PRACTICE TEST 1

1. Four categories of complex, highly organized molecular substances are needed for nearly all of the processes that take place in organisms. Which of the following correctly identifies these four categories of complex, highly organized molecular substances?

   A. lipids, proteins, water, nucleic acids
   B. lipids, proteins, enzymes, nucleic acids
   C. carbohydrates, lipids, proteins, nucleic acids
   D. carbohydrates, enzymes, nucleotides, amino acids

2. How do enzymes affect the reactions in which they take part?

   A. Most enzymes slow down chemical reactions.
   B. Enzymes are converted into products in the reaction.
   C. Enzymes increase the activation energy of the reaction.
   D. Enzymes decrease the activation energy of the reaction.

3. Most enzymes operate most efficiently within a certain range of temperatures. Enzymes in your body probably work best at what temperature?

   A. 25°C
   B. 30°C
   C. 37°C
   D. 98°C

4. Many organelles in a cell are bound by membranes. Which organelles consist of membranous tubes and sacs and serve as part of the cell’s packaging and transport system?

   A. mitochondria and lysosomes
   B. mitochondria and chloroplasts
   C. ribosomes and endoplasmic reticulum
   D. Golgi apparatus and endoplasmic reticulum
5 The illustration below shows a single-cell organism.

What is the role of the chloroplasts in this organism?
A to store energy
B to absorb water
C to aid in asexual reproduction
D to make food through the process of photosynthesis

6 The illustration below shows a human reproductive cell called a sperm cell.

A sperm cell uses structure A to move around. What is structure A?
A a cilium
B a flagellum
C a pilus
D a pseudopod
The diagram below shows a cell.

What type of organism might contain this type of cell?

A. animal
B. bacterium
C. plant
D. prokaryote

Daniel found the equation below in a textbook about cells.

\[ 6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow{\text{light}} \text{C}_6\text{H}_12\text{O}_6 + 6\text{O}_2 \]

What process is described by this equation?

A. cellular respiration
B. fermentation
C. glycolysis
D. photosynthesis

Which is a product of cellular respiration?

A. carbon dioxide
B. oxygen
C. protein
D. sugar
10 The diagram below is an energy pyramid.

In what level is there the LEAST energy available?

A the level that contains rats
B the level that contains grasses
C the level that contains the owl
D the level that contains grasshoppers

11 A carbon sink is a part of the Earth’s ecosystem that stores carbon in one form or another for hundreds, thousands, and even millions of years. Forests and oceans are known to be carbon sinks. Which of the following marine organisms play a major role in making the ocean a carbon sink?

A marine mammals, because they are high up on the food chain
B whales, because they are large and can take up large amounts of carbon dioxide
C seaweeds and phytoplankton, because they use carbon dioxide during photosynthesis
D zooplankton, because they make shells and skeletons from calcium carbonate dissolved in seawater
12 As an increasing amount of carbon dioxide is sent into the atmosphere by burning fossil fuels, the oceans absorb more and more of the excess carbon. Some of the carbon reacts chemically in seawater to form an acid. The more carbon the ocean takes in, the more acidic the water becomes. If the water becomes too acidic, tiny organisms that make up plankton may not be able to make protective shells. One of the areas that would be greatly affected is the Antarctic. What effect, if any, might this harm to plankton have on an Antarctic marine food web?

A  It would have no effect, because the organisms in plankton include algae, which do not have shells.

B  It would be beneficial, because consumers in the third trophic level could more easily eat zooplankton that does not have protective shells.

C  Damage to the Antarctic ecosystem would be extensive but could be repaired as new plankton drifts south to replace the plankton that died off.

D  The dying off of these tiny organisms would be disastrous, because zooplankton is a major source of food for small and large marine organisms.

13 Two species of finches are in competition for the limited resources of an ecosystem. One species eats fruit and the second species eats seeds. If a third species of herbivore finches moves into the area, how will the ecosystem change?

A  Resources will be more abundant.

B  Water will become more available.

C  The climate of the ecosystem will change.

D  Fruit and seed resources will become less abundant.

14 The population size that an environment can sustain is called the carrying capacity. Which of the following factors would NOT decrease the carrying capacity of a pond environment?

A  drought

B  flooding

C  food shortages

D  unusually low temperatures
DNA is composed of strands of nucleotides that pair in regular patterns and are held together by the forces shown in the diagram below.

