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Office Hours: 10:00 a.m. – 2:00 p.m.

## Pre-AP Biology

### Learning Packet Overview

The attached review packet is broken down by unit. It is recommended that students spend approximately 30 minutes each ensure they have strong foundational knowledge of the material.

Within the learning packet the following can be found:
- Old vocabulary words/definitions
- Recall questions organized by unit
- Practice quizzes

The following will be available via Google Classroom as well:
- Previous PowerPoints from beginning of the year up until the most recent unit
- Link to a quizlet to study vocabulary
- **BONUS** - 2 ACT Science passages and their answer keys

Biology is a recall heavy subject. It is recommended that students spend a minimum of 30-45 minutes a day reviewing materials within the packet.

### Necessary Materials

- Notes from class
- Vocabulary flashcards

### Suggested Materials

- Previous class handouts
- Previous exit tickets

<table>
<thead>
<tr>
<th>How students will be successful in Pre-AP Biology</th>
<th>How caregivers can help students be successful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students will be successful if:</td>
<td>Caregivers can help students be successful by:</td>
</tr>
<tr>
<td>• They spend 10 minutes a day reviewing all relevant vocabulary</td>
<td>• Quiz students on previous vocabulary words and recall questions.</td>
</tr>
<tr>
<td>• Can answer 70% of recall questions without the use of notes/internet</td>
<td>• Encourage students to complete each practice tests using the four round process of:</td>
</tr>
<tr>
<td>• Attains 70% mastery on all practice quizzes</td>
<td>o Round 1 – Without notes</td>
</tr>
<tr>
<td></td>
<td>o Round 2 – With notes</td>
</tr>
<tr>
<td></td>
<td>o Round 3 – Use answer key to check your work</td>
</tr>
<tr>
<td></td>
<td>o Round 4 – Ask yourself the question “Why did I get this wrong? What do I need to remember next time?”</td>
</tr>
<tr>
<td></td>
<td>• Encourage students to take Practice ACT Science passages (under the allotted time of 35 minutes). These will be added to Google Classroom on Tuesday 3/24.</td>
</tr>
</tbody>
</table>
**Structure of the Packet:**

The packet below is separated by units. Within each unit, the following structure is used:

1. Unit Vocabulary
2. Recall questions
3. Practice Quiz

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1- Ecology</td>
<td>3-12</td>
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<tr>
<td>Unit 2- Chemistry of Life</td>
<td>13-21</td>
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<tr>
<td>Unit 3- Homeostasis</td>
<td>22-28</td>
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<tr>
<td>Unit 4- DNA, RNA, and Proteins</td>
<td>29-35</td>
</tr>
<tr>
<td>Unit 5- Heredity</td>
<td>36-41</td>
</tr>
<tr>
<td>Answer Key for Practice Quizzes</td>
<td>42</td>
</tr>
</tbody>
</table>

**Additional Resources will be posted on Google Classroom no later than Tuesday 3/24:**

- Quizlet posted on Google Classroom – use it! Make it a competition between friends!
- All PowerPoints from the start of the school year
- Ask Ms. Thompson – if you’re struggling with a topic, reach out and ask me for help!
### Vocabulary Word | Definition
--- | ---
Living | Organisms that make their own food through photosynthesis (or chemosynthesis)
Non-living | Feed on other organisms (obtain energy from others)
A category of consumers that are important for returning organic matter back to the soil so plants can re-use it
Organisms that make their own food through photosynthesis (or chemosynthesis)
Anything that slows, or limits, population growth. They can be abiotic or biotic.
Number of individuals in relation to the space a population occupies
Under ideal conditions both the total population size and the rate of population increases rise steadily across time
In logistic growth, the population levels off at the carrying capacity of the environment due to limitations of resources.
The largest population size an environment can sustain.
A graphical representation designed to show the biomass at each trophic level
A system that includes all biotic and abiotic factors within an area functioning together as a unit
Where an organism lives and what it does there
A plant or animal that plays a unique and crucial role in the way an ecosystem functions
The variety of species in an ecosystem, includes where the organisms live and the genetic variation between different species and within a species itself
A type of non-native species that is taking over the habitat that it was introduced to
Property of a molecular with oppositely charged end, allowing for water to dissolve many different substances
An ecological interaction between two organisms
Organisms that produce energy available for other organisms to eat
Organism that eats primary consumers
Organism that eats secondary consumers
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship in which both organisms benefit</td>
<td>A relationship in which both organisms benefit</td>
</tr>
<tr>
<td>Relationship between two organisms in which one benefits and the other is unchanged</td>
<td>A relationship between two organisms in which one benefits and the other is unchanged</td>
</tr>
<tr>
<td>Relationship between two organisms where one benefits at the expense of the other</td>
<td>A relationship between two organisms where one benefits at the expense of the other</td>
</tr>
<tr>
<td>Any abiotic or biotic factor that restricts the existence, numbers, reproduction, or distribution of organisms</td>
<td>Any abiotic or biotic factor that restricts the existence, numbers, reproduction, or distribution of organisms</td>
</tr>
<tr>
<td>The series of changes that occur in an area where no ecosystem previously existed</td>
<td>The series of changes that occur in an area where no ecosystem previously existed</td>
</tr>
<tr>
<td>The series of changes that occur after a disturbance in an already existing ecosystem; disturbances, natural disasters, logging, farming, and mining</td>
<td>The series of changes that occur after a disturbance in an already existing ecosystem; disturbances, natural disasters, logging, farming, and mining</td>
</tr>
<tr>
<td>The first species to populate an area; they are often lichens and mosses carried to the area by wind or water</td>
<td>The first species to populate an area; they are often lichens and mosses carried to the area by wind or water</td>
</tr>
<tr>
<td>Water is attracted to other substances.</td>
<td>Water is attracted to other substances.</td>
</tr>
</tbody>
</table>

**Word Bank:**

- Abiotic
- Decomposers
- Keystone Species
- Biodiversity
- Invasive Species
- Polarity
- Symbiosis
- Secondary Succession
- Pioneer Species
- Adhesion of Water
- Logistic Growth
- Secondary Consumer
- Tertiary Consumer
- Trophic Pyramid
- Ecosystem
- Niche
- Primary Consumer
- Unifying Characteristics of Living Things
- Consumers/Heterotroph
- Limiting factor
- Population Density
- Exponential Growth
- Mutualism
- Commensalism
- Parasitism
- Limiting Factor
- Primary Succession
- Carrying Capacity
- Biotic
- Producers/autotrophs
Ecology Recall Questions:

1. What is an example of an abiotic factor?
2. What is an example of a biotic factor?
3. What do we call a benefit humans receive from an ecosystem?
4. Why might a population change size?
5. Why might a population of organisms change from their current location?
6. What is the process that releases carbon dioxide?
7. What is the process that takes in carbon dioxide?
8. Is it good or bad for biodiversity when a keystone species is removed?
9. Why might an invasive species be bad for an ecosystem?
10. Why is water able to dissolve other molecules?
11. Why do we need bacteria for the nitrogen cycle?
12. What is the ten percent rule?
13. What is the biggest difference between primary and secondary succession?
14. What do lichens do?
15. What type of succession do lichens exist in?
16. What are the three types of symbiotic relationships?
17. Is commensalism beneficial or not?
18. What does an omnivore eat?
19. How does an autotroph get its food?
20. What type of growth occurs when there are no limiting factors?
21. What is a potential limiting factor?
22. What type of growth occurs when a population reaches its carrying capacity?
23. Is 40 degrees Celsius hot or cold?
24. What gives plants energy?
25. What gives primary consumers energy?
26. What characteristics define a terrestrial ecosystem?
27. What characteristics might define an aquatic ecosystem?
28. What is one way that humans increase the amount of carbon in the atmosphere?
Ecology Practice Quiz

Questions 1-2

The diagram below shows a possible energy pyramid in a grassland ecosystem.

