Collegiate Assessment of Academic Proficiency

Science

Sample Test Questions Booklet

ACT®

Note to Users

Welcome to the CAAP Sample Science Test!

You are about to look at some sample test questions as you prepare to take the actual CAAP test. The examples in this booklet are similar to the kinds of test questions you will see when you take the actual CAAP test. Since this is a practice exercise, you won't receive a real test score. The aim of this booklet is to give a sense of the kinds of questions examinees will face and their levels of difficulty. An answer key is provided at the end of the booklet.

We hope you benefit from these sample questions, and we wish you success as you pursue your education and career goals!

CAAP Science Test

The CAAP Science Test is a 45-item, 40-minute test that measures students' knowledge and skills in science. The contents of the test are drawn from biological sciences (e.g., biology, botany, and zoology), chemistry, physics, and the physical sciences (e.g., geology, astronomy, and meteorology). The test emphasizes scientific knowledge and reasoning skills.

The CAAP Science Test consists of eight passage sets, each of which contains scientific information and a set of multiple-choice test questions. A passage may conform to one of the three formats listed below:

- **Data Representation:** This format presents students with graphic and tabular materials similar to those found in science journals and texts. The test questions associated with this format measure knowledge and skills such as graph reading, interpretation of scatterplots, and interpretation of information presented in tables, diagrams, and figures.
- **Research Summaries:** This format provides students with descriptions of one experiment or of several related experiments. The test questions focus on the design of the experiments and the interpretation of results.
- **Conflicting Viewpoints:** This format presents students with several hypotheses or views that are mutually inconsistent owing to different premises, incomplete data, or differing interpretations of data. The passage may contain illustrations, charts, graphs, tables, diagrams, or figures. The test questions measure students' knowledge and skills in understanding, analyzing, and comparing alternative viewpoints or hypotheses.

The test questions fall into three major groups. Each group is intended to address an important element of scientific inquiry. These groups are described below:

- **Understanding:** Identify and evaluate scientific concepts, assumptions, and components of an experimental design or process; identify and evaluate data presented in graphs, figures, or tables; translate given data into an alternate form.
- **Analyzing:** Process information needed to draw conclusions or formulate hypotheses; determine whether information provided supports a given hypothesis or conclusion; evaluate, compare, and contrast experimental designs or viewpoints; specify alternative ways of testing hypotheses or viewpoints.
- **Generalizing:** Extend information given to a broader or different context; generate a model consistent with given information; develop new procedures to gain new information; use given information to predict outcomes.

Samples of test questions in the CAAP Science Test are provided on the following pages.

SCIENCE TEST

40 Minutes—45 Questions

DIRECTIONS: There are eight passages in this test. Each passage is followed by several questions. After reading a passage, choose the best answer to each question by circling the corresponding answer option. You may refer to the passages as often as necessary.

You are NOT permitted to use a calculator on this test.

Passage I

Cavity-nesting birds must find trees that provide suitable sites for nest construction. These birds excavate nest depressions by removing wood from the tree, making a hollow cavity that provides a shelter for the nest. Once constructed, cavities may serve as nest sites for many years.

A study was done to provide information about the characteristics of trees used by 4 species of cavity-nesting birds. Such information could prove useful to resource managers who are concerned about creating a balance between resource exploitation (e.g., lumbering) and the preservation of wildlife (e.g., cavity-nesting birds).

Nest sites were sampled for yellow-bellied sapsuckers, hairy woodpeckers, downy woodpeckers, and black-capped chickadees. The characteristics of nest trees used by these 4 bird species are shown in the Table 1. In addition, trees were investigated that appeared to be suitable for nesting but were not currently being used for that purpose by any of the study birds. These "non-nest" trees displayed at least 2 of the following qualities.

- Fungal conks (areas of fungal decomposition of the wood)
- Branch or stem stubs
- Old wounds or scars
- Existing woodpecker holes
- Dead portions (trees can be living with dead portions visible)

Both nest trees for the 4 species and adjacent non-nest trees were measured for total tree height and trunk diameter at chest height. Nest trees only were also measured for nest height and trunk diameter at nest height (see Table 2).

