

## GENERAL BIOLOGY I / REVIEW QUESTIONS

**NOTE:** This set of questions is just to help you concentrate on important topics you should know by the end of this course. This in **NO WAY** means that the final exam's content will be just from the questions in this list.

### Chapter 1 (Exploring Life)

1. Diagram the hierarchy of structural levels in biological organization from the simplest to the most complex level.
2. Distinguish between prokaryotic and eukaryotic cells.
3. Distinguish between positive and negative feedback.
4. What is homeostasis?
5. What are the three domains of life?
6. List and distinguish among the three kingdoms of multicellular eukaryotic life.
7. Distinguish between discovery science and hypothesis-based science.
8. Distinguish between quantitative and qualitative data.
9. Describe what is meant by a controlled experiment.

### Chapter 2 (The Chemical Context of Life)

10. Distinguish between an element and a compound.
11. Distinguish between each of the following pairs of terms:
  - a. neutron and proton.
  - b. atomic number and mass number
12. Explain how the atomic number and mass number of an atom can be used to determine the number of neutrons.
13. Explain how two isotopes of an element are similar. Explain how they are different.
14. Distinguish among **nonpolar covalent**, **polar covalent** and **ionic bonds**.
15. Distinguish between **hydrogen bonds** and **van der Waals interactions**.
16. Define the terms **energy**, **potential energy**, and **kinetic energy**.

### Chapter 3 (Water and the Fitness of the Environment)

17. With the use of a diagram or diagrams, explain why water molecules are:
  - a. polar
  - b. capable of hydrogen bonding with four neighboring water molecules
18. List four characteristics of water resulting from hydrogen bonding.
19. Define cohesion and adhesion.
20. Explain the following observations by referring to the properties of water:
  - a. Insects like water striders can walk on the surface of a pond without breaking the surface.
  - b. Ice floats on water.
  - c. Humans sweat to cool themselves on hot days.

21. Distinguish among a solute, a solvent, and a solution.
22. Distinguish between hydrophobic and hydrophilic substances.
23. Define **acid**, **base**, and **pH**.
24. Explain how acids and bases may directly or indirectly alter the hydrogen ion concentration of a solution.
25. Using the bicarbonate buffer system as an example, explain how buffers work.

#### **Chapter 4 (Carbon and the Molecular Diversity of Life)**

26. Explain how carbon's electron configuration accounts for its ability to form large, complex, and diverse organic molecules.
27. Describe the basic structure of a hydrocarbon and explain why these molecules are hydrophobic.
28. Distinguish among the three types of isomers: structural, geometric, and enantiomer.
29. Name the major functional groups found in organic molecules. Draw and describe the basic structure of each functional group.

#### **Chapter 5 (The Structure and Function of Macromolecules)**

30. List the four major classes of macromolecules.
31. Distinguish between monomers and polymers.
32. Distinguish between **condensation** and **hydrolysis** reactions.
33. Distinguish among monosaccharides, disaccharides, and polysaccharides.
34. Describe the building-block molecules, structure, and biological importance of fats and phospholipids.
35. Distinguish between saturated and unsaturated fatty acids.
36. Distinguish between a protein and a polypeptide.
37. List the four major components of an amino acid. Explain how amino acids may be grouped according to the physical and chemical properties of the R group.
38. Name two types of secondary protein structure. What type of chemical bonds stabilizes the secondary structure.
39. What types of chemical bonds stabilize the tertiary protein structure. These bonds are formed between **the R-groups of the amino acids OR the polypeptide backbone** (choose one answer).
40. List conditions under which proteins may be denatured.
41. List the major components of a nucleotide.
42. Distinguish between ribose and deoxyribose
43. List three basic structural differences between DNA and RNA.
44. What are the building blocks of each of the following macromolecules:
  - a. Carbohydrates.
  - b. Fats.
  - c. Proteins.
  - d. The nucleic acids DNA and RNA.

