AP Biology **Name _____**
Summer Reading Guide Packet

Chapter 1: Exploring Life

1. Briefly explain the properties of life listed below:
   a. Order

   b. Evolutionary adaptation

   c. Response to the environment

   d. Regulation

   e. Energy processing

   f. Growth and development

   g. Reproduction

2. Diagram or define the ten levels of biological organization

3. Explain or diagram how energy moves through an ecosystem

4. How does DNA function in a living cell?

5. Complete the following chart:

Quality	Prokaryotic Cells	Eukaryotic Cells
Relative size		
What types of organisms?		
Possess a Nucleus?		
Two other organelles present		

6. Define the concept of **emergent properties** and explain how it relates to "being alive".

7. What is **Reductionism**? Why is it useful in the Biological sciences?

8. How does **Systems Biology** differ from Reductionist ways of looking at Biology?

9. Diagram a flow-chart for a negative feedback system (living or non-living):

10. Why is classification of living organisms necessary to understanding biology?

11. Explain the meaning of the phrase "Form fits Function."

12. What does the statement "there is unity in diversity" mean in terms of biology and why is it said that "Evolution is the unifying theme of biology?"

13. How is **Discovery Science** different from **Hypothesis-Based Science**?

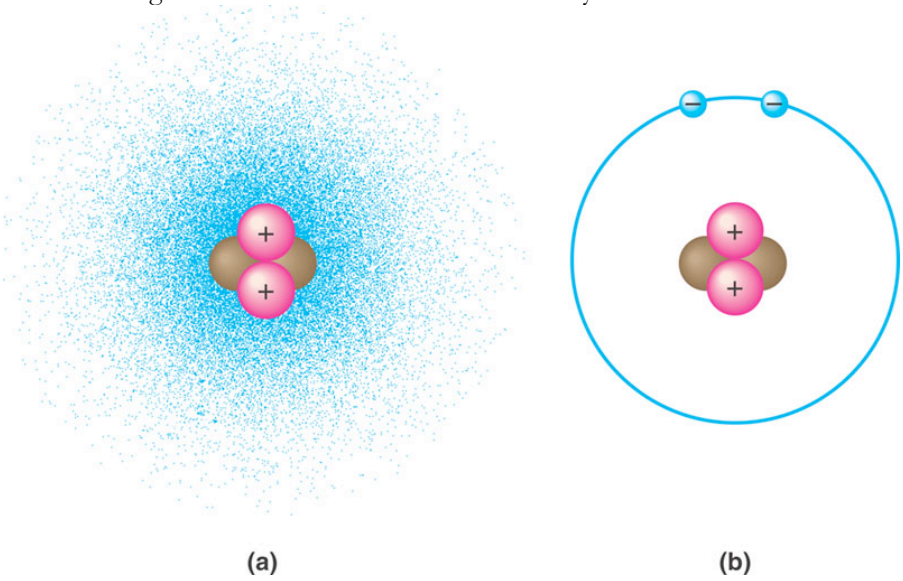
14. What's a **model**? How are they useful? What are their limitations? Are models accurate representations of actual things?

15. Draw a diagram explaining the relationship between **science** and t**echnology**.

Chapter 2: The Chemical Context of Life

1. What is the relationship between the term "**element**" and "**compound**"?

2. Label the diagram below and define the terms that you use to label them.



3. Using only the periodic table, explain how can you tell the following:
   a. The number of **protons** in an atom

   b. The number of **electrons** in an atom

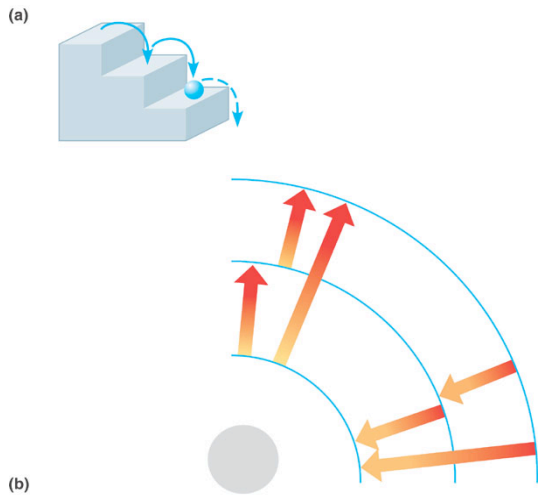
   c. The **atomic mass** of an atom

4. How is atomic mass different from **atomic weight**?

5. What is an **isotope** and what is "special" about radioactive isotopes?

6. Explain scientific uses of **radioactivity.**

7. Explain how the movement of electrons relates to the concept of potential energy – use the diagram below to help answer the question.



