



Sample Test Questions

Science



SAMPLE TEST QUESTIONS

The sample test questions in this document are designed to give you an introduction to the nature of the questions included in the Washington Educator Skills Tests—Endorsements (WEST–E). They represent the various types of questions you may expect to see on an actual test in this test field; however, they are *not* designed to provide diagnostic information to help you identify specific areas of individual strength or weakness or to predict your performance on the test as a whole.

Work through the sample questions carefully before referring to the answer key that follows. The answer key provides the correct response for each question and lists the objective within the test framework to which each question is linked. When you are finished with the sample questions, you may wish to review the test objectives and descriptive statements provided in the test framework for this test field.

In addition to reading and answering the sample questions, you should also utilize the following preparation materials available on the WEST Web site:

- Read **WEST–E Test-Taking Strategies** to understand how test questions are designed to measure specific test objectives and to learn important test-taking strategies for the day of the test.
- Review the **Test Summary and Framework** for your test field to familiarize yourself with the structure and content of the test. This document contains general testing information as well as the percentage of the total test score derived from each content domain described in the test framework.

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

A scientific calculator may be used for this test as needed in responding to the sample test questions, and one will be provided at the test administration. Please refer to the current WEST registration information regarding the use of calculators at the test administration.

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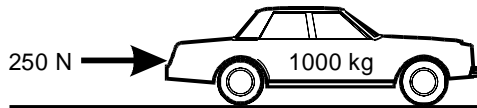
SAMPLE MULTIPLE-CHOICE QUESTIONS

- The type of chemical bond that an element will form with another element is most directly related to:
 - the difference between the total number of protons in the two elements.
 - the total number of electron energy levels in each of the two different elements.
 - the difference between the total number of neutrons and electrons in each element.
 - the number of electrons in the highest energy levels of the two elements.
- A chemist is studying a compound that forms when one atom loses an electron and another atom gains the lost electron. Which of the following types of chemical bond is formed?
 - a covalent bond
 - an ionic bond
 - a metallic bond
 - a hydrogen bond
- In the 1930s scientists demonstrated that mass could be converted into energy by bombarding a particular element with neutrons. Aside from energy, which of the following describes the products of this nuclear fission process?
 - lighter elements and neutrons
 - a chemical compound and subatomic particles
 - heavier elements and protons
 - a radioactive compound and electrons
- A scientist adds 1 mol of salt to 1 kg of water to raise the water's boiling point. The scientist then tries adding 1 mol of sugar to 1 kg of water, but discovers that it does not raise the boiling point as much as the salt does. Which of the following explains why salt raises the boiling point of water more than sugar does?
 - Dissolution of the sugar molecules increases the density of the water.
 - Sugar reduces the surface tension of the water.
 - Ionization of the salt creates twice as many particles in the water.
 - Salt reduces the vapor pressure of the water.



5. A chemist determines that the hydrogen ion concentration $[H^+]$ of a solution is $3.2 \times 10^{-9} M$. Given that $pH = -\log [H^+]$, what is the approximate pH of the solution?
- A. 8.5
 - B. 9.0
 - C. 9.3
 - D. 9.5
6. The air pressure exerted on the outside of a balloon inflated to a volume of 1.0 L at the earth's surface is 100 kPa. If the balloon is brought to an elevation where the pressure exerted on the balloon is 80 kPa and the temperature is the same, what will the volume of the balloon be?
- A. 0.25 L
 - B. 0.8 L
 - C. 1.25 L
 - D. 1.8 L
7. Which of the following physical phenomena is primarily responsible for the chill that a person often experiences immediately after bathing?
- A. evaporation
 - B. convection
 - C. condensation
 - D. diffusion
8. In the absence of air resistance, which of the following best describes why a 1 kg mass and a 2 kg mass dropped from the same height will both fall the same distance in the same amount of time?
- A. The gravitational force acting on the two objects is independent of their masses.
 - B. The 2 kg mass falls more slowly at first, but then catches up with the 1 kg mass because it accelerates more rapidly.
 - C. The two masses have the same amount of potential energy when they are first released.
 - D. The greater gravitational force on the 2 kg mass is compensated for by the greater value of its mass, producing the same acceleration.