1. (1.07) Which of the following is NOT a correct statement about the Energy Pyramid above?
   a. The hawk, a heterotroph, is a tertiary consumer
   b. The fox, a heterotroph, is a secondary consumer
   c. The rabbit, an autotroph, is a primary consumer
   d. The plants, an autotroph, are primary producers

2. (1.08) If the rabbits in the Energy Pyramid above contained 327 kCal of energy, about how much energy is found in the hawk’s trophic level?
   a. 327 kCal
   b. 32.7 kCal
   c. 3.27 kCal
   d. 0.327 kCal

3. (1.05) The carbon cycle moves carbon atoms through the ecosystem above. What process is responsible for decreasing the amount of carbon in the atmosphere?
   a. Cellular Respiration
   b. Combustion
   c. Diffusion between the air and ocean
   d. Photosynthesis
4. (1.07) What is the main source of ENERGY for the autotrophs in the energy pyramid above?
   a. Nutrients
   b. Water
   c. Sunlight
   d. Carbon Dioxide

5. (1.05) What is the main source of MATTER for all autotrophs?
   a. Nutrients
   b. Water
   c. Sunlight
   d. Carbon Dioxide

Use the food web below to answer questions 8 – 9.

6. (1.07) Which pyramid identifies each organism in the correct trophic level?
7. (1.08) If the trophic level of the grains in the food web above holds 9000 kCal of energy, about how much energy is found at the level of the Owl?
   a. 9000 kCal
   b. 900 kCal
   c. 90 kCal
   d. 9 kCal

Use the passage and graph below to answer Questions 10 – 12.

Two students are doing an experiment to see which type of fertilizer has the biggest impact on the growth of garden plants. To perform the experiment they set up four different groups. Group one received a fertilizer with an abundance of nitrogen only. Group two received a fertilizer high in Phosphorus only. Group three received a fertilizer with both nitrogen and phosphorus. The fourth group represented the control. The graph below shows their results:

8. (1.09) Which of the following correctly identifies the testable question of the experiment outlined above?
   a. What is the effect of time on the biomass of above ground plants for three different fertilizers?
   b. What is the effect of nutrient type on the biomass of above ground plants?
   c. What is the effect of fertilizer on nutrient type?
   d. What is the effect of plant height on the type of fertilizer?

9. (1.09) According to the experiment, which of the following is the best control group?
   a. Fertilizer with both N + P
   b. Fertilizer with just N
   c. Fertilizer with just P
   d. Sample with no fertilizer

10. (1.06) What conclusions can be made from the results of the experiment?
   a. Phosphorous is the most important nutrient for healthy plant growth
   b. Nitrogen is the most important nutrient for healthy plant growth
   c. Neither nitrogen nor phosphorous are necessary for healthy plant growth
   d. Both nitrogen and phosphorous are necessary for healthy plant growth
11. (1.13) Removal of a _______ from a community significantly affects community structure and ecosystem balance.
   a. Autotroph
   b. Top Predator
   c. Tertiary consumer
   d. Keystone Species

12. (1.05) Scientists studying Earth’s climate created the graph below from data over the last 175 years. It shows the relationship between CO$_2$ in the atmosphere and global temperatures.

What process below could be leading to an increase in global temperature change?
   a. Denitrification
   b. Combustion
   c. Photosynthesis
   d. Excretion

13. (1.05) Scientists are trying to come up with ways that could reduce the amount of Carbon Dioxide in the atmosphere. Which of the following would NOT decrease CO$_2$ levels?
   a. Increase the amount of vehicles on the road
   b. Increase the amount of plants in urban areas
   c. Decrease combustion of fossil fuels
   d. Decrease the number of trees that are cut down each year

14. (1.06) The largest sink of nitrogen in the world is in the atmosphere, which is 78% nitrogen gas (N$_2$). However, animals are unable to incorporate N$_2$ into their tissues. How do animals get the nitrogen they need to survive?
   a. They breathe N gas in the air
   b. They must consume nitrogen-fixing bacteria from the soil
   c. They must consume plants that contain nitrogen
   d. They get it from drinking water with dissolved nitrogen
15. Bees and flowers show an important symbiotic relationship. When bees visit flowers, they consume nectar, providing them with much needed energy. In return, the bees pick up pollen and transfer it to other flowers in the area, pollinating the flowers and allowing them to reproduce. Which of the following is exemplified by this relationship?
   a. Commensalism
   b. Parasitism
   c. Mutualism
   d. Predation

16. (1.11) The graphs below show two possible growth scenarios for a population of deer living in Eastern Colorado.

[Graphs showing exponential and logistical growth]

Which statement below correctly identifies the type of growth shown in each scenario?
   a. Scenario 1 shows logistical growth; Scenario 2 shows exponential growth
   b. Scenario 1 shows exponential growth; Scenario 2 shows logistical growth
   c. Scenario 1 and Scenario 2 show exponential growth
   d. Scenario 1 and 2 show logistical growth

The figure below shows succession in an ecosystem.

[Figure showing succession stages]

17. (1.14) The first species to inhabit an area after a disturbance is a
   a. Pioneer species
   b. Primary succession
   c. Climax community
   d. Secondary succession
18. (1.14) What **organisms** are primarily found in the oldest mature forest of this ecosystem?
   a. Lichens and mosses  
   b. Trees and shrubs  
   c. Weeds and grasses  
   d. Volcanoes and soil

19. (1.14) Which of the following occurs when there is **bare rock** and no soil in an ecosystem?
   a. Secondary Extinction  
   b. Secondary Production  
   c. Primary Competition  
   d. Primary Succession

**Question 20**

20. The diagrams above show an area that was once a pasture for cattle that has since undergone changes to the vegetation over time. Which of the following changes in the hydrologic cycle is most likely to occur as a result of the change in vegetation in the area?
   a. Increased runoff  
   b. Decreased transpiration  
   c. Decreased precipitation  
   d. Increased infiltration

**Biomass is the total mass of all living things in a particular area. The following biomass data was recorded at the succession site.**

21. (1.10) According to the graph, which conclusion is best supported by the data?
   a. Intermediate tree species begin growing first after a disturbance  
   b. Climax tree species grow the fastest  
   c. Pioneer tree species contribute greatly to the total biomass after 300 years  
   d. As the forest ages, the most abundant tree species changes
Question 22

22. Which letter correctly identifies the part of the hydrologic cycle that is most directly affected by impervious building materials, such as concrete and asphalt?
   a. A
   b. B
   c. C
   d. D

23. Water molecules are able to form strong hydrogen bonds. This allows for water to move up the roots of plants into the leaf tissues where these molecules are used in the process of photosynthesis. The water molecules in the image below are considered to be polar molecules.

