

General Science: Content Knowledge, Part 1 (0431)

Test at a Glance

Test Name	General Science: Content Knowledge, Part 1		
Test Code	0431		
Time	1 hour		
Number of Questions	60		
Format	Multiple-choice questions		
	Content Categories	Approximate Number of Questions	Approximate Percentage of Questions
	I. Methodology/Philosophy; Math/Measurement/Data; Laboratory/Safety II. Basic Principles of Science III. Life Science IV. Earth/Space Science; Science, Technology, and Society	14 14 13 19	23% 23% 22% 32%

About This Test

The General Science: Content Knowledge, Part 1, test is designed to measure the knowledge and competencies necessary for a beginning teacher of secondary school general science. The 60 multiple-choice questions assess knowledge of fundamental scientific concepts, principles, phenomena, and interrelationships. Some questions may integrate concepts from more than one category. In general, questions focus on examinees' ability to define terms, comprehend essential properties, apply knowledge, and analyze content.

The test covers the basic principles of science; life science; earth/space science; science, technology, and society; and methodology, measurement, and safety.

To communicate an accurate understanding of various science fields to secondary school students, teachers need to understand the subject matter from a more advanced viewpoint than that actually presented to the students. Accordingly, some questions of a more advanced nature are included. These questions cover topics that examinees will have studied in freshman college-level courses in physics, chemistry, life science, and earth science.

This test may contain some questions that will not count toward your score.

Topics Covered

Representative descriptions of topics covered in each category are provided below.

I. Methodology/Philosophy; Math/Measurement/Data; Laboratory/Safety

- Methodology and philosophy: scientific methods and processes; facts, models, theories, and laws; history of science
- Mathematics, measurement, and data manipulation: measurement and notation systems; data presentation and interpretation, including error analysis
- Laboratory procedures and safety: techniques of safe preparation, storage, use, and disposal of laboratory and field materials; selection and use of appropriate laboratory equipment

II. Basic Principles of Science

- Matter and energy: structure and properties of matter, occurrence and abundance of elements, physical and chemical changes, forms and transformations of energy, conservation of mass and energy
- Heat and thermodynamics: thermal energy, measurement, transfer and effects on matter, first and second laws of thermodynamics
- Atomic and nuclear structure: atomic and nuclear structure and related chemical properties; nuclear transformations and characteristics of radioisotopes and radiation

III. Life Science

- The Cell: biologically important macromolecules, structure and function of cells, cell organelles, cellular bioenergetics, the cell cycle, meiosis
- Genetics: DNA replication, protein synthesis, Mendelian and non-Mendelian inheritance, mutations, genetic engineering, human genetic disorders
- Evolution: evidence, theories and patterns of evolution, factors affecting evolution, speciation, hypotheses relating to the origin of life
- Diversity of life: general characteristics, five-kingdom classification, viruses
- Plants: structure and function of roots, stems, and leaves; nonvascular plants; transport systems; control mechanisms; sexual and asexual reproduction
- Animals: anatomy and physiology of systems, homeostasis, response to stimuli

- Ecology: population dynamics, social behavior, interspecific relationships, community structure, succession, ecosystems, food webs and energy flow, cycling of materials, biomes

IV. Earth/Space Science; Science, Technology, and Society

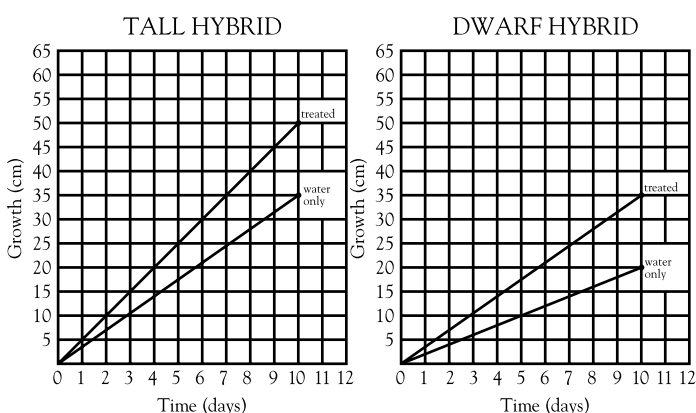
- Physical geology: minerals and rocks, folding and faulting, earthquakes and volcanoes, structure of the Earth, plate tectonic theory and its supporting evidence, hydrologic cycle, weathering, erosional and depositional processes
- Historical geology: uniformitarianism, time scales, fossils and stratigraphy, Earth history
- Oceanography: waves, tides, and currents; ocean floor and margins; chemistry of seawater
- Meteorology:
 - structure and properties of the atmosphere
 - seasonal and latitudinal variation of solar radiation
 - heat budget
 - circulation patterns and winds
 - humidity
 - clouds and precipitation
 - air masses, high and low pressure systems, frontal systems, maps, and forecasting
 - climate and climatic change
- Astronomy:
 - theories of the origin and structure of the universe
 - stars
 - major features and structure of the solar system
 - Sun-Moon-Earth relationships
 - artificial satellites and space exploration
- Science, Technology, and Society:
 - use of science and technology in daily life
 - impact of science and technology on the environment and human affairs, including issues associated with the production of energy, consumer products, and foods
 - conservation of resources
 - biotechnology
 - health

Sample Test Questions

The sample questions that follow illustrate the kinds of questions in the test. They are not, however, representative of the entire scope of the test in either content or difficulty. Answers with explanations follow the questions.

Directions: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the one that is best in each case.

In an experiment to study the effect of a new fertilizer on the growth of tall hybrid corn and dwarf hybrid corn, from immediately after germination to ten days of growth, the data below were obtained. Other growing conditions such as water and sunlight were the same for both groups.



