.
As one goes from left to right and bottom to top the elements the general trend is to become more reactive.

3.) **P.L.O. - tell the difference between acids and bases.**

**P.L.O. - know the properties, names, and formulae for acids, bases, and salts.**

a.) What indicates that a chemical is an acid or a base?

*Compounds that start with an H are acids and compounds that end in an OH are bases.*

b.) What word describes what acids, bases, and salts do when put in water?

*Dissociate.*

c.) Name two properties of acids and bases.

<table>
<thead>
<tr>
<th>Acids</th>
<th>Bases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sour taste</td>
<td>Bitter taste</td>
</tr>
<tr>
<td>Conduct electricity</td>
<td>Conduct electricity</td>
</tr>
<tr>
<td>React with metals</td>
<td>Don't react with metals</td>
</tr>
</tbody>
</table>

d.) What is the name of the scale used to measure strength of acids and bases.

*pH scale. pH stands for "the power of hydrogen".*

e.) Which solution has more H\(^+\) ions, and how much more, in a solution with a pH of 3 than a solution with a pH of 9?

*pH of three has much more H\(^+\) ions as it is the stronger acidic solution. There are 10x more H\(^+\) ions for each digit that 3 is lower than 9. So . . . pH of 3 has \(10^6\) or \(1\,000\,000\) (million) times more H\(^+\) ions in solution.*

f.) Write the name and formula of two acids and two bases.

*Acids = sulphuric acid (H\(_2\)SO\(_4\)), acetic acid (CH\(_3\)COOH), phosphoric acid (H\(_3\)PO\(_4\)), and hydrochloric acid (HCl) etc.*

*Bases = sodium hydroxide (NaOH), magnesium hydroxide (Mg(OH)\(_2\)), calcium hydroxide (Ca(OH)\(_2\)), aluminum hydroxide (Al(OH)\(_3\)) and iron (II) hydroxide (Fe(OH)\(_2\)) etc.*

g.) What are the products when an acid and a base are mixed?

*When an acid and base are mixed a salt (composed of the metal from the base and the non-metal from the acid) and water are always produced.*
4.) **P.L.O. - describe and locate protons, neutrons and electrons.**
   a.) Which subatomic particle is the largest and heaviest?
      Neutron.
   b.) Which particle accounts for most of the space in an atom?
      Electron.
   c.) Which particle causes bonding to occur?
      Electron.
   d.) Which particle decides what element an atom is?
      Proton.

5.) **P.L.O. - know what ionic and covalent bonding are.**
   Describe how an ionic bond and a covalent bond are formed.
   Ionic - ionic bonds are formed by the metal giving up it's valence electrons to the non-metal so that it has a full outer shell.
   Covalent - covalent bonds are formed between two non-metals sharing their valence electrons between them.

Label each of the following compounds as ionic or covalent depending on the type of bond forming them.

i.) Fe₂(SO₄)₃ ___ ionic _____  
   iv.) NF₃ _____ covalent ______

ii.) CO _____ covalent _____
    v.) Zn(NO₃)₂ _____ ionic ______

iii.) Ag₂Cr₂O₇ _____ ionic ___
     vi.) SiO₂ _____ covalent _____

6.) **P.L.O. - draw Bohr diagrams.**

Draw Bohr models for the following elements and compounds.

   Sodium           Sodium Chloride
   Carbon Dioxide   Fluorine
7.) P.L.O. - identify valence electrons, paired and unpaired electrons, lone pairs, and bonding pairs.
   
   a.) What is the definition of “valence electrons”?
      
      Valence electrons are the electrons found in the outer shell of an atom that are used to form bonds by donating them or sharing them.
   
   b.) Why do we care so much about valence electrons?
      
      Valence electrons are used to form bonds.
   
   c.) When do electrons pair?
      
      Electrons pair only after the shell is half full. Then they spin pair to maximize the distance between each electron as they repel each other.

8.) P.L.O. - draw Lewis diagrams.
   
   Draw the following elements or compounds as Lewis structures.
   
   Sodium
   
   . Na
   
   Sodium Chloride
   
   [Na]\(^+\) [Cl]\(^-\)
   
   Carbon Dioxide
   
   . .
   
   :O::C::O:
   
   Fluorine
   
   . .
   
   :F:

9.) P.L.O. - be able to name and write formulas.
   
