Student Name _____

Teacher Name _____

School _____

System _____

# BIOLOGY I

# Item Sampler

## Tennessee End of Course Assessment
## Biology I  Form 1

## Reporting Category 1:
## Inquiry, Technology and Engineering, Mathematics

PEARSON

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# Introduction to Biology I

## Content of tests

The testing program titled the *Tennessee End of Course Assessment* was established to meet the Tennessee mandate for end of course assessments in Tennessee secondary schools. These tests measure the Tennessee State Performance Indicators. Subject areas covered by the end of course assessments include Mathematics, Language Arts, History, and Science.

## Test development

For the *Tennessee End of Course Assessment*, a staff of writers – composed of both teachers and professional test developers experienced in each of the content areas – researched and wrote the items. Professional editors and content specialists carefully reviewed all items and test directions for content and accuracy. To provide a large pool of items for final test selection, the test developers created approximately twice as many items as were needed in the final editions of the tests.

After tryout tests were administered, student responses were analyzed. Professional content editors and researchers carefully reviewed items, their data, and test directions for content, suitability, and accuracy before including particular items and test directions in operational tests.

## Test administration

Tennessee End of Course Assessments are given to students as they near the end of courses that are included in the program. Tests may be given midyear for block schedules or near the end of the school year.

You will have ample time to read and answer each of the questions. The Biology I test has been designed to be administered in one session and is not timed.

# Tips for Taking the Test

**Preparing for the test**

- Review this Tennessee End of Course Item Sampler for Biology I carefully and thoroughly.
- Acquire the Tennessee End of Course Practice Test for Biology I, and take the test several times.
- Become familiar with the correct way to mark answers on the answer sheet.

**Before the test**

- Get a good night's sleep. To do your best, you need to be rested.

**During the test**

- Relax. It is normal to be somewhat nervous before the test. Try to relax and not worry.
- Listen. Listen to and read the test directions carefully. Ask for an explanation of the directions if you do not understand them.
- Plan your time. Do not spend too much time on any one question. If a question seems to take too long, skip it and return to it later. First answer all questions that you are sure about.
- Think. If you are not sure how to answer a question, read it again and try your best to answer the question. Rule out answer choices that you know are incorrect and choose from those that remain.

# Directions for Using the Item Sampler

This Item Sampler for Biology I provides specific information to students and teachers. It contains examples of different item types for each Performance Indicator that may be tested in any given end of course test administration. Performance Indicators have been grouped by Reporting Categories. These Reporting Categories will be used to report information regarding performance on the end of courts test to students, teachers, schools, and systems.

The items in this Item Sampler will not be found in the end of course tests. The number of items in this Item Sampler does not reflect the emphasis of content on the test. In order to identify the emphasis of content, the End of Course Assessment Practice Test for Biology I should be used. The Practice Test gives a better representation of content emphasis across Reporting Categories and Performance Indicators.

An Answer Key is located in Page 37. Use it to check your answers. Review items that you get wrong.

## Reporting Category: Inquiry, Technology and Engineering, Mathematics

**Numbers 1 through 60**

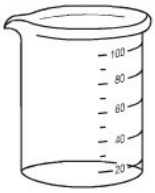
**Performance Indicator:** 3210.TE.1 Distinguish among tools and procedures best suited to conduct a specified scientific inquiry.

1.

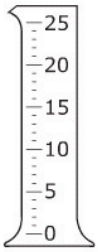
**Students did an experiment to determine if a substance contained glucose. To determine if glucose was present, they added 5 mL of Benedict's solution to a test tube of corn syrup and then heated the mixture. A change to a brick red color was a positive indicator for glucose. Which piece of equipment provides the <u>most</u> precise measurement of the volume of the Benedict's solution?**

○ **A**

○ **C**




○ **B**




○ **D**

**Performance Indicator:** 3210.TE.1 Distinguish among tools and procedures best suited to conduct a specified scientific inquiry.

2.

**Students are investigating how nutrients affect the rate of plant growth. Before beginning the investigation, the students determine how they will change the independent variable and measure the plant growth. Which variable should be different in each experimental group?**

○ **A** type of plant

○ **B** amount of water

○ **C** amount of fertilizer

○ **D** quantity of sunlight

Go On ▶

**Performance Indicator:** 3210.TE.2 Evaluate a protocol to determine the degree to which an engineering design process was successfully applied.

3.

**A student team begins a project to design a water-purifying system that removes chemical and biological impurities from pond water. The team started the following design process:**

1. **Brainstorm design requirements for purifying water.**
2. **Generate ideas on techniques of purifying water.**
3. **Evaluate ideas generated by the team.**

**What should the students do for step 4?**

- **A** Evaluate costs of purifying water.
- **B** State a procedure to build a model.
- **C** Build a water-purification prototype.
- **D** Select a water-purifying idea to pursue.

**Performance Indicator:** 3210.TE.3 Evaluate the overall benefit to cost ratio of a new technology.

4.

**Bats use sound waves for navigation during flight and to find prey. The sound waves emitted by bats bounce off objects, enabling them to sense the location and distance of an object. Sound waves are also used by humans in sonar devices for finding depths of oceans and ships at sea. Scientists have developed an artificial plastic that bends sound waves so they do not bounce back to a sonar device. Currently this material is being considered for use in military ships. What is another benefit this material could provide?**

- **A** The material could be used in buildings to reduce energy loss.
- **B** The material could be used in food packaging to prevent spoiling.
- **C** The material could be used in buildings to reduce internal noise.
- **D** The material could be used in sports equipment to prevent injury.

*Go On* ▶

**Performance Indicator:** 3210.TE.3 Evaluate the overall benefit to cost ratio of a new technology.

5.

**A new food technology may extend the shelf life of food. Tests show that a combination of boiling water and microwaves preserves food longer than traditional canning in boiling water alone. Applying microwaves will be an additional step in processing food with the new technology. In what way will this new technology affect the cost and benefit of food production?**

- **A** Cost will increase and benefit will increase.
- **B** Cost will increase and benefit will decrease.
- **C** Cost will decrease and benefit will increase.
- **D** Cost will decrease and benefit will decrease.

**Performance Indicator:** 3210.TE.4 Use design principles to determine if a new technology will improve the quality of life for an intended audience.

6.

**Vitamin A deficiency can result in diseases affecting normal eyesight. Rice is a grain that is low in vitamin A, and individuals living in countries where rice is a major component of the diet are at risk for developing vitamin A deficiency. A genetically modified form of rice called golden rice has been produced and contains the gene for the vitamin A precursor. Which experimental design would <u>best</u> allow scientists to determine if golden rice is effective in preventing vitamin A deficiencies?**

- **A** Give golden rice to 10 people and determine if their eyesight is normal.
- **B** Have 50 people eat golden rice and measure changes in the amount of vitamin A in their blood.
- **C** Ask 50 people who have impaired vision to eat golden rice and determine if their vision improves.
- **D** Let 100 people choose to eat regular rice or golden rice and determine which people have normal eyesight.

