

SCIENCE

High School Student Guide

Science is both a body of knowledge that represents current understanding of natural systems and the process that continually extends, refines, and revises that body of knowledge. Progress in science cannot be made without an understanding of both. While knowing specific facts and details about the natural world is important, science is much more than merely learning content. It is the active process of investigation and the critical review of evidence related to the world around us. Science is the process of gathering and evaluating information, looking for patterns, and testing possible explanations.

Students often wonder why science is necessary for them. Science students learn to think critically and to develop reasoning skills that allow them to become independent, lifelong learners. Science methods and thought processes have applications well beyond the bounds of science, and students who understand the rules of evidence can transfer that knowledge into practical everyday life and to future employment opportunities.

A study by Arizona State University indicated that students who opt out of advanced levels of mathematics and science may now eliminate up to 75% of career opportunities from which to choose.[†] Employers want their employees to be able to make observations; gather, analyze, and critically review information; communicate information effectively; and work with other people to reach goals. It is clear that the science literacy of the twentieth century will **not** be sufficient for the twenty-first century.

[†]ASU Research, Fall, 1998, p. 41

ABOUT THE TEST

The science test contains 65 multiple-choice questions. Calculators are not allowed; however, the calculations required can be readily handled with pencil and paper. The questions will emphasize conceptual understanding, the inquiry process, and problem solving skills.

Hints for taking AIMS – Science

- Remember that this is **not** a timed test. Take your time and do your **best** work.
- Since calculators are not allowed on this test, double-check your work!
- Carefully read each question and all of the answer choices.

Sample Questions for Science

What To Expect From This Section

This AIMS Student Guide for Science provides examples of the format and types of questions that will appear on AIMS Science. An attempt has been made to provide a sampling of the types of questions that might be asked; however, not every concept in each strand has a corresponding sample question in this Guide. An answer key for all Science sample questions is provided in the appendices.

Strand 1: Inquiry Process

General concepts you should know:

- Formulate predictions, questions, or hypotheses based on observations. Evaluate appropriate resources.
- Design and conduct controlled investigations.
- Evaluate experimental design; analyze data to explain results and propose further investigations.
- Communicate results of investigations.

1.

A student must heat the contents of a test tube. Which of the following shows the correct technique the student should use to heat and hold the test tube while it is in the hot water bath?



A



C



B



D

2.

The table below shows the number of unprovoked shark attacks on humans in 5 states.

**Number of Unprovoked
Shark Attacks (1670–2004)**

State	Total Attacks
California	85
Florida	500
Hawaii	100
North Carolina	28
South Carolina	47

What is the mean number of unprovoked shark attacks in the 5 states?

- A** 47
- B** 85
- C** 127
- D** 152

3.

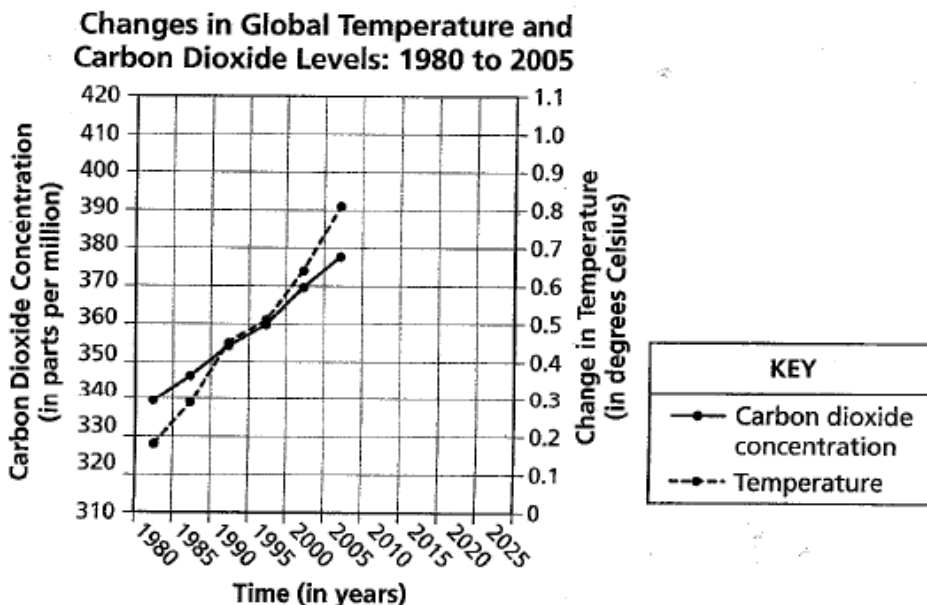
A student completed an experiment that compared the amount of nitrogen given to a tomato plant to how many tomatoes the plant produced. Which of the following is the best axis label and placement for the independent variable?