9. Use the diagram below to answer the question that follows.

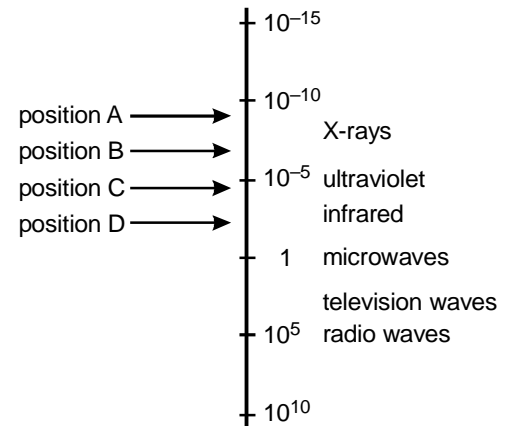


A 1000 kg car is being pushed with a constant 250 N force as shown in the diagram above. Assuming no friction, what is the car's acceleration on a flat surface?

- A. 0.25 m/s²
- B. 0.4 m/s²
- C. 2.5 m/s²
- D. 4.0 m/s²

10. Use the diagram below to answer the question that follows.

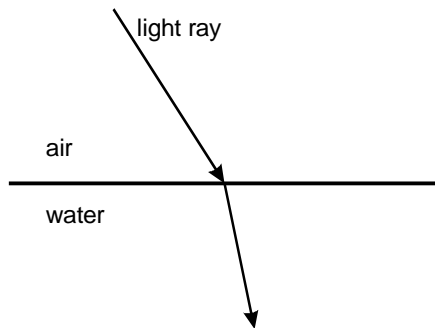
Approximate Wavelengths of Electromagnetic Radiation in Centimeters



The wavelengths of the different types of electromagnetic radiation in the electromagnetic spectrum are shown in the diagram above. Which of the following positions on the scale best approximates the location of the spectrum of visible light?

- A. position A
- B. position B
- C. position C
- D. position D

11. Use the diagram below to answer the question that follows.



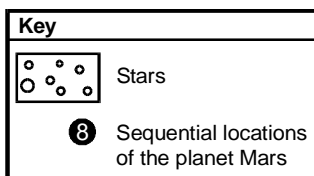
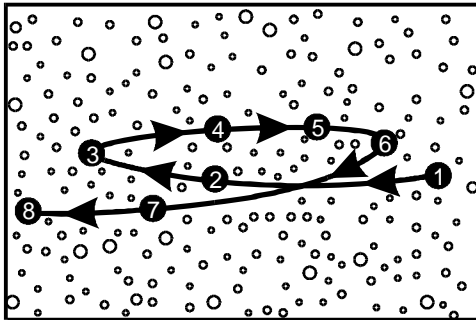
The diagram above shows a light ray striking the surface of a lake. As the light ray passes from the air into the water, the light bends. Which of the following statements best explains why the light bends as it passes into the water?

- A. The longer wavelengths are reflected by the surface of the water.
- B. The speed of the light decreases as it passes from the air into the water.
- C. The shorter wavelengths of light are absorbed by water molecules.
- D. The speed of the light increases as it passes from the air into the water.

12. According to Ohm's law, which of the following statements is accurate?
- A. Potential difference is directly proportional to resistance and inversely proportional to current.
 - B. Resistance is directly proportional to current and inversely proportional to voltage.
 - C. Current is directly proportional to voltage and inversely proportional to resistance.
 - D. Amperage is inversely proportional to potential difference and directly proportional to resistance.
13. Appliances and other electrical devices are connected in parallel to household circuits. Too many electrical devices connected to one circuit can overload the circuit because each additional electrical device:
- A. lowers the total resistance of the circuit.
 - B. raises the total voltage across each appliance's individual wiring.
 - C. reduces the circuit's capacity to transfer current.
 - D. increases the amperage supplied to each appliance.