   A. Write correct formula for these compounds.
   
   1. boron chloride ___________ BCl\(_3\) ___________ 11. magnesium carbonate ___________ MgCO\(_3\) ___________
   
   2. aluminum hydroxide ___________ Al(OH)\(_3\) ___________ 12. calcium hydroxide ___________ Ca(OH)\(_2\) ___________
   
   3. silver sulphide ___________ Ag\(_2\)S ___________ 13. cesium sulphide ___________ Ce\(_2\)S ___________
   
   4. iron (II) iodide ___________ FeI\(_2\) ___________ 14. carbon tetrachloride ___________ CCl\(_4\) ___________
   
   5. copper (I) oxide ___________ Cu\(_2\)O ___________ 15. hydrogen gas ___________ H\(_2\) ___________
   
   6. tin (IV) nitrate ___________ Sn(NO\(_3\))\(_4\) ___________ 16. carbon disulphide ___________ CS\(_2\) ___________
   
   7. zinc bromide ___________ ZnBr\(_2\) ___________ 17. beryllium nitrate ___________ Be(NO\(_3\))\(_2\) ___________
   
   8. nickel (III) oxide ___________ Ni\(_2\)O\(_3\) ___________ 18. sodium hydrogen carbonate ___________ NaHCO\(_3\) ___________
   
   9. ruthenium sulphide ___________ Ru\(_2\)S\(_3\) ___________ 19. water ___________ H\(_2\)O ___________
   
   10. titanic oxide ___________ Ti\(_2\)O\(_3\) ___________ 20. lanthanum oxide ___________ La\(_2\)O\(_3\) ___________
### B. Name the following compounds correctly.

<table>
<thead>
<tr>
<th>Number</th>
<th>Compound</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dihydrogen Oxide</td>
<td>H₂O</td>
</tr>
<tr>
<td>2</td>
<td>Lead (II)iodide</td>
<td>PbI₂</td>
</tr>
<tr>
<td>3</td>
<td>Magnesium chloride</td>
<td>MgCl₂</td>
</tr>
<tr>
<td>4</td>
<td>Sodium oxide</td>
<td>Na₂O</td>
</tr>
<tr>
<td>5</td>
<td>Mercury (II) chloride</td>
<td>HgCl₂</td>
</tr>
<tr>
<td>6</td>
<td>Silver oxide</td>
<td>Ag₂O</td>
</tr>
<tr>
<td>7</td>
<td>Sodium phosphate</td>
<td>Na₃PO₄</td>
</tr>
<tr>
<td>8</td>
<td>Calcium carbonate</td>
<td>CaCO₃</td>
</tr>
<tr>
<td>9</td>
<td>Iron (II) carbonate</td>
<td>FeCO₃</td>
</tr>
<tr>
<td>10</td>
<td>Yttrium bromide</td>
<td>YBr₃</td>
</tr>
<tr>
<td>11</td>
<td>Aluminum oxide</td>
<td>Al₂O₃</td>
</tr>
<tr>
<td>12</td>
<td>Carbon dioxide</td>
<td>CO₂</td>
</tr>
<tr>
<td>13</td>
<td>Silicon dioxide</td>
<td>SiO₂</td>
</tr>
<tr>
<td>14</td>
<td>Nitrogen dioxide</td>
<td>NO₂</td>
</tr>
<tr>
<td>15</td>
<td>Sulphuric acid</td>
<td>H₂SO₄</td>
</tr>
<tr>
<td>16</td>
<td>Sodium chlorate</td>
<td>NaClO₃</td>
</tr>
<tr>
<td>17</td>
<td>Gold (III) chloride</td>
<td>AuCl₃</td>
</tr>
<tr>
<td>18</td>
<td>Bismuth (V) chloride</td>
<td>BiCl₅</td>
</tr>
<tr>
<td>19</td>
<td>Rubidium nitride</td>
<td>Rb₃N</td>
</tr>
<tr>
<td>20</td>
<td>Barium nitrate</td>
<td>Ba(NO₃)₂</td>
</tr>
</tbody>
</table>

### 10.) P.L.O. - write and balance chemical equations.

Balance the following reactions.