*Go On* ▶

**Performance Indicator:** 3210.TE.4 Use design principles to determine if a new technology will improve the quality of life for an intended audience.

7.

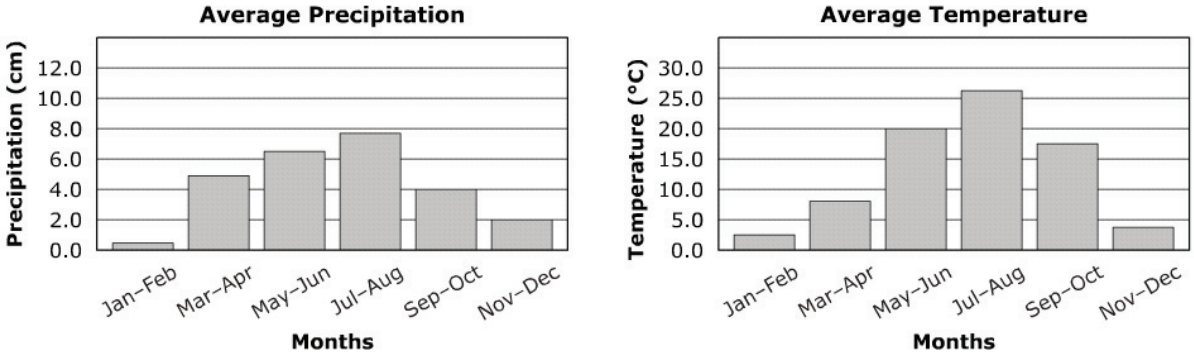
**A medical company is developing a device that allows the company to monitor the blood pressure of elderly people in their homes. Which test group would provide the most accurate information about the ability of older people to use the device?**

- **A** elderly people with high blood pressure
- **B** elderly people without high blood pressure
- **C** people in a range of ages with high blood pressure
- **D** people in a range of ages without high blood pressure

**Performance Indicator:** 3210.Math.1 Interpret a graph that depicts a biological phenomenon.

8.

**A scientist recorded the precipitation and temperature at the Cimarron National Grassland for an entire year. The results are shown in the graphs below.**



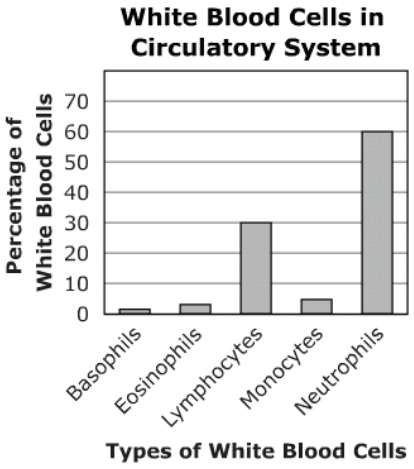

**The vegetation in the Cimarron National Grassland most likely grows the fastest during which months?**

- **A** March and April
- **B** May and June
- **C** July and August
- **D** September and October

**Performance Indicator:** 3210.Math.1 Interpret a graph that depicts a biological phenomenon.

9.

**In humans, white blood cells defend the body against infection. Different types of white blood cells respond to specific challenges. The percentages of these cells in the circulatory system during healthy conditions are represented in the graph below.**




| Type of White Blood Cells | Challenge |
|---|---|
| Basophil | Inflammation |
| Eosinophil | Allergens |
| Lymphocyte | Toxins |
| Monocyte | Germs |
| Neutrophil | Microorganisms |

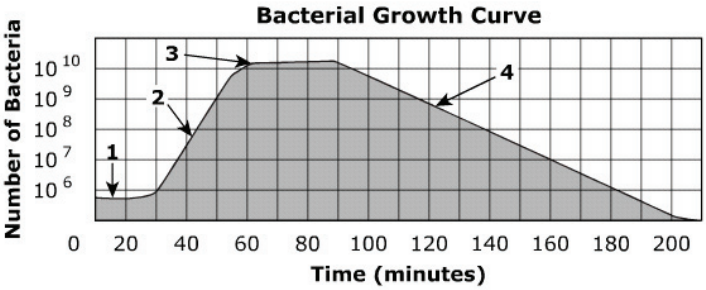
**What percentage of white blood cells in the circulatory system responds to pollen in the air?**

- **A** 4%
- **B** 7%
- **C** 30%
- **D** 60%

**Performance Indicator:** 3210.Math.1 Interpret a graph that depicts a biological phenomenon.

10.

**The graph below shows a typical bacterial growth curve.**




**What is happening at Point 3 in the graph?**

- **A** The bacteria have excess nutrients available, but the rapid rate of division is not noticeable because of the small population.
- **B** The bacteria have used up the majority of their nutrients, and they are dividing at the same rate they are dying.
- **C** The bacteria are dividing rapidly, and they have an abundance of nutrients available.
- **D** The bacteria have no more nutrients, and they are dying in large numbers.

*Go On* ▶

**Performance Indicator:** 3210.Math 2 Predict the outcome of a cross between parents of known genotype.

11.

**In humans, unattached earlobes are coded for by gene *A*. Attached earlobes are coded for by gene *a*. If an *AA* father and an *Aa* mother have children, what could be the possible genotype(s) of the children?**

- **A** *AA* only
- **B** *Aa* only
- **C** *AA* or *Aa*
- **D** *AA* or *aa*

**Performance Indicator:** 3210.Math 2 Predict the outcome of a cross between parents of known genotype.

12.

**In humans, freckles result from gene *F*, while a lack of freckles results from gene *f*. If an *Ff* father has a child with an *ff* mother, what is the probability of the child inheriting an *F* gene?**

- **A** 25%
- **B** 50%
- **C** 75%
- **D** 100%

Go On ▶

**Performance Indicator:** 3210.Inq.1 Select a description or scenario that reevaluates and/or extends a scientific finding.

13.

**Biologists Schleiden and Schwann developed the cell theory which states that all organisms are made of cells and that the cell is the fundamental unit of life. Which is an example of research that extended Schleiden and Schwann's findings?**

- **A** Virchow determined that all cells come from preexisting cells.
- **B** Needham concluded that organisms developed in broth that had been boiled.
- **C** Hooke determined that cork from oak trees was made of "boxes" that he called cells.
- **D** Leuwenhoek viewed bacteria and protists through a microscope and referred to the single cells as "animalcules."

**Performance Indicator:** 3210.Inq.1 Select a description or scenario that reevaluates and/or extends a scientific finding.

14.

