

Dear future AP Biology student:

Congrats! You have chosen AP Biology for the next school year at Eastlake High School. AP Biology is an intensive and interesting course as it provides real-world examples and synthesizes the concepts you have been introduced to in your previous Biology and Chemistry classes. If you love learning about the world around you in terms of how biological systems interact, you are in the right place.

Upon successful completion of AP Biology, you will have covered content that is equivalent to the first *year* of college majors Biology; both lecture and lab credits can apply, depending on the college. The course moves at a fast pace, and you should expect to spend between 4+ hours *outside of class* working on AP Biology every week (note that this doesn't mean AT HOME time, it could Wolf Times). Being on time, present, and prepared for class will also be critical to your success. To be successful, you must be willing to learn independently and advocate for yourself if you do not understand something.

Some tips that may help you are reviewing material daily, completing homework when it is ASSIGNED (not when you get around to it), forming a study group (hint!!), and seeking teacher assistance during office hours and Wolf Times (yea! They are back!!). These habits will serve you well in class and in your future when you move on to the university-level, post-secondary education, or the work force.

For the summer assignment for AP Biology 2026 – 2027, you need to recall knowledge from your previous Biology and Chemistry classes and will add new content to complete this work. **On the first day of school in the Fall, you must bring in a complete packet. The work will be checked in as an assignment, and a key will be available. It is on you to do this work and understand it as we will not be covering this material directly in class due to time constraints. But you will be responsible for it in assessments.**

To make the most of this packet and start the semester off right, follow the instructions on the pages. Do not try to finish immediately after school ends for the summer, the topics should be fresh in your mind for the Fall! Do not attempt to do it the night before the first day of classes, you will find yourself buried in Bio! Start work in early August so that you can decide where you need a refresher or relearn this content.

Looking forward to seeing you all in September,

Mr. Cervený

Instructions:

1. **TODAY:** Save this document to a place where you will be able to access it. No, really! Do this NOW! Before you forget! Did you do it?
 2. **TODAY:** Please check that the textbook link works from whatever computer you plan on working from. It should, but let's not take any chances! You can download a free copy of it if you'd like, but avoid printing it, it's huge.
 3. **Early August:** Begin working your way through this packet. You may already know how to do a lot of this, which is great! For anything you don't know, use the resources listed. **You can complete this assignment digitally or print it out and complete it by hand. Either way, you need to bring A PRINTED COMPLETED COPY with you on the first day of class!**
 4. **You can expect some sort of assessment covering parts 1 – 5 during the first week of class.**
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Resources:

Openstax Biology for AP Courses:

<https://openstax.org/details/books/biology-ap-courses?Book%20details>

- Yes, you'll get a textbook in the Fall, but it isn't Fall yet. So, this book should help.
- Most of what you will want is in Chapters 1 – 3. We'll start with the structural aspects of macromolecules discussed in Chapter 3 at the start of the course.

Videos: there are so many available, from the Amoeba sisters (yay) to Khan Academy (snooze). Find a system that works for YOU.

AP Biology Study Guide: Again, there are many of these. **Get one this summer.** See if a previous AP Biology student can bear to part with theirs or can recommend which to get. They all look the same to me. The sooner you get one of these the better.

A Glossary of the Meaning of Key Command Words

As you go through this packet, you will notice some words in bold. These are prompt command terms. You must know what each means so that you can properly answer prompts on assessments.

Explain... This command word may require a definition but will also require development of the point or points being asked. You therefore need to give a little detail about the term or issue being questioned. Look at the remainder of the question to make a judgement about how much detail to give and where the detail needs to be focused. If the question asks you to explain TWO factors or ONE factor, make sure you do as you are asked - give two factors or one but not more than that asked for!

Discuss... This is a higher order command word. You would be expected to put both sides of a case or an issue/argument in your answer and to make some evaluative comment about the factors you are discussing.

Assess..., To what extent..., How far... All these are evaluation command words. Here you are expected to present judgements of the factors you raise - are they significant? How important are they? Why are they important or significant? In many cases you will have to consider the **'it depends'** clause. What this means is that you need to consider that your answer may depend on a range of factors that the context might be able to

give you. For example, if you are asked to consider the extent of the impact on a company from a rise in interest rates the answer will depend on **how big** the rise in the rates is - if it is only a $\frac{1}{4}\%$, then perhaps the effect will only be tiny. It might also depend on the number of loans the company has - if it only has a gearing ratio of 10% then a rise in the interest rate may only have a minor effect, if it has a gearing ratio of 65% then the impact would be much more severe. Not enough students consider this 'it depends' factor in their answers!