## **Chapter 6 (A Tour of the Cell)**

45. Describe magnification of a microscope.
46. Describe the structure and function of the nuclear envelope, including the role of the pore complex.
47. Explain how the nucleolus contributes to protein synthesis.
48. Describe the structure and function of a eukaryotic ribosome.
49. Distinguish between free and bound ribosomes in terms of location and function.
50. List the components of the endomembrane system, and describe the structure and functions of each component.
51. Compare the structure and functions of smooth and rough ER.
52. Describe the function of the lysosomes.
53. Name three different kinds of vacuoles, giving the function of each kind.
54. Briefly describe the energy conversions carried out by mitochondria and chloroplasts.
55. Describe the structure of a mitochondrion.
56. Describe the structure of a chloroplast.
57. Explain the roles of peroxisomes in eukaryotic cells.
58. Describe the functions of the cytoskeleton.
59. Explain how the ultrastructure of cilia and flagella relates to their functions.
60. Name the intercellular junctions found in plant and animal cells and list the function of each type of junction.

## **Chapter 7 (Membrane Structure and Function)**

61. Explain why phospholipids are amphipathic molecules.
62. Describe the fluidity of the components of a cell membrane and explain how membrane fluidity is influenced by temperature and membrane composition.
63. Distinguish between peripheral and integral membrane proteins.
64. List six major functions of membrane proteins.
65. Define diffusion, passive transport, and active transport.
66. Distinguish among hypertonic, hypotonic, and isotonic solutions.
67. Define osmosis and predict the direction of water movement based on differences in solute concentrations.
68. Describe how living cells with cell walls regulate water balance.
69. Distinguish among osmosis, simple diffusion, and facilitated diffusion.
70. Explain how large molecules are transported across a cell membrane.
71. Distinguish between exocytosis, phagocytosis, pinocytosis and receptor-mediated endocytosis.

## **Chapter 8 (An Introduction to Metabolism)**

72. Distinguish between catabolic and anabolic pathways in cellular metabolism.
73. Explain why an organism is considered an open system.
74. Explain the first and second laws of thermodynamics in your own words.

75. Distinguish between exergonic and endergonic reactions.
76. List the three main kinds of cellular work.
77. Describe the structure of ATP.
78. Explain how ATP performs cellular work.
79. Describe the function of enzymes in biological systems.
80. Explain how enzyme structure determines enzyme specificity.
81. Explain the induced-fit model of enzyme function.
82. What effects do the enzymes have on the activation energy of the reaction?
83. Explain how temperature, pH, and enzyme inhibitors can affect enzyme activity.

### **Chapter 9 (Cellular Respiration: Harvesting Chemical Energy)**

84. In general terms, distinguish between fermentation and cellular respiration.
85. Write the summary equation for cellular respiration.
86. Define *oxidation* and *reduction*.
87. Describe the role of  $\text{NAD}^+$  in cellular respiration.
88. In general terms, explain the role of the electron transport chain in cellular respiration.
89. Name the three stages of cellular respiration and state the region of the eukaryotic cell where each stage occurs.
90. What stages of cellular respiration make ATP by substrate-level phosphorylation.
91. List the products of the citric acid cycle. Explain why it is called a cycle.
92. Explain oxidative phosphorylation in general terms, that is, how the exergonic “slide” of electrons down the electron transport chain is coupled to the endergonic production of ATP by chemiosmosis.
93. Once NADH donates its electrons to the electron transport chain, what is the molecule that accepts these electrons at the end of this chain? *In other words, what is the final electron acceptor in the electron transport chain?*

### **Chapter 10 (Photosynthesis)**

94. Distinguish between autotrophic and heterotrophic nutrition.
95. Describe the structure of a chloroplast, listing all membranes and compartments.
96. Write a summary equation for photosynthesis.
97. Describe the two main stages of photosynthesis in general terms.
98. List the wavelengths of light that are most effective for photosynthesis.
99. Explain what happens when chlorophyll *a* in an intact chloroplast absorbs photons.

100. Describe the Calvin cycle in terms of what molecules get in and out of it.
101. Describe the relationship between the light reactions and the Calvin cycle.
102. Describe important photosynthetic adaptations that minimize photorespiration.