**A standard model of the mechanism of inheritance has linked genes and traits for decades. Based on Mendel's research, this model was expanded and refined with the discovery of chromosomes and DNA. Research continues to modify the model. Which discovery about the behavior of genes forced the <u>most</u> significant re-evaluation of this standard model of inheritance?**

- **A** The pattern of non-genetic methylation markers on DNA molecules modifies the amount of expression of alleles present in cells.
- **B** Many traits show more than two forms in species because of the availability of more than two alleles for the trait in species gene pools.
- **C** When an allele does not show complete dominance, heterozygous individuals express a form of the encoded trait neither entirely dominant nor entirely recessive.
- **D** Traits which modify body structure can be acquired during the lifespan of an individual, but they cannot be passed on to offspring.

*Go On* ▶

**Performance Indicator:** 3210.Inq.1 Select a description or scenario that reevaluates and/or extends a scientific finding.

15. **In 1993, scientists identified short (~20 base pair) nucleotide sequences called microRNAs (miRNA) in eukaryotic cells. It was not until 2000 that scientists understood that miRNAs function by binding to complementary mRNA sequences and disrupt their expression. Which phrase best extends the understanding of a cellular process by this discovery?**

- **A** the regulation of cells entering cytokinesis
- **B** the repair of mutations passed during transcription
- **C** the transport of proteins through the cell membrane
- **D** the regulation of genes by blocking protein-building instructions

**Performance Indicator:** 3210.Inq.2 Analyze the components of a properly designed scientific investigation.

16. **Students are comparing plant growth with and without fertilizer. All plants will be grown at the same temperature with the same amount of sunlight and water. The growth of each plant will be measured every five days. What component of this experiment would be classified as a dependent variable?**

- **A** the growth of the plants
- **B** if the plants received fertilizer
- **C** the amount of water given to the plants
- **D** the amount of sunlight the plants receive

*Go On* ▶

**Performance Indicator:** 3210.Inq.2 Analyze the components of a properly designed scientific investigation.

17. **A student observed a plant near a window growing toward the window. The student hypothesized that environmental conditions affect the growth of plants. The table shows the student's protocol for an investigation.**

| Step | Method |
|---|---|
| 1 | Observe the plant. |
| 2 | Develop a hypothesis. |
| 3 | Gather information about plant growth. |
| 4 | Identify the independent, dependent, and control variables. |
| 5 | Develop and proceed with a carefully controlled experiment. |
| 6 | Gather and analyze data. |
| 7 | |

**What should the student do for step 7?**

- **A** Develop a conclusion.
- **B** Investigate multiple variables.
- **C** Repeat the controlled investigation.
- **D** Compare the results with a published work.

**Performance Indicator:** 3210.Inq.2 Analyze the components of a properly designed scientific investigation.

18. **When conducting a scientific investigation, what should be done after a testable hypothesis has been established?**

- **A** Research the information used to form the hypothesis.
- **B** Perform the experiments designed to test the hypothesis.
- **C** Compare the hypothesis with the hypotheses of other scientists.
- **D** Report the results of the observations that led to the hypothesis.

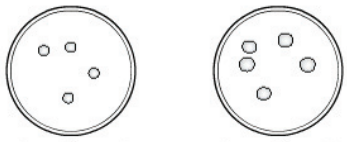
**Performance Indicator:** 3210.Inq.3 Determine appropriate tools to gather precise and accurate data.

19. **Students monitoring a pond ecosystem collect rain in several rain gauges positioned around the pond. The students measure the volume of water collected in each gauge after a storm to document the amount of rainfall the ecosystem receives. Which tool would be best to use to accurately measure the amount of water collected in each rain gauge?**

- **A** petri dish
- **B** glass beaker
- **C** medicine dropper
- **D** graduated cylinder

**Performance Indicator:** 3210.Inq.3 Determine appropriate tools to gather precise and accurate data.

20. **Students compare the size of bacterial colonies grown on two different agar plates. The illustration below shows colonies grown on Agar Plate 1 and Agar Plate 2.**



Agar Plate 1 Agar Plate 2

**Which ruler would most accurately measure the diameter of the colonies on Agar Plate 1 and Agar Plate 2?**

- **A** a ruler that measures to the nearest millimeter
- **B** a ruler that measures to the nearest centimeter
- **C** a ruler that measures to the nearest decimeter
- **D** a ruler that measures to the nearest meter

Go On ▶

**Performance Indicator:** 3210.Inq.3 Determine appropriate tools to gather precise and accurate data.

21. **A student is instructed to measure 1 mL of a solution during a biology laboratory session. Which tool should the student use to perform this task?**

- **A** an Erlenmeyer flask
- **B** a graduated cylinder
- **C** a test tube
- **D** a pipette

**Performance Indicator:** 3210.Inq.4 Evaluate the accuracy and precision of data.

22. **At the beginning of an experiment, students measured the height of a plant three times. Their measurements are shown in the table below.**

**Plant Height Measurements**

| Student | Trial 1 | Trial 2 | Trial 3 |
|---|---|---|---|
| 1 | 15.1 cm | 15.9 cm | 15.3 cm |
| 2 | 17.2 cm | 17.0 cm | 17.1 cm |
| 3 | 13.7 cm | 18.4 cm | 15.0 cm |
| 4 | 16.5 cm | 11.9 cm | 20.2 cm |

**It was determined that the actual height of the plant was 15.6 cm. Which student's measurements are the <u>most</u> accurate and precise to the actual height of the plant?**

- **A** Student 1
- **B** Student 2
- **C** Student 3
- **D** Student 4

*Go On* ▶

**Performance Indicator:** 3210.Inq.4 Evaluate the accuracy and precision of data.

23. **Students counted the population of trees in a forest to determine the numbers of four species. The actual number of trees in the forest area and each student's count are in the table.**

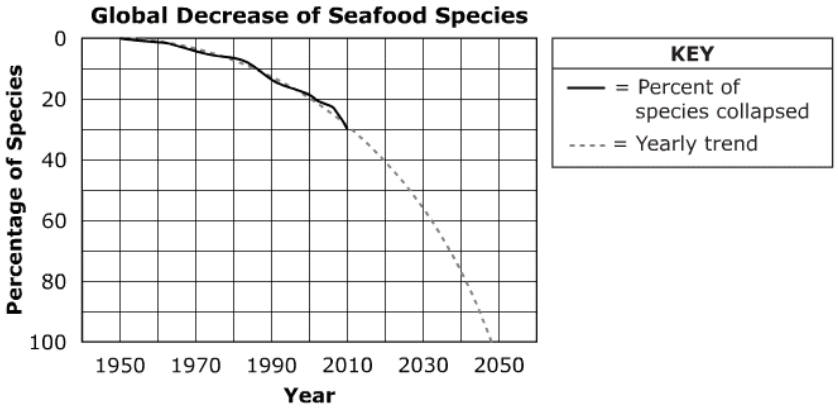
| Tree | Actual Population | Student 1 | Student 2 | Student 3 | Student 4 |
|---|---|---|---|---|---|
| Cedar | 62 | 60 | 65 | 20 | 75 |
| Pine | 253 | 200 | 252 | 230 | 235 |
| Oak | 124 | 100 | 127 | 75 | 93 |
| Walnut | 168 | 200 | 170 | 175 | 121 |

**Which student had the <u>most</u> accurate count of tree species?**

- **A** Student 1
- **B** Student 2
- **C** Student 3
- **D** Student 4

**Performance Indicator:** 3210.Inq.5 Defend a conclusion based on scientific evidence.

24. **A study by a group of scientists measured the number of seafood species lost since 1950. The data from the study is shown in the graph below.**




**Based on the data, the scientists concluded that all seafood species populations will collapse by the year 2050. Other scientists have questioned this claim. What evidence from the study <u>best</u> defends the initial scientists' conclusion?**

- **A** No seafood population data was collected before 1950.
- **B** The long-term trend conflicts with the data from 1950 to 2010.
- **C** Seafood populations may decline rapidly between 2010 and 2050.
- **D** The data shows a general decrease in seafood populations after 1950.