14. Use the diagram below to answer the question that follows.

Observed Retrograde Motion of Mars as Seen from the Earth over the Course of Ten Months



The diagram above illustrates the observed motion of Mars against the background of stars over a period of ten months. As viewed from the earth, Mars appears to reverse direction at location 3 and then resume its initial direction at location 6. Which of the following is the cause of this observed retrograde motion of the planet Mars?

- A. The earth orbits the sun in less time than Mars does.
- B. The earth's orbital speed changes during the year.
- C. Mars orbits the sun in less time than the earth does.
- D. Mars's orbital speed changes during the year.

15. An astronomer using a spectroscope to view a star observes a continuous spectrum with a series of dark lines running through it. This dark-line spectrum provides which of the following types of information about the star?

- A. the speed at which the star is receding from the earth
- B. the specific elements being used for fuel in the star's interior
- C. the rate at which planetary objects surrounding the star system are orbiting
- D. the types of atoms in the gas cloud through which the star's light is traveling

16. Differences in the density of ocean waters help drive ocean circulation. Which of the following factors directly increases the density of ocean surface waters?

- A. dilution of ocean waters with runoff from continents
- B. production of biomass in subtropical ocean waters
- C. precipitation over the open ocean in the tropics
- D. formation of sea ice in polar ocean areas



17. As water falls through the atmosphere and percolates through soil, it becomes increasingly acidic due to the presence of:
- A. absorbed aerosols.
 - B. volatile hydrocarbons.
 - C. dissolved carbon dioxide.
 - D. dissociated hydroxide ions.
18. In the summer, instability in the atmosphere promotes cloud formation and precipitation. Under which of the following conditions will the atmosphere be most unstable?
- A. There is little to no change in the temperature of the atmosphere with increased altitude.
 - B. A rising parcel of air is warmer than the surrounding atmosphere.
 - C. There is a layer of warm air in the atmosphere overlying cool air near the earth's surface.
 - D. A rising parcel of air initially has a very low moisture content.
19. The seasonal expansion of the Pacific high-pressure system over much of the northeast Pacific Ocean typically has which of the following effects on the weather of Washington State?
- A. increasing the flow of warm coastal air masses from the south
 - B. increasing the frequency of atmospheric inversions in coastal valleys
 - C. reducing the amount of precipitation in the western part of the state
 - D. reducing the strength of onshore winds blowing toward the interior from the coast
20. Which of the following materials found in an archaeological excavation would be suitable for dating by measuring the amount of carbon-14 in the material?
- A. a ceramic bowl
 - B. a quartz pendant
 - C. a deer antler
 - D. an iron knife



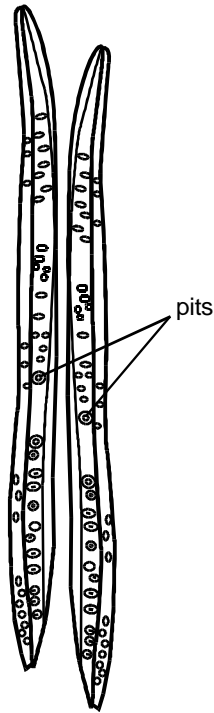
21. According to the theory of plate tectonics, the lava that erupts from volcanoes in the northwestern United States is derived primarily from:
- A. the partial melting of the upper mantle and melted continental crust.
 - B. magma produced by the melting of near-surface continental crust.
 - C. the partial melting of basaltic oceanic crust and ocean-floor sediments.
 - D. magma plumes generated by melting at the core-mantle boundary.
22. Fossils known as index fossils are more useful than other types of fossils for establishing stratigraphic relationships and for relative dating of geologic deposits. Which of the following characteristics of a species would make its fossilized remains more useful as an index fossil than other fossilized species?
- A. The species had many close relatives and lived during several different geologic periods.
 - B. The species existed for a brief period in geologic time and had a worldwide distribution.
 - C. The species had a long life span and was adapted to a specific ecological niche.
 - D. The species existed over short periods of geologic time and was unique to certain environments.
23. The intensity of shaking in large earthquakes can vary dramatically over short distances, causing significant differences in the amount of damage experienced in adjacent neighborhoods. Which of the following is primarily responsible for this kind of local variation in the ground shaking produced by major earthquakes?
- A. Seismic waves pass more easily through bedrock than through unconsolidated sediments, causing increased shaking in areas overlying sediments.
 - B. When seismic waves bounce off of angled bedrock, they increase in magnitude due to constructive interference.
 - C. Seismic waves are absorbed by igneous rocks more effectively than by metamorphic rocks, causing greater displacement of the land surface overlying igneous rocks.
 - D. When seismic waves traveling along the ground surface strike buildings with deep foundations, shaking is increased due to wave reflection.