### **Chapter 12 (The Cell Cycle)**

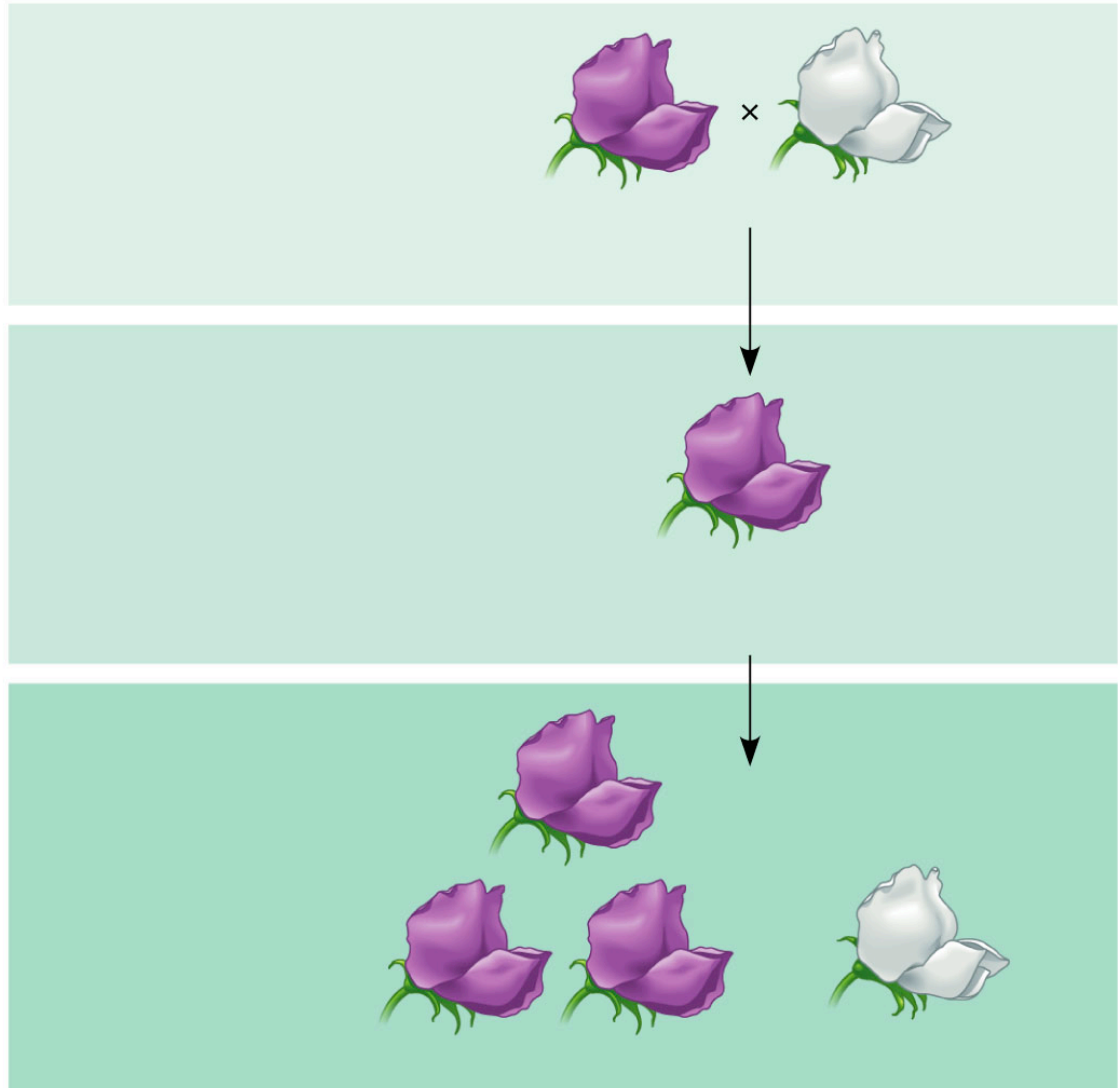
103. List the phases of the cell cycle and describe the sequence of events that occurs during each phase.
104. List the phases of mitosis and describe the events characteristic of each phase.
105. Recognize the phases of mitosis from diagrams and micrographs.
106. Draw or describe the spindle apparatus, including centrosomes, kinetochore microtubules, nonkinetochore microtubules, asters, and centrioles (in animal cells).
107. Compare cytokinesis in animals and in plants.
108. Distinguish among benign, malignant, and metastatic tumors.