8. What determines interactions between atoms? Why are **valence electrons** important?

9. Define the following terms:
   a. Chemical bond

   b. Covalent bond

   c. Single bond

   d. Double bond

   e. Valence

   f. Electronegativity

   g. Nonpolar covalent bond

   h. Polar covalent bond

16. What is the difference between a **structural** and **molecular formula**?

17. How do **ionic bonds** compare with **covalent bonds**?

18. Compare and contrast **hydrogen bonds** and **van der Waals interactions**.

19. Based on the reading, give an example of how molecular shape is critical in a living system.

20. Define **dynamic chemical equilibrium** in terms of quantities of reactants and products.

Chapter 3: Water and the Fitness of the Environment

1. Why is water considered a **polar** molecule?

2. Briefly define each property of water, explain how molecular polarity or hydrogen bonding contributes to the property and how each property is useful for living things.
   a. Cohesion

   b. Adhesion

   c. Surface tension

d. High specific heat

e. Heat of vaporization

f. Evaporative cooling

3. What is unique about the **density** of water?

4. Define the following terms:
   a. Solute

   b. Solvent

   c. Aqueous solution

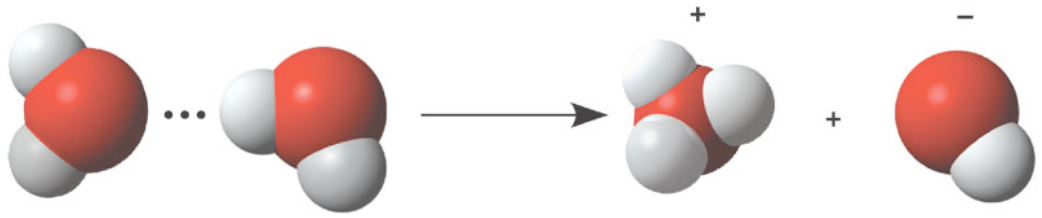
   d. Hydrophilic

   e. Hydrophobic

   f. Hydration shell

   g. Molarity

5. Label the diagram below to demonstrate the **dissociation** of the water molecule and then relate this diagram to pH.



6. What defines an **acid** and a **base**?

7. Why are "apparently" small changes in pH so important in biology (hint: how much more acidic is a solution with a pH of 6 compared to a solution with a pH of 7)?

8. What is a **buffer**? Explain the necessity of the carbonic acid buffer system in human blood.

9. What is **acid precipitation** and how is it harmful to living organisms?

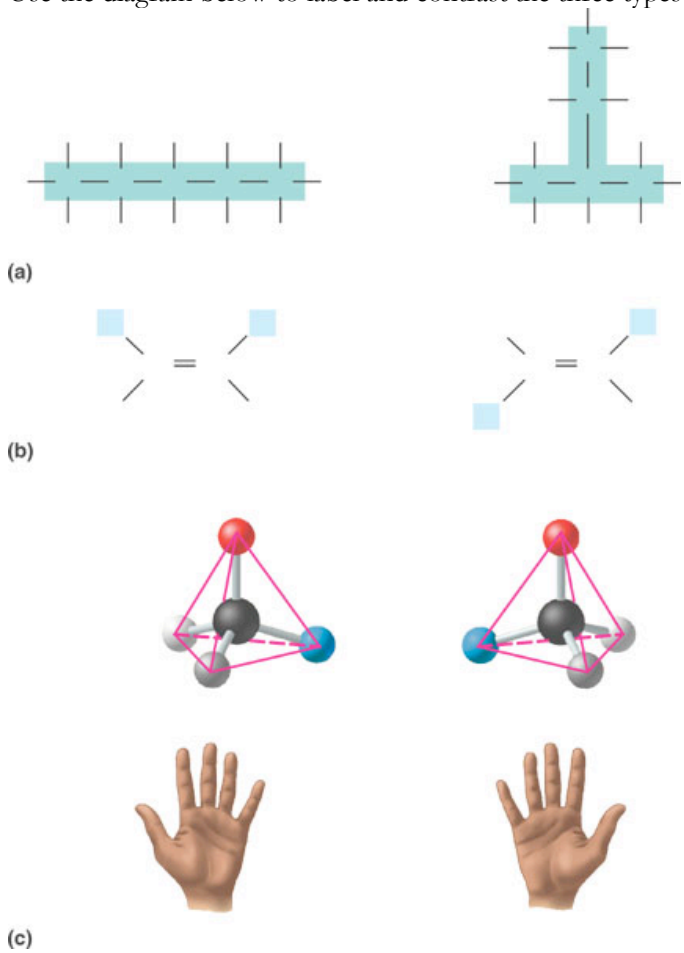
Chapter 4: Carbon and the Molecular Diversity of Life

