

# Biology 12

## Cell Biology

# Study Guide

## DNA & Enzymes

### Vocabulary (2 Quizlet Sets on DPSS Biology 12)

#### 4.1 DNA Structure

- DNA (deoxyribonucleic acid)
- phenotype
- genotype
- nucleotide
  - phosphate
  - pentose sugar
  - nitrogenous base
    - purine
      - adenine
      - guanine
    - pyrimidine
      - thymine
      - cytosine
- double helix
- complementary base pairing
- antiparallel

#### 4.2 DNA Replication

- DNA replication
- semiconservative
- DNA helicase
- DNA polymerase
- leading strand
- lagging strand
- Okazaki fragments
- DNA ligase

#### 4.3 Gene Expression

- gene expression
- RNA (ribonucleic acid)
- uracil
- mRNA (messenger)
- rRNA (ribosomal)
- tRNA (transfer)
- transcription

- gene
- RNA polymerase
- promoter
- introns
- exons
- translation
- codon
- anticodon
- amino acid
- ribosomes
- polyribosomes
- initiation
- start codon
- elongation
- termination
- stop codon

#### 4.4 Gene Mutations & Cancer

- gene mutation
- mutagens
- transposons
- frameshift mutation
- point mutation

#### 4.5 DNA Cloning

- genome
- genetic engineering
- cloning
- gene cloning
- transgenic organisms
- recombinant DNA (rDNA)
- vector
- plasmids
- polymerase chain reaction
- gel electrophoresis
- DNA fingerprint

#### 4.6 Biotechnology

- genetically modified organisms (GMOs)
- biotechnology
- transgenic bacteria
- transgenic plants
- transgenic animals
- gene therapy

#### 5.1 Energy Transformations & Metabolism

- metabolism
- catabolism
- anabolism
- free energy
- exergonic reactions
- endergonic reactions
- ATP
- ADP

#### 5.2 Enzymes & Meta Pathways

- metabolic pathway
- enzyme
- substrate
- energy of activation ( $E_a$ )
- active site
- lock and key model
- induced fit model
- denatured
- enzyme inhibition
- non-competitive inhibitor
- competitive inhibitor
- cofactors
- heavy metals
- coenzymes
- vitamins

### Key Points

PLO B5 describe DNA replication

PLO B6 describe recombinant DNA

PLO B7 demonstrate an understanding of the process of protein synthesis

PLO B8 explain how mutations in DNA affect protein synthesis

PLO B11 analyze the roles of enzymes in biochemical reactions

## Potential Short Answer Test Questions *(may also choose from the written textbook review questions)*

### Chapter 4 (DNA)

1. What was the contribution of Hershey & Chase to our knowledge of genetic material?
2. What was the contribution of Watson & Crick to our knowledge of DNA?
3. Name the three subunits of DNA.
  - a. Draw a simplified diagram showing
    - i. which are found in the “backbone” and
    - ii. how complementary base pairing works (including number of bonds between matching base pairs)
4. Draw a diagram to show that DNA strands run antiparallel.
5. Explain why DNA replication is said to be “semi-conservative”.
6. Using the three types of DNA enzymes, describe the steps of DNA replication.
7. What is the difference between how the “leading” and “lagging” daughter strands are created during DNA replication?
8. Name (abbreviated and full) and differentiate between the three types of RNA.
9. What is the difference between transcription and translation? Refer to both the location and the function.
10. Describe the three steps of translation. Include the terms: start codon, anticodon and stop codon.
11. Given a segment of a gene from DNA, write out the mRNA codons, tRNA codons, and amino acid sequence.
12. Discuss why the genetic code is said to be degenerate. What is the advantage of this property?
13. Name the three possible causes of gene mutations.
14. Mutations can be caused by errors in replication, mutagens or transposons.
  - a. Why are errors in replication so rare?
  - b. Give specific examples of mutagens.
  - c. What is another name for transposons?
15. Distinguish between a point mutation and a frameshift mutation
16. Using a given DNA sequence, demonstrate
  - a. frameshift mutation
  - b. pointshift mutation
  - c. the completed amino acid sequence for each
17. Discuss two specific uses for genetic engineering.
18. List one beneficial use for each of: transgenic bacteria, plants, and animals.
19. Distinguish between a transgenic organism and a cloned organism.
20. What is the Human Genome Project? Explain its importance to humanity.

### Chapter 5 (Enzymes)

21. Give an example of a body process that is endergonic and one that is exergonic.
22. Explain whether an anabolic reaction is more likely to be exergonic or endergonic.
23. Use the template to show the effect of an enzyme on the energy of activation required for a reaction.
  - a. Include the terms: energy of reactant, energy of product, energy of activation (with enzyme), energy of activation (without enzyme)
24. What gives an enzyme the ability to be substrate specific?
25. Draw a diagram explaining the lock-and-key model of enzyme specificity.
  - b. Label the enzyme, active site, substrate, enzyme-substrate complex and products.
26. How does the induced fit model differ from the lock-and-key model?
27. Why is only a small amount of enzyme required in a reaction?
28. Name two things that will increase enzyme activity and two that will decrease enzyme activity. *Ensure all answers are unique and not just the reverse of another answer.*
29. Explain why denaturing an enzyme causes a change in its ability to act as a catalyst.
  - c. Name two things that could denature an enzyme
30. Describe the difference between non-competitive and competitive enzyme inhibitors. Give an example of each.
31. Why do low temperatures slow enzymatic activity?
32. During an experiment, it was discovered that increasing the amount of substrate did not speed up the reaction. Explain.
33. How does a cofactor differ from a coenzyme?
34. Where is the thyroid located and what element is needed to create thyroxine?
35. Discuss the effect of the thyroid hormones on metabolic rate