Table 1

Tree characteristic	Number of nests			
	Yellow-bellied sapsucker	Hairy woodpecker	Downy woodpecker	Black-capped chickadee
Species				
Quaking aspen	26	7	1	9
American beech	2	0	0	3
Paper birch	0	4	0	6
Yellow birch	0	0	0	4
Red maple	6	5	2	7
Sugar maple	2	1	2	3
Other	2	4	2	12
TOTAL	38	21	7	44
Attribute				
Living	33	11	5	3
Broken top	14	11	4	41
Branch stub	38	19	6	10
Hard outer wood	34	18	6	11
Fungal conk	32	14	6	24
Soundness (% nondecayed wood)				
0–25	11	5	2	35
26–50	16	6	1	5
51–75	4	6	3	3
76–100	7	4	1	1
% bark cover				
0–25	0	0	0	3
26–50	0	1	0	9
51–75	4	0	0	9
76–100	34	20	7	23

Table 2

	Yellow-bellied sapsucker (20 cm)[a]		Hairy woodpecker (19 cm)[a]		Downy woodpecker (14 cm)[a]		Black-capped chickadee (11 cm)[a]	
Tree measurement	NST	NNST	NST	NNST	NST	NNST	NST	NNST
Trunk diameter, chest height (cm)	33.6	28.1	27.1	23.9	30.7	20.4	15.8	16.1
Trunk diameter, nest height (cm)	22.8	—	22.4	—	17.1	—	13.2	—
Total height (m)	19.4	14.1	17.5	14.1	19.7	10.0	3.8	8.5
Nest height (m)	8.6	—	8.3	—	9.3	—	2.5	—

[a] = total, live body length
NST = nest tree
NNST = non-nest tree

Tables adapted from D. E. Runde and D. E. Capen, "Characteristics of Northern Hardwood Trees Used by Cavity-nesting Birds." ©1987 by The Wildlife Society, Inc.

1. The data in Table 1 suggest that black-capped chickadees tend to avoid which kind of tree?

A. Those with broken tops
B. Those with 25% or less sound wood
C. Those that are living
D. Birches

2. Managed stands of timber usually have few older, dying, or dead trees. In such a forest, one would expect the number of cavity-nesting birds to be:

F. high, because of the great number of live trees.
G. high, because nest trees would have small trunk diameters.
H. low, because most of the trees would be sound.
J. low, because the average tree height would be over 10 m.

3. Which of the 4 bird species studied would most likely be found nesting in woodlots containing *only* paper-birch and yellow-birch trees?

I. Yellow-bellied sapsucker
II. Hairy woodpecker
III. Downy woodpecker
IV. Black-capped chickadee

A. I only
B. III only
C. I and III only
D. II and IV only

4. Which of the following data from Table 2 would support the hypothesis that birds longer than 15 cm choose larger nest trees than birds less than 15 cm in length?

I. Tree trunk diameter at nest height
II. Tree trunk diameter at chest height
III. Total tree height

F. I only
G. II only
H. I and II only
J. I, II, and III

5. Which characteristic of non-nest trees would researchers NOT be likely to identify?

A. Total height
B. Trunk diameter at nest height
C. Species
D. Soundness

6. Which statement below *best* describes why the researchers considered the characteristics of both nest and non-nest trees?

F. Nest trees are used as an experimental control for non-nest trees.
G. Non-nest trees are used as an experimental control for nest trees.
H. Comparing both types of trees allows for a better definition of nest-tree criteria.
J. Non-nest trees are used as lookout points for spotting cavity-nesting birds.

GO ON TO THE NEXT PAGE.

Passage II

The relationship between an applied force and the resulting acceleration of a cart carrying different masses is studied. (See Figure 1.) The cart moves from A to B, and distance and time measurements are made. Laboratory weights are used for the applied force. The surface over which the cart travels is level and nearly frictionless.

A timer that makes a mark every .1 second is attached to the underside of the cart. The marks are recorded on a strip of paper that lies flat on the surface over which the cart travels. The timer starts simultaneously with the release of the cart. The marks on the paper are measured, and the distance from Point A is recorded. The distances represent the location of the cart after each .1 second interval. Velocity was calculated at each data point. Average acceleration was calculated by dividing the change in velocity for each interval by the length of time of each interval. The measured and calculated data are given in Table 1.