   What is a polar molecule?
   a. A molecule with identical charges at opposite ends
   b. A molecule with opposite charges at opposite ends
   c. A molecule with no charge
   d. A molecule with an equal number of protons and electrons.
**UNIT 2: CHEMISTRY OF LIFE**

<table>
<thead>
<tr>
<th>Vocabulary Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic molecules that provide functions necessary for quality of life.</td>
<td>Matter derived from the breakdown of living things (composed of C, H, N, S, or P atoms)</td>
</tr>
<tr>
<td>A compound made up of several repeating monomers</td>
<td>The simplest unit, or the repeating unit, of a polymer</td>
</tr>
<tr>
<td>Serve as the primary source of energy for organisms</td>
<td>Used as a source of energy and building blocks of biological membranes</td>
</tr>
<tr>
<td>Responsible for storing and transferring genetic information in the form of DNA</td>
<td>Responsible for numerous cellular functions, such as catalyzing reactions and assisting in cellular transport/signaling</td>
</tr>
<tr>
<td>Monomer of protein</td>
<td>Monomer of nucleic acid</td>
</tr>
<tr>
<td>Monomer of lipid</td>
<td>Monomer of carbohydrate</td>
</tr>
<tr>
<td>Type of protein that catalyzes (speeds up) biochemical reactions</td>
<td>Energy required to start a chemical reaction</td>
</tr>
<tr>
<td>Molecule that binds with an enzyme</td>
<td>When an enzyme changes shape</td>
</tr>
<tr>
<td>pH and temperature</td>
<td>A cell containing a nucleus and other membrane bound organelles. Capture energy from the sunlight and use it to produce food for the cell.</td>
</tr>
<tr>
<td>A cell that lacks a nucleus and other membrane bound organelles. Includes archaea and bacteria.</td>
<td>Chemical formula for glucose</td>
</tr>
<tr>
<td>The process by which plant and some other organisms use light energy to convert water and carbon dioxide into glucose and starches</td>
<td>6CO₂ + 12H₂O (light energy) ( \rightarrow ) C₆H₁₂O₆ + 6O₂ + 6 H₂O</td>
</tr>
<tr>
<td>First stage of photosynthesis, when light energy is captured and converted into ATP. Water molecules are split.</td>
<td>Carbohydrate molecules are assembled from carbon dioxide using the chemical energy harvested during the light-dependent reactions.</td>
</tr>
</tbody>
</table>

*Note from Ms. Thompson:* Your first step is to make sure you know which definition goes with each word. *But this shouldn’t be your last step!* Review using flashcards, phone a friend and quiz them (via social distancing), rewrite the words, etc.
Temporary energy storage molecule in cells, currency of energy

The process by which cells make ATP (energy) by breaking down organic molecules

\[ C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + ATP \]

Converting glucose into ATP with the presence of oxygen

First stage of cellular respiration

Second stage of cellular respiration

Third stage of cellular respiration

Oxygen is not required. If no oxygen is not available, the pyruvic acid will be converted into lactic acid. In total, one glucose molecule produces only 2 molecules of ATP.

Type of anaerobic respiration used by organisms such as yeast.

**Word Bank:**

<table>
<thead>
<tr>
<th>Macromolecule</th>
<th>Protein</th>
<th>Prokaryotic Cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic Matter</td>
<td>Amino Acid</td>
<td>Photosynthesis</td>
</tr>
<tr>
<td>Polymer</td>
<td>Nucleotide</td>
<td>Chemical Formula for Photosynthesis</td>
</tr>
<tr>
<td>Monomer</td>
<td>Fatty Acid</td>
<td>Chemical Formula for Cellular Respiration</td>
</tr>
<tr>
<td>Photosynthesis</td>
<td>Glucose</td>
<td>Respiration</td>
</tr>
<tr>
<td>Light Dependent Reaction</td>
<td>Enzyme</td>
<td>Aerobic Respiration</td>
</tr>
<tr>
<td>Calvin Cycle</td>
<td>Activation Energy</td>
<td>Glycolysis</td>
</tr>
<tr>
<td>Adenosine Tri-Phosphate (ATP)</td>
<td>Substrate</td>
<td>Krebs Cycle</td>
</tr>
<tr>
<td>Cellular Respiration</td>
<td>Denatured</td>
<td>Electron Transport Chain</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>C6H12O6</td>
<td>Anaerobic Respiration</td>
</tr>
<tr>
<td>Lipids</td>
<td>Factors Affecting Enzymes</td>
<td>Alcoholic Fermentation</td>
</tr>
<tr>
<td>Nucleic Acid</td>
<td>Eukaryotic Cell</td>
<td></td>
</tr>
</tbody>
</table>
Chemistry of Life Recall Questions

1. What is the chemical equation for photosynthesis?
2. Determine if each of the following is used or produced during photosynthesis.
   a. Glucose
   b. Carbon dioxide
   c. Water
   d. Light
   e. Oxygen
3. When does photosynthesis occur?
4. What is the role of enzymes in photosynthesis?
5. What is the relationship between light and photosynthesis?
6. What is the purpose of cellular respiration?
7. What is ATP and what does it stand for?
8. What does ADP stand for?
9. What happens when ATP is converted to ADP?
10. What are the 3 steps of cellular respiration?
11. What molecule does glycolysis start with?
12. What molecules does glycolysis end with?
13. How many ATP are made during glycolysis?
14. Is glycolysis aerobic or anaerobic?
15. Where does glycolysis occur?
16. What is pyruvic acid converted to in aerobic respiration?
17. What is pyruvic acid converted to in anaerobic respiration?
18. How many ATP are made in the Krebs Cycle?
19. Where does Krebs Cycle occur?
20. What is the Electron Transport Chain of Cellular Respiration?
21. How many ATP are made during the ETC of Cellular Respiration?
22. Is the ETC of Cellular Respiration aerobic or anaerobic?
23. Where does the ETC occur?
24. What are the differences between aerobic and anaerobic respiration?
25. Under what circumstances does fermentation occur?
26. Is fermentation aerobic or anaerobic?
27. What are two types of fermentation?
28. Which organism performs alcoholic fermentation?
29. What is produced by alcoholic fermentation?
30. Which types of cells perform lactic acid fermentation?
31. What is produced by lactic acid fermentation?
32. When do humans produce lactic acid?
33. What is the physical result of lactic acid fermentation in humans?
34. What is the chemical equation for aerobic respiration?
35. What is the role of enzymes in cellular respiration?
36. Determine if each of the following is used or produced during cellular respiration.
   a. Glucose
   b. Carbon dioxide
   c. Water
   d. ATP
   e. Oxygen
37. What organisms go through both photosynthesis and cellular respiration? Explain how you know.
Chemistry of Life Practice Quiz

1. A chart listing the characteristics of four molecules is shown below.

<table>
<thead>
<tr>
<th>Molecule</th>
<th>Function</th>
<th>Monomer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stores Energy</td>
<td>Monosaccharides</td>
</tr>
<tr>
<td>2</td>
<td>Forms structure of cell membrane</td>
<td>Fatty acids</td>
</tr>
<tr>
<td>3</td>
<td>Carries genetic information</td>
<td>Nucleotides</td>
</tr>
<tr>
<td>4</td>
<td>Builds muscles</td>
<td>Amino acids</td>
</tr>
</tbody>
</table>

Which molecule listed in the chart is a protein?

(A) 1

(B) 2

(C) 3

(D) 4

Questions 2 & 3

You’re the manager of a factory that produces enzyme-washed blue jeans (the enzymes lighten the color of the denim, giving a faded appearance). When the most recent batch of fabric came out of the enzyme wash, however, the color wasn’t light enough to meet your standards. Your quality control laboratory wants to do some tests to determine why the wash enzymes didn’t perform as expected.