**Performance Indicator:** 3210.Inq.6 Determine why a conclusion is free of bias.

25.

**A scientist in a research facility develops a procedure for a carefully controlled investigation. The experiments are repeated several times, and all of the data collected is analyzed and used to form a conclusion. What is the most likely next step the scientist should take to ensure that the conclusion is unbiased?**

- **A** The scientist should submit the investigation to be published in a scientific journal.
- **B** The scientist should have the investigation repeated by an outside research company.
- **C** The scientist should share the investigation information with scientists in the same research facility.
- **D** The scientist should compare the experimental data with data from scientists performing similar research.

**Performance Indicator:** 3210.Inq.6 Determine why a conclusion is free of bias.

26.

**A pharmaceutical company developed a new drug (drug A) to replace an existing drug (drug B) that had been used in treating a disease for 25 years. The hypothesis was that patients would have fewer side effects from drug A than from drug B. The company appointed an independent coordinator to select a group of people with the disease for testing. The coordinator randomly divided the people into two equal groups. One group received drug A, and the other group received drug B. At the end of the study, the coordinator revealed to the company researchers that drug A treated the disease as well as drug B, and patients had fewer side effects.**

**Why is the conclusion from this study free of bias?**

- **A** No new drug had been tested for the disease in 25 years.
- **B** The study contained a dependent variable and an independent variable.
- **C** Neither the test subjects nor the company knew which group received the new drug.
- **D** The hypothesis that drug A had fewer side effects than drug B was supported by the data.

*Go On* ▶

**Performance Indicator:** 3210.Inq.6 Determine why a conclusion is free of bias.

27. **A student grows three groups of bean plants. One group of bean plants receives type A fertilizer every 10 days, one group receives type B fertilizer every 10 days, and one group does not receive any fertilizer. All other variables are held constant. Based on average height, the student concludes that type A fertilizer is more effective than type B, and both brands are more effective than growing plants without fertilizer. Which statement best explains why this conclusion is free of bias?**

- **A** A control group was included in the experimental design.
- **B** The number of fertilizer brands tested was too small to allow bias.
- **C** The type of investigation makes it impossible to show bias in the conclusions.
- **D** An independent variable was clearly defined, and a dependent variable was accurately collected.

**Performance Indicator:** 3210.Inq.7 Compare conclusions that offer different, but acceptable, explanations for the same set of experimental data.

28. **A group of students is given a data table that shows the population of native black and brown beetles counted in the same area during a four-week period. The data trend shows the brown beetle population is gradually increasing, and the black beetle population is rapidly decreasing. Based on the population trend of the beetles, four students offer different explanations of the data.**

| Student | Explanation |
|---|---|
| 1 | The black beetle is a predator of the brown beetle. |
| 2 | The black beetle has adapted to different temperatures. |
| 3 | The black beetle is less adapted to its surroundings, increasing predation. |
| 4 | The black beetle has a life cycle that is different from the brown beetle to reduce competition. |

**Which two students offer explanations that are most likely possible based on the data trend?**

- **A** Student 1 and Student 3
- **B** Student 1 and Student 4
- **C** Student 2 and Student 4
- **D** Student 3 and Student 4

Go On ▶

**Performance Indicator:** 3210.Inq.7 Compare conclusions that offer different, but acceptable, explanations for the same set of experimental data.

29.

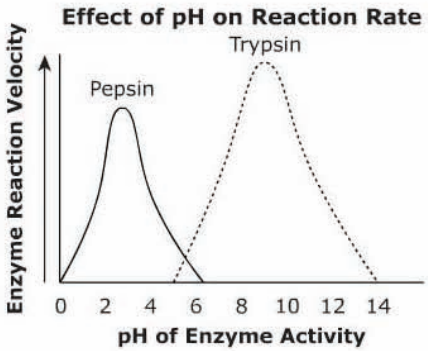
**Plants in two experimental trials grew to a similar average height. The plants in one trial were given more water than the plants in the other trial. All other variables were held constant. A scientist studying the results concluded that plant height is determined by inheritance rather than environmental factors. What other conclusion also supports the results in this experiment?**

- **A** The amount of soil nutrients is unknown.
- **B** Sunlight has the greatest effect on plant height.
- **C** Both trials lacked an essential amount of water.
- **D** The amount of water has little effect on plant height.

**Performance Indicator:** 3210.Inq.7 Compare conclusions that offer different, but acceptable, explanations for the same set of experimental data.

30.

**Students compared the activity rate of pepsin and trypsin, two enzymes. Pepsin is found in the stomach and trypsin is found in the small intestine. The data collected are illustrated in the graph. Based on the data, students made conclusions about the activity of the two enzymes.**




**Which conclusion could <u>not</u> be determined based on the information in the graph?**

- **A** Pepsin and trypsin have an optimal pH for activity.
- **B** Pepsin and trypsin are most active at different pH ranges.
- **C** Pepsin is active only at a pH around 3, and trypsin is active only at a pH around 9.
- **D** Pepsin is most active in an acidic environment, and trypsin is most active in an alkaline environment.

*Go On* ▶

**Performance Indicator:** 3210.TE.1 Distinguish among tools and procedures best suited to conduct a specified scientific inquiry.

31.

**Students are performing an experiment to study how colored light affects the rate of photosynthesis in plants. Which laboratory tool would be most useful in this experiment?**

- **A** pH meter
- **B** oxygen sensor
- **C** carbon sensor
- **D** digital thermometer

**Performance Indicator:** 3210.TE.2 Evaluate a protocol to determine the degree to which an engineering design process was successfully applied.

32.