\[
\begin{align*}
2 \text{ K}_\text{s} & + \text{ F}_\text{2(g)} \rightarrow 2 \text{ KF}_\text{(s)} \\
2 \text{ Sr}_\text{(s)} & + \text{ O}_\text{2(g)} \rightarrow 2 \text{ SrO}_\text{(s)} \\
2 \text{ Ni}_\text{3(s)} & \rightarrow \text{ N}_\text{2(g)} + 3 \text{ I}_\text{2(g)} \\
\text{Ca(OH)}_\text{2(s)} & \rightarrow \text{ CaO}_\text{(s)} + \text{ H}_\text{2O}_\text{(g)} \\
\text{NH}_\text{4NO}_\text{2(s)} & \rightarrow \text{ N}_\text{2(g)} + 2 \text{ H}_\text{2O}_\text{(l)} \\
2 \text{ MoS}_\text{2(s)} & + 7 \text{ O}_\text{2(g)} \rightarrow 2 \text{ MoO}_\text{3(s)} + 4 \text{ SO}_\text{2(g)} \\
3 \text{ Mg(OH)}_\text{2(aq)} & + 2 \text{ H}_\text{3PO}_\text{4(aq)} \rightarrow \text{ Mg}_\text{3(PO}_\text{4}^\text{2(aq)} + 6 \text{ H}_\text{2O}_\text{(l)} \\
\text{Pb(NO)}_\text{3(aq)} & + \text{ K}_\text{2CrO}_\text{4(aq)} \rightarrow \text{ PbCrO}_\text{4(aq)} + 2 \text{ KNO}_\text{3(aq)} \\
\text{CaCO}_\text{3(aq)} & + 2 \text{ HC}_\text{2H}_\text{3O}_\text{2(aq)} \rightarrow \text{ Ca(C}_\text{2H}_\text{3O}_\text{2}^\text{2(aq)} + 6 \text{ H}_\text{2O}_\text{(l)} + \text{ CO}_\text{2(g)} \\
2 \text{ NH}_\text{4Cl}_\text{(aq)} & + \text{ Pb(NO)}\text{3}_\text{2(aq)} \rightarrow \text{ PbCl}_\text{2(s)} + 2 \text{ NH}_\text{4NO}_\text{3(aq)} \\
\text{C}_\text{6H}_\text{12O}_\text{6(aq)} & + 6 \text{ O}_\text{2(aq)} \rightarrow 6 \text{ CO}_\text{2(aq)} + 6 \text{ H}_\text{2O}_\text{(l)} \\
2 \text{ NaHCO}_\text{3(s)} & \rightarrow \text{ H}_\text{2O}_\text{(g)} + \text{ CO}_\text{2(g)} + \text{ Na}_\text{2CO}_\text{3(s)} \\
\text{Na}_\text{2CO}_\text{3(s)} & + 2 \text{ HCl}_\text{(aq)} \rightarrow 2 \text{ NaCl}_\text{(aq)} + \text{ H}_\text{2O}_\text{(l)} + \text{ CO}_\text{2(g)} \\
\text{Cl}_\text{2(aq)} & + 2 \text{ KI}_\text{(aq)} \rightarrow 2 \text{ KCl}_\text{(aq)} + \text{ I}_\text{2(aq)} 
\end{align*}
\]
11.) \textit{P.L.O. - understand how atoms are conserved during a chemical reaction including: synthesis, decomposition, single replacement, double replacement, combustion, and neutralization.}

a.) Write the names of the products expected in each of the following reactions, and classify each reaction into one of the six types discussed in the chapter.

i) the reaction between magnesium and oxygen
   \textit{magnesium oxide (synthesis)}

ii) the conversion of calcium nitride into its elements
   \textit{calcium + nitrogen (decomposition)}

iii) the reaction between sodium and water
   \textit{sodium hydroxide + hydrogen (single replacement)}

iv) the reaction between nitric acid and magnesium hydroxide
   \textit{magnesium nitrate + water (neutralization)}

v) the reaction between potassium chromate and silver nitrate
   \textit{silver chromate + potassium nitrate (double replacement)}

b.) Assume that the formula for candle wax is \( \text{C}_{26}\text{H}_{54} \). Write a balanced formula equation for the combustion reaction that occurs when a candle burns.

\[
2 \text{C}_{26}\text{H}_{54} + 79 \text{O}_2 \rightarrow 52 \text{CO}_2 + 54 \text{H}_2\text{O}
\]

12.) \textit{P.L.O. - describe how temperature, concentration, catalysts, and surface area affect reaction rate.}

List four methods of increasing reaction rates, and indicate how each is thought to work.