What forces, represented by dotted lines, hold together the two strands of DNA shown in the diagram above?

A. ionic bonds  
B. covalent bonds  
C. hydrogen bonds  
D. carbon-carbon bonds

According to the genetic code, the mRNA codons UCU, UCC, UCA, and UCG all code for the amino acid serine. What does this fact tell you?

A. The genetic code is the same for nearly all organisms.  
B. The genetic code does not dictate the amino acid sequence of proteins.  
C. A mutation in one base will always have a physical effect on the resulting protein.  
D. A mutation in one base could have absolutely no physical effect on the resulting protein.
17 Which of the following statements BEST describes the process of gene expression?

A Messenger, transfer, and ribosomal RNA transcribe information onto a cell's DNA.

B The information in DNA is transcribed to RNA and then transcribed to amino acids.

C The information in DNA is transcribed to RNA and then translated to make specific proteins.

D The information in DNA is translated by messenger RNA and then translated to make ribosomal RNA.

18 Construction workers attach ropes and pulleys to wooden timbers on an old bridge. They use the rope and pulley system like the one in the diagram below to move the timbers away from each other, in order to dismantle the bridge.

Which stage of mitosis is similar to this way of dismantling a bridge?

A anaphase

B metaphase

C prophase

D telophase
19 Every human begins as a single, fertilized egg. After about five days, a hollow ball has formed that contains about 30 specialized cells called stem cells. Embryonic stem cells can divide endlessly and give rise to every type of tissue in the body. Scientists hope that someday stem cells will make it possible to repair or replace damaged tissues. Embryonic stem cells used in research come from eggs that were fertilized in the laboratory and donated for research. Adult stem cells used in research are found in adult tissues. The use of embryonic stem cells is controversial because a human embryo is destroyed to obtain these cells. However, adult stem cells cannot be grown in the lab, and they occur in limited numbers in the body. Currently, large numbers of stem cells are needed for stem cell therapy. How does this fact affect the debate about the two sources of stem cells?

A Embryonic stem cells are readily available but are not thought to be useful for stem cell therapy.

B Adult stem cells are rare, and research needs to be done in order to find techniques to harvest more adult stem cells.

C Embryonic stem cells are rare, and research needs to be done in order to find techniques to harvest more adult stem cells.

D Somatic cells are destroyed during the collection of adult stem cells and there would be too much damage to justify the harvesting of these cells.

20 The following chart shows the number of $2n$ chromosomes in various organisms.

<table>
<thead>
<tr>
<th>Organism</th>
<th>Number of $2n$ Chromosomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosquito</td>
<td>6</td>
</tr>
<tr>
<td>Corn</td>
<td>20</td>
</tr>
<tr>
<td>Human</td>
<td>46</td>
</tr>
<tr>
<td>Dog</td>
<td>78</td>
</tr>
</tbody>
</table>

Which series lists the number of chromosomes in each gamete of a mosquito, corn, a human, and a dog?

A 3, 10, 23, 39

B 3, 15, 22, 46

C 6, 20, 23, 39

D 6, 20, 46, 78
21 For a certain animal, black fur color is dominant over brown fur color. The pedigree below shows a cross between two individuals that have black fur.

Which of the following must be true?
A Both parents are homozygous for the black-fur trait.
B Both parents are heterozygous for the black-fur trait.
C The offspring with brown fur has a mutant gene for fur color.
D One parent is heterozygous and one is homozygous for fur color.

22 During replication, a double-stranded DNA molecule opens up exposing the bases on each strand. Complementary bases line up with the bases on each of the exposed original strands, forming two new strands. The sequence of bases on one of the original strands is CGGTAGGG. What is the sequence of bases on its complementary strand of DNA?
A CGGTAGGG
B CGGTUGGG
C GCCATCCC
D GCCAUCCC
23 Mutations can occur during mitosis, which produces body cells, and meiosis, which produces gametes. Which of the following statements about mutations is true?

A Mutations in the DNA of body cells cannot affect the individual in which they happen.

B A mutation in the DNA of a body cell can cause the cell to produce a protein that does not function.

C A mutation in the DNA of a gamete affects the body cells of the individual that produced the gamete.

D Mutations in the DNA of body cells can cause the offspring to produce a protein that does not function.