24. Which of the following is a major source of the earth's internal energy?
- A. frictional heating due to the rotation of the earth's outer core
 - B. fluctuations of the earth's magnetic field
 - C. decay of long-lived radioactive isotopes deep within the earth
 - D. conduction of heat from the earth's surface into the mantle
25. Which of the following is the fundamental process that drives the hydrologic cycle?
- A. the conversion of heat energy from the sun into the gravitational potential energy of water vapor
 - B. the transformation of radiant energy from the sun into the kinetic energy of water molecules
 - C. the absorption of thermal energy from the sun by water vapor in the atmosphere
 - D. the emission of energy as sunlight separates the oxygen and hydrogen atoms in water molecules
26. Scientists have identified the acidification of the oceans as a threat to the health of the world's coral reefs. Which of the following human activities is most likely to lead to this change in the acidity of the world's oceans?
- A. runoff of heavy metals into coastal waters near industrial manufacturing and mining operations
 - B. extensive logging in rain forest regions and the consequent sedimentation of major rivers
 - C. overfishing of major fisheries in regions of high biological productivity
 - D. burning of fossil fuels and the consequent increase in atmospheric carbon dioxide

27. Use the diagram below to answer the question that follows.

Tracheid Cell in Plants



Tracheid cells are an important part of a plant's vascular tissue. As these cells become functionally mature, the interior of the cell disintegrates and the cell dies, leaving behind a network of rigid tracheid cell walls interconnected by the small pits shown in the diagram above. These dead cells function primarily as channels for:

- A. nutrients moving from the soil into the root system.
- B. gases diffusing through stems into the living interior of the plant.
- C. sugars moving from the leaves to the roots through the phloem.
- D. water flowing through xylem from the roots to the stems and leaves.

28. Which of the following is a unique characteristic of a nerve cell that gives it the specialized ability to produce a response in a muscle?
- A. multiple nuclei that facilitate signal processing
 - B. a porous cell membrane that allows the transfer of regulatory proteins
 - C. long cell extensions that transmit electrical impulses
 - D. cytoplasm that generates charged ions for cell-to-cell communication
29. Which of the following is a characteristic of ruminants, such as cattle and sheep, that gives them the ability to derive adequate nutrition from a diet rich in cellulose?
- A. an extremely long large intestine
 - B. a capacity to convert simple sugars into complex carbohydrates
 - C. an acidic stomach environment
 - D. a mutualistic relationship with intestinal microorganisms



30. Use the information below to answer the question that follows.

$$\pi = MRT$$

where:

π = osmotic pressure

osmotic pressure (π) of seawater = 30 atm

M = molarity of solution in mol/L

R = 0.0821 L•atm/K•mol (the gas constant)

T = 298 K (absolute temperature in Kelvin)

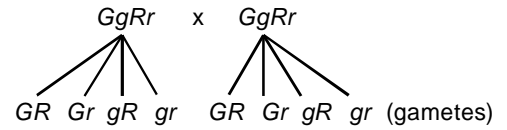
A biologist studying plant tolerance of salt water wants to create a NaCl solution that has the same osmotic pressure (π) as seawater. Given the equation and values shown above, what will be the molarity (M) of a NaCl solution that has the same osmotic pressure as seawater?