1.) \textit{Increase reactant concentration(s): this increases the number of reactant collisions.}

2.) i) \textit{Increase reactant concentration(s): this increases the number of reactant collisions.}

3.) \textit{Increase reactant temperature: this increases the number and intensity of reactant collisions.}

4.) \textit{Add a catalyst: this causes the reactants to align better with one another prior to collision.}

13.) \textit{P.L.O. - use the pH scale to compare common household substances.}

List 4 household substances, 2 of which are acidic and 2 of which are basic

\textbf{Acidic} – milk, citrus fruits, pop.

\textbf{Basic} – baking soda, eggs, bleach, soap.
14.) **P.L.O. - use indicators to identify acids and bases.**

Pick two indicators from your data booklet or textbook. Describe how each indicator would identify whether the solution was acid or base.

1.) Methyl Orange – red for acids (below 4) and yellow above 4.

2.) Phenolphthalein – colorless for acids (up to 10) and vivid pink for bases.

15.) **P.L.O. - know the difference between organic and inorganic compounds.**

a.) Describe how you would identify an organic and inorganic compound.

Organic compounds always contain carbon and usually hydrogen. However, there are carbonates, carbides and carbon oxides that contain carbon and are not organic.

To identify organic look for the high carbon content with hydrogen and it can't be a carbide, carbonate or carbon oxides.

b.) Give three examples of common organic compounds, one of which is an acid, and two compounds containing carbon that are not organic.

Acetic acid – CH₃COOH is an organic acid.

Carbonates – CaCO₃ and carbides – WC₃ are not organic but contain carbon.

16.) **P.L.O. - be able to use standard atomic notation.**

Use your periodic table to fill in the blank spaces in the following table.

<table>
<thead>
<tr>
<th>Isotope Name</th>
<th>Proton Number</th>
<th>Neutron Number</th>
<th>Mass Number</th>
<th>Atomic Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>technetium-99</td>
<td>43</td>
<td>56</td>
<td>99</td>
<td>( ^{99}_{43} \text{Tc} )</td>
</tr>
<tr>
<td>iridium-192</td>
<td>77</td>
<td>115</td>
<td>192</td>
<td>( ^{192}_{77} \text{Ir} )</td>
</tr>
<tr>
<td>tungsten-184</td>
<td>74</td>
<td>110</td>
<td>184</td>
<td>( ^{184}_{74} \text{W} )</td>
</tr>
<tr>
<td>mendelevium-256</td>
<td>101</td>
<td>155</td>
<td>256</td>
<td>( ^{256}_{101} \text{Md} )</td>
</tr>
<tr>
<td>lawrencium-256</td>
<td>103</td>
<td>153</td>
<td>256</td>
<td>( ^{256}_{103} \text{Ir} )</td>
</tr>
<tr>
<td>einsteinium-253</td>
<td>99</td>
<td>154</td>
<td>253</td>
<td>( ^{253}_{99} \text{Es} )</td>
</tr>
</tbody>
</table>
17.) P.L.O. - complete and balance nuclear equations.

Write nuclear equations for the following examples of radioactive decay:

a) alpha decay of neodymium-144

\[ ^{144}_{60}\text{Nd} \rightarrow ^{140}_{58}\text{Ce} + ^{4}_{2}\text{He} \]

b) gamma decay of californium-254

\[ ^{254}_{98}\text{Cf}^* \rightarrow ^{254}_{98}\text{Cf} + ^{0}_{0}\text{\gamma} \]

c) beta decay of neptunium-239

\[ ^{239}_{93}\text{Np} \rightarrow ^{239}_{94}\text{Pu} + ^{0}_{-1}\text{e} \]

18.) P.L.O. - know the difference between alpha, beta, and gamma decay.

Several subatomic particles involved in nuclear reactions can be represented with two symbols, each meaning the same thing. Complete the following table by writing the two symbols that could represent each of the particles.

<table>
<thead>
<tr>
<th>Particle Name</th>
<th>Symbol #1</th>
<th>Symbol #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>alpha particle</td>
<td>(^{4}_{2}\text{He})</td>
<td>(^{4}_{2}\text{\gamma})</td>
</tr>
<tr>
<td>beta particle</td>
<td>(^{0}_{-1}\text{e})</td>
<td>(^{0}_{-1}\text{\gamma})</td>
</tr>
<tr>
<td>proton</td>
<td>(^{1}_{1}\text{p})</td>
<td>(^{1}_{1}\text{H})</td>
</tr>
</tbody>
</table>

19.) P.L.O. - explain how half-life is related to radioactive decay.

a.) Explain what is meant by the term “Half-life”?

