SECTION 4

TEST II 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.

Please note that a periodic table and a set of constants and formulas are provided for this test. Please refer to these materials as needed in responding to the sample test questions and assignments. These materials are located in the Assessment Reference Materials section at the end of this preparation guide.

A scientific calculator may be used for this test as needed in responding to the sample test questions and assignments. Please refer to the current GACE registration bulletin for information about the use of calculators at the test administration.

QUESTIONS

1. The noble gases were once referred to as inert because they are chemically unreactive under most conditions. The very low reactivity of these gases results from the fact that:

   A. the atoms of these elements are electrically neutral.

   B. they have an extremely low specific gravity.

   C. their outermost electron shells are filled.

   D. they form their own diatomic molecules.

2. **Use the balanced equation below to answer the question that follows.**

   $CaCO_3 \longrightarrow CaO + CO_2\,(g)$

   What is the approximate theoretical yield of CaO when a 50.0 g sample of $CaCO_3$ is heated?

   A. 14.0 g

   B. 25.0 g

   C. 28.0 g

   D. 50.0 g

3. A heated 100 g sample of copper (specific heat = 0.382 J/g•°C) is placed in 200 g of cool water (specific heat = 4.18 J/g•°C). The temperature of the water rises by 1°C as the temperature of the copper and water come into equilibrium. Assuming no heat is lost to the surroundings, how far did the temperature of the copper sample fall?

   A. 0.046°C

   B. 1.25°C

   C. 3.19°C

   D. 21.9°C

4. A spacecraft has a mass of 1000 kg and a velocity of 50 m/s as it travels through outer space. A retrorocket is fired that applies a braking force of 200 N to the spacecraft. How long will it take the spacecraft to come to a complete stop?

   A. 10 s

   B. 20 s

   C. 250 s

   D. 400 s

5. Which of the following best demonstrates the principle of interference?

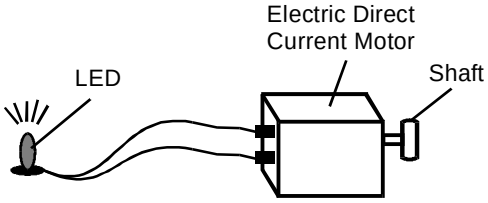
   A. A filter reduces the glare from the surface of a lake.

   B. A colorful pattern is created on the surface of a bubble.

   C. A prism separates a beam of white light into many colors.

   D. A microscope produces a magnified image of a plant cell.

6. **Use the information below to answer the question that follows.**



In the diagram above a light-emitting diode (LED) is attached to the terminals of an electric direct current motor. When the shaft of the motor is rotated, the LED is illuminated. The principle explaining the generation of electricity in this circuit is best described by which of the following?

   A. The power in a circuit is the product of the voltage across the circuit and the charge flowing through it.

   B. When a conductive wire is moved in a magnetic field, a force is exerted on the electrons in the wire.

   C. The voltage in a conductor is proportional to the current through the circuit.

   D. When two surfaces are rubbed together, electrons are transferred from one surface to the other.

7. A researcher is using the following materials to gather information about the factors that affect the rate at which a solute dissolves in a liquid: sugar cubes, water, 250 mL beakers, a glass stirring rod, a hammer, and a stopwatch. The researcher is using only one cube per trial. Which of the following hypotheses could be most accurately tested using only the materials listed above?