**An engineering team is interested in exploring the possibility of using sound to repel insects that harm crops. Their design process proceeded as follows:**

1. **They identified that insecticides are environmentally problematic and that alternatives are needed.**
2. **They thought about alternatives and decided that specific sounds would repel insects.**
3. **They built a powerful all-weather speaker system, they placed the speaker system in a field, and they tested the effects of different sounds on insects.**

**Which step should the engineering team have taken before step 3?**

- **A** phrasing their investigation properly in terms of the scientific method
- **B** experimentally testing other alternatives to insecticides apart from sound
- **C** performing market surveys of the openness of farmers to their solution to the problem
- **D** building a small-scale prototype and testing it on a small number of insects under controlled conditions

**Performance Indicator:** 3210.TE.2 Evaluate a protocol to determine the degree to which an engineering design process was successfully applied.

33. **The burning of fossil fuels releases carbon dioxide into the atmosphere. To reduce the dependency on fossil fuels for generating electricity, an electrical company is developing a proposal to place either wind turbines or hydroelectric dams in different areas of a state. Scientists working for the company collect average monthly data on wind speeds and the rate of river water flow for different locations across the state. They also research the potential environmental impact wind turbines and hydroelectric dams could have on the areas. What next step should the scientists do in the proposal development?**

- **A** Gather information.
- **B** Define the problem.
- **C** Evaluate models to design.
- **D** Select one of the solutions.

**Performance Indicator:** 3210.TE.3 Evaluate the overall benefit to cost ratio of a new technology.

34. **Recent research on extremely primitive bacteria has shown that the bacteria include granules that are able to store a great deal of chemical energy. Which type of device could benefit from improvements in this biological technology?**

- **A** motors
- **B** batteries
- **C** electromagnets
- **D** light-emitting diodes

**Performance Indicator:** 3210.TE.4 Use design principles to determine if a new technology will improve the quality of life for an intended audience.

35. **A group of scientists are working on designing a drug to treat high blood pressure. Which experimental design would provide the best results?**

- **A** using one volunteer selected at random as a test subject
- **B** using ten different volunteers selected at random as test subjects
- **C** using one family of volunteers selected at random as test subjects
- **D** using ten adult female volunteers selected at random as test subjects

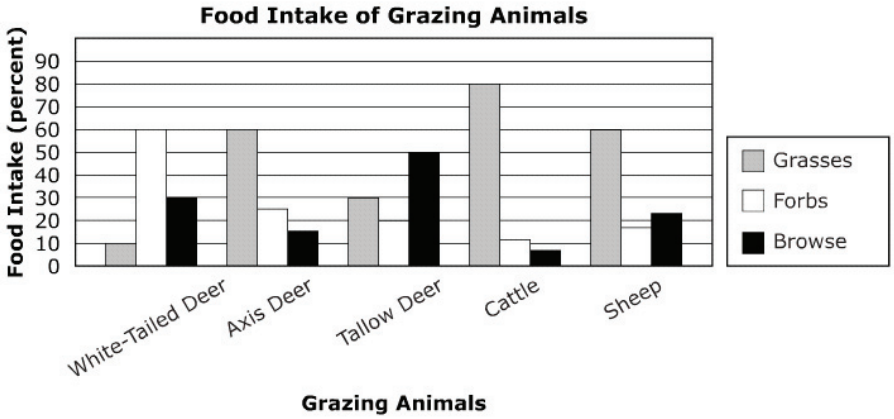
**Performance Indicator:** 3210.TE.4 Use design principles to determine if a new technology will improve the quality of life for an intended audience.

36. **Glaucoma is an eye disease that can cause blindness if not properly treated. Daily eye drops are one of the treatments commonly used. One group of scientists thinks that wearing special contact lenses to provide delivery of the medicine over a longer period of time is a treatment option. Which step should the researchers do next?**

- **A** Test the contact lenses on other organisms.
- **B** Distribute the contact lenses to eye doctors.
- **C** Test one group of people using the eye drops and test another group using the contact lenses.
- **D** Make the contact lenses available to all people who have glaucoma.

**Performance Indicator:** 3210.Math.1 Interpret a graph that depicts a biological phenomenon.

37. **The graph below shows the food intake of various species of grazing animals.**

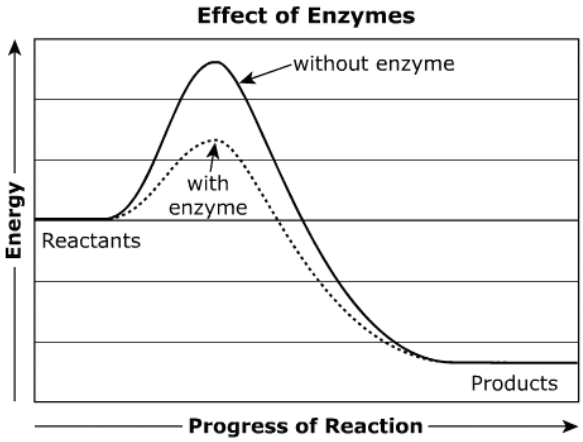



**Which statement correctly describes the feeding pattern of one of these animals?**

- **A** Cattle are least dependent on grasses.
- **B** Tallow deer feed primarily on grasses.
- **C** White-tailed deer are most dependent on forbs.
- **D** Sheep feed equally on forbs and browse species.

**Performance Indicator:** 3210.Math.1 Interpret a graph that depicts a biological phenomenon.

38. **Enzymes assist in chemical reactions in cells. The diagram below shows a reaction with and without an enzyme.**




**Which statement correctly describes the relationship between enzymes and chemical reactions?**

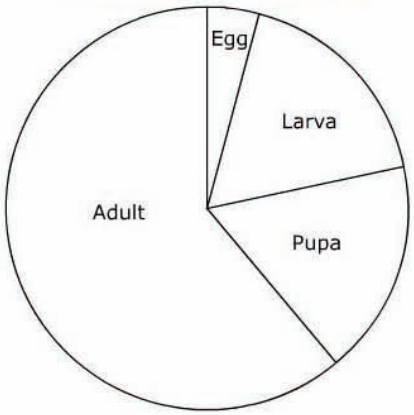
- **A** The amount of product increases without an enzyme.
- **B** The activation energy decreases with an enzyme.
- **C** The rate of reaction increases without an enzyme.
- **D** The type of product changes with an enzyme.

Go On ▶

**Performance Indicator:** 3210.Math.1 Interpret a graph that depicts a biological phenomenon.

39. **A graph depicting the stage distribution in the life cycle of *Drosophila melanogaster* is shown below.**

**Proportions of Life Stages**




**According to the information in the graph, which statement best describes *Drosophila melanogaster*?**

- **A** *Drosophila melanogaster* spends equal time as an egg and a pupa.
- **B** *Drosophila melanogaster* spends less time as a larva than as a pupa.
- **C** *Drosophila melanogaster* spends the least amount of its life as a larva.
- **D** *Drosophila melanogaster* spends the largest portion of its life as an adult.