### **Chapter 13 (Meiosis and Sexual Life Cycles)**

109. Explain in general terms how traits are transmitted from parents to offspring.
110. Distinguish between asexual and sexual reproduction.
111. Distinguish between the following pairs of terms:
  - a. somatic cell and gamete
  - b. autosome and sex chromosome
112. Explain how haploid and diploid cells differ from each other. State which cells in the human body are diploid and which are haploid.
113. Explain why fertilization and meiosis must alternate in all sexual life cycles.
114. List the phases of meiosis I and meiosis II and describe the events characteristic of each phase.
115. Recognize the phases of meiosis from diagrams or micrographs.
116. Describe the process of synapsis during prophase I and explain how genetic recombination (i.e. new genetic combination of the chromosomes) occurs.
117. Describe three events that occur during meiosis I but not during mitosis.
118. Explain how independent assortment, crossing over, and random fertilization contribute to genetic variation in sexually reproducing organisms.

## Chapter 14 (Mendel and the Gene Idea)

119. In Mendel's monohybrid cross of pea plants with different flower colors, use the following figure to:
- label the P, F1, and F2 generations.
  - Indicate the genotypes and phenotypes of the shown plants.
  - Indicate the ratio of purple to white flower colored plants in each of F1 and F2 generations.



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120. What is the difference between:
- An allele and a gene
  - Homozygous and heterozygous individual for a particular gene.
  - An organism's phenotype and genotype.
  - Monohybrid and dihybrid crosses.
  - Complete dominance, incomplete dominance, and codominance.
  - The law of segregation and the law of independent assortment.

121. a. What is a testcross?  
b. What is the purpose of a testcross?
122. Define and give an example of:  
a. Multiple alleles.  
b. Pleiotropy.  
c. Polygenic inheritance.  
d. Dominantly inherited disorder.  
e. Recessively inherited disorder.

### **Chapter 15 (The Chromosomal Basis of Inheritance)**

123. What is the relationship between chromosomes, genes, and DNA.  
124. What are linked genes?  
125. What is a recombinant chromosome?  
126. What is the Barr body?  
127. How does nondisjunction work?  
128. What is aneuploidy?  
129. What are the alterations that might happen to a chromosomal structure?

### **Chapter 16 (The Molecular Basis of Inheritance)**

130. The DNA double helix has a uniform diameter because \_\_\_\_\_, which have two rings, always pair with \_\_\_\_\_, which have one ring.  
A) purines; pyrimidines  
B) pyrimidines; purines  
C) deoxyribose sugars; ribose sugars  
D) ribose sugars; deoxyribose sugars  
E) nucleotides; nucleoside triphosphates
131. What kind of chemical bond is found between paired bases of the DNA double helix?  
A) hydrogen  
B) ionic  
C) covalent  
D) sulfhydryl  
E) phosphate
132. Which of these is always *true with regard to a DNA double helix*?  
**A)** The amount of adenine is equal to the amount of uracil, and the amount of guanine is equal to the amount of cytosine.  
**B)** The amount of adenine is equal to the amount of thymine, and the amount of

guanine is equal to the amount of uracil.

- C)** The amount of adenine is equal to the amount of guanine, and the amount of thymine is equal to the amount of cytosine.
- D)** The amount of adenine is equal to the amount of cytosine, and the amount of guanine is equal to the amount of thymine.
- E)** The amount of adenine is equal to the amount of thymine, and the amount of guanine is equal to the amount of cytosine.



133. The monomers of DNA and RNA are

- A) amino acids.
- B) monosaccharides.
- C) nucleotides.
- D) fatty acids.
- E) nucleic acids.