1. Why is organic chemistry so important in the study of biology?

2. Explain how the ideas of **vitalism** and **mechanism** differ? Is either one correct?

3. What is special about carbon that makes it the central atom in the chemistry of life?

4. Use the diagram below to label and contrast the three types of isomers.



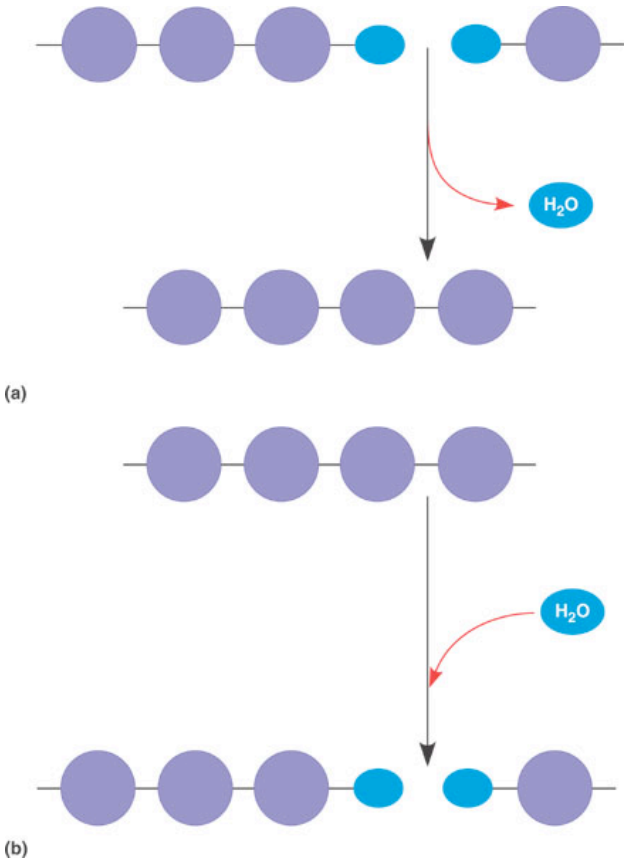
5. Create a table below: after each functional group – draw the structure, note the functional properties and answer the miscellaneous question.

Functional Group	*Structure*	*Functional Properties*	*Miscellaneous Question*
Hydroxyl			What common beverage (though not for you) features this functional group?
Carbonyl			What is the difference between a ketone and an aldehyde?
Carboxyl			Name one acid that features the carboxyl group:

Amino	Find a picture of an amino acid and draw it here:
Sulfhydryl	What type of biological molecule contains sulfur?
Phosphate	Phosphates are high in energy. Can you name a biological molecule that uses phosphates for energy?

Chapter 5: The Structure and Function of Macromolecules

1. Identify the **monomer, polymer, condensation reaction**, and **hydrolysis** in the diagram below.



2. What are the three hexose ("six carbon") **monosaccharides**?

3. What is a **glycosidic linkage** and what do the numbers 1-4 and 1-2 relate to?

4. Compare and contrast the two **storage polysaccharides**.

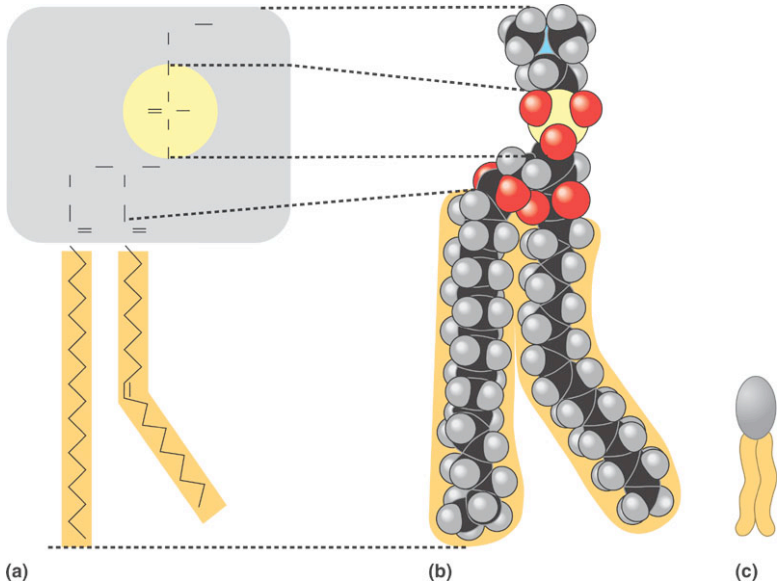
5. Compare and contrast the two **structural polysaccharides**.