Half-life is described as the amount of time it takes for half of a sample to transmutate from nuclear decay.
Use the following information and graph to answer the next three questions.

A hypothetical radioisotope decays via beta emission to a stable isotope in one step. The decay curve for this is shown below.

b.) What is the approximate half-life of this radioisotope?

5 days.

c.) What mass of the parent isotope remains after 25 days?

5 half-lifes so that is about 6.25 grams.

d.) How much time has elapsed since the parent isotope's original mass of 200 g began decaying if 187.5 g of the daughter isotope have been produced?

187.5 grams means that 4 half-lifes have occurred. 4 half-lifes means that 20 days have passed.

20.) P.L.O. - compare fission and fusion.

a.) Below, state two ways in which nuclear fission and nuclear fusion are similar and two ways in which they are different.

Similarities:

i) Both involve nuclear changes in which matter is converted to energy.

ii) Both convert starting nuclei into different elements as a result of nuclear changes.

iii) Both release far more energy than any chemical change.

Differences:

i) Fission splits a large nucleus apart producing two smaller daughter nuclei, whereas fusion begins with two smaller nuclei and joins them together to produce a larger nucleus.

ii) Nuclear fusion requires extremely high temperatures to force two positive particles together. Fission has no repulsive forces to overcome and so does not require high temperatures.

iii) Nuclear fusion is capable of producing much more energy than nuclear fission.
b.) Convert the following written description of a nuclear fusion event into a balanced nuclear equation: A nucleus of hydrogen-2 (deuterium) and a nucleus of hydrogen-3 (tritium) undergo fusion producing helium-4, 1 neutron, and energy.

\[ ^1_2 H + ^3_1 H \rightarrow ^4_2 He + ^1_0 n + \text{energy} \]

c.) Physicists refer to a hydrogen bomb as a “thermonuclear device.” This is because the fusion of hydrogen in the bomb requires a fission detonation to occur first. Explain why this initial fission event is necessary.

Nuclear fusion involves the collision and fusion of two positively charged nuclei—namely, nuclei each containing protons. For this to occur, the strong repulsive forces between the charged nuclei must be overcome by generating immense temperatures of tens of millions of degrees Celsius. This heat can be produced only by a fission detonation.

**Physics**

1.) *Explain the relationship between displacement and time interval to velocity of objects in uniform motion.*

a.) Explain how displacement is different than distance.

Displacement is the distance the object is from the starting point. Distance is the total length travelled towards and away from the starting point all added together.

b.) What is the difference between a scalar and a vector and give an example of each.

* A scalar quantity is a magnitude alone. A vector is a magnitude and direction.

  * Scalar example = speed    vector example = velocity

A student is waiting at a bus stop and starts to pace back and forth. Use the following position-time graph showing the student’s motion to answer the following questions.

![Position-time graph](image)

c.) During which time interval(s) is the student standing still?

0 s to 2 s; 7 s to 12 s; 16 s to 18 s
d.) Describe the motion of the student during the time interval 2 s to 5 s. Determine the velocity during this time interval.

The student is moving to the left, away from the bus stop with uniform motion. The velocity is -1 m/s.

e.) Describe the motion of the student during the time interval 14 s to 16 s. Determine the velocity during this time interval.

The student is moving to the right, toward the bus stop with uniform motion. The velocity is +2 m/s.

f.) What is the student's position at 7 s?

2 m [right]

g.) What is the student's displacement between 12 s and 14 s?

8 m [left]

h.) What is the total distance covered by the student during the first 16 s?

20 m

i.) What is the student's displacement during the time interval 0 s to 20 s?

0 m

2.) Use graphs to represent the relationship between displacement, time interval and velocity.

i.) Sketch a position-time graph for each of the following scenarios.

a) Starting at a positive position with a positive velocity.

![Graph of position vs. time for positive position and velocity](image)

b) Starting at a negative position with a positive velocity.

![Graph of position vs. time for negative position and velocity](image)

c) Starting at a negative position with a zero velocity.

![Graph of position vs. time for negative position and zero velocity](image)
d) Starting at a positive position with a negative velocity.

![Position-time graph showing downward motion.]

e) Starting at a positive position with zero velocity.

![Position-time graph showing zero velocity.]

ii.) The velocity-time graph shown below shows the motion of a coin tossed in the air. Use the graph to answer the following questions.