134. Which of these is a difference between a DNA and an RNA molecule?

- A)** DNA contains uracil, whereas RNA contains thymine.
- B)** DNA is a polymer composed of nucleotides, whereas RNA is a polymer composed of nucleic acids.
- C)** DNA is double-stranded, whereas RNA is single-stranded.
- D)** DNA contains five-carbon sugars, whereas RNA contains six-carbon sugars.
- E)** DNA contains nitrogenous bases, whereas RNA contains phosphate groups.

135. The strands that make up DNA are antiparallel. This means that

\_\_\_\_\_

136. Refer to the following list of enzymes and proteins to answer the following questions. The answers may be used once, more than once, or not at all.

- A. helicase
- B. nuclease
- C. ligase
- D. DNA polymerase I
- E. primase
- F. single strand binding proteins

137. separates the DNA strands during replication \_\_\_\_\_

138. covalently connects segments of DNA \_\_\_\_\_

139. synthesizes short segments of RNA \_\_\_\_\_

140. DNA-cutting enzymes used in the repair of DNA damage \_\_\_\_\_

141. removes the RNA nucleotides from the primer and adds equivalent DNA nucleotides to the 3' end of Okazaki fragments \_\_\_\_\_

142. catalyzes the elongation of a DNA strand in the 5' → 3' direction by adding new nucleotides to the 3' end \_\_\_\_\_

143. help to hold the DNA strands apart while they are being replicated \_\_\_\_\_

144. The leading and the lagging strands differ in that:

- A)** the leading strand is synthesized in the same direction as the movement of the replication fork, and the lagging strand is synthesized in the opposite direction.
- B)** the leading strand is synthesized by adding nucleotides to the 3' end of the growing strand, and the lagging strand is synthesized by adding nucleotides to the 5' end.

**C)** the leading strand is synthesized continuously, whereas the lagging strand is synthesized in short fragments called **Okazaki Fragments** that are ultimately stitched together.

**D)** both A and B

**E)** both A and C

145. We would expect that a 15-nucleotide sequence will direct the production of a polypeptide that consists of

A) 2 amino acids.

D) 3 amino acids.

B) 5 amino acids.

E) 7 amino acids.

C) 15 amino acids.

146. Which one of the following is *not* a function of tRNA?
- A) joining to only one specific type of amino acid
  - B) recognizing the appropriate codons in mRNA
  - C) transferring nucleotides to rRNA
  - D) helping to translate codons into amino acids
  - E) All of the choices are functions of tRNA.

### Chapter 17 (From Gene to Protein)

147. a. What is a nucleotide?  
b. What are its components?
148. What is gene expression?
149. What are the two major stages of gene expression?
150. What is the one-gene one-polypeptide hypothesis?
151. What is the chain of command (i.e. the flow of information) to make a polypeptide (protein) from DNA?
152. What is transcription?
153. a. What are the nucleotide bases in DNA? \_\_\_\_\_
154. How many types of amino acids are used to make proteins? \_\_\_\_\_
155. How many DNA nucleotides make an order for one amino acid? \_\_\_\_\_
156. a. How many mRNA nucleotides are translated into one amino acid? \_\_\_\_  
b. What do you call this triplet of nucleotides? \_\_\_\_\_
157. When RNA is being made, the RNA base **A, U, C, OR G** (CHOOSE ONE) always pairs with the base adenine (A) in DNA.
158. What is the first phase of transcription called? \_\_\_\_\_
159. What is the name of the DNA sequence where RNA polymerase attaches to initiate transcription? \_\_\_\_\_
160. What is translation?
161. Where does translation take place in the cell? In the \_\_\_\_\_
162. What type of RNA transfers the amino acids to the ribosomes? \_\_\_\_\_
163. Complete this sentence: The codon is a part of (m- or t-) RNA, while the anticodon is a part of (m- or t-) RNA.
164. How many subunits a ribosome has? \_\_\_\_\_
165. What are the three stages of translation?
166. When does termination of translation take place?
167. What is a mutation?
168. What is point mutation?
169. What are the possible consequences of a point mutation?
170. What are the two general categories of point mutation?  
a. \_\_\_\_\_  
b. \_\_\_\_\_
171. What is a base-pair substitution mutation?