2. Which hypothesis is most likely to be productive for the initial investigation?

(A) The nucleotide chain of the enzymes may be incorrectly formed

(B) The dye in the fabric may have hydrolyzed the fatty acids in the enzymes

(C) The polysaccharides in the enzymes may have separated in the wash water

(D) The three-dimensional amino acid structure of the enzyme may have been altered

3. Based on your understanding of enzyme structure, which of the following would you recommend that the lab also investigate?

(A) The temperature of the liquid in the washing vat

(B) Washing the blue jeans in smaller vats

(C) The manufacturer of the fabric

(D) Switching to another product for the enzyme wash
4. Lemurs’ bodies are adapted to efficiently store energy for times when food is scarce. This adaptation may help to explain how lemur ancestors survived the trip across the Mozambique Channel from mainland Africa to Madagascar. Which of the following types of molecules are primarily used for long-term energy storage in the lemur?
   (A) monosaccharides
   (B) nucleic acids
   (C) lipids
   (D) proteins

5. The accompanying table represents the results of an experiment where the effects of pH buffers on an enzyme found in saliva (amylase) were studied. A spectrophotometer set at 500nm was used to measure absorbance at the various pH levels every 20 sec for 2 min. The higher absorbance values would indicate greater enzyme activity. All experiments were conducted at the same temperature.

**Absorbance at Various pH Levels**

<table>
<thead>
<tr>
<th>Time (sec)</th>
<th>pH 4</th>
<th>pH 5</th>
<th>pH 6</th>
<th>pH 7</th>
<th>pH 8</th>
<th>pH 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>0.003</td>
<td>0.025</td>
<td>0.055</td>
<td>0.146</td>
<td>0.005</td>
<td>0.004</td>
</tr>
<tr>
<td>40</td>
<td>0.009</td>
<td>0.109</td>
<td>0.152</td>
<td>0.300</td>
<td>0.015</td>
<td>0.008</td>
</tr>
<tr>
<td>60</td>
<td>0.012</td>
<td>0.195</td>
<td>0.255</td>
<td>0.432</td>
<td>0.038</td>
<td>0.010</td>
</tr>
<tr>
<td>80</td>
<td>0.020</td>
<td>0.215</td>
<td>0.341</td>
<td>0.552</td>
<td>0.065</td>
<td>0.012</td>
</tr>
<tr>
<td>100</td>
<td>0.023</td>
<td>0.333</td>
<td>0.413</td>
<td>0.659</td>
<td>0.081</td>
<td>0.013</td>
</tr>
<tr>
<td>120</td>
<td>0.025</td>
<td>0.360</td>
<td>0.478</td>
<td>0.755</td>
<td>0.090</td>
<td>0.013</td>
</tr>
</tbody>
</table>

Which statement correctly identifies the result that the optimum pH for amylase function is 7?
   (A) The pH with the lowest absorbance values would indicate the optimum pH for amylase since this pH does not affect the structure or function of the protein.
   (B) The pH with the highest absorbance values would indicate the optimum pH for amylase since this pH does not affect the structure or function of the protein.
   (C) At pH 9, the enzyme is denatured and will lose its function, but not its structure.
   (D) At pH 4, the structure of the enzyme will be altered, and the enzyme would not be able to catalyze the reaction.
Questions 6 & 7

A study was conducted to examine whether female *Blatella germanica* (a species of cockroach) prefer to eat cat food, cheese, ham, or peanuts. First, 200 mg of each of the four foods was separately placed into a single box. Then, adult female *B. germanica* were added to the box. Figure 1 shows how the mass, in mg, of each food in the box changed over time after the addition of the *B. germanica*. Table 1 shows the percent by mass of carbohydrates, lipids, proteins, and water, respectively, present in each of the four foods tested in the study.

6. Consider the four foods in order of the percent by mass of proteins, from lowest to highest. From food to food, as the percent by mass of proteins increased, the mass of food remaining at 28 hr:
   (A) Increased only
   (B) Decreased only
   (C) Increased and then decreased
   (D) Decreased and then increased

7. A student predicted that the *B. germanica* would eat less cat food than ham by the end of the study. Do the data in Figure 1 support this prediction?
   (A) Yes; at 28 hr, the mass of cat food remaining was about 55mg greater than the mass of ham remaining.
   (B) Yes; at 28 hr, the mass of cat food remaining was about 95mg greater than the mass of ham remaining.
   (C) No; at 28 hr, the mass of cat food remaining was about 55mg less than the mass of ham remaining.
   (D) No; at 28 hr, the mass of cat food remaining was about 95mg less than the mass of ham remaining.
8. People who have Alzheimer’s disease experience an increasing loss of brain function and cognition over time. Alzheimer’s is characterized by a buildup of abnormal protein fragments that damage brain cells. Recently scientists have discovered an enzyme, BACE2, that decreases these abnormal protein fragments in the brain of a person with Alzheimer’s disease. Which statement explains how BACE2 most likely works?

(A) BACE2 breaks down smaller pieces that react with the abnormal protein fragments, forming more complex molecules.

(B) BACE2 speeds up the reaction that breaks down the abnormal protein fragments.

(C) BACE2 molecules link several abnormal protein fragments together, forming a complete protein.

(D) BACE2 is a reactant that combines with the abnormal protein fragments.

9. Based on the diagram, determine the pH necessary in order to achieve the maximum rate of both chymotrypsin and arginase activity in the same reaction.

(A) 2.0

(B) 7.4

(C) 8.0

(D) 8.3

10. What form of energy is produced in the mitochondria?

a. ATP

b. Glucose

c. Oxygen

d. RNA

11. During what stage of cellular respiration is the most ATP created?

a. Glycolysis

b. Oxidation of pyruvate

c. Krebs cycle

d. Fermentation

e. Electron Transport Chain
12. Which of the following is a true statement concerning aerobic respiration in humans and bean plants? (When does it occur?)
   a. Molecular oxygen is used by humans and by bean plants 24 hours per day
   b. Molecular oxygen is used by humans 24 hours per day and by bean plants only in sunlight
   c. Molecular oxygen is used by humans 24 hours per day and by bean plants during darkness
   d. Molecular oxygen is used by bean plants 24 hours per day and by humans only during darkness

13. The energy released from the anaerobic respiration of a glucose molecule is less than that released from the aerobic respiration of a glucose because
   a. Oxygen allows for bonds for more of the glucose molecule to be broken in aerobic respiration than in anaerobic respiration
   b. More enzymes are required for anaerobic respiration than for aerobic respiration
   c. Anaerobic respiration occurs 24 hours a day while aerobic respiration can only occur at night
   d. Anaerobic respiration requires oxygen but aerobic respiration does not require oxygen

14. Shown are two phrases, A and B. Select the statement, chosen from the list below that best describes the relationship between the two phrases. Hint: Write out the number of ATP produced in each.