Examine... Another higher order command word. You will be expected to do some analysis and to make some judgements about the points you are examining. There will be an element of analysis inherent in such an answer and some evaluative comments. You are seeking to develop the points you raise and may be expected to offer balance in your answer. 'Examine' implies some detail, some reflection on the point or issue or some scrutiny of the matter in hand.

Describe... Tell a story. A description suggests that you convey a mental image or give an account of something. This tends to be a lower order skill. For example, you may be asked to describe the trends in a graph or a piece of data. In such a case you would have to convey to the reader what is happening in the data - is the variable rising or falling or is it static? If it is rising or falling, how quickly is it rising or falling, etc.

Consider... Another higher order command word. You would be expected to offer some detail about an issue, event or whatever and to deliberate about the value of that issue/event. If you are asked to 'consider the impact of...', then you would need to describe what the impact was and then to say what effect it had - this involves the **'it depends'** rule again. The significance of the impact will depend upon...

Why... Offer some reasons, factors, causes as to some occurrence, action or event. Why did the managing director decide to introduce the new shift pattern? You would be expected to give the reasons for his or her decision - to improve productivity, to improve production, to meet new demand, etc.

Compare... Point out the similarities and the differences between two or more factors.

Contrast... Point out the differences only between two factors/issues, etc.

Identify..., Give... A lower order skill requires you to pick out some key factors and name them.

Demonstrate..., Show... To describe or illustrate how some relationship or event has occurred.

Outline... A knowledge-based skill, requiring the identification of a point and some brief development as opposed to 'explain' which requires more detail.

Suggest... Make a judgement and give some support or reason for your suggestion.

Calculate... Work out a numerical question, always show how you have worked out your answer and give **appropriate formulas** in your answer. Don't take short cuts with these questions - you can miss marks as a result!

Evaluate... Again, this involves making judgements. In so doing, you might be expected to distinguish between fact and opinion. Look at the extract or evidence you are given and make some judgements about who is saying what, when, where and to who - this might make a difference to your answer. Often a useful way of helping to arrive at a judgement!

Comment... This requires you to give a judgement on an issue by considering the issues relevant to it.

Molecules of Life

1. Chemical Foundation of Life (chapter 2.1)

Answer the following questions as you go through the chapter:

A form of matter that cannot be broken down into smaller substances is an:

Use the table below to organize the 6 elements common to all living organisms. You can use a periodic table if needed. These are the elements you need to know inside and out.

Element	Carbon	Hydrogen	Oxygen	Nitrogen	Phosphorus	Sulfur
Symbol						
Atomic Number						
# electrons (neutral)						
# electrons in outermost energy level						
Max # of bonds						

Describe how isotopes of an element differ, and how they are similar. Why would it be useful in biology to use isotopes? How does the presence of isotopes affect the mass number of an element?

Bonding:

Complete the following table

Bond	Description of bond	Types of bond (if applicable)	Examples
Ionic			
Covalent			
Hydrogen			

2. Properties of Water (chapter 2.2)**Learning Target(s):**

Explain how the properties of water that result from its polarity and hydrogen bonding affect its biological function.

Water's polar nature is a result of its:

Draw a series of water molecules. Using dashed lines, indicate the hydrogen bonds between them. How many hydrogen bonds can one molecule of water form? Indicate on one of them which atoms have a positive charge, and which have a negative charge.

A substance that dissolves in water is called _____

Two examples of this type of substance are _____

A nonpolar substance is referred to as _____

List two examples of nonpolar substances _____

When water freezes, it becomes more/less dense than liquid water. (circle one)

Why is it important to life that ice floats?

Why would it be bad for living tissue to freeze?

Ice on a lake is the classic example of frozen water's insulative properties. **Describe** another example of this, not involving ice on a lake. (hint: what is another form of frozen water?)

What is meant by a substance's "specific heat"

Does water have a high or low specific heat? How does this impact life?

Based on the specific heat of water and what you know about how heat moves, **propose** an explanation why coastal regions (like the part of Seattle where Cerveny lives) tend to have more moderate environments than inland areas (like Sammamish).

Heat of vaporization refers to the amount of energy needed to change liquid water into a:

When water molecules escape from the surface of water and vaporize it is called:

Why is this property of water important to life?

Explain why water is considered the universal solvent. Give examples of important molecules that are easily dissolved in water.