![Velocity-time graph showing linear decrease and increase.]

a) Which part of the graph shows the coin at its highest point?
   The coin is at its highest point when the graph intersects the x-axis (halfway).

b) When does the coin have zero velocity?
   The coin has zero velocity when it is at the highest point of the throw for an instant since the direction of the coin is changing.

c) Describe the speed of the coin on its way up.
   The speed of the coin decreases on its way up.

d) Describe the speed of the coin on its way down.
   The speed of the coin increases on its way down.

e) What direction is the acceleration when the coin is moving up and when the coin is moving down?
   The acceleration is always toward the ground.

f) Use the graph to summarize the motion of the coin that is tossed upward and then falls back down to the thrower.
   The coin was initially moving upward, but the speed decreased steadily as gravity slowed it down. The upward motion stopped for a moment at the peak of the throw. The coin then moved downward at increasing speed as gravity pulled it back down to the thrower.
3.) Calculate average velocity, displacement and time interval for an object in uniform motion using $\bar{v}_{av} = \frac{\Delta d}{\Delta t}$.

Calculate the following.

a.) What is the average velocity of a honey bee that flies 35 m [S] in 4.5 s?

Using $\bar{v}_{av} = \frac{\Delta d}{\Delta t}$

then $\bar{v}_{av} = \frac{35}{4.5}$

so $\bar{v}_{av} = 7.78 \text{ m/s}$

b.) If a raquetball is hit at 25 m/s towards the wall, what is the raquetball’s displacement after 0.65 s?

Using $\bar{v}_{av} = \frac{\Delta d}{\Delta t}$

then $\Delta d = 25 \times 0.65$

so $\Delta d = 16.25 \text{ m towards the wall.}$

c.) A chicken wants to cross a 450 m wide eight lane highway. If it crosses the highway at 2.5 m/s, how long does it take to cross the highway?

Using $\bar{v}_{av} = \frac{\Delta d}{\Delta t}$

then $\Delta t = \frac{\Delta d}{\bar{v}_{av}}$

so $\Delta t = \frac{450}{2.5}$

so $\Delta t = 180 \text{ s or 3 minutes.}$

d.) A car’s displacement is 42 km [S] after travelling for 45 minutes. What is the cars average velocity in km/h and m/s?

Using $\bar{v}_{av} = \frac{\Delta d}{\Delta t}$

then $\bar{v}_{av} = \frac{(42\times10^3)}{(45\times60)}$

so $\bar{v}_{av} = 15.55 \text{ m/s or } \bar{v}_{av} = 56 \text{ km/h}$

4.) Conduct experiments to determine the velocity of an object in uniform motion.

Use the following position-time graph to answer the next two questions.

a.) Rank the following lines on the position-time graph shown from greatest average velocity to least average velocity?

C, D, A, B - the negative slope of D is a larger value of velocity than A, just in the negative direction.

b.) What is the slope of line A in the graph shown above?

$slope = \frac{4 \text{ m}}{15 \text{ s}}$ or $0.267 \text{ m/s}$

c.) What does the slope of a position/time graph line represent?

The slope of this line represents velocity.
5.) Use positive, negative and zero acceleration to describe: falling objects, accelerating from rest, slowing down or stopping, and uniform motion.

Complete the following table by describing the velocity, acceleration, and motion for each time interval in the velocity-time graph shown below.

a) For velocity, indicate whether it is positive or negative.

b) For acceleration, indicate whether it is positive, negative, or zero.

c) For motion, indicate whether the object is speeding up, is slowing down, or has uniform motion.

\[ \text{Velocity (m/s)} \]

\[ 0 \quad t_1 \quad t_2 \quad t_3 \quad \text{Time (s)} \]

<table>
<thead>
<tr>
<th>Time Period</th>
<th>0 to ( t_1 )</th>
<th>( t_1 ) to ( t_2 )</th>
<th>( t_2 ) to ( t_3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Velocity</td>
<td>negative</td>
<td>negative</td>
<td>negative</td>
</tr>
<tr>
<td>b) Acceleration</td>
<td>Negative</td>
<td>zero</td>
<td>positive</td>
</tr>
<tr>
<td>c) Motion</td>
<td>speeding up</td>
<td>uniform motion</td>
<td>slowing down</td>
</tr>
</tbody>
</table>

6.) Calculate acceleration using \( \ddot{a} = \frac{\Delta \ddot{v}}{\Delta t} \), where \( \Delta \ddot{v} = \ddot{v}_f - \ddot{v}_i \)

a.) If a car accelerates from rest at a constant +6.5 m/s\(^2\), how long will it take for the car to reach a velocity of +30 m/s?

\[
\ddot{a} = \frac{\Delta \ddot{v}}{\Delta t} = 6.5 = \frac{30 - 0}{\Delta t} \quad t = \frac{30}{6.5} \quad t = 4.62 \text{ s}
\]

b.) A car accelerates uniformly at +2 m/s\(^2\) for 3 s. If the car’s initial velocity was 12 m/s, how far did the car travel in 3 s?

