April Break Work

Directions: You are receiving a packet to complete over the break. This will be graded in part based on effort and in part on accuracy, and it will count as a test grade. If you complete your April break work, you will be in study hall for the week after we return; if you do not, you will be in mandatory HWC until 4:00.

Multiple Choice: Underline key information in each question and cross out information you don’t need.

1. The feather color of Andalusian chickens is controlled by a single gene with two alleles. A cross between a true-breeding, white-feathered Andalusian hen and a true-breeding, black feathered Andalusian rooster results in 100% blue-feathered Andalusian offspring.

Which of the following describes the inheritance pattern for feather color in these chickens?

a. It is a polygenic pattern because more than two phenotypes are possible.
b. It is a dominant-recessive pattern because both parents are true breeding.
c. It is a sex-linked pattern because the hen and rooster have different feather colors.
d. It is a codominant pattern because the heterozygous offspring have a different phenotype than either parent.

2. In the presence of the enzyme CPK, the reaction below can occur in muscle cells.

\[
\text{CPK} \quad \text{Phosphocreatine} + \text{ADP} \rightarrow \text{Creatine} + \text{ATP}
\]

Based on this information, when should the CPK enzyme be most active?

a. during sleep, when body temperature is low
b. during exercise, when the need for energy is high
c. during digestion, when the need for glucose is high
d. during periods of growth, when nutrient levels are low

3. Which of the following is the best evidence that two birds belong to the same species?

a. The two birds eat the same food.
b. The two birds have common behaviors.
c. The two birds are the same color and size.
d. The two birds mate and produce fertile offspring.

4. Which of the following is always a part of normal sexual reproduction?

a. The male produces gametes by mitosis.
b. An offspring looks identical to its parents at birth.
c. The female carries only one fertilized egg at a time.
d. An offspring receives half its chromosomes from each parent.
5. The shape of songbirds wings affects the efficiency of flight. Birds with more pointed wings fly long distances more efficiently, and birds with more rounded wings fly short distances more efficiently.

Over the last 100 years, large portions of forests have been cut down, forcing many songbirds to travel to other forests to find mates. Which of the following evolutionary changes has most likely occurred in these bird populations as a result?

- a. Bird wings are more pointed than they previously were.
- b. Bird wings are more rounded than they previously were.
- c. Young birds learn to use their pointed wings later than they previously did.
- d. Young birds learn to use their rounded wings earlier than they previously did.

6. In pea plants, the allele for smooth seeds (R) is dominant to the allele for wrinkled seeds (r). Two parent plants are crossed. Almost half of the offspring have smooth seeds, while the rest of the offspring have wrinkled seeds.

Which of the following identifies the most likely genotypes of the two parent plants?

- a. RR and Rr
- b. RR and rr
- c. Rr and rr
- d. Rr and Rr

7. Maltose is a carbohydrate molecule that provides energy to plants early in their life cycle. Which elements are most common in a molecule of maltose?

- a. carbon and hydrogen
- b. copper and nitrogen
- c. iron and phosphorous
- d. magnesium and sulfur

8. A substitution mutation occurs in a DNA sequence, as represented below.

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<table>
<thead>
<tr>
<th>mRNA Codon</th>
<th>AUG</th>
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<th>UCC</th>
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Based on this information, what is the expected effect of the mutation?

- a. The polypeptide will have fewer amino acids.
- b. The polypeptide will have the same amino acids.
- c. The polypeptide will contain a different amino acid.
- d. The polypeptide will contain an additional amino acid.
Open Response: For each question, underline the key words in the question and write down important ideas/concepts that are connected to the key words. Make sure to pay attention to what each part of the question is asking and to answer all sections of the question in CAF.

1. The diagram below shows the chemical structure of a type of lipid molecule called a phospholipid.

![Diagram of a phospholipid molecule](image)

Atoms of five different elements make up the phospholipid molecule.

   a. Besides phosphorus, identify two other elements in the phospholipid molecule.

   The building block (monomer) of lipids is labeled X in the diagram.

   b. Identify this building block of lipids.

Lipids have important functions in the body.

   c. Describe two functions of lipids in the human body.
2. The American curl is a type of cat with curled ears. A single gene with two alleles codes for the ear-shape trait. The dominant allele (R) codes for curled ears, and the recessive allele (r) codes for straight ears. A heterozygous male curl cat is crossed with a heterozygous female curl cat.

a. Using the allele symbols above, identify the genotype of the parent cats.

b. Determine the expected phenotype ratio of the offspring that result from the cross. Draw a Punnett square to support your answer.

c. Which of Mendel's laws, the law of segregation or the law of independent assortment, is demonstrated by the cross represented by the Punnett square you drew in part (b)? Explain your answer.

d. Do the four squares in the Punnett square represent gametes or body cells? Explain your answer.
3. The lizard *Gallotia galloti* lives on four of the Canary Islands, as shown on the map below. Each island has its own population of lizards, numbered 1 to 4 on the map.

![Map of the Canary Islands with 4 populations marked](image)

Scientists have sequenced and compared DNA from lizards in each population. The cladogram below shows one hypothesis regarding how the lizard populations are related.

![Cladogram showing relatedness of lizard populations](image)

a. The DNA sequences of individuals from population 3 are probably most similar to the DNA sequences of individuals from which other population (1, 2, or 4)? Explain your answer.

Scientists also sometimes analyze behaviors when investigating relatedness among organisms.

b. Besides DNA and behavior, identify one type of evidence scientists could have used to investigate relatedness among the four lizard populations.

Scientists predict that, much like the finches on the Galápagos Islands, the four populations of *Gallotia galloti* will become separate species over time.

c. Describe the roles of both the environment and geographic isolation in the lizards’ becoming different species.
4. A certain genetic disorder is caused by a single base mutation in the DNA of a certain gene. The mutation changes the amino acid glutamate (Glu) to aspartate (Asp).

a. Identify the type of macromolecule (carbohydrate, lipid, nucleic acid, protein) that changes when Glu changes to Asp. Explain your answer.

A portion of the amino acid sequence that includes this mutation is shown below.

Val-Ser-Ala-Arg-Asp

The sample of DNA below is being analyzed to determine if a patient has the genetic disorder.

3'CAA-TCG-CGG-TCT-CTT 5'

b. Determine the mRNA sequence from the patient's DNA sequence.

c. Using the information in the codon table below, determine the amino acid sequence that is coded for by the mRNA sequence you determined in part (b).

d. Determine whether the patient has the genetic disorder. Explain your answer.

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