**Performance Indicator:** 3210.Math 2 Predict the outcome of a cross between parents of known genotype.

40. **In humans, cleft chins are coded by gene *C*, while non-cleft chins are coded by gene *c*. A male and female couple has a 25% chance of producing a child with a non-cleft chin and a 50% chance of producing children heterozygous for the trait. What are the genotypes of the male and female?**

- **A** *CC* and *Cc*
- **B** *CC* and *cc*
- **C** *Cc* and *Cc*
- **D** *Cc* and *cc*

**Performance Indicator:** 3210.Math 2 Predict the outcome of a cross between parents of known genotype.

41. **In pea plants, tall height results from gene *T*, while short height results from gene *t*. If a *TT* plant produces offspring with a *tt* plant, the offspring must have which genotype?**

- **A** *TT*
- **B** *tt*
- **C** *Tt*
- **D** *TTtt*

**Performance Indicator:** 3210.Inq.1 Select a description or scenario that reevaluates and/or extends a scientific finding.

42. **Gregor Mendel established the foundation of genetics with his findings about dominant and recessive inheritance. Which example best represents a direct extension of Mendel's scientific research?**

- **A** Barbara McClintock discovered that genes can change locations on chromosomes.
- **B** Cohen and Boyer isolated a gene from a frog and inserted the gene into DNA of bacteria.
- **C** Reginald Punnett developed a diagram to predict all possible outcomes of genetic crosses.
- **D** Watson and Crick determined that DNA is a double-helix molecule with strands of linked nucleotides.

**Performance Indicator:** 3210.Inq.1 Select a description or scenario that reevaluates and/or extends a scientific finding.

43.

**A student sets up a sealed ecosystem containing a snail (a consumer) and an elodea (a producer). The balance of gases in the ecosystem remains stable over a period of several days. The student concludes that the gas output of the snail equals the gas intake of the elodea and that the gas input of the snail equals the gas output of the elodea. Which finding would suggest that the student's conclusion must be re-evaluated due to another consumer accidentally being included in the ecosystem?**

- **A** Oxygen content of air in the ecosystem rises when the snail is removed.
- **B** Oxygen content of air in the ecosystem falls when the elodea is removed.
- **C** Carbon dioxide content of air in the ecosystem shows little change when the snail is removed.
- **D** Carbon dioxide content of air in the ecosystem shows little change when the elodea is removed.

**Performance Indicator:** 3210.Inq.1 Select a description or scenario that reevaluates and/or extends a scientific finding.

44.

**Rosalind Franklin used x-ray crystallography, a method of determining atomic structure in a molecule, during her research of nucleic acids. Franklin's work provided information for the discoveries made by which of these scientists?**

- **A** Hooke, who first used the term *cell* when looking at cork
- **B** Pasteur, who showed that airborne microbes cause disease
- **C** Watson and Crick, whose work described the structure of DNA
- **D** Morgan, who determined that genes are located on chromosomes

Go On ▶

**Performance Indicator:** 3210.Inq.2 Analyze the components of a properly designed scientific investigation.

45.

**A student notices that butterflies in a garden often land on flowers that have white petals. She wants to use this observation to perform a scientific investigation. What should the student do next to proceed with her investigation?**

- **A** Form a testable hypothesis.
- **B** Plant additional white flowers in the garden.
- **C** Gather materials needed for the investigation.
- **D** Write a detailed description of the butterflies in a lab notebook.

**Performance Indicator:** 3210.Inq.2 Analyze the components of a properly designed scientific investigation.

46.

**Which of the following <u>best</u> describes a well-designed scientific experiment?**

- **A** The test subject is used repeatedly.
- **B** The data are collected at random times.
- **C** The hypothesis is based on an observation.
- **D** The conclusions are based on the researcher's opinion.

**Performance Indicator:** 3210.Inq.3 Determine appropriate tools to gather precise and accurate data.

47.

**Students are studying the effect of fertilizer on plant growth. The students will measure 75 milliliters (mL) of water and 5 milliliters (mL) of liquid fertilizer and mix the two together before adding the mixture to plants. Which piece of equipment would be most accurate for measuring the water that the students will need?**

- **A** a 100 mL beaker
- **B** a 100 mL test tube
- **C** a 100 mL Erlenmeyer flask
- **D** a 100 mL graduated cylinder

**Performance Indicator:** 3210.Inq.3 Determine appropriate tools to gather precise and accurate data.

48.

**A student is comparing hundreds of leaves of the same tree species. The student will calculate each leaf area using a formula. The formula requires the measurements of length and width of each leaf. When all the data are collected, the student will display differences of leaves from individual trees on a graph. Which of these tools will the student use to gather and display the data in this investigation?**

- **A** microscope and digital balance
- **B** magnifying glass and hand calculator
- **C** metric ruler and spreadsheet program
- **D** computer sensor and pie chart generator

*Go On* ▶

**Performance Indicator:** 3210.Inq.3 Determine appropriate tools to gather precise and accurate data.

49. **Students are completing a laboratory investigation. The students will use certain tools in carrying out part of the procedures in the investigation. The procedures are shown below.**

| Procedure | Description |
|---|---|
| 1 | Remove a 0.1 mL sample from culture 1 and prepare a wet mount slide. |
| 2 | Place the slide under the microscope and adjust to view individual cells. |
| 3 | Sketch pictures of the cells on drawing paper and label all observed features of the cells. |

| Science Tools | | | |
|---|---|---|---|
| Pencil | Notebook | Test Tube | Filter Paper |
| Spoon | Calculator | Cover Slip | Drawing Paper |
| Pipette | Microscope | Hand Lens | Microscope Slide |

**The students know that they will use a microscope slide, a microscope, a pencil, and drawing paper to complete the procedures. What additional tools will allow the students to gather data?**

- **A** Hand Lens and Spoon
- **B** Cover Slip and Pipette
- **C** Notebook and Calculator
- **D** Filter Paper and Test Tube

**Performance Indicator:** 3210.Inq.3 Determine appropriate tools to gather precise and accurate data.

50. **Different types of microscopes are used to gather data for various research applications. Which microscope is <u>best</u> for observing and identifying the external features of a fruit fly?**

- **A** compound microscope
- **B** dissecting microscope
- **C** scanning electron microscope
- **D** transmission electron microscope

**Performance Indicator:** 3210.Inq.4 Evaluate the accuracy and precision of data.

51.

**A student wants to be sure the triple beam balance she uses is accurate and precise. She checks the measurement of four different balances using a 5.0 gram mass. The results are shown in the table below.**

| Balance | Trial 1 | Trial 2 | Trial 3 | Trial 4 | Trial 5 |
|---|---|---|---|---|---|
| 1 | 5.6 g | 4.2 g | 5.2 g | 4.5 g | 4.1 g |
| 2 | 4.5 g | 4.4 g | 4.5 g | 4.4 g | 4.5 g |
| 3 | 5.0 g | 5.0 g | 4.9 g | 5.1 g | 4.9 g |
| 4 | 4.2 g | 4.5 g | 5.0 g | 5.8 g | 5.5 g |

**Which balance should the student use to collect the most accurate and precise data?**

- **A** Balance 1
- **B** Balance 2
- **C** Balance 3
- **D** Balance 4

**Performance Indicator:** 3210.Inq.4 Evaluate the accuracy and precision of data.

52.