- A** Amount of Nitrogen Given (in kilograms), *x*-axis
- B** Amount of Nitrogen Given (in meters), *y*-axis
- C** Amount of Tomatoes Produced (in kilograms), *x*-axis
- D** Amount of Tomatoes Produced (in meters), *y*-axis

Directions:

Use the information below to answer Numbers 4 and 5.

Scientists have collected data that indicate Earth's temperature is in a warming trend. Many scientists believe this temperature increase may be caused by an increase in the amount of carbon dioxide in the atmosphere. The graph below shows the changes in global temperature and carbon dioxide levels from 1980 to 2005.

**4.**

Based on the data in the graph, which of the following is the **best** prediction of what the carbon dioxide level will be in the year 2020?

- A** 375 parts per million
- B** 385 parts per million
- C** 395 parts per million
- D** 405 parts per million

5.

Which hypothesis is **best** supported by the **overall** data trends in the graph?

- A** As the carbon dioxide level rises, temperature rises.
- B** As the carbon dioxide level rises, temperature falls.
- C** As the carbon dioxide level rises, the ocean level rises.
- D** As the carbon dioxide level rises, the ocean level falls.

Strand 2: History and Nature of Science

General concepts you should know:

- Identify individual, cultural, and technological contributions to scientific knowledge.
- Understand how science is a process for generating knowledge.

6.

The discovery of which of the following has most directly led to advances in the identification of suspects in criminal investigations and in the identification of genetic diseases?

- A** antibiotics
- B** cell structure
- C** DNA structure
- D** sterile procedures

7.

Darwin's theory states that evolutionary changes occur gradually over a long period of time. However, scientists have recently discovered that some mutations lead to rapid and dramatic changes in a short period of time. What does this discovery suggest about Darwin's theory?

- A** It may need to be modified.
- B** It should be discarded as incorrect.
- C** It is supported by modern and historical species.
- D** It is correct in its original form about all species.

Strand 3: Science in Personal and Social Perspectives

General concepts you should know:

- Describe the interactions between human populations, natural hazards, and the environment.
- Develop viable solutions to a need or problem.
- Analyze factors that affect human populations.

8.

In recent years, cattle producers have used growth hormones to increase the rate of growth in their cattle. Which statement does **not** support the use of growth hormones in cattle?

- A** Using these hormones might cause an increase in reproduction in cattle.
- B** Using these hormones might increase creation of lean muscle on the cattle.
- C** Using these hormones might cause meat products from the cattle to be unsafe to eat.
- D** Using these hormones might increase beef production and lower prices of beef products.

9.

The percentage of severely overweight children in the United States has been steadily increasing since 1970. Being severely overweight has been linked to an increase in the probability that a person will develop diabetes and heart disease. If the percentage of severely overweight children continues to rise, which of the following is the **most** likely outcome?

- A** More people will have heart disease and diabetes.
- B** Fewer people will be overweight and have heart disease.
- C** Fewer people will be overweight, and fewer people will have diabetes.
- D** More people will have diabetes, and fewer people will have heart disease.

Strand 3 is also addressed in Item 18.

Strand 4: Life Science

General concepts you should know:

- Understand the role of the cell and cellular processes.
- Understand the molecular basis of heredity and resulting genetic diversity.
- Analyze the relationships among various organisms and their environment.
- Understand the scientific principles and processes involved in biological evolution.
- Understand the organization of living systems and the role of energy within those systems.

10.

Which structure is outside the nucleus of a cell and contains DNA?

- A** chromosome
- B** gene
- C** mitochondrion
- D** vacuole

11.

The genome of a goldfish contains 96 chromosomes. How many chromosomes will each daughter cell have after mitosis of a goldfish cell is complete?

- A** 24
- B** 48
- C** 96
- D** 192

12.

Which of the following is the template for the production of RNA within a cell?

- A** DNA
- B** ATP
- C** protein
- D** carbohydrate

13.