24 Most mutations involve a misplacement of a nucleotide on a DNA segment. Which of the following is NOT a possible result of a mutation?

A The mutation will be passed on to the next generation.

B The mutation will cause immediate death of the individual.

C The gene that contains the mutation will be expressed in a new way.

D The gene that contains the mutation will be expressed in the same way as before the mutation.
In the Linnaean system of classification, organisms are grouped in successive levels of hierarchy based on similarities in their form and structure. The diagram below models the eight basic levels of the modern Linnaean system.

Which level of the Linnaean system does level 8 represent in the figure?

A. class  
B. domain  
C. family  
D. species
In a classroom experiment, high school students conducted a survey to determine the similarities and differences among groups of invertebrates. They recorded their observations in Figure 1. They also made a chart of phyla in the animal kingdom showing evolutionary milestones (Figure 2). They wanted to know where each invertebrate specimen they examined would fit on a phylogenetic tree, with Chordata being the most evolved and Porifera being the least evolved.

<table>
<thead>
<tr>
<th>Animal</th>
<th>Phylum</th>
<th>Symmetry</th>
<th>Internal body plan</th>
<th>Other observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sponge</td>
<td>Porifera</td>
<td>Asymmetrical</td>
<td>Full of holes</td>
<td></td>
</tr>
<tr>
<td>Hydra</td>
<td>Cnidaria</td>
<td>Radial</td>
<td>Tissues &amp; Stinging cells</td>
<td></td>
</tr>
<tr>
<td>Planarian</td>
<td>Platyhelminthes</td>
<td>Bilateral</td>
<td>Acetomate</td>
<td>Gut has one opening</td>
</tr>
<tr>
<td>Roundworm</td>
<td>Nematoda</td>
<td>Bilateral</td>
<td>Pseudocoelomate</td>
<td>Threadlike</td>
</tr>
<tr>
<td>Earthworm</td>
<td>Annelida</td>
<td>Bilateral</td>
<td>Coelomate</td>
<td>Segmentation</td>
</tr>
<tr>
<td>Snail</td>
<td>Mollusca</td>
<td>Bilateral</td>
<td>Coelomate</td>
<td>Muscular foot</td>
</tr>
<tr>
<td>Beetle</td>
<td>Arthropoda</td>
<td>Bilateral</td>
<td>Coelomate</td>
<td>Pained legs</td>
</tr>
<tr>
<td>Starfish</td>
<td>Echinodermata</td>
<td>Bilateral</td>
<td>Coelomate</td>
<td>Five arms with tube feet</td>
</tr>
</tbody>
</table>

Examine the phyla in the chart of evolutionary milestones. Which two of the animals studied would be MOST closely related, according to the evolutionary hypothesis represented by a phylogenetic tree?

- **A** the earthworm and the planarian
- **B** the earthworm and the beetle
- **C** the sponge and the snail
- **D** the starfish and the hydra

27 Charles Darwin published his theory of evolution in 1859. In what way does modern evolutionary theory differ from the theory as proposed by Darwin?

- **A** Darwin inferred that individuals can evolve, but modern genetic science has shown that this is not true.
- **B** Darwin inferred that individuals do not evolve, but modern genetic science has shown that this is not true.
- **C** Modern science has disproved most of Darwin's original theory of evolution, because Darwin knew nothing about genes and their role in heredity.
- **D** Genetic studies have shown that gene expression and other factors operate along with natural selection, and most of Darwin's theory has been supported by modern science.
Evidence exists that during the millions of years in which the Grand Canyon formed, the canyon divided a single population of tufted-ear squirrels into two populations. One of these squirrel populations, the Kaibab squirrel, now lives in isolation from the other tufted-ear squirrels on the North Rim of the canyon. The other population, the Abert’s squirrel, lives on the South Rim. Some biologists think that the two populations of squirrels have evolved into two separate species. Other biologists think that the Kaibab squirrel is a subspecies of the Abert’s squirrel.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Abert’s squirrel</th>
<th>Kaibab squirrel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>western United States; Mexico</td>
<td>North Rim; Kaibab Plateau</td>
</tr>
<tr>
<td>Habitat</td>
<td>ponderosa pine forest</td>
<td>ponderosa pine forest</td>
</tr>
<tr>
<td>Belly</td>
<td>white</td>
<td>black</td>
</tr>
<tr>
<td>Tail</td>
<td>white</td>
<td>white</td>
</tr>
<tr>
<td>Ears</td>
<td>tufted</td>
<td>tufted</td>
</tr>
<tr>
<td>Predators</td>
<td>hawks; human hunters</td>
<td>hawks</td>
</tr>
</tbody>
</table>

The cladogram above shows the evolution of the original tufted-ear squirrel population into two separate species. Which of the following factors would make the evolution of the squirrel population into separate species LESS LIKELY?

