



SECTION 2

TEST I SAMPLE QUESTIONS

This section of the Georgia Assessments for the Certification of Educators® (GACE™) Preparation Guide provides sample selected-response questions with an annotated answer key for you to review as part of your preparation for the test. The sample selected-response questions are designed to illustrate the nature of the test questions. Work through the questions carefully before referring to the annotated answer key, which follows the sample selected-response questions. The answer key provides the correct response to each question, describes why each correct response is the best answer, and lists the objective within the test framework to which each question is linked.

Section 2: Test I Sample Questions

QUESTIONS

1. Trypsinogen, a digestive enzyme secreted by pancreatic cells, undergoes processing in both the rough endoplasmic reticulum (rER) and the Golgi apparatus during its synthesis. In which of the following ways is trypsinogen transferred between these two organelles?
 - A. Trypsinogen is actively transported through a channel membrane connecting the rER and the Golgi apparatus.
 - B. The lumen of the rER is contiguous with the lumen of the Golgi apparatus.
 - C. Vesicles containing the enzyme bud from the rER and fuse with the Golgi apparatus membrane to release their contents.
 - D. Trypsinogen diffuses through the cytoplasm from the rER to the Golgi apparatus.
2. A bacterium is a facultative anaerobe and is capable of carrying out both anaerobic and aerobic respiration. When it is in an anaerobic environment, the bacterium will:
 - A. produce lactate rather than ethanol as a by-product.
 - B. require more glucose to produce the same amount of ATP.
 - C. use FADH_2 instead of NADH as an electron donor.
 - D. generate more CO_2 as a waste product.
3. Poisons that block the function of protein complexes in the electron transport chain interfere with the production of ATP by inhibiting:
 - A. the direct phosphorylation of ADP into ATP.
 - B. the transfer of intermediate compounds between the electron transport chain and the citric acid cycle.
 - C. the reduction of NAD^+ to NADH and FAD to FADH_2 .
 - D. the movement of H^+ across the inner mitochondrial membrane.
4. Two identical cells in an early embryo develop into cells of different tissues in the fully formed organism. This process occurs due to differences in:
 - A. the genomic composition of the embryonic cells.
 - B. gene expression triggered by signals from neighboring cells.
 - C. the rates of cell division in the various layers of the embryo.
 - D. ATP production in various regions of the developing body.

5. Two genes are linked on the same autosomal chromosome in an animal species. An individual of the species had parents with the genotypes *DDMM* and *ddmm* for these two genes. When the individual produces gametes, they have the haploid genotypes *DM*, *dm*, *Dm*, and *dM*. These gametic genotypes can be best accounted for by:
- independent assortment of homologous chromosomes during meiosis I.
 - errors in chromosome duplication preceding meiosis.
 - random movements of sister chromatids to either end of the cell during meiosis II.
 - crossing over between homologous chromosomes during meiosis I.
6. In contrast to the secondary structure of DNA, the secondary structure of tRNA:
- exhibits complementary base pairing within the same strand.
 - is achieved through a series of highly endergonic reactions.
 - is stabilized by hydrogen bonding between complementary bases.
 - is most often circular with the ends joined.
7. In contrast to the domain Eukarya, the domain Archaea includes organisms with:
- cell walls composed of cellulose or chitin.
 - the ability to produce ATP using a wide variety of electron donors.
 - linear DNA that is associated with histone proteins.
 - the metabolic machinery to produce their own food.
8. Which of the following best describes the mechanism by which a non-native bird species that arrives on an island becomes a distinct species from their mainland ancestors?
- Changes in allele frequencies in either population cannot be shared with the other due to geographic isolation.
 - The non-native island birds are not subject to the level of predation present on the mainland and become reproductively more successful.
 - Without a large breeding population, the non-native island birds are forced to interbreed with native bird species.
 - Differences in the type of food available on the island lead to extensive physiological adaptations in the non-native birds.