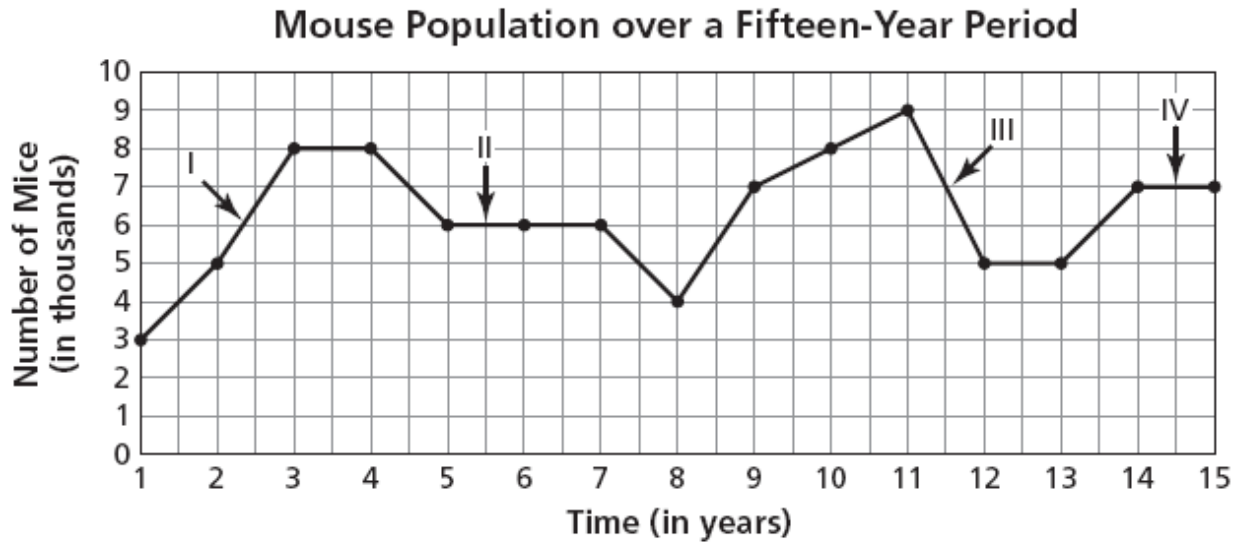
Which sequence of DNA bases would pair with the ones shown in the partial strand below?

1 2 3
A T G T G A C A G

- A** 1 2 3
A T G T G A C A G
- B** 1 2 3
T A C A C T G T C
- C** 1 2 3
G T A A G T G A C
- D** 1 2 3
C A T T C A C T G

14.

The graph below shows the population of mice living in a certain area over a fifteen-year period.



Which numeral on the graph points to a time when the birth rate exceeded the death rate of the mice?

- A** I
- B** II
- C** III
- D** IV

15.

A termite population was sprayed with a certain brand of insecticide. After being sprayed, the number of surviving termites within the population were counted and recorded as a percentage of the total. This process was repeated until a total of six generations of termites had been sprayed. The results are shown in the table below.

Termite Generation	Percentage of Surviving Termites After Spraying
1	5%
2	10%
3	25%
4	40%
5	60%
6	80%

Which statement **best** explains why later generations had higher percentages of termites that survived?

- A Earlier generations had several members that were old and weak.
- B Earlier generations had smaller numbers of termites than later generations.
- C Later generations were able to live through the spraying because they were used to it.
- D Later generations were the offspring of termites that were more resistant to the spraying.

16.

Which statement about fossils could be used as evidence that evolution by natural selection has been in effect for millions of years?

- A Fossils found in higher layers of rock are older than those found in lower layers.
- B Fossils found in lower layers of rock are more complex than those found in higher layers.
- C Fossils of current species have been found throughout rock layers that are billions of years old.
- D Fossils of species that no longer exist but are ancestors of current species have been found in rock layers.

17.

Which molecule supplies the energy for cellular functions?