- A. 1.23 M
- B. 0.816 M
- C. $1.09 \times 10^5 M$
- D. $8.26 \times 10^{-3} M$

31. The spherical shape of the alveoli in the lungs maximizes their ability to:
- A. isolate infectious pathogens that enter the lungs.
 - B. diffuse gases between the lungs and circulatory system.
 - C. generate mucus that protects the lining of the lungs.
 - D. eliminate dust that builds up as air moves in and out of the lungs.

32. The elbow joint allows movement in two directions. In comparison, the shoulder joint allows a much wider range of motion. This difference in movement is primarily due to differences in:
- A. the shape of tendons connecting the muscles to the two types of joints.
 - B. the size of the muscles surrounding the two types of joints.
 - C. the amount of cartilage within and surrounding the two types of joints.
 - D. the shape of the joint surfaces making up the two types of joints.

33. Use the diagram below to answer the question that follows.



Key	
$G_$	= green seeds
gg	= brown seeds
$R_$	= round seeds
rr	= wrinkled seeds

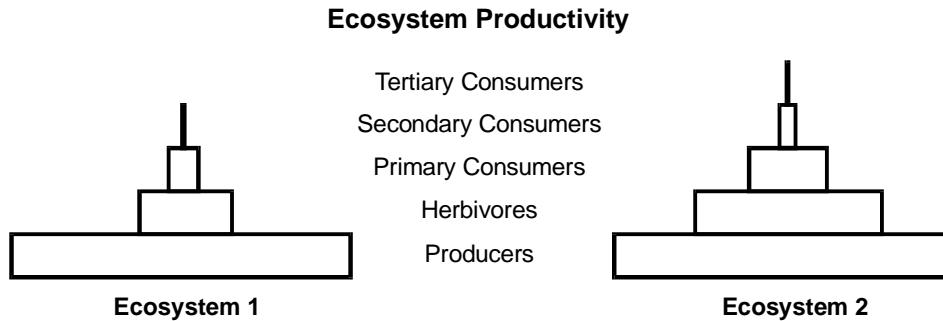
Two bean plants that are heterozygous for the traits controlling seed shape and color are crossed. The traits assort independently, as indicated by the formation of gametes shown in the diagram above. Given the independent assortment of the traits, what proportion of these two plants' offspring would be expected to have seeds that are brown and round?

- A. $\frac{1}{16}$
- B. $\frac{3}{16}$
- C. $\frac{9}{16}$
- D. $\frac{12}{16}$



34. Which of the following is a direct outcome of crossing over during sexual reproduction?
- A. The gametes that are produced will have a mix of paternal and maternal genetic material.
 - B. The genome of the offspring that are produced will lack a complete set of the parents' genetic material.
 - C. The traits that are linked to the male's Y chromosome will not be expressed in female offspring.
 - D. The fertilized egg that is produced will have an activated set of genes from only one of the parents.
35. Which of the following scenarios is an example of the process of natural selection?
- A. A population of beetles expands its range to higher elevations as the region's climate warms.
 - B. The starlings that move into a region reduce the population of local bluebirds by outcompeting them for nesting locations.
 - C. An invasive species of weed moves rapidly along highway corridors as its seeds are carried by automobiles.
 - D. The less drought-tolerant members of a population of lizards are unable to reproduce during a long-term drought.
36. Which of the following factors has had the largest effect on the evolution of many of the bird species that live on the Hawaiian Islands?
- A. regular volcanic eruptions
 - B. the nutrient content of the soils
 - C. isolation from other land masses
 - D. the frequency of storms
37. Which of the following is a physical characteristic that helps a variety of mammal species regulate body temperature in hot desert climates?
- A. thick subcutaneous fat
 - B. dark skin or fur
 - C. short limbs
 - D. large ears
38. What is the primary factor that limits the diversity of tree species that grow in northern coniferous forests?
- A. average soil pH
 - B. mean annual precipitation
 - C. average wind speed
 - D. mean annual temperature

39. Use the diagrams below to answer the question that follows.



The diagrams above show pyramids of productivity for two different ecosystems. Which of the following is a valid conclusion based on the shapes of these pyramids?