Define the term “surface tension”:

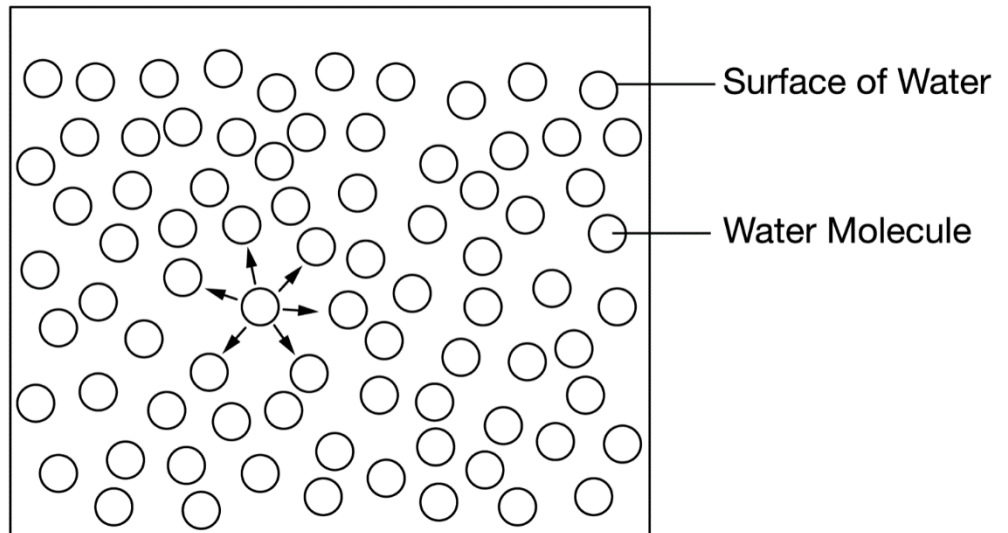
Compare and contrast the terms adhesion & cohesion:

Give examples showing why these forces are important for life:

Based on your life experience. Is the glass that makes up the windshield of your car polar or nonpolar. **Explain** your reasoning.

Many outdoor clothes have a fabric called Gore-Tex in them. This material is used to keep moisture from passing through the garment and get the deeper layers wet. To do this, the material has very small holes in it which enable it to do its job. Using your knowledge of cohesion, adhesion, and evaporation, **propose a reason** why Gore-Tex works.

To explain surface tension, use a single water molecule in the figure to the right and **draw** arrows representing the possible locations of hydrogen bonds formed by this molecule. The possible hydrogen bonds formed by a water molecule below the surface are shown.



3. Acids/Bases, Buffers, and pH

Define what an acid is:

Define what a base is:

Define what a buffer is and why they are important to biological systems:

The pH scale is measured from 1 – 14.

- **Explain** what is being measured in with the pH scale.
- **Explain** where on the pH scale you would expect to find the pH of acids, bases, and pure water.

4. Organic Chemistry (chapter 2.3)

Learning Target(s):

Describe the composition of macromolecules required by living organisms

The fundamental substance in all biomolecules is:

What is the property of carbon that makes it ideal as a structural component?

What is a hydrocarbon and what are some examples of this in our daily lives?

Draw carbon – carbon bonds showing the following types of bonds:

Single

Double

Triple

Which of these bonds would store the most energy?

Functional Groups:

You **must** be able to recognize different functional groups in figures and be able to explain and apply their chemistry to answering biological questions. This is one of those times that you must memorize the information.

Use the table below to organize the functional groups.

	Structure	Properties	Examples
Hydroxyl			
Carbonyl			
Carboxyl			
Amino			
Sulfhydryl			
Phosphate			
Methyl			

5. Biological Macromolecules (Chapter 3)

Learning Targets

- a. **Describe** the properties of the monomers and the type of bonds that connect the monomers in biological macromolecules
- b. **Explain** how a change in the subunits of a polymer may lead to changes in structure or function of the macromolecule
- c. **Describe** the structural similarities and differences between DNA & RNA

Define the terms monomer and polymer:

What happens during dehydration synthesis? Draw an example reaction using letters A, B etc.

What happens during a hydrolysis reaction? Draw a example reaction using letters A, B etc.

Biological Macromolecules

Complete the following table:

Type of Macromolecule	Elements present	Monomer	Polymer	Properties	Examples

Carbohydrates:

- What is the ratio of carbon to hydrogen in a carbohydrate?
- **List** the two major functions carbohydrates play in living organisms.
- What monosaccharide is used for energy by living organisms?
 - a. How is this monosaccharide stored in plants?
 - b. How is this monosaccharide stored in animals?
- What two monosaccharides are found in sucrose?
- If you wanted to make a disaccharide from 2 monosaccharides, what sort of reaction would you use? What would be your products?
- If you synthesize a polymer of monosaccharides 50 residues long, how many of the side products from the above question would you create?
- What are plants cell walls made of?
- What is the carbohydrate that makes up the exoskeletons of crustaceans and insects? What is unique about this carbohydrate?
- What is the main carbohydrate that makes up the cell walls of bacteria? How is it different from other carbohydrates?