   Phrase A: the number of ATP molecules produced during fermentation of one glucose molecule
   Phrase B: the number of ATP molecules produced during aerobic respiration of one glucose molecule

   a. A is less than B
   b. A is greater than B
   c. A and B are the same
   d. It is impossible to tell

15. Ethyl alcohol may be formed as a result of the process of
   a. Aerobic respiration
   b. Photosynthesis
   c. Anaerobic respiration in animals
   d. Fermentation in yeast

16. Which reactions could take place in human muscle tissue?

   A. \( \text{Glucose} \xrightarrow{\text{enzymes}} 2 \text{ethyl alcohol} + 2 \text{CO}_2 + 2 \text{ATP} \)
   B. \( 2 \text{pyruvic acid} + 6\text{O}_2 \xrightarrow{\text{enzymes}} 6\text{CO}_2 + 6\text{H}_2\text{O} + 34 \text{ATP} \)
   C. \( 2 \text{pyruvic acid} \rightarrow 2 \text{lactic acid} \)

   Use the list above to help you pick an answer choice below

   a. A only
   b. B only
   c. A and C
   d. B and C only
17. Given the diagram below

![Cell Respiration Diagram]

X most likely represents (Hint: it is an output of cellular respiration)

a. ATP  
b. Glucose  
c. Lactic acid  
d. Ethyl alcohol

18. Fermentation in humans will occur in cells when

a. carbon dioxide is present in high concentrations  
b. muscle cells lack oxygen  
c. light is no longer present  
d. oxygen is in high concentrations in the liver

19. An organism that cannot produce its own food, is one cell, and living in a environment without oxygen. Identify the characteristics of cell respiration that would further describe this organism.

a. produces ethyl alcohol, carbon dioxide, and ATP  
b. produces glucose and ATP  
c. produces ATP in the mitochondria and cytoplasm  
d. produces oxygen and glucose without making ATP

20. In cell respiration, oxygen is most directly involved with production of

a. ATP in the mitochondria  
b. glucose in the cytoplasm  
c. carbon dioxide for exhalation  
d. excited chlorophyll molecules
**UNIT 3: HOMEOSTASIS**

**Note from Ms. Thompson:** Your first step is to make sure you know which definition goes with each word. *But this shouldn’t be your last step!* Review using flashcards, phone a friend and quiz them (via social distancing), rewrite the words, etc.

<table>
<thead>
<tr>
<th>Vocabulary Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The ability of the body to maintain a relatively stable internal conditions even though the outside world is changing.</td>
</tr>
<tr>
<td></td>
<td>Thin, flexible barrier around a cell, it regulates what enters and leaves the cell. Present in both eukaryotic and prokaryotic cells.</td>
</tr>
<tr>
<td></td>
<td>Feedback loop that works to return properties back to their target values.</td>
</tr>
<tr>
<td></td>
<td>Feedback loop that amplifies the stimulus, moving the system away from the starting set point.</td>
</tr>
<tr>
<td></td>
<td>Structure that allows some molecules to pass through, while others cannot. This is determined by the molecule’s polarity, charge, and size.</td>
</tr>
<tr>
<td></td>
<td>Allows some things to pass through, but blocks other materials.</td>
</tr>
<tr>
<td></td>
<td>Repelling, or incapable of dissolving in water. The two tails that prevent polar molecules from passing through a membrane.</td>
</tr>
<tr>
<td></td>
<td>Having an affinity for water, readily absorbing or dissolving water. The heads face the water.</td>
</tr>
<tr>
<td></td>
<td>Allow large or charged molecules into and out of the cell.</td>
</tr>
<tr>
<td></td>
<td>Molecules attracted to polar molecules.</td>
</tr>
<tr>
<td></td>
<td>Molecules attracted to nonpolar molecules.</td>
</tr>
<tr>
<td></td>
<td>Used as a source of energy and building blocks of biological membranes.</td>
</tr>
<tr>
<td></td>
<td>Monomer of lipid.</td>
</tr>
<tr>
<td></td>
<td>Transport across a membrane where energy is required.</td>
</tr>
<tr>
<td></td>
<td>Diffusion of molecules along a concentration gradient, does not require energy.</td>
</tr>
<tr>
<td></td>
<td>Movement of molecules along a concentration gradient, from an area of high concentration to an area of low concentration.</td>
</tr>
<tr>
<td></td>
<td>Diffusion of water molecules.</td>
</tr>
<tr>
<td></td>
<td>Solutions that have a higher solute concentration than the cell. Water moves out of the cell.</td>
</tr>
<tr>
<td></td>
<td>Solutions have a lower solute concentration than the cell. Water moves into the cell.</td>
</tr>
<tr>
<td></td>
<td>Solutions have equal concentrations of solvent and solute on both sides of the membrane. Water moves in both directions in equal amounts.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>When molecules move down a concentration gradient with the use of an integral/channel protein</td>
<td>Substance that is dissolved in solvent to make a solution.</td>
</tr>
<tr>
<td>The substance in which a solute is dissolved to form a solution.</td>
<td>Movement of molecules along a concentration gradient, from an area of high concentration to an area of low concentration</td>
</tr>
<tr>
<td>Diffusion of water molecules</td>
<td>Organ system responsible for transporting materials throughout the body.</td>
</tr>
<tr>
<td>Organ system responsible for gas exchange.</td>
<td>The way in which oxygen and carbon dioxide move across the alveoli.</td>
</tr>
<tr>
<td>Tiny air sacs in the lungs.</td>
<td>Part of the circulatory system that surrounds the alveoli. Also surrounds nephrons.</td>
</tr>
<tr>
<td>Small filtering units in the kidney.</td>
<td>Pumps blood towards the heart.</td>
</tr>
<tr>
<td>Pumps blood away from the heart.</td>
<td>Related to the lungs</td>
</tr>
<tr>
<td>Organ system responsible for removing waste, a specific way in which this does so is by filtering the blood.</td>
<td>Organ system responsible for breaking down food and absorbing substances.</td>
</tr>
<tr>
<td>Movement of molecules into the cell through active transport.</td>
<td>Movement of molecules out of the cell through active transport.</td>
</tr>
</tbody>
</table>

**Word Bank:**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homeostasis</td>
<td>Osmosis</td>
</tr>
<tr>
<td>Plasma (Cell) Membrane</td>
<td>Diffusion</td>
</tr>
<tr>
<td>Negative Feedback Loop</td>
<td>Osmosis</td>
</tr>
<tr>
<td>Positive Feedback Loop</td>
<td>Circulatory System</td>
</tr>
<tr>
<td>Phospholipid Bilayer</td>
<td>Respiratory System</td>
</tr>
<tr>
<td>Semi-Permeable</td>
<td>Hydrophilic</td>
</tr>
<tr>
<td>Hydrophobic</td>
<td>Transport/Channel Protein</td>
</tr>
<tr>
<td>Nonpolar molecules</td>
<td>Polar Molecules</td>
</tr>
<tr>
<td>Lipids</td>
<td>Solute</td>
</tr>
<tr>
<td>Fatty Acid</td>
<td>Diffusion</td>
</tr>
<tr>
<td>Active Transport</td>
<td>Alveoli</td>
</tr>
<tr>
<td>Passive Transport</td>
<td>Capillaries</td>
</tr>
<tr>
<td>Diffusion</td>
<td>Nephrons</td>
</tr>
</tbody>
</table>
Homeostasis Recall Questions:

1. What solution causes a cell to lose mass?
2. What solution causes a cell to gain mass?
3. What happens in an isotonic solution?
4. What is osmosis?
5. What molecules can move across a cell membrane?
6. What are the components of the circulatory system?
7. What are the components of the respiratory system?
8. What makes up a cell membrane?
9. What is the function of a transport protein?
10. What is a phospholipid bilayer?
11. Why do molecules move across a membrane?
12. What is diffusion?
13. What gas moves from the lungs into the capillaries?
14. What gas moves from the capillaries into the alveoli?
15. What is similar between nephrons, alveoli, and capillaries?
16. What is different between nephrons, alveoli, and capillaries?
17. How do the respiratory system and circulatory system work together to maintain homeostasis?
18. How do the excretory system and circulatory system work together to maintain homeostasis?
19. How does glucose get to muscle cells for cellular respiration?
20. How does oxygen get to the muscle cells for cellular respiration?
21. What is a byproduct of cellular respiration?
22. How is carbon dioxide removed from the body?