6. Why are **lipids** grouped together?

7. What are the building blocks of fats?

8. Contrast **saturated** and **unsaturated** fats – how does their structure determine their function?

9. Label the molecule below.

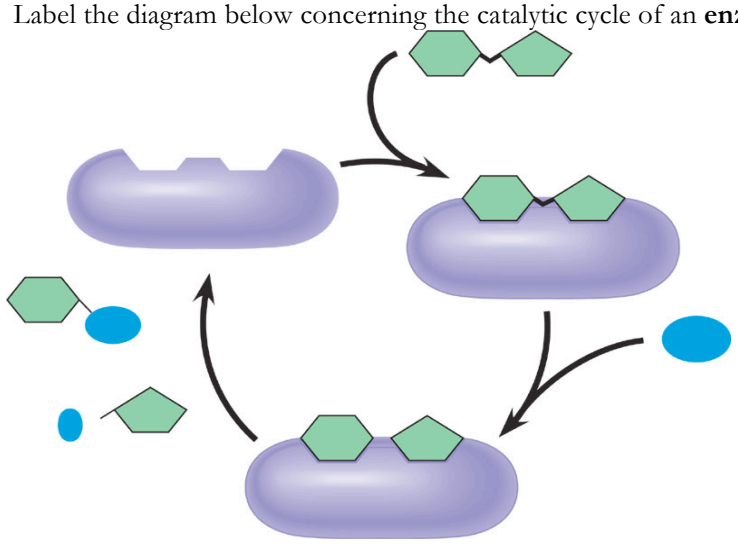


10. How would you recognize a basic **steroid** molecule?

11. List at least five functions of **proteins**:

12. What are the names for the monomers and polymers of proteins? Why do they have these names?

13. Label the diagram below concerning the catalytic cycle of an **enzyme**:



14. Draw two **amino acids** – note the **amino group**, the **carboxyl group** and the **alpha carbon**, circle the **water molecule** to be removed and then note the **peptide bond** formed when the two are joined.

15. Explain what determines the four levels of protein structure –
    a. Primary

    b. Secondary

    c. Tertiary

    d. Quaternary

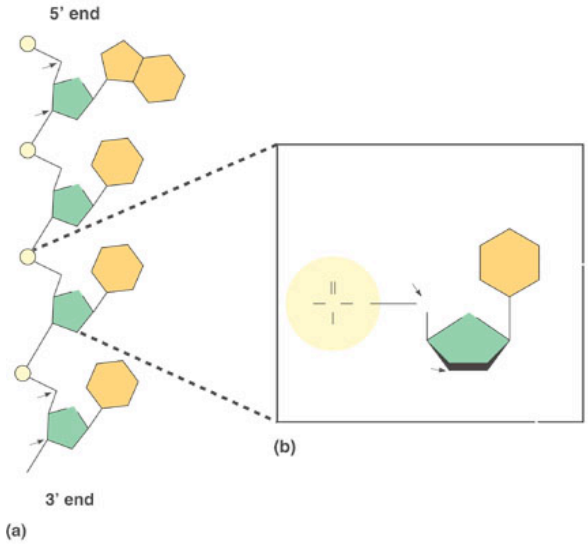
16. How does the characteristics of an amino acid – nonpolar, polar, acidic or basic relate to the tertiary and quaternary structure of a protein?

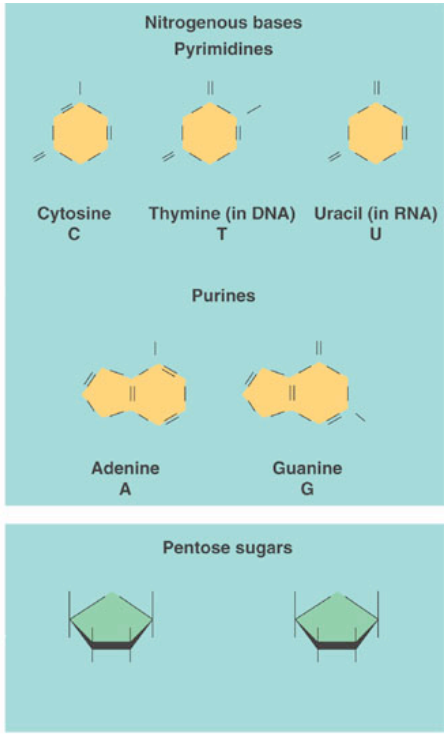
17. Why is **denaturation** important and how is it caused?

18. BRIEFLY Describe the technique of **x-ray crystallography**.

19. What is the role of **nucleic acids** in biological systems?

20. Label the blank diagram below:





(c)

21. BRIEFLY explain how the structure of **DNA** allows it to be copied.