SECTION 2

TEST I SAMPLE QUESTIONS

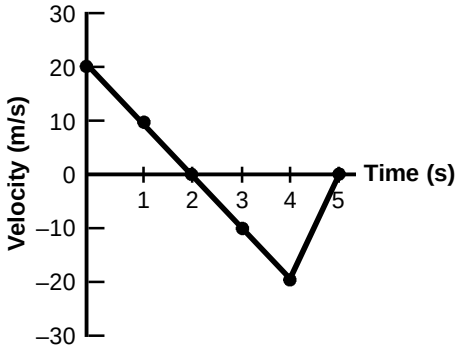
This section of the Georgia Assessments for the Certification of Educators® (GACE™) Preparation Guide provides sample selected-response questions with an annotated answer key for you to review as part of your preparation for the test. The sample selected-response questions are designed to illustrate 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.

Please note that 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. **Use the graph below to answer the question that follows.**



The graph above shows the velocity versus time of a particle moving in a straight line. If the particle's initial position is $x = 0$ m, what is the particle's position at $t = 5$ s?

A. $x = -20$ m

B. $x = -10$ m

C. $x = 0$ m

D. $x = 45$ m

2. A 0.25 kg mass is swung by a thin thread in a circular path of radius 0.5 m on a smooth horizontal surface. If the thread breaks when the tension is equal to 32 N, what is the tangential speed of the mass?

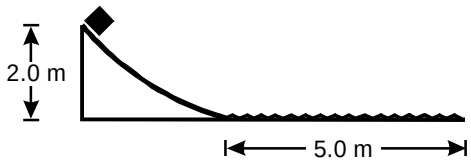
A. 4 m/s

B. 8 m/s

C. 16 m/s

D. 64 m/s

3. **Use the diagram below to answer the question that follows.**



A 0.5 kg block is released on a frictionless ramp 2 m high. The block slides across a rough horizontal surface and comes to a stop 5 m from the base of the ramp. Assuming the frictional force between the block and the rough surface is constant, what is the coefficient of friction between the block and the rough surface?

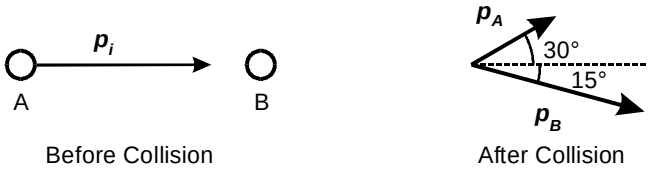
A. 0.10

B. 0.20

C. 0.25

D. 0.40

4. **Use the diagram below to answer the question that follows.**



The diagram above shows the momentum of two disks on a frictionless horizontal surface before and after a collision. Before the collision, Disk A has momentum p_i in the horizontal direction and Disk B is at rest. After the collision, the magnitudes of the momenta of Disk A and Disk B are p_A and p_B, respectively, in the directions shown. Given this information, which of the following equations must be true?

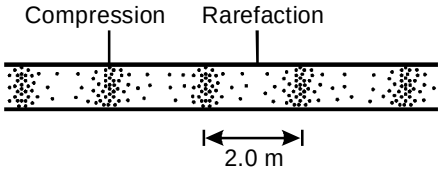
A. $p_A \cos 30° + p_B \cos 15° = p_i$

B. $p_A \cos 30° + p_B \cos 15° = 0$

C. $p_A \sin 30° + p_B \sin 15° = p_i$

D. $p_A \sin 30° + p_B \sin 15° = 0$

5. **Use the diagram below to answer the question that follows.**



The diagram above shows the distance between regions of rarefaction and compression of a harmonic sound wave traveling in a long tube containing a gas. If the frequency of the sound wave is 150 Hz, what is the speed of sound in the gas?

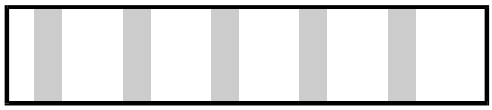
A. 75 m/s

B. 225 m/s

C. 300 m/s

D. 600 m/s

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



The diagram above shows the pattern formed on a screen by a laser beam that is passed through two narrow adjacent slits. This pattern is a consequence of the:

A. change in the speed of light as it passes through different media.

B. functional dependence of the angle of refraction on the wavelength of light.

C. polarization of the light waves into perpendicular components.

D. superposition of waves traveling different path lengths.

7. **Use the table below to answer the question that follows.**

Material	Specific Heat
Water	1.00 kcal/kg•°C
Glass	0.20 kcal/kg•°C

Boiling water (T = 100.0°C) is poured into a glass cup (T = 20.0°C). The mass of the water is 200 g and the mass of the cup is 100 g. Assuming no heat is exchanged with the surroundings, what is the final temperature of the water in the cup?

