

Format:

- Section I      25 multiple choice questions  
Section II     4 short free response questions

Reading:      Hillis chapters 6 and 7 (and all previous readings)

Concepts to Review:

- EVERYTHING FROM EXAMS 1–3
- Energetics
  - Understand how and why exergonic and endergonic reactions are coupled in cells.
  - Be able to explain the purpose of *chemiosmosis*, how the process occurs, and the role of *ATP synthase*.
  - Be able to identify the roles of the following coenzymes: ADP/ATP, NAD<sup>+</sup>/NADH, FAD/FADH<sub>2</sub>, and NADP<sup>+</sup>/NADPH.
  - Be able to explain the terms *substrate-level phosphorylation*, *oxidative phosphorylation* and *photophosphorylation*.
- Respiration
  - Understand the differences between *anaerobic respiration* and *aerobic respiration*.
  - Be able to summarize the processes of cellular respiration (*glycolysis*, *pyruvate oxidation*, *Krebs cycle*, *electron transport chain*).
  - Be able to explain the role of oxygen (O<sub>2</sub>) in the electron transport chain of respiration.
  - Be able to explain the purpose of *fermentation* in anaerobic respiration.
  - Know the structure of a *mitochondrion* and where each step of respiration takes place.
- Photosynthesis
  - Be able to summarize the processes of photosynthesis (*light-dependent reactions* and *Calvin cycle*).
  - Be able to explain the role of water (H<sub>2</sub>O) in the light-dependent reactions of photosynthesis.
  - Know the structure of a *chloroplast* and where each step of photosynthesis takes place.
- Cell Cycle and Its Regulation
  - Know the stages of the *cell cycle* and what happens during each stage.
  - Be able to compare the processes of *mitosis* and *meiosis*.
  - Be able to explain the role of *cyclins* and *cyclin-dependent kinases* in cell cycle regulation.
  - Understand the terms *haploid* and *diploid* and the symbols *n* and *2n*.
  - Be able to compare plant and animal life cycles and understand the terms *alternation of generations*, *zygote*, *gamete*, and *spore*.
  - Be able to explain what *apoptosis* is, how it occurs in a eukaryotic cell, and why it is necessary.
  - Be able to explain how malfunctions in cell cycle regulation can lead to *cancer*.
- Labs
  - Be able to graph data, including labeling both axes with units.
  - Be prepared to discuss the following labs: *Cell Respiration*, *Chromatography*, *Spectrophotometry*, and *Timing the Cell Cycle*.
  - Be able to write a null hypothesis and use a chi-square test to accept or reject the null hypothesis.

## 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 than memorizing facts and definitions.\*\***

1. Why does it matter for a cell whether a vital chemical reaction is endergonic or exergonic?
2. How are the three methods of ATP synthesis we have explored—substrate-level phosphorylation, oxidative phosphorylation, and photophosphorylation—different?
3. How does each step in cell respiration (glycolysis, pyruvate oxidation, Krebs cycle, electron transport) contribute to the synthesis of ATP? How does each step in photosynthesis (electron transport, Calvin cycle) contribute to the synthesis of carbohydrates?
4. Why must oxygen be reduced during aerobic respiration? Why must water be oxidized during the light reactions of photosynthesis? What is the role of carbon dioxide in the Calvin cycle?
5. Why is glycolysis enough for prokaryotes to survive on, but not capable of sustaining most eukaryotes?
6. If the purpose of photosynthesis is to make carbohydrates, why must ATP be synthesized in the process?
7. Why is mitosis necessary in multicellular organisms?
8. How is the genetic make-up of a cell different in the G<sub>1</sub>, S, and G<sub>2</sub> phases of the cell cycle?
9. What are some conditions under which a cell might divide? What are some conditions under which a cell would not divide? How is the decision to divide or not divide regulated?
10. What are some evolutionary advantages of a cell cycle checkpoint system?
11. How does mitosis ensure that the number of chromosomes is conserved from parent cells to daughter cells?
12. Why does Mr. Sprague claim that cancer is like a case of natural selection among the cells of an individual?
13. How were we able to time the cell cycle without watching it proceed? Why does this technique work?
14. Why is meiosis necessary? Why does the creation of gametes require a different mechanism than the creation of other cells?
15. What events in mitosis and meiosis are similar? What events in mitosis and meiosis are different?
16. What is meant by “independent assortment” of chromosomes? How does this lead to genetic variation?
17. How does crossing over lead to genetic variation?
18. Why does an X-ray technician care more about protecting your gonads than your vital organs?
19. How is an alternation of generations life cycle different than a typical animal life cycle? What are the advantages of alternation of generations?

## 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.

## Free Response Question Hints:

Of the four short free response questions:

- Question 1 will assess your ability to analyze an experimental design and predict the results of the experiment.
- Question 2 will assess your ability to use biology concepts to predict the results of a disruption in a biological system.
- Question 3 will assess your ability to analyze and construct biological models.
- Question 4 will assess your ability to analyze data and construct a scientific argument.