- A. There is a greater total number of organisms in ecosystem 2 than in ecosystem 1.
- B. Energy transfer between trophic levels is more efficient in ecosystem 2 than in ecosystem 1.
- C. More light energy is converted to chemical energy by the producers in ecosystem 2 than in ecosystem 1.
- D. The average body size of herbivores and consumers is larger in ecosystem 2 than in ecosystem 1.



40. Which of the following would constitute a biological population?
- A. remora fish and the sharks that they rely on for food
 - B. a pride of lions that are descendants of the same father
 - C. a group of red squirrels that interact and use the same resources
 - D. a variety of songbirds that share the same forest habitat
41. The validity of models used to predict long-term changes in climate is based on which of the following principles?
- A. Data on correlated climate phenomena in the past can be used to estimate future climate trends.
 - B. Climate phenomena that occur simultaneously can be assumed to have a causal relationship.
 - C. Numeric analysis can be used to remove uncertainty from forecasted changes in climate patterns.
 - D. Local climate trends can be extrapolated to large-scale changes in atmospheric circulation.
42. A researcher is studying a large-scale die-off of conifers that appears to have been caused by an infestation of bark beetles endemic to the region. The researcher notes that the annual number of frost-free days in the region has increased significantly over the past 25 years and wonders if the die-off is an indirect consequence of the warming climate. Which of the following specific questions would be most appropriate as the basis for a scientific investigation trying to identify the cause of the problem?
- A. Have the beetles shifted to other tree species as the conifers have died off?
 - B. Has the change in the number of frost-free days resulted in an increase in the population of beetles?
 - C. Have large-scale die-offs of trees occurred in other ecosystems during the same period?
 - D. Does the presence of the beetle affect other biotic components of the forest ecosystem?



43. A scientist wants to estimate the prevalence of distemper in raccoons in the two dozen suburban neighborhoods surrounding a large city. Due to a limited budget, the scientist can only trap and test raccoons in 100 locations. Which of the following sampling strategies would likely provide the most accurate estimate of the prevalence of the disease in the entire suburban area surrounding the city?
- A. setting traps in the neighborhoods that have the largest areas of undeveloped land providing good habitat for raccoons
 - B. setting all of the traps in one randomly selected neighborhood to thoroughly evaluate the raccoon population in that area
 - C. setting traps in each of the surrounding neighborhoods in several randomly selected locations frequented by raccoons
 - D. setting all traps in the neighborhoods where sightings of raccoons with symptoms of distemper have been most common
44. A researcher wants to evaluate a nutrition program's effect on height after a 15-year period. The researcher plans to compare the mean height of a thousand 14 year olds who participated in the program to the mean height of a thousand 14 year olds in a similar community that did not participate in the program. The mean is a useful measure to use because it:
- A. indicates the spread in different height values of individuals in a group.
 - B. summarizes the collective heights of all the members of a group.
 - C. identifies the middle value for all of the height measurements made in a group.
 - D. determines the most frequently occurring height in a group.



45. Use the table below to answer the question that follows.

Suspended Solids (g/L)	Result
0 to 1.59×10^{-3}	Grade A
1.60×10^{-3} to 2.49×10^{-3}	Grade B
2.50×10^{-3} to 3.49×10^{-3}	Grade C
$> 3.5 \times 10^{-3}$	Reject

A quality control technician at a chemical manufacturing plant has determined that 5.69×10^{-6} g of suspended solids are present in 2.79×10^{-3} L of product. According to the manufacturing guidelines shown in the table above, what result should be recorded for this sample?