A. 81.8°C

B. 89.1°C

C. 92.7°C

D. 98.0°C

ANNOTATED ANSWER KEY

For question	The correct response is	Reason	Test Objective
1	B	The velocity of a particle is $v = \frac{dx}{dt}$. The displacement is $dx = v\,dt$, which is equal to the signed area under the v versus t graph. Since the graph is composed of two line segments, the area can be determined by finding the area of two triangles. From $t = 0$ s to $t = 2$ s, the area is $\frac{1}{2}(+20 \text{ m/s})(2 \text{ s}) = +20$ m. From $t = 2$ s to $t = 3$ s the area is $\frac{1}{2}(-20 \text{ m/s})(3 \text{ s}) = -30$ m. The displacement is the sum of these two or –10 m. Since the particle started at the origin, it has moved 10 meters in the negative x-direction and is located at the position $x = -10$ m.	0001
2	B	The only force acting on the 0.25 kg mass in the horizontal plane is T, the tension in the string, directed toward the center of the circle. Since the mass is moving in a circle of radius r at a tangential speed of v, Newton's second law, $\Sigma F = ma$ becomes $T = m\frac{v^2}{r}$. The thread breaks when $T = 32$ N, so the tangential speed can be found by using the values given and rearranging terms in the equation. This results in $v^2 = \frac{(32 \text{ N})(0.5 \text{ m})}{0.25 \text{ kg}}$, or $v = 8$ m/s.	0002
3	D	From the work-energy theorem, the initial potential energy must equal the energy lost due to the work done by friction. Let F_f = the constant frictional force, x = the distance the mass travels on the rough surface, and F_n = the normal force on the block. Then $mgh = F_f x$. In addition, the normal force is related to the frictional force and the weight of the block by $F_f = \mu F_n$ and $F_n = mg$. Combining these results into a single equation $mgh = F_f x = (\mu F_n)x = \mu mgx$, and solving gives $\mu = \frac{h}{x} = 0.40$.	0003

For question	The correct response is	Reason	Test Objective
4	A	Since there are no net external forces acting on the system of two disks, momentum is conserved. Momentum is a vector quantity, so the initial momentum of both disks in the *x*-direction and *y*-direction must equal the final momentum of both disks in the *x*-direction and *y*-direction, respectively. The initial momentum in the *x*-direction is p_i. The final momentum in the *x*-direction of Disk A is $p_A \cos 30°$. The final momentum in the *x*-direction of Disk B is $p_B \cos 15°$. Therefore, $p_A \cos 30° + p_B \cos 15° = p_i$.	0004
5	C	Sound is a longitudinal wave that propagates through air causing compressions (increased pressure) in some regions and rarefactions (reduced pressure) in other regions. The distance between compressions is equal to the wavelength of the sound wave. Since the speed of a wave is equal to the product of the frequency and wavelength, $v = f \bullet \lambda = (150 \text{ Hz})(2.0 \text{ m}) = 300 \text{ m/s}$.	0005
6	D	When light passes though each narrow slit, rays of light spread out in all directions as they travel toward the screen. Since laser light is monochromatic and coherent, if the paths of two rays of light that meet on the screen have traveled the same distance, or if they differ by a whole number of wavelengths, the light waves will be in phase and their amplitudes will add constructively to create a bright region on the screen. If the paths traveled by two waves differ by one-half wavelength, the rays will be out of phase and their amplitudes will add destructively and create a dark region on the screen. This is an application of the superposition principle for waves, which states that the resultant of two waves is the algebraic sum of the amplitudes of the waves.	0006
7	C	According to the law of conservation of energy, the thermal energy lost by the water will equal the thermal energy gained by the glass cup. This can be represented by the equation $m_w c_w \Delta T_w = m_g c_g \Delta T_g$, where m represents mass, c the specific heat, and ΔT the temperature change of the water (subscript w) and glass (subscript g). When the system is in equilibrium, the final temperature of the water is equal to the final temperature of the glass. Denote this temperature by T. The equation then becomes: $(0.20 \text{ kg})(1.00 \text{ kcal/kg} \bullet °\text{C})(100° - T) = (0.1 \text{ kg})(0.200 \text{ kcal/kg} \bullet °\text{C})(T - 20°\text{C})$. Solving gives $T = 92.7°\text{C}$.	0007