The vehicle is travelling 12 m each second when time STARTS and after each second its distance has increased by 2 m to 14 m. That means the AVERAGE distance for the first second is 13 m and the average distance for the second second is 15 m and the average distance for the last second was 17 m. If we add these distances up the vehicle travelled 45 m.

c.) After accelerating at +4.8 m/s\(^2\) for 1.6 s, a vehicle’s velocity was +16 m/s. What was the vehicle’s initial velocity?

\[
\ddot{a} = \frac{\Delta \ddot{v}_f - \ddot{v}_i}{\Delta t} = 4.8 = \frac{16 - \ddot{v}_i}{1.6} \quad \ddot{v}_i = 8.32 \frac{m}{s}
\]
d.) A bird endures tremendous acceleration as it digs insects out of a tree. Its beak moves at a velocity of +5.7 m/s but is reduced to 0 m/s within 0.006 s by the impact with the tree. What acceleration does the bird's brain withstand?

\[ \ddot{a} = \frac{\Delta v_f - \Delta v_i}{\Delta t} \]

\[ \ddot{a} = \frac{0 - 5.7}{0.006} \quad \ddot{a} = -950 \text{ m/s}^2 \]

e.) A boy on a bike starts from rest and reaches a velocity of 20.2 m/s [N] in 4.2 s. What is the boy's average acceleration?

\[ \ddot{a} = \frac{\Delta v_f - \Delta v_i}{\Delta t} \]

\[ \ddot{a} = \frac{20.2 - 0}{4.2} \quad \ddot{a} = 4.81 \text{ m/s}^2 [N] \]

Earth Science

1.) P.L.O. - describe evidence for continental drift theory.

a.) What is continental drift?

A theory that the continents of the world are moving. This theory came about as the east coast of South America fits so nicely with the west coast of Africa. The idea was proposed by a scientist named Wegner.

b.) What are three pieces of evidence that Wegner presented in support of the idea of continental drift?

1.) Certain fossils of plants and animals were appearing on different continents. Because these continents are too far apart for the animals to travel between, Wegner guessed that the different continents were once attached.

2.) Some mountain ranges start on one continent, go right to the coast, and then start again on the other continent across the ocean.

3.) Glaciers from millions of years ago carved up the ground as they expanded outward. The tracks they left are consistent across different continents.

2.) P.L.O. - explain how the world distribution of volcanoes, earthquakes, various geological features, hot spot and subduction zone eruptions, magnetic reversals and rock ages at spreading ridges support the plate tectonic theory.

a.) Describe the evidence used to devise plate tectonics.

i.) Scientists found that the sea floor was spreading out and the youngest rock was in the middle of the ocean. They found this was occurring because magma was coming up (new rock) and pushing the older rock to the side causing the sea floor to spread.

ii.) Scientists found a magnetic striping in this new rock over periods millions of years. This striping was caused by the magnetic field of the earth reversing polarity.
iii.) Hot spots are figured to occur in an area that is hot and when a tectonic plate moves over this area it moves the solidified rock from the hot spot. This idea fits with plate tectonics and explains how the Hawaiian Islands are being created. It also fits that the plates will collide at some point causing mountain ranges and cause earthquakes and volcanoes.

b.) Why do earthquakes and volcanoes often occur in the same region?

Earthquakes and volcanoes often occur in the same area as this area is a plate boundary. Boundaries allow magma to surface and when plates meet they can collide, pull apart, or rub which can cause earthquakes.

3.) P.L.O. - relate plate movement to the composition of the different layers of the Earth including: crust, lithosphere, asthenosphere, mantle, outer core, and inner core.

a.) Why do scientists think the earth is made of five major layers?