- A. Grade A
- B. Grade B
- C. Grade C
- D. Reject



46. A burette would be the most appropriate measuring device for which of the following procedures?
- A. making a supersaturated solution from glucose and water
 - B. carrying out a titration to determine the concentration of ascorbic acid in a fruit drink
 - C. determining the wavelength of light absorbed by a plant pigment
 - D. burning a 5 g sample of table sugar to determine the total calories it contains
47. **Use the information below to answer the question that follows.**
- $$y = (3.2 \times 10^3) \times (4.6 \times 10^2)$$
- Taking significant figures into account, which of the following is the correct way to report the value of y above?
- A. 1.5×10^5
 - B. 14.7×10^5
 - C. 1.472×10^6
 - D. 1.5×10^6
48. A scientist needs to dilute concentrated sulfuric acid. Which of the following describes the appropriate procedure for diluting this concentrated acid?
- A. mixing equal parts of acid and water in a separate beaker first, then adding the remaining water to the partially diluted acid
 - B. adding the acid to the water slowly while continually stirring the mixture
 - C. mixing several drops of water with the acid first, then letting it diffuse for several minutes before adding the remaining water
 - D. adding a few drops of water at a time to the acid while continually stirring the mixture



49. Which of the following provides the best example of a positive feedback mechanism in the earth's climate system?
- A. Due to global cooling, a continental glacier spreads over the land, reducing absorption of solar energy.
 - B. As a result of cooling air temperatures during the fall, the surface water of a pond becomes denser and sinks.
 - C. Due to a drop in cloud cover over the oceans, more evaporation occurs, increasing precipitation.
 - D. As a result of increased concentrations of atmospheric carbon dioxide, absorption of the gas into the oceans increases.
50. Which of the following provided Galileo Galilei with direct evidence supporting the Copernican sun-centered theory of the solar system?
- A. his review of previous work completed by Kepler
 - B. his discovery that the acceleration of objects does not depend on their mass
 - C. his observation that Venus has phases just like the moon
 - D. his observations with a telescope that showed there were more objects in the sky than previously known



ANSWER KEY

Question Number	Correct Response	Test Objective
1	D	0001
2	B	0001
3	A	0002
4	C	0002
5	A	0002
6	C	0003
7	A	0003
8	D	0004
9	A	0004
10	C	0005
11	B	0005
12	C	0006
13	A	0006
14	A	0007
15	D	0007
16	D	0008
17	C	0008
18	B	0009
19	C	0009
20	C	0010
21	A	0010
22	B	0010
23	A	0011
24	C	0011
25	B	0012

Question Number	Correct Response	Test Objective
26	D	0012
27	D	0013
28	C	0013
29	D	0014
30	A	0014
31	B	0015
32	D	0015
33	B	0016
34	A	0016
35	D	0017
36	C	0017
37	D	0017
38	D	0018
39	B	0018
40	C	0018
41	A	0019
42	B	0019
43	C	0020
44	B	0020
45	B	0020
46	B	0021
47	D	0021
48	B	0021
49	A	0022
50	C	0022



REFERENCE MATERIALS

Please use the reference materials on the following pages as needed in responding to the sample test questions. These materials will also appear in test booklets.

FORMULAS

Description	Formula
Ideal gas law	$PV = nRT$
Boyle's law	$\frac{V}{V'} = \frac{p'}{p}$
Charles' law	$\frac{V}{V'} = \frac{T}{T'}$
Mechanics	$F = ma$ $P = mv$
Circular motion	$a = \frac{v^2}{r}$
Pendulum	$T = 2\pi\sqrt{\frac{L}{g}}$
Wave relationship	$v = f\lambda$
Energy	$\Delta Q = mc\Delta T$ $KE = \frac{1}{2}mv^2$ $PE = mgh$
Ohm's law	$V = IR$

NOTES FOR SCIENCE TEST

Not all formulas necessary are listed, nor are all formulas listed used on this test.

In questions on electricity and magnetism, the term *current* refers to "conventional current" and the use of the right-hand rule is assumed.

While attention has been paid to significant figures, no answer should be considered incorrect solely because of the number of significant figures.