Lipids

- What are the main functions of lipids in living organisms?
- What are the two main components of a fat molecule?
- Fatty acids that contain only single bonds are called _____ while those with double bonds are called _____. What forms do these two lipids take when kept at room temperature?
- Besides fatty acids, what are the other types of lipids found in living organisms?

Proteins

What is the subunit of a protein?

Draw a picture of a generic amino acid. Label the amino group, carboxyl group, R group and central carbon. (inserting a picture from the internet does not work here)

What is the bond that forms between two amino acids in a protein? **Identify** what type of bond it is (ionic, metallic, etc). **Explain** how this bond contributes to the overall direction of a protein's sequence

Provide functions and examples of each type of protein listed in the table below:

Type	Function	Example
Enzymes		
Transport		
Structure		
Storage		
Defense		
Motor/Contraction		
Hormones		

Nucleic Acids

What role do nucleic acids play in living organisms?

Describe the three structural components of a nucleotide.

Compare DNA & RNA in the table below:

Characteristics	DNA	RNA
Bases used		
Composition of a generic nucleotide		
Strand description		
Role in a cell		
Location in prokaryotic cells		
Location in eukaryotic cells		

Explain how DNA, RNA, and protein are linked to one another.

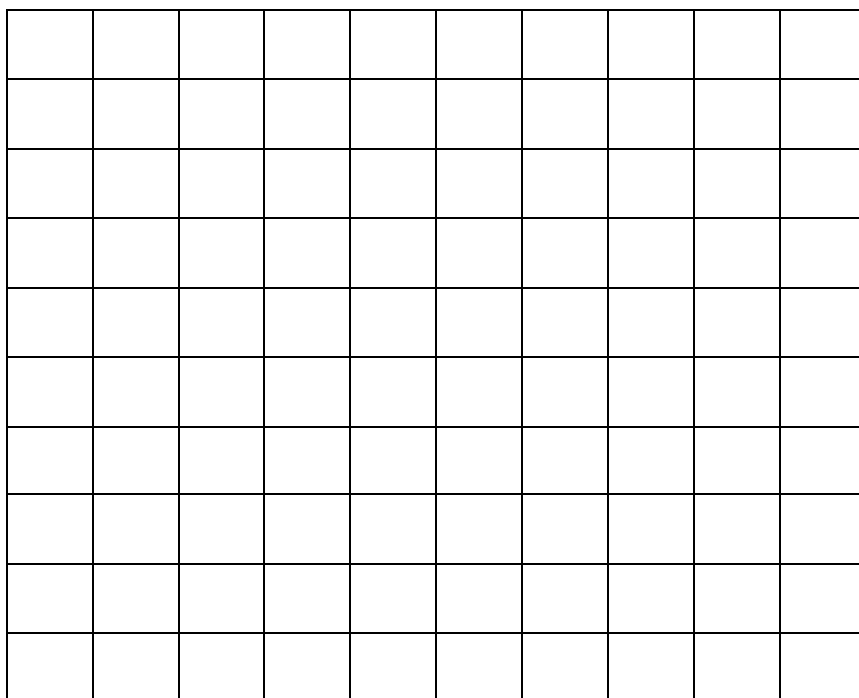
Scientific Practices Review

Read the problem below and then graph the data. Remember that a good graph includes a title, axis labels and units, as well as an appropriate scale, and a caption. Make sure to take up the whole graphing area!

Festus is being tested for lactose intolerance. His blood is drawn and circulating glucose is measured over time. The normal range for blood glucose is 70-110 mg/dL. The normal range for blood pH is 7.35-7.45. If he can digest lactose, his blood glucose should rise and decrease. In a normal response the islet cells in his pancreas will detect the elevated concentration of glucose and release insulin to travel through his body and direct cells such as those in his liver to produce more glucose transporters and remove the excess glucose from the blood. If this happens, blood glucose concentrations should decrease with time.

Using the data in the table below, create a graph using the grid below. Do not just insert an Excel or other computer-generated graph. You may be expected to properly draw a graph on the AP Biology exam.

Time	Blood Glucose (mg/dL)
0 minutes	96
15 minutes	105
30 minutes	146
45 minutes	143
60 minutes	98



Using the information given in the scenario, the table and your graph above answer the following questions. Be sure to focus on the **bold type** words as these are the response prompts.

1. **Identify** the type of feedback being shown in this scenario and why you decided on this type of feedback.
2. **Identify** the independent and dependent variables for this test
Independent =
Dependent =
Controlled variable(s) [those you DON'T change] =
3. **Describe** the trend of blood glucose concentration seen during the duration of the test.
4. **Calculate** the rate of increase in Festus' blood glucose concentration between time 0 & 30 minutes.
Show your work.
5. If Festus has Type I diabetes (he is unable to produce insulin), **predict** what the blood glucose response would look like. **Justify** your answer using information given in the scenario.