AP Biology – Fall 2019 Edward R. Murrow High School
Exam 2 Review Sheet Mr. Sprague

Format:

Section I 24 multiple choice questions
Section II 1 essay question and 2 short free response questions

Reading: Hillis chapters 2 and 3 (and all previous readings)

Concepts to Review:

- EVERYTHING FROM EXAM 1

- Chemistry
  - Understand the defining characteristics of *hydrogen bonds* and *hydrophilic/hydrophobic interactions*.
  - Know the difference between *endergonic* and *exergonic* chemical reactions, and be able to give examples.
  - Be able to interpret a model showing free energy changes over the course of a chemical reaction.
  - Be able to explain how *condensation (dehydration synthesis) reactions* and *hydrolysis reactions* build up or break down molecules.

- Biological Macromolecules
  - Know the monomers, polymers, and functions of *carbohydrates*, *lipids*, *nucleic acids*, and *proteins*.
  - Be able to recognize diagrams of *monosaccharides*, *fatty acids*, *glycerol*, *nucleotides*, and *amino acids*.
  - Be able to describe the factors that influence the primary, secondary, tertiary, and quaternary levels of protein structure.

- Enzymes
  - Be able to explain the way that an enzyme works, including the roles of *substrates*, *coenzymes*, *activators*, *inhibitors*, *kinases*, and *allosteric regulators*.
  - Be able to explain how environmental factors (temperature, pH, salinity, enzyme/substrate concentration) affect enzyme activity.

- Labs
  - Understand the term *model*.
  - Be able to write a hypothesis and identify the *independent variable*, *dependent variable*, *control group*, *experimental group*, and *constants* (see Elements to Consider when Designing a Controlled Experiment handout).
  - Understand why large sample sizes, multiple trials, and statistical analyzes are used to verify results.
  - Be able to graph data appropriately and add 95% confidence intervals to a graph.
  - Be prepared to discuss the following labs: *Enzyme Catalysis* and *Toothpickase*.
  - Be able to explain how and why the rate of enzyme activity changes over time.
  - Be able to calculate the rate of a chemical reaction using the slope formula (dy/dx or dY/dt).

Overarching Questions to Consider:

Suggestion: Answer all of these questions in writing, then compare answers with a classmate. I promise that taking the time to do so will be well worth it and much more useful then memorizing facts and definitions.

1. Why does Mr. Sprague feel that the term *hydrogen bond* is misleading?
2. Why does it matter for a cell whether a vital chemical reaction is endergonic or exergonic?
3. Why do cells require enzymes? If an enzyme does not change a chemical reaction, how does it make the reaction go faster?
4. Why do different amino acids have different properties? Why does changing the primary structure of a protein result in changes to the secondary, tertiary, and quaternary levels too?

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5. Why does altering the temperature or pH cause an enzyme to denature? Why is a denatured protein unable to function?
6. Why does the rate of an enzyme-mediated reaction increase at first, then level off as you add more substrate?
7. How are the time of a reaction, the amount of substrate used, the amount of product formed, and the reaction rate related?
8. How does DNA control cell activities and give you your unique characteristics?

Practice Exam Questions:

Visit the course website and click on the "Multiple Choice Practice" link. Complete all practice questions for the relevant chapters and check your work against the answer key. Note: these items are password protected.

Practice multiple choice and partial versions of free response questions are also available through the College Board by logging into AP Central with the class code.

Essay Question Sneak Peak:

Read each question carefully and completely. Answers must be written out in paragraph form. Outlines, bulleted lists, or diagrams alone are not acceptable.

1. An experiment was conducted to measure the reaction rate of the human salivary enzyme α-amylase. Ten mL of a concentrated starch solution and 1.0 mL of α-amylase solution were placed in a test tube. The test tube was inverted several times to mix the solution and then incubated at 25°C. The amount of product (maltose) present was measured every 10 minutes for an hour. The experiment was repeated five times and the resulting means and 2 standard errors of the mean are provided in Table 1. As a negative control treatment, the experiment was run with no α-amylase present.

TABLE 1. MALTOSE PRODUCTION AS A RESULT OF α-AMYLASE CATALYSIS

Time (minutes)	Mean Maltose Concentration (μM)	$2SE_{\bar{X}}$
0	0.0	0.0
10	5.1	1.2
20	8.6	1.2
30	10.4	1.0
40	11.1	1.0
50	11.4	0.8
60	11.5	0.8

(a) **Explain** why α-amylase is capable of catalyzing the hydrolysis of starch but not capable of catalyzing the hydrolysis of protein.

(b) On the axes provided, **construct** an appropriately labeled graph to illustrate the mean maltose concentration over time. **Explain** how the expected results from the negative control treatment would demonstrate that α-amylase catalyzes the hydrolysis of starch into maltose.

(c) **Calculate** the rate of the reaction in $\frac{\mu\text{M}}{\text{minute}}$ for the time period 0 to 30 minutes. **Describe** how the reaction rate changed after 30 minutes. **Provide reasoning** to connect this change to enzyme-substrate interactions.

(d) Researchers claim that each of the following changes will decrease the reaction rate.

- Adding a noncompetitive inhibitor to the mixture
- Decreasing the pH from 7.0 to 4.0

Provide reasoning to support the claims by connecting each factor to changes in the structure of the enzyme.