Note from Ms. Thompson: You should be able to answer these questions from memory (without Google!). If you find yourself struggling, answer them first with assistance and then quiz yourself similarly to how you would study your vocabulary.
Homeostasis Practice Quiz

1. During diffusion molecules tend to move ________________
   a. up the concentration gradient
   b. down the concentration gradient
   c. from an area of lower concentration to an area of higher concentration
   d. in a direction that doesn’t depend on concentration

2. When the concentration of a solute is the same throughout a system, the system has reached ________________.
   a) maximum concentration
   b) homeostasis
   c) osmotic pressure
   d) equilibrium

3. The diffusion of water across a selectively permeable membrane is called ________________.
   a) active transport
   b) facilitated diffusion
   c) osmosis
   d) phagocytosis

4. Gases like oxygen and carbon dioxide move across cell membranes using ________________
   a) endocytosis
   b) ion channels
   c) passive transport
   d) active transport
5. Which substances may pass through a cell membrane by simple diffusion?
   a. Starch and protein
   b. Protein and fat
   c. Oxygen and water
   d. Carbon dioxide and starch

6. Which of the following describes facilitated diffusion?
   a) A passive movement of a particle through the phospholipid bilayer of the cell membrane.
   b) The movement of a particle down a concentration gradient helped by active transport.
   c) The passive movement of a particle across a cell membrane via a transport protein.
   d) The movement of a particle up a concentration gradient helped by active transport.

7. Which of the following is NOT true of passive transport?
   a. Solutes move from an area of high concentration to an area of low concentration
   b. Added energy is not required
   c. Solute moves down a concentration gradient
   d. Solute moves from a hypotonic area to a hypertonic area

8. Which statements are characteristics of diffusion through membranes?
   I. Sugar can move through the phospholipid bilayer.
   II. It can be facilitated by special protein channels.
   III. It is affected by concentration gradients.

   a) I and II only
   b) I and III only
   c) II and III only
   d) I, II, and III

9. Solution X is hypotonic to Solution Y. B. Which of the following is true?
   A. Solution X is more concentrated than Solution Y
   B. Solution X has more solute in a given volume than Solution Y
   C. Solution X is less concentrated than Solution Y
   D. Solution X has the same solute in a given volume compared to Solution Y
10. In osmosis, water always moves towards the ___________ solution: that is, towards the solution with the ___________ solute concentration.
   a. Isotonic...greater
   b. Hypertonic...greater
   c. Hypertonic...lesser
   d. Hypotonic....greater
   e. Hypotonic....lesser

11. The concentration of solutes in a red blood cell is about 2%. Sucrose cannot pass through the membrane, but water and urea can. Osmosis would cause red blood cells to shrink the most when immersed in which of the following solutions?
   a. a hypertonic sucrose solution
   b. a hypotonic sucrose solution
   c. a hypertonic urea solution
   d. a hypotonic urea solution
   e. pure water

12. If the volume of a cell increases when it is placed in a solution, that solution is said to be _______ to the cell.
   a. hypertonic
   b. isotonic
   c. gin and tonic
   d. hypotonic

13. Which are the components of the circulatory system:
   a. Nephrons and capillaries
   b. Blood vessels, heart, capillaries, and lungs
   c. Blood, blood vessels, capillaries, and heart
   d. Heart, blood, and alveoli

14. Which type of blood vessel carries blood from the heart?
   a. Veins
   b. Arteries
   c. Capillaries
   d. Lymph nodes

15. Blood going away from the lungs through the pulmonary veins contains a high concentration of ___________ and a low concentration of ___________.
   a. Oxygen; oxygen
   b. Carbon dioxide; oxygen
   c. Oxygen; carbon dioxide
   d. Carbon dioxide; carbon dioxide

16. Blood going towards the lungs through the pulmonary arteries contains a high concentration of ___________ and a low concentration of ___________.
   a. Oxygen; oxygen
   b. Carbon dioxide; oxygen
   c. Oxygen; carbon dioxide
   d. Carbon dioxide; carbon dioxide
17. The two organ systems shown above are the
   a. Respiratory and urinary system
   b. Circulatory and urinary system
   c. Circulatory and endocrine system
   d. Circulatory and respiratory system

18. The diagram above shows
   a. Movement of carbon dioxide from the alveoli into the blood through active transport
   b. Movement of carbon dioxide from the alveoli into the blood through passive transport
   c. Movement of carbon dioxide from the blood into the alveoli through active transport
   d. Movement of carbon dioxide from the blood into the alveoli through passive transport

19. Which of the following statements best describes the function of veins?
   a. Veins allow gas exchange to occur between cells and blood
   b. Veins allow waste exchange to occur between nephrons and blood
   c. Veins carry blood away from the heart to the body
   d. Veins carry blood to the heart back from the rest of the body

20. Nutrients and oxygen are distributed through the body mainly by the ___________ system.
   a. Endocrine
   b. Immune
   c. Respiratory
   d. Circulatory
## UNIT 4: DNA, RNA, AND PROTEIN

**Note from Ms. Thompson:** Your first step is to make sure you know which definition goes with each word. **But this shouldn’t be your last step!** Review using flashcards, phone a friend and quiz them (via social distancing), rewrite the words, etc.

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<td>Monomer of nucleic acids</td>
<td>Adenine, Guanine, Cytosine, Thymine</td>
</tr>
<tr>
<td>Adenine, Guanine, Cytosine, Thymine</td>
<td>Adenine, Guanine, Cytosine, Uracil</td>
</tr>
<tr>
<td>Predictable interactions between nitrogen bases on opposite strands of DNA and between DNA and RNA; consists of adenine-thymine and guanine-cytosine (adenine-uracil in RNA) base pairing.</td>
<td></td>
</tr>
<tr>
<td>RNA is produced from DNA</td>
<td>RNA is used to build proteins</td>
</tr>
<tr>
<td>Molecule that conveys information from the DNA to the ribosome to specify a specific amino acid sequence.</td>
<td>Site of protein synthesis</td>
</tr>
<tr>
<td>RNA molecule that carries amino acids to the mRNA during protein synthesis.</td>
<td>Random change in DNA sequence</td>
</tr>
<tr>
<td>Sequence of three nucleotides that together form a unit of genetic code in a DNA or RNA molecule.</td>
<td>Sequence of three nucleotides forming a unit of genetic code in a transfer RNA molecule.</td>
</tr>
<tr>
<td>Nucleotide in DNA. Pairs with Thymine.</td>
<td>Nucleotide in DNA. Pairs with Adenine.</td>
</tr>
<tr>
<td>Nucleotide in DNA. Pairs with Guanine.</td>
<td>Nucleotide in DNA. Pairs with Cytosine.</td>
</tr>
<tr>
<td>Nucleotide in mRNA. Pairs with Adenine.</td>
<td>RNA in the ribosome that combines with specific proteins to form ribosomes, the site of protein synthesis.</td>
</tr>
<tr>
<td>Genetic instructions to code for proteins.</td>
<td>Molecule that contains the genetic code of organisms.</td>
</tr>
<tr>
<td>Small, circular DNA that exists in some eukaryotes.</td>
<td>Large molecule made up of chains of amino acids.</td>
</tr>
<tr>
<td>Enzyme responsible for transcribing a gene on a DNA strand into an RNA molecule during transcription.</td>
<td>Sequence of three nucleotides forming a unit of genetic code in a transfer RNA molecule.</td>
</tr>
</tbody>
</table>
**Word Bank:**