**A group of students were investigating how the pH of water affects the development of plants. The students measured the pH of four water solutions. Their results are shown in the table.**

| Water Solution | Actual pH | Student 1 | Student 2 | Student 3 | Student 4 |
|---|---|---|---|---|---|
| 1 | 7.0 | 6.9 | 7.0 | 7.2 | 6.8 |
| 2 | 11.5 | 11.0 | 11.4 | 11.5 | 11.3 |
| 3 | 7.8 | 7.3 | 7.9 | 7.8 | 8.0 |
| 4 | 4.9 | 4.9 | 4.9 | 5.5 | 4.2 |

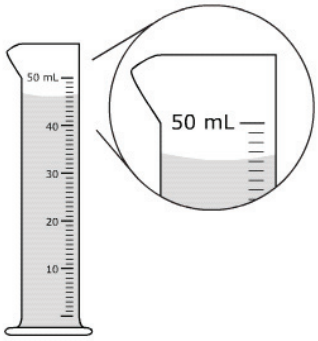
**Which student recorded the most accurate pH measurements of the solutions?**

- **A** Student 1
- **B** Student 2
- **C** Student 3
- **D** Student 4

*Go On* ▶

**Performance Indicator:** 3210.Inq.4 Evaluate the accuracy and precision of data.

53. **Students measured the volume of a water solution in a graduated cylinder.**




**Which measurement is most accurate of the water volume?**

- **A** 50 mL
- **B** 47 mL
- **C** 46 mL
- **D** 40 mL

**Performance Indicator:** 3210.Inq.5 Defend a conclusion based on scientific evidence.

54. **A researcher observing an ecosystem asks the question, "What is the flow of energy among the organisms present in this ecosystem?" The researcher observes the interactions of the organisms in the ecosystem in order to construct a food web. The researcher concludes that the data collected is insufficient to produce a complete food web for the ecosystem. The table of organism interactions on which the researcher's conclusion is based is shown below.**

| Organism | What the Organism Consumes |
|---|---|
| Salmon | Zooplankton |
| Sand lance | Zooplankton |
| Puffin | Salmon |
| Gull | Sand lance |
| Fox | Puffin |

**Based on the researcher's observations, why is the conclusion valid?**

- **A** Many species have only one food resource.
- **B** Organisms from only two Kingdoms were observed.
- **C** The producers in the food web have not been observed.
- **D** The organisms come from aquatic and terrestrial environments.

**Performance Indicator:** 3210.Inq.6 Determine why a conclusion is free of bias.

55.

**A student examines data collected by a researcher on several different organisms.**

| Organism | Net Gas Output |
|---|---|
| 1 | Oxygen |
| 2 | Carbon Dioxide |
| 3 | Carbon Dioxide |

**Which conclusion can best be defended based on this data set?**

- **A** Organisms 2 and 3 are producers because they release carbon dioxide.
- **B** Organisms 2 and 3 are consumers because they release carbon dioxide.
- **C** Organism 1 is a decomposer because it releases oxygen.
- **D** Organism 1 is a consumer because it releases oxygen.

**Performance Indicator:** 3210.Inq.6 Determine why a conclusion is free of bias.

56.

**After years of research, a scientist thinks he has isolated a plant compound that is an effective mosquito repellent. The scientist develops controlled experiments to determine the effectiveness of the isolated compound repellent on different species of mosquitoes. The experimental results indicate that the isolated compound effectively stops 10 out of the 15 tested mosquito species from biting when the repellent is applied to the surface of skin. Before publishing the results, what must the scientist do to show that the conclusion is unbiased?**

- **A** Investigate the effectiveness of the mosquito repellent on the skin of other organisms.
- **B** Investigate the effectiveness of the repellent on mosquito species not tested.
- **C** Recruit volunteers to use the mosquito repellent outdoors for a period of time.
- **D** Recruit an external research company to reproduce the investigation.

*Go On* ▶

**Performance Indicator:** 3210.Inq.6 Determine why a conclusion is free of bias.

57.

**Scientists often send their research designs, data, and conclusions to colleagues for peer review before submitting their findings to scientific journals. Why is having scientists review research findings an important part of research development?**

- **A** This gives scientists an opportunity to receive additional conclusions that can be added to their research.
- **B** This gives scientists an opportunity to compare their research designs with other researchers.
- **C** It allows the research to be checked to make sure the scientific method was followed properly.
- **D** It allows other scientists to repeat the research to remove the chance of bias in the findings.

**Performance Indicator:** 3210.Inq.6 Determine why a conclusion is free of bias.

58.

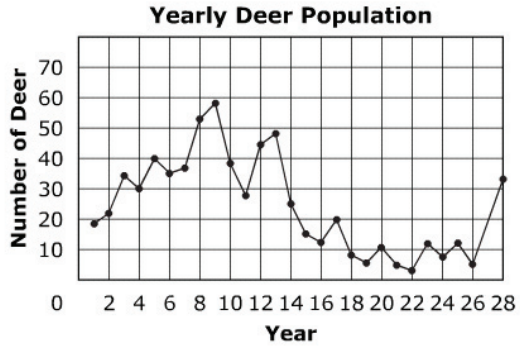
**In human testing of new medicines, double-blind testing is generally used. Neither the researchers nor the patients know which patients are receiving the medicines and which are receiving medically neutral substitutes. How does this procedure help to eliminate bias in conclusions reached based on such tests?**

- **A** Double-blind testing ensures that at least some patients will show positive results from the testing.
- **B** Double-blind testing ensures that all experiments include a responsibly constructed control group.
- **C** Double-blind testing prevents researchers from observing results they would expect and reduces patient response to any factor but the medicine itself.
- **D** Double-blind testing prevents researchers from forming hypotheses that favor the results they want and patients from selecting whether they want the medicines or the substitutes.

*Go On* ▶

**Performance Indicator:** 3210.Inq.7 Compare conclusions that offer different, but acceptable, explanations for the same set of experimental data.

59. **The graph below shows the changes in a deer population in a park over many years.**




**Some scientists conclude that the deer population in the park is still decreasing. Other scientists conclude that the deer population is now increasing. What evidence best allows scientists to conclude that the population is still increasing?**

- **A** The yearly change in population decreased with time.
- **B** The overall trend of the graph shows a population decrease.
- **C** The population trend changed over the last few years of data.
- **D** The most recent data indicates a scientific error in measurement.

**Performance Indicator:** 3210.Inq.7 Compare conclusions that offer different, but acceptable, explanations for the same set of experimental data.