- A** ATP
- B** oxygen
- C** DNA
- D** water

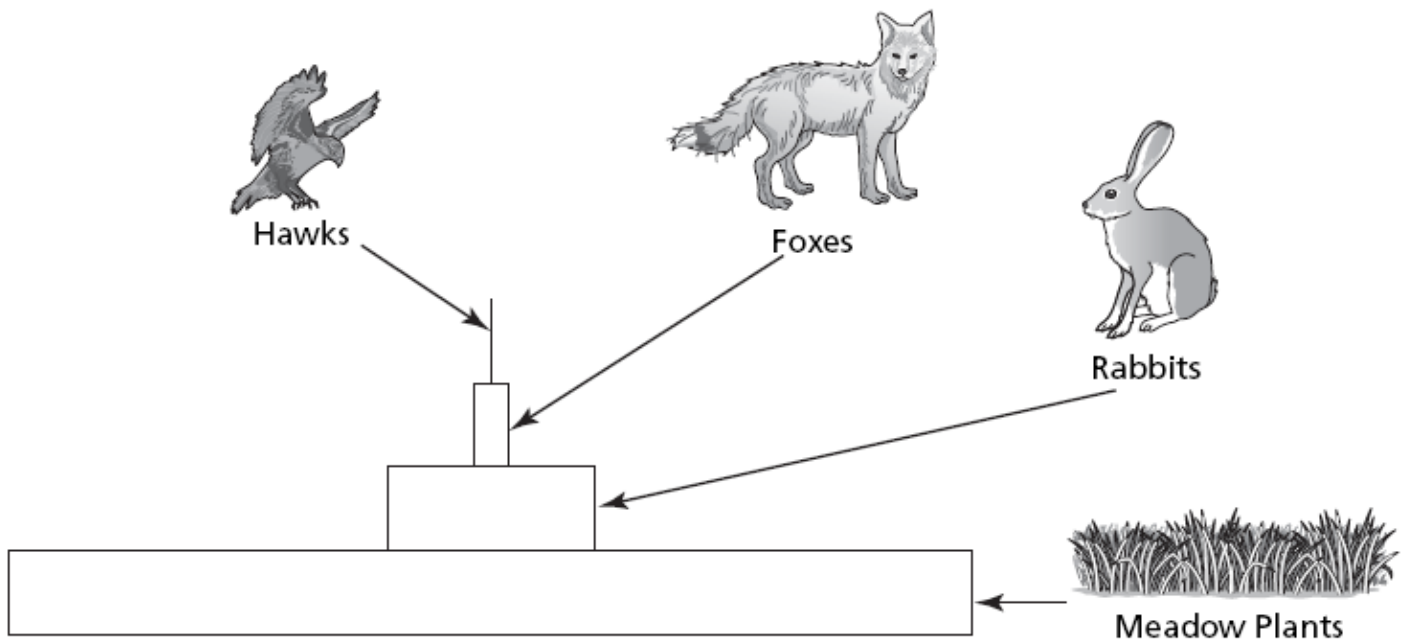
Strand 4 is also addressed in Items 19 and 20.

The following item set addresses Strand 3 (Science in Personal and Social Perspectives) and Strand 4 (Life Science):

Directions: Use the information below to answer Numbers 18 through 20.

The picture below shows the energy flow through a meadow community.

Energy Transfer in a Meadow Community



18.

Which of the following would most likely occur to the populations within the community of organisms immediately after a wildfire burns the environment?

- A Hawks would increase and foxes would increase.
- B Hawks would decrease and foxes would increase.
- C Meadow plants would increase and rabbits would decrease.
- D Meadow plants would decrease and rabbits would decrease.

19.

Which statement **best** describes what will happen if the population of herbivores in the community decreases?

- A** The population of foxes will increase.
- B** The population of hawks will increase.
- C** The population of rabbits will increase.
- D** The population of meadow plants will increase.

20.

Which statement **best** describes the flow of energy as it passes through the organisms in the pyramid?

- A** Energy flows through the organisms from bottom to top and increases at each level.
- B** Energy flows through the organisms from bottom to top and decreases at each level.
- C** Energy flows through the organisms from top to bottom and increases at each level.
- D** Energy flows through the organisms from top to bottom and decreases at each level.

Scoring Key and Coding of Items

<u>Science Key:</u>	<u>Strand:</u>	<u>Concept:</u>	<u>PO</u>
Question #1: D	1	2	1
Question #2: D	1	3	6
Question #3: A	1	4	2
Question #4: D	1	1	4
Question #5: A	1	3	2
Question #6: C	2	1	3
Question #7: A	2	2	4
Question #8: C	3	2	3
Question #9: A	3	3	3
Question #10: C	4	1	2
Question #11: C	4	1	5
Question #12: A	4	2	1
Question #13: B	4	2	2
Question #14: A	4	3	3
Question #15: D	4	4	3
Question #16: D	4	4	5
Question #17: A	4	5	2
Question #18: D	3	1	2
Question #19: D	4	3	1
Question #20: B	4	5	4