- Nucleotide
- Nucleotides of DNA
- Nucleotides of mRNA
- Complementary Base Pair Rule
- Transcription
- Translation
- mRNA
- Ribosome
- tRNA
- Uracil
- rRNA
- Mutation
- Codon
- Adenine
- Thymine
- Cytosine
- Guanine
- Gene
- DNA
- Plasmid
- Protein
- RNA Polymerase
- Anticodon

**DNA, RNA, and Protein Recall Questions**

1. What is the monomer of nucleic acid?
2. What are two similarities between RNA and DNA?
3. What are two differences between RNA and DNA?
4. What is transcription?
5. What is translation?
6. What are the three types of RNA?
7. What is the function of mRNA?
8. What is the function of tRNA?
9. What is the monomer of a protein?
10. What is the function of a protein?
11. What nucleotides pair with adenine? (there are two)
12. What are the nucleotides of DNA?
13. What are the nucleotides of RNA?
14. Where does transcription occur?
15. Where does translation occur?
16. What are the seven steps of protein synthesis?

**Note from Ms. Thompson:** You should be able to answer these questions from memory (without Google!). If you find yourself struggling, answer them first with assistance and then quiz yourself similarly to how you would study your vocabulary.
<table>
<thead>
<tr>
<th>Second Letter</th>
<th>U</th>
<th>C</th>
<th>A</th>
<th>G</th>
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<tbody>
<tr>
<td>U</td>
<td>UUU</td>
<td>UUC</td>
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<td></td>
<td>Leu</td>
<td>Ser</td>
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<td>CUU</td>
<td>CCU</td>
<td>CAU</td>
<td>GCU</td>
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<td>Leu</td>
<td>Pro</td>
<td>His</td>
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<td>ACC</td>
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<tr>
<td></td>
<td>Val</td>
<td>Ala</td>
<td>Asp</td>
<td>Gly</td>
</tr>
</tbody>
</table>

DNA Strand: TCA ACT GGT CAT TTG

Transcription:

Translation:

DNA Strand: TCA ACT GGT CAT TTG

Transcription:

Translation:

DNA Strand: TCA ACT GGT CAT TTG

Transcription:

Translation:
DNA, RNA, and Protein Practice Quiz

1. (4.02) Which of the following best describes the *monomer* that makes up a DNA polymer.
   a. Amino acid  
   b. Polysaccharide  
   c. Nucleotide  
   d. Nucleic acid

2. (4.02) Which of the following best identifies what the arrow is pointing to in the diagram below?
   a. Sugar  
   b. Phosphate  
   c. Thymine  
   d. Nitrogenous Base

3. (4.04) Which of the following is *true* of RNA, but *NOT* DNA?
   a. This is a polymer made of nucleotide monomers.  
   b. Structural support results from the covalently bonded sugar-phosphate backbone  
   c. Nitrogenous bases form hydrogen bonds with complementary bases  
   d. In complementary base pairing, Guanine bonds with Cytosine and Uracil binds with Adenine

4. (4.05) Below is a piece of DNA that codes for the enzyme that breaks down fat in the brain.

   \[3' – A \text{ G A G T C G A T T A G C A G} – 5'\]

Which of the following best represents the mRNA strand this DNA strand codes for?
   a. \[5' – U C U C A G C U A A U C G U C – 3'\]  
   b. \[5’ – T C T C A G C T A A T C G T C – 3’\]  
   c. \[3’ – U C U C A G C U A A U C G U C – 5’\]  
   d. \[3’ – T C T C A G C T A A T C G T C – 5’\]

5. (4.06) Within what part of the cell do the processes of transcription and translation occur?
a. Transcription occurs in the cytoplasm; Translation occurs in the nucleus
b. Transcription occurs in the nucleus; Translation occurs in the cytoplasm
c. Transcription and translation both occur in the nucleus
d. Transcription and translation both occur in the cytoplasm

Use the image below to answer questions 6-8.

6. (4.07) Which of the following best identifies the structure labeled 2 above?
   a. mRNA
   b. Ribosome
   c. Peptide
   d. tRNA
   e. RNA Polymerase

7. (4.07) Which of the following best identifies the structure labeled 4 above?
   a. Ribosome
   b. Codon
   c. RNA Polymerase
   d. tRNA
8. (4.07) Which of the following best explains the importance of structure 7 above.
   a. It is a DNA molecule—it contains the code necessary to synthesize proteins
   b. It is a codon—it base pairs with the tRNA to ensure the right amino acid is brought to the ribosome
   c. It is a tRNA molecule—it is made by the ribosome as a result of translation
   d. It is an mRNA molecule—it is read by the ribosome to synthesize a protein

9. (4.07) What is the function of a transfer RNA (tRNA) molecule?
   a. To move a completed protein from the ribosome to the cell membrane
   b. To move genetic information from the nucleus to the cytoplasm
   c. To match to an mRNA codon and bring the right amino acid during protein synthesis
   d. To cut out extra information from mRNA strands before they are translated into proteins

10. (4.06) Which of the following best describes the role of a transcription factor in protein synthesis?
    a. Activating a gene by giving RNA polymerase a location to start transcription
    b. Terminating the transcription process
    c. Using the code in mRNA to make a protein by linking amino acids together
    d. Delivering amino acids to the ribosome in order to make a protein

11. (4.06) Transcription and translation in muscle cells and brain cells create different proteins because these cells
    a. contain different DNA sequences.
    b. each express different genes.
    c. contain different genetic codes on the DNA.
    d. use different ribosomes to make the proteins.
    e. have different amounts of DNA.

12. (4.07) After studying the role of transcription factors in the role of proteins synthesis, Michael made the following conclusion:

    Proteins can still be made without transcription factors. RNA polymerase is responsible for copying DNA’s code, which has nothing to do with transcription factors.

    Which of the following best evaluates this response?
    a. Michael is correct. Protein synthesis does not rely on transcription factors in order for RNA polymerase to copy DNA
    b. Michael is correct. Transcription factors are integral in recruiting RNA polymerase to copy the DNA
    c. Michael is incorrect. Protein synthesis does not rely on transcription factors in order for RNA polymerase to copy DNA
    d. Michael is incorrect. Transcription factors are important in recruiting RNA polymerase to copy the DNA.
13. The diagram shown TO THE RIGHT represents Watson and Crick’s model of DNA

The substance indicated by the arrow could be

a. Thymine
b. Deoxyribose
c. Ribose
d. Uracil

14. Four events occurred in a leaf cell of an oak tree:
   P – A protein was manufactured by a ribosome.
   Q - Protons were pumped across a membrane in the chloroplast.
   R - A molecule of mRNA was transcribed from a strand of DNA.
   S - A strand of nucleotides moved from the nucleus to the cytoplasm.