   A. The temperature of the solvent affects the rate at which the solute dissolves.

   B. The rate at which the solute dissolves in the solvent depends on the density of the solution.

   C. The amount of solute being dissolved in the solvent affects the rate at which it dissolves.

   D. The rate at which the solute dissolves in the solvent increases when the solution is agitated.

8. Which of the following techniques can be used to help determine whether a rock sample is limestone?

   A. weighing the sample in water and in the air to determine its volume and specific gravity

   B. pouring a small amount of dilute hydrochloric acid on the sample to determine if it reacts with the acid

   C. scratching the surface of the sample with a variety of materials to determine its hardness

   D. comparing the color of the sample to the streak it leaves on a streak plate to determine its mineral composition

9. The use of significant figures in scientific calculations is designed to ensure that:

   A. the result of a calculation does not imply more precision than the measurements on which it is based.

   B. the level of accuracy of original measurements is maintained in any related calculations.

   C. scientific calculations can be replicated by researchers working under different conditions.

   D. scientific measurements are made in a standardized manner that is understandable to other scientists.

10. Scientists rely on computer models to predict climate primarily because:

    A. the variables in the climate system are complex and cannot be manipulated by scientists.

    B. the large amounts of data generated from weather observations must be correlated.

    C. the multiple factors involved in the climate system act independently of each other.

    D. the data used to understand climate include information collected using different research methods.

ANNOTATED ANSWER KEY

For question	The correct response is	Reason	Test Objective
1	C	The noble gases have very stable arrangements of electrons. With the exception of helium, the noble gases have eight valence electrons, causing them to have a low affinity for additional electrons and to be chemically unreactive.	0011
2	C	In the balanced equation: $CaCO_3 \longrightarrow CaO + CO_2$, 1 mole of $CaCO_3$ produces 1 mole of CaO. Given this one-to-one relationship, the moles of $CaCO_3$ that are heated will yield the same numbers of moles of CaO. It can be determined from the periodic table that 1 mole of $CaCO_3$ = 100.1 g and 1 mole of CaO = 56.1 g. Since the 50.0 g of $CaCO_3$ that are heated is equal to 0.5 moles of $CaCO_3$, the molar mass of CaO produced by the reaction will be 0.5 moles of CaO or 28.0 g. The calculations can be carried out as follows: $(50.0\text{ g } CaCO_3) \bullet \left(\frac{1\text{ mole}}{100.1\text{ g } CaCO_3}\right) \bullet \left(\frac{56.1\text{ g CaO}}{1\text{ mole}}\right) = 28.0\text{ g CaO}$	0012
3	D	Once the system has reached equilibrium, the energy gained by the water that caused its temperature to rise by 1°C must equal the energy lost by the sample of copper. Since copper has a much lower specific heat than water and the mass of the copper sample is half the mass of the water, the drop in temperature of the copper is much greater than the 1°C rise in the temperature of the water. The formula for calculating the temperature of the sample of copper once the system reaches equilibrium is as follows: $(0.382\text{ J/g}\bullet\text{°C}) \bullet (100\text{ g}) \bullet (X) = (4.18\text{ J/g}\bullet\text{°C}) \bullet (200\text{ g}) \bullet (1\text{°C})$. Rearranging the equation to solve for X gives the following equation: $X = \frac{(4.18\text{ J/g} \bullet \text{°C}) \bullet (200\text{ g})}{(0.382\text{ J/g} \bullet \text{°C}) \bullet (100\text{ g})} = 21.9\text{°C}$	0013
4	C	When the retrorocket is fired, a negative force, or a force in the opposite direction of the velocity of the rocket, causes the rocket to undergo negative acceleration. The acceleration, a, can be found using $F = ma$, where F is the braking force (–200 N) and m is the mass of the rocket (1000 kg). This gives the equation: $-200\text{ N} = (1000\text{ kg}) \bullet a$, hence $a = -0.2\text{ m/s}^2$. Since the acceleration is constant, $v_f = at + v_i$, where v_f and v_i are the initial and final velocities of the rocket, respectively. The initial velocity is 50 m/s and the final velocity is 0 m/s when the rocket has come to a complete stop. Hence, $0\text{ m/s} = -0.2\text{ m/s}^2\, t + 50\text{ m/s}$. Rearranging the equation to solve for t gives: $t = \frac{50\text{ m/s}}{0.2\text{ m/s}^2}$ or $t = 250$ s.	0014

For question	The correct response is	Reason	Test Objective
5	B	The phenomenon of interference results from the superimposing of different wavelengths. Light waves reflected from the outer and inner surfaces of the bubble travel different distances, causing the wavelengths to interfere with each other. When destructive interference occurs, a particular wavelength of light, yellow for example, will be subtracted from the white light making the reflected light appear blue, the complementary color of yellow. The variable thickness of different parts of a bubble will cause interference of different wavelengths and hence a variety of colors may appear on the surface of a bubble.	0015
6	B	The light-emitting diode receives energy from the electric current in the wire. The movement of electrons that produces that electric current is generated by a coil of conductive wire being moved through a magnetic field as the shaft of the electric motor is turned. The process of generating electricity by moving a conductive wire through a magnetic field demonstrates that magnetism and electricity are interrelated phenomena.	0016
7	D	The presence of a stopwatch in the tools provided for testing the hypothesis suggests that time is the independent variable. The use of a stirring rod indicates that stirring is also an important part of the experiment designed to test the hypothesis. In addition, the experimental design states that only one cube will be used per trial. Given these three parameters, the hypothesis that can be tested is the hypothesis stating that "The rate at which the solute dissolves in the solvent increases when the solution is agitated."	0017
8	B	Limestone (calcium carbonate) visibly reacts when drops of dilute hydrochloric acid are placed on it. It is a standard field and laboratory procedure used to identify limestone.	0018
9	A	Significant figures in a measurement include all digits that are known with certainty, plus the first digit that is uncertain. The number of significant figures in a measurement reflects the precision of the measurement. When measurements are made at a particular level of precision, to avoid implying more precision than is warranted, the number of significant figures used in calculations that involve those measurements must be the same as the number of significant figures used in making the original measurements.	0019
10	A	Computer models of climate are useful to scientists primarily because the variables that affect climate are complex and cannot be directly manipulated. Scientists enter many of the variables believed to affect climate into a model of a climate system on a computer and then alter one or two of the variables to demonstrate how changes in those variables may affect climate.	0020