ANNOTATED ANSWER KEY

For question	The correct response is	Reason	Test Objective
1	C	Synthesis of many secretory proteins, such as trypsinogen, begins in ribosomes attached to the rough endoplasmic reticulum. These proteins are wrapped in the membranes of vesicles that bud from a specialized region of the rough endoplasmic reticulum called the transitional endoplasmic reticulum. These vesicles, called transport vesicles, travel to the Golgi apparatus where they are modified, stored, and then sent to other destinations.	0001
2	B	Facultative anaerobes can make ATP by aerobic respiration or by the anaerobic process of fermentation depending on whether or not oxygen is present. In aerobic respiration, glycolysis produces 2 ATP molecules and pyruvate; approximately 32 additional ATP molecules are then produced from the pyruvate by oxidative phosphorylation driven by the electron transport chain, and the Krebs cycle. In fermentation, the electron transport chain and the Krebs cycle are both absent, ATP is produced only by glycolysis, and the energy stored in the pyruvate is not released. Thus, aerobic respiration yields far more energy from each glucose molecule than does fermentation.	0002
3	D	The electron transport chain is a collection of molecules that are embedded in the inner membrane of a mitochondrion. Electrons travel down the chain releasing energy that is used to pump H^+ ions across the inner mitochondrial membrane, creating a H^+ gradient. Diffusion of H^+ ions back across the membrane is limited to places on the membrane occupied by a particular protein complex called ATP synthase. ATP is synthesized as the H^+ ions pass through a channel in the ATP synthase molecule. Thus, poisons that inhibit the movement of H^+ ions across the inner mitochondrial membrane will interfere with the production of ATP.	0003
4	B	Since a body grows by mitotic division from the original zygote, all of a body's somatic cells contain the same complement of genes. However, as the embryo develops, cells differentiate and become specialized for making different proteins, which are used to construct tissues and organs. Cells make different proteins because different gene sequences are turned on or turned off in different types of cells. Research has demonstrated that each developing cell influences which genes will be turned on or turned off in neighboring cells.	0004

For question	The correct response is	Reason	Test Objective
5	D	Since both parents are homozygous, each can only produce a homozygous gamete and the individual will receive one homozygous dominant chromosome (<i>DM</i>) from one parent and one homozygous recessive (<i>dm</i>) from the other. However, since the individual produces two heterozygous gametes (<i>Dm</i> and <i>dM</i>), as well as the expected two homozygous gametes (<i>DM</i> and <i>dm</i>), some reshuffling of alleles must have occurred during meiosis. Because the genes are linked on the same chromosome, random assortment of chromosomes cannot be a factor. Crossing over, or the exchange of genes between two homologous chromosomes, is the only other process that leads to the reshuffling of alleles during meiosis.	0005
6	A	The secondary structures of DNA and RNA molecules are determined by hydrogen bonds between complementary nitrogenous bases. In a double-stranded DNA molecule, the nitrogenous bases (e.g., adenine, guanine) of one strand are paired by hydrogen bonds with the complementary bases of the other strand in a characteristic double helix shape. Transfer RNA (tRNA) molecules consist of a single, short strand of RNA that folds back on itself to form a compact three-dimensional secondary structure. This folded structure is reinforced by hydrogen bonds between the bases of one region and the complementary bases of another region of the same strand.	0006
7	B	In the Eukarya, production of energy used to make ATP depends on the oxidation of glucose. In this process, electrons are removed from the glucose molecule and transferred to oxygen, liberating energy as a result. Members of the Archaea, in contrast, depend on a wide range of other substances such as methane or sulfur as "food," and production of ATP in these organisms involves removal of electrons from these substances rather than from glucose.	0007
8	A	Populations of mainland birds that become isolated on islands are typically very small and usually represent only a fraction of the genetic variation present in the species in the original mainland habitat. If the island population remains small for a period of time, genetic drift will cause the genome of the island population to further diverge from that of the mainland population. Differences in ecological conditions between the island and the mainland will lead to additional genetic divergence in the two populations due to natural selection. Ultimately, this divergence will lead to reproductive isolation of the island population and the development of a distinct species.	0008