These four events are a **cause-and-effect** sequence. Therefore, the order in which these events occurred is (choose one)

a. R-S-P-Q.
b. S-R-P-Q.
c. P-R-Q-S.
d. R-Q-P-S.
### Vocabulary Word | Definition
--- | ---
An ordered sequence of events in the life of a eukaryotic cell, process of growth and cellular division. | A type of cell division that results in two identical daughter cells.
Phase of mitosis where chromosomes at the end of each cell clump together and a new nuclear envelope is formed. | Phase after mitosis where the cytoplasm divides that results in two identical daughter cells.
Type of DNA replication in which the replicated double helix consists of one old strand, derived from the old molecule, and one newly made strand. | An enzyme that catalyzes the elongation of new DNA at a replication, brings nucleotides to the DNA strand.
Chromosome pairs (one from each parent) that are similar but not identical. Each carries the same genes in the same order, but the alleles for each trait may not be the same. | Identical chromosomes that are created in the S-Phase of the cell cycle.
Phase of mitosis where chromosomes coil tightly, becoming more dense. | Phase of mitosis where duplicated chromosomes line up in the middle of the cell.
Main stage of the cell cycle in which the cell grows, carries out normal functions, and duplicates its DNA | Interphase stage of the cell cycle where DNA is replicated.
Interphase stages of the cell cycle in which a cell grows and organelles are copied. | A characteristic of nucleic acids in which the sequence of bases on one strands is paired with the other sequence of bases on a separate strand.
An enzyme that unwinds and unzips the DNA (double helix) during DNA replication | Phase of mitosis where spindle fibers pull apart sister chromatids.

| Homologous Chromosomes | Growth Phase (G1 and G2) | Metaphase |
| Sister Chromatids | Semi-Conservative Replication | Anaphase |
| Cell Cycle | DNA Polymerase | Telophase |
| Mitosis | Complementary Base Pair Rule | Cytokinesis |
| Interphase | Helicase | |
| S Phase | Prophase | |
MITOSIS PRACTICE QUIZ:

1. Base your answer to the following question on the following list that describes some of the events associated with normal cell division:
   a. Nuclear membrane formation around each set of newly formed chromosomes
   b. Alignment of duplicated chromosomes in middle of cell
   c. Replication of each chromosome
   d. Movement of chromosomes

   What is the normal sequence in which these events occur?
   a. A→B→C→D
   b. C→B→D→A
   c. C→D→B→A
   d. D→C→A→B

2. A photomicrograph of cells involved in various stages of nuclear development is shown below.

   ![Photomicrograph of cells](image)

   What would be the appropriate order of these images if they were being witnessed in a dividing leukocyte?
   a. D, A, C, B
   b. D, C, A, B
   c. D, B, C, A
   d. B, D, A, C

3. Which of the photos in the diagram above is showing metaphase?
   a. A
   b. B
   c. C
   d. D

4. What happens during the S-phase of the cell cycle?
   a. Cell size doubles
   b. DNA replicates
   c. Chromosomes are separated
   d. Organelles are synthesized
5. The number in each circle below represents the chromosome number of the cell. Which diagram represents the production of cells as a result of mitosis?
   a.  
   ![Diagram A]
   b.  
   ![Diagram B]
   c.  
   ![Diagram C]
   d.  
   ![Diagram D]

6. What would most likely result if mitosis was not accompanied by cytokinesis?
   a. Two cells, each with one set of DNA
   b. Two cells, each without any DNA
   c. One cell with two sets of DNA
   d. One cell without any DNA

7. Sister chromatids are _________________.
   a. Dense patches within the nucleus
   b. Bacterial chromosomes
   c. Joined strands of duplicated genetic material
   d. Homologous chromosomes
8. A human body cell ordinarily will have 23 pairs of chromosomes. At the end of a cell cycle, including mitosis, the new cells will have
   a. Only the 23 maternal chromosomes
   b. 92 chromosomes, as a result of doubling during the S-phase of the cell cycle
   c. 23 pairs of chromosomes
   d. Only 23 chromosomes, approximately half from each parent

9. During which phase of the cell cycle does mitosis happen?
   a. G1 Phase
   b. G2 Phase
   c. M Phase
   d. S Phase

10. Which of the following represents the phases of mitosis in their proper sequence?
    a. Prophase, metaphase, anaphase, telophase
    b. Interphase, prophase, metaphase, anaphase, telophase
    c. Interphase, prophase, metaphase, telophase
    d. Prophase, anaphase, metaphase, telophase

11. What is the role of spindle fibers during mitosis?
    a. They help separate the chromosomes
    b. They break down the nuclear membrane
    c. They duplicate the DNA
    d. They make the chromosomes visible

12. During normal mitotic cell division, a parent cell that has four chromosomes will produce two daughter cells each containing
    a. Two chromosomes
    b. Four chromosomes
    c. Eight chromosomes
    d. Sixteen chromosomes

13. Which term best describes the objects pointed to at number 19 in the diagram to the right?
    a. Sister Chromatids
    b. Spindle Fibers
    c. Homologous Chromosomes
    d. Centromeres
14. Which of the following best predicts the sex of the individual from which the chromosomes in the karyotype above came from?
   a. A male because the karyotype shows two X chromosomes
   b. A female because the karyotype shows one X chromosome and one Y chromosome
   c. A female because the karyotype shows two X chromosomes
   d. A male because the karyotype shows one X chromosome and one Y chromosome

15. Which stage of the cell cycle was this cell likely in when the chromosomes were extracted for the karyotype?
   a. G1 because only homologous pairs are present (no sister chromatids)
   b. G1 because each chromosome has a sister chromatid
   c. S because the DNA is replicating
   d. G2 because only homologous pairs are present (no sister chromatids)

16. Which of the following best describes how a homologous pair of chromosomes differs from sister chromatids?
   a. Homologous chromosomes are identical copies of one another whereas sister chromatids share the same types of genes but may have a different genetic code
   b. Both sister chromatids and homologous chromosomes are identical copies of one another, but sister chromatids can only be found before the cell goes into S-phase of interphase.
   c. Sister chromatids are identical copies of one another whereas homologous chromosomes share the same types of genes but may have a different genetic code
   d. They are not different, and the two terms can be used interchangeably.

Use the passage below to answer questions 17-19

Two students are doing an investigation to better understand what part of the cell cycle a cell spends most of its time. To do this, they cut off the tip of an onion root and prepared a slide to display the stages of the cell cycle each cell is in. After counting all of the cells visible on the microscope slide, the students tallied the number of cells in each stage. They repeated this process for 3 total fields of view (3 different slides). The data below shows their findings.

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<th>Control: Number of Cells</th>
<th>Slide 1</th>
<th>Slide 2</th>
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<tr>
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<td>23</td>
<td>70</td>
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<td>3</td>
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<td>Anaphase</td>
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<td>2</td>
<td>7</td>
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<tr>
<td>Telophase</td>
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<td>11</td>
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<tr>
<td>Total:</td>
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<td></td>
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17. Which of the following conclusions can be made by using the information above?
   a. A cell spends more time dividing its cytoplasm than dividing its nucleus
   b. A cell spends more time replicating DNA and growing than it does separating its nucleus
   c. A cell spends more time dividing its nucleus than dividing its cytoplasm
   d. A cell spends more time separating its nucleus than replicating DNA and growing

18. According to the data above, approximately what percent of time does the cell spend in mitosis?
   a. 90%
   b. 10%
   c. 9%
   d. 7%
19. According to the table above, which picture below would best represent the majority of the cells categorized during the data collection process?

A

B

C

D
### Assessment Answer Keys:

<table>
<thead>
<tr>
<th>Unit 1- Ecology Answer Key</th>
<th>Unit 2- Chemistry of Life Answer Key</th>
<th>Unit 3- Homeostasis Answer Key</th>
<th>Unit 4- DNA, RNA, and Proteins Answer Key</th>
<th>Unit 5- Heredity Answer Key</th>
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<tr>
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