60. **Scientists know that Earth's climate has changed over time. The evidence includes the study of tree rings, ice cores, ocean sediments, and glacier lengths. Evidence indicates that Earth is presently becoming warmer. Some scientists conclude that the global warming is from human activities, and other scientists conclude that the warming is a result of Earth's natural cycles. Which concept is best illustrated by this information?**

- **A** Some scientific conclusions are biased, based on the scientist's opinion.
- **B** Scientists may interpret the results from an investigation differently.
- **C** Repeated experimentation provides the correct conclusion.
- **D** Appropriate tools are needed to gather accurate data.

| **Reporting Category 1:** Inquiry, Technology and Engineering, Mathematics | | |
|---|---|---|
| **Item Number** | **Correct Answer** | **Performance Indicator** |
| 1 | B | 3210.TE.1 Distinguish among tools and procedures best suited to conduct a specified scientific inquiry. |
| 2 | C | 3210.TE.1 Distinguish among tools and procedures best suited to conduct a specified scientific inquiry. |
| 3 | D | 3210.TE.2 Evaluate a protocol to determine the degree to which an engineering design process was successfully applied. |
| 4 | C | 3210.TE.3 Evaluate the overall benefit to cost ratio of a new technology. |
| 5 | A | 3210.TE.3 Evaluate the overall benefit to cost ratio of a new technology. |
| 6 | B | 3210.TE.4 Use design principles to determine if a new technology will improve the quality of life for an intended audience. |
| 7 | A | 3210.TE.4 Use design principles to determine if a new technology will improve the quality of life for an intended audience. |
| 8 | C | 3210.Math.1 Interpret a graph that depicts a biological phenomenon. |
| 9 | A | 3210.Math.1 Interpret a graph that depicts a biological phenomenon. |
| 10 | B | 3210.Math.1 Interpret a graph that depicts a biological phenomenon. |
| 11 | C | 3210.Math 2 Predict the outcome of a cross between parents of known genotype. |
| 12 | B | 3210.Math 2 Predict the outcome of a cross between parents of known genotype. |
| 13 | A | 3210.Inq.1 Select a description or scenario that reevaluates and/or extends a scientific finding. |
| 14 | A | 3210.Inq.1 Select a description or scenario that reevaluates and/or extends a scientific finding. |

| | | |
|---|---|---|
| 15 | D | 3210.Inq.1 Select a description or scenario that reevaluates and/or extends a scientific finding. |
| 16 | A | 3210.Inq.2 Analyze the components of a properly designed scientific investigation. |
| 17 | C | 3210.Inq.2 Analyze the components of a properly designed scientific investigation. |
| 18 | B | 3210.Inq.2 Analyze the components of a properly designed scientific investigation. |
| 19 | D | 3210.Inq.3 Determine appropriate tools to gather precise and accurate data. |
| 20 | A | 3210.Inq.3 Determine appropriate tools to gather precise and accurate data. |
| 21 | D | 3210.Inq.3 Determine appropriate tools to gather precise and accurate data. |
| 22 | A | 3210.Inq.4 Evaluate the accuracy and precision of data. |
| 23 | B | 3210.Inq.4 Evaluate the accuracy and precision of data. |
| 24 | D | 3210.Inq.5 Defend a conclusion based on scientific evidence. |
| 25 | B | 3210.Inq.6 Determine why a conclusion is free of bias. |
| 26 | C | 3210.Inq.6 Determine why a conclusion is free of bias. |
| 27 | D | 3210.Inq.6 Determine why a conclusion is free of bias. |
| 28 | D | 3210.Inq.7 Compare conclusions that offer different, but acceptable, explanations for the same set of experimental data. |
| 29 | D | 3210.Inq.7 Compare conclusions that offer different, but acceptable, explanations for the same set of experimental data. |
| 30 | C | 3210.Inq.7 Compare conclusions that offer different, but acceptable, explanations for the same set of experimental data. |

| | | |
|---|---|---|
| 31 | B | 3210.TE.1 Distinguish among tools and procedures best suited to conduct a specified scientific inquiry. |
| 32 | D | 3210.TE.2 Evaluate a protocol to determine the degree to which an engineering design process was successfully applied. |
| 33 | D | 3210.TE.2 Evaluate a protocol to determine the degree to which an engineering design process was successfully applied. |
| 34 | B | 3210.TE.3 Evaluate the overall benefit to cost ratio of a new technology. |
| 35 | D | 3210.TE.4 Use design principles to determine if a new technology will improve the quality of life for an intended audience. |
| 36 | C | 3210.TE.4 Use design principles to determine if a new technology will improve the quality of life for an intended audience. |
| 37 | C | 3210.Math.1 Interpret a graph that depicts a biological phenomenon. |
| 38 | B | 3210.Math.1 Interpret a graph that depicts a biological phenomenon. |
| 39 | D | 3210.Math.1 Interpret a graph that depicts a biological phenomenon. |
| 40 | C | 3210.Math 2 Predict the outcome of a cross between parents of known genotype. |
| 41 | C | 3210.Math 2 Predict the outcome of a cross between parents of known genotype. |
| 42 | C | 3210.Inq.1 Select a description or scenario that reevaluates and/or extends a scientific finding. |
| 43 | C | 3210.Inq.1 Select a description or scenario that reevaluates and/or extends a scientific finding. |
| 44 | C | 3210.Inq.1 Select a description or scenario that reevaluates and/or extends a scientific finding. |
| 45 | A | 3210.Inq.2 Analyze the components of a properly designed scientific investigation. |

| | | |
|---|---|---|
| 46 | C | 3210.Inq.2 Analyze the components of a properly designed scientific investigation. |
| 47 | D | 3210.Inq.3 Determine appropriate tools to gather precise and accurate data. |
| 48 | C | 3210.Inq.3 Determine appropriate tools to gather precise and accurate data. |
| 49 | B | 3210.Inq.3 Determine appropriate tools to gather precise and accurate data. |
| 50 | B | 3210.Inq.3 Determine appropriate tools to gather precise and accurate data. |
| 51 | C | 3210.Inq.4 Evaluate the accuracy and precision of data. |
| 52 | B | 3210.Inq.4 Evaluate the accuracy and precision of data. |
| 53 | C | 3210.Inq.4 Evaluate the accuracy and precision of data. |
| 54 | C | 3210.Inq.5 Defend a conclusion based on scientific evidence. |
| 55 | B | 3210.Inq.6 Determine why a conclusion is free of bias. |
| 56 | D | 3210.Inq.6 Determine why a conclusion is free of bias. |
| 57 | D | 3210.Inq.6 Determine why a conclusion is free of bias. |
| 58 | C | 3210.Inq.6 Determine why a conclusion is free of bias. |
| 59 | C | 3210.Inq.7 Compare conclusions that offer different, but acceptable, explanations for the same set of experimental data. |
| 60 | B | 3210.Inq.7 Compare conclusions that offer different, but acceptable, explanations for the same set of experimental data. |