Use data on vibrations from earthquake readings scientists have found the earth transmits vibrations differently in different layers. These differences have been attributed to differences in composition and states (solid, liquid, or gas) of the layers.

b.) How do these many layers of the earth fit with the tectonic plate theory?

Data collected has confirmed that the upper mantle is in a semi liquid state. Liquids can undergo convection currents from different temperature zones. These currents would “pull” on the crust layer above differently in different spots. This pulling action would cause different parts of the crust to move in different directions and speeds. Ultimately this movement would cause collisions of these pieces of crust and tearing. This tearing we know as sea floor spreading and the collisions are what are causing volcanoes, mountains and earthquake.

4.) P.L.O. - describe transform, divergent and convergent plate boundaries.

a.) What is a plate boundary?

A plate boundary is where two different plates converge or pull apart.

b.) What are the different types of plate boundaries and explain how each “works”.

1.) Divergent plates - plates that are pulling apart from each other. This pulling apart allows hot magma to come up from the mantle causing volcanoes and pushing the older rock on either side further apart. This pushing action is called a ridge push. When the plates are diverging under water we call it a ridge. When the plates diverge on land we call it a rift valley.
2.) **Converging plates** - plates that are colliding into each other. This collision causes a subduction zone. A subduction zone is when one plate is pushed under the other.

3.) **Transform plates** - sometimes called a strike-slip fault. Plates that are sliding past each other. These boundaries don't cause volcanoes or mountains but earthquakes.

c.) Give a real example for each type of boundary.

- **Divergent plates** – Mid-Atlantic Ridge
- **Transform plates** - San Andreas Fault.
- **Converging plates** - Himalayan Mountains

5.) **P.L.O. - identify tectonic mapping symbols.**

Draw the different symbols for each plate boundary.

- Divergent boundary - 
- Transform boundary - 
- Convergent boundary -

6.) **P.L.O. - explain how plate movement produces; epicenters, shallow- to deep-focus earthquakes, volcanism, mountain ranges, mid-ocean ridges, and hot-spot chains.**

a.) *How do tectonic plates cause an earthquake?*

There is a lot of energy used to move tectonic plates. Sometimes they stuck from moving due to friction. This builds up energy until the plate breaks free and snaps loose. This quick movement causes an **earthquake** (a massive release of energy that shakes the crust).

b.) *How does the type of plate boundary change an earthquake?*

Earthquakes can occur inside the earth or on the surface. Where it occurs depends on the boundary type that caused the earthquake. A subduction zone earthquake often occurs deeper than a transform (strike-slip fault) boundary.

c.) *What are the different types of vibrations produced by an earthquake?*

1.) **Body waves** - are vibrations that travel underground or through the body of the earth. There are 2 types of body waves.

   a.) **Primary waves (P-waves)** - these are the fastest waves at 6 km/s. They are able to travel through solids, liquids and gases. These vibrations travel in the same direction as they compress and stretch (like an accordion).
b.) **Secondary waves (S-waves)** - these waves are second to arrive and travel at 3.5 km/s. These waves can travel through solids only. These vibrations travel in a direction perpendicular to the wave motion. That is the wave moves up and down, while it moves forward. THESE ARE THE MOST DAMAGING WAVES. These waves teach us the most about the anterior of the earth. They speed up in dense material and slow down in less dense material. As well they cannot go through the liquid outer core.

2.) **Surface waves (L-waves)** - these are the last to arrive. They travel like ripples on a pond.

d.) What is the device called that measures earthquake magnitude?

   Richter scale.

7.) **P.L.O. - connect sources of heat within the Earth to mantle convection, plate motion, and hot spot activity.**

   a.) What are sources of heat in the earth?

   Both nuclear decay and friction are sources of heat in the earth.

   b.) How does this heat cause mantle convection.

   Convection currents are started in fluids when one area is warmer than another. The warmer less dense liquid rises and is replaced by the cooler and denser liquid. This starts a circular current called a convection current.

   c.) How do convection currents cause plate movement?

   The moving liquid mantle (from convection currents) pulls the crust above it along. This causes plate movement.

   d.) Why do hot spots exist?

   Hot spots are localized areas that are hotter than the surrounding. The convection current in this area is particularly active in moving the plate above it. The hot spot causes magma to flow upward through the plate at the area of the hot spot. Over long periods of time the plate moves causing the magma to stop flowing above that area of the plate and for magma to start flowing over the area of the plate that is now above that hotspot. This is why the Hawaiian Islands have been formed in a chain as the plate moved over the hot spot.