1. Which of the following is the most reasonable conclusion that can be drawn from the data above?

- (A) The new fertilizer influences the growth of both corn varieties tested.
- (B) The new fertilizer causes faster growth rate for both varieties than do other fertilizers.
- (C) The new fertilizer improves the root system of the tall hybrid to a greater extent than it does that of the dwarf hybrid.
- (D) The new fertilizer is effective in producing faster growth for both varieties for the first ten days only.

2. Which of the following poses the greatest safety risk while being heated in a school laboratory?

- (A) A mixture of iron and sulfur
- (B) Mercury(II) oxide
- (C) Sodium chloride
- (D) Copper(II) sulfate hydrate

3. Which of the following is an example of kinetic energy?

- (A) An object in circular motion
- (B) An electrochemical cell
- (C) A boulder at rest at the top of a hill
- (D) Gasoline in a can

4. The symbol for a specific isotope of gold is $^{197}_{79}\text{Au}$. Which of the following is consistent with this symbol?

- (A) 197 neutrons in the nucleus
- (B) 79 neutrons in the nucleus
- (C) 118 protons in the nucleus of each of its atoms
- (D) 79 electrons in a neutral atom

5. Both prokaryotic cells and eukaryotic cells possess which of the following?

- (A) Endoplasmic reticulum
- (B) Cell walls made of cellulose
- (C) Lysosomes
- (D) The capability of manufacturing proteins

6. Which of the following is most likely to cause a rise in the average temperature of the Earth in the future?

- (A) Atomic warfare
- (B) CO_2 from fossil fuels
- (C) Dust clouds from volcanoes
- (D) Depletion of the Earth's ozone layer

7. Which of the following is matched with its correct function?
- (A) Ovule production of pollen
 - (B) Vascular cambium formation of apical meristem
 - (C) Xylem transport of sugars
 - (D) Guard cell regulation of transpiration rate
8. Which of the following statements is correct about a trophic structure in which a leaf-eating grasshopper is eaten by a frog, which in turn is eaten by a snake?
- (A) The frog is a herbivore.
 - (B) The snake is a secondary consumer.
 - (C) The grasshopper is a primary consumer.
 - (D) The snakes outnumber the grasshoppers in the community.
9. The accumulation of stress along the boundaries of lithospheric plates results in which of the following?
- (A) Earthquakes
 - (B) Magnetic reversals
 - (C) Hurricanes
 - (D) Increased deposition of deep-sea sediments
10. The Earth's seasons can be attributed primarily to which of the following in conjunction with its revolution about the Sun?
- (A) The tilt of the Earth's axis of rotation relative to the ecliptic
 - (B) The varying amount of sunspot activity
 - (C) The Earth's orbit about the Sun as an ellipse rather than a circle
 - (D) The rotation of the Earth during a 24-hour day
11. Supplies appropriate for the measurement in a school laboratory of the density of a small rock sample include all of the following EXCEPT
- (A) water
 - (B) a graduated cylinder
 - (C) a platform balance
 - (D) a thermometer
12. Which of the following properties of a substance depends on the amount of the sample?
- (A) Temperature
 - (B) Half-life
 - (C) Density
 - (D) Inertia

Answers

1. The correct answer is A. Both graphs indicate more rapid growth for the treated samples than for the untreated samples. The other options describe results not tested in the experiments and so not indicated by the data.

2. The best answer is B. Mercury(II) oxide breaks down on heating to metallic mercury and oxygen. Mercury vapor that is given off is highly toxic when inhaled or absorbed through the skin, and exposure to mercury in a school should be greatly limited if not eliminated altogether.

3. The correct answer is A. Kinetic energy is the energy of motion.

4. The correct answer is D. The numbers before the symbol for an element have the following meanings:

Top number: isotopic mass = the sum of the number of protons plus the number of neutrons in the nucleus of each of its atoms.

Bottom number: atomic number = the number of protons in the nucleus of each of its atoms.

Thus, each nucleus of this isotope contains 79 protons and $197 - 79 = 118$ neutrons. In a neutral atom, the number of electrons is equal to the number of protons, 79 in this case.

5. The correct answer is D. Both prokaryotic and eukaryotic cells are able to synthesize proteins. Prokaryotic cells do not possess endoplasmic reticulum, cell walls made of cellulose, or lysosomes.

6. The correct answer is B. Increased carbon dioxide (a greenhouse gas) in the atmosphere will probably result in global warming. Atomic warfare would more likely result in a "nuclear winter." Volcanoes would probably cause cooling due to high

atmospheric dust absorbing the Sun's rays so they cannot reach the ground. The depletion of the ozone layer will let more ultraviolet radiation through the atmosphere but in itself should not cause warming.

7. The correct answer is D. Stomata open and close due to the changing shape of the guard cells. Water exits freely through the stomata when they are open.

8. The correct answer is C. The grasshopper is the herbivore and thus the primary consumer.

9. The correct answer is A. Earthquakes are the abrupt release of energy that occurs when a rock under stress fractures and displacement occurs.

10. The correct answer is A. Seasons are best explained as resulting from the Earth's axial tilt and not from distance variations, sunspot activity, atmospheric transparency, or rotation.

11. The density of a rock is subject to very small variations with temperature, so the thermometer is not important. The other pieces of equipment are needed for the determination since density is mass per unit volume. The correct answer is D.

12. Inertia is a property of a substance, proportional to its mass, and therefore depends on the amount of the sample. The correct answer is D.



Listening. Learning. Leading.®

www.ets.org