A. Different predators live on the North and South Rims of the canyon.
B. A few of the squirrels manage to cross the canyon and breed with squirrels on the other side.
C. Different trees grow on the North and South Rims of the canyon because of changes in the water table.
D. A disease attacks one population of squirrels and kills most of them. The squirrels on the other side of the canyon are not affected.
A population of crabs living on a sandy beach exhibits three colors: dark brown, light brown, and speckled, as shown below. The genotypes for these colors are $BB$ for dark brown, $bb$ for light brown, and $Bb$ for speckled. The speckled color blends in extremely well with the color of the sand on the beach. The pattern appears to provide the speckled crabs with some protection from predatory birds.

**PHENOTYPES AND GENOTYPES OF CRABS**

<table>
<thead>
<tr>
<th>Phenotype</th>
<th>Genotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speckled</td>
<td>$Bb$</td>
</tr>
<tr>
<td>Dark Brown</td>
<td>$BB$</td>
</tr>
<tr>
<td>Light Brown</td>
<td>$bb$</td>
</tr>
</tbody>
</table>

Which of the following conclusions can be drawn from the information above?

A. Only the speckled crabs will survive, and all of their offspring will be speckled.

B. The allele for light brown color will be lost because of predatory birds eating light brown crabs.

C. The allele for dark brown color will be lost because of predatory birds eating dark brown crabs.

D. Both the light brown and dark brown alleles will continue to be passed on in the crab population.

Which of the following mutations would be MOST LIKELY to improve the chances that an organism would survive and reproduce?

A. a stronger scent that makes an animal easier to find

B. a weaker scent that makes a flower less attractive to bees

C. weaker eyesight that makes an animal less likely to find prey

D. stronger leg muscles that allow an animal to jump away from danger
31 Genetic variation can increase the pace of evolution. Which would most likely increase genetic variation in a population?

A cloning
B twinning
C crossing-over
D asexual reproduction

32 The experimental setup shown in the illustration below tests a scientific theory or model of the origin and history of life on Earth.

Which theory or model does this experimental setup represent?

A the bubble model
B the endosymbiotic theory
C the primordial soup model
D the formation of microspheres and coacervates
Imagine that a membrane that is permeable to sodium ions divides two sides of a beaker. On the right side of the beaker, there is a higher concentrated solution of sodium ions. On the left side of the beaker, there is a less concentrated solution of sodium ions.

A. Sodium ions can freely cross the membrane by diffusion. What is diffusion?

B. In which direction will diffusion of the sodium ions take place? Explain.

Metabolism is the sum of all of the chemical reactions carried out in an organism.

A. What molecule temporarily stores energy that cells can use to carry out the reactions of metabolism?

B. How do cells generate this molecule that stores energy?
In healthy people, red blood cells have a flat, round shape. Sickle cell anemia is a genetic disorder in which red blood cells have a flat, sickle shape. The sickle cell trait is caused by a recessive allele that produces a defective protein.

A. Which protein found in red blood cells is defective in people with sickle cell disease?

B. What is the function of this protein?

A heterozygous cross is a cross between two individuals that are heterozygous for a trait. That is, each parent displays the dominant trait but has both a recessive allele and a dominant allele for that trait.

A. What are the predicted genotype ratios of the offspring of a heterozygous cross?

B. What are the predicted phenotype ratios of the offspring of a heterozygous cross?
37 Describe the role of ribosomes in a cell.

38 What do the arrows on a food chain or food web represent?
39 A mutation occurs during gamete formation, producing a sperm cell that has a defective gene. After fertilization, the resulting zygote contains a copy of the defective gene. Which cells in the developing individual will also contain a copy of that defective gene? Explain.

40 Describe an example of a trait with multiple alleles.