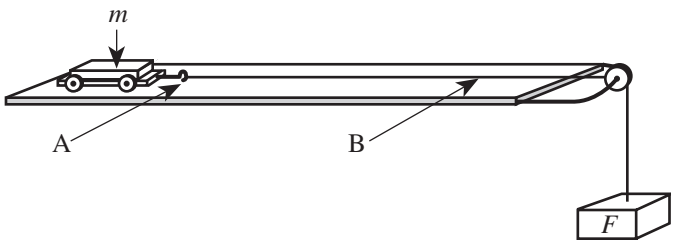


Figure 1

Table 1

Trial	Data point	Force (newtons)	Mass (kg)	Distance from A (m)	Velocity (m/s)	Average acceleration (m/s^2)
1	1	.5	.20	.010	.20	2.0
	2	.5	.20	.040	.40	2.0
	3	.5	.20	.090	.60	2.0
	4	.5	.20	.160	.80	2.0
2	1	2.0	.20	.025	.49	4.9
	2	2.0	.20	.098	.98	4.9
	3	2.0	.20	.220	1.47	4.9
	4	2.0	.20	.392	1.96	4.9
3	1	2.0	.10	.033	.65	6.5
	2	2.0	.10	.130	1.30	6.5
	3	2.0	.10	.293	1.95	6.5
	4	2.0	.10	.520	2.60	6.5

kg = kilograms
m = meters
s = seconds

7. If data had been collected for a fifth data point in Trial 1, what would the velocity have been?

A. .80 m/s
B. 1.00 m/s
C. 1.20 m/s
D. 1.40 m/s

8. If the 3 trials could be run simultaneously on parallel setups, in what order, from first to last, would the carts get to Point B ?

F. Trial 1, Trial 2, Trial 3
G. Trial 1, Trial 3, Trial 2
H. Trial 2, Trial 1, Trial 3
J. Trial 3, Trial 2, Trial 1

9. Mass is added to the cart by the addition of a wooden block that rests on top of it. When the force is increased to 4.0 newtons, the block falls off as the cart begins to accelerate. Why does it fall off when the force is increased to this level?

A. The force accelerating the cart becomes large enough so that the force of friction holding the block on is overcome.
B. The force of friction holding the block in place becomes large enough to overcome the force accelerating the cart.
C. The mass of the cart becomes too large, and the load must be reduced for the cart to accelerate.
D. The acceleration becomes nonuniform with this force.

10. Another experiment showed the velocities for a trial to be 1.0 m/s, 2.5 m/s, 4.5 m/s, and 7.0 m/s when measured in the same way. What trend occurred in the average acceleration?

F. It was constant.
G. It decreased by 10.0 m/s^2 each interval.
H. It decreased by 5.0 m/s^2 each interval.
J. It increased by 5.0 m/s^2 each interval.

11. If Trial 3 were redone with a force of 1.0 newton, then compared to that found in Trial 3, the average acceleration would be:

A. initially lower and decreasing.
B. initially lower and constant.
C. the same.
D. initially higher but decreasing.

Passage III

Urease is an enzyme used by plants to break down *urea* (a nitrogen-containing compound) into carbon dioxide and ammonia. Plants need nitrogen to grow and can obtain it from ammonia, but not from urea. In soybean plants there are 2 different kinds of urease, one produced in the seeds and the other produced in the leaves of the plant. Mutations in the chromosomes of the soybean can stop production of either enzyme. In the following experiments, 3 types of soybean plants were used: normal soybeans and 2 mutant strains, 1 lacking the seed urease (Strain 1) and 1 lacking the leaf urease (Strain 2).

Experiment 1

Separate areas in a field were planted with normal, Strain 1, and Strain 2 soybeans. All types of soybeans appeared to grow, flower, and produce seeds equally well. There were no externally detectable differences among the strains.

Experiment 2

Small pieces of plant tissue of equal weight were obtained from each type of soybean plant and separately placed on media in culture dishes. Tissue growing in this way will become an unorganized clump of cells referred to as *callus*. To provide a controlled nitrogen source, half the tissue samples of each type were placed on media containing urea, and the other half of the samples were placed on media containing ammonia. After 30 days, the weight gain for each of the callus samples was determined. Results are shown in the table below.

	Weight gain (mg)	
Plant type	Urea	Ammonia
Normal	150	180
Strain 1	155	160
Strain 2	50	170

12. Which of the following best describes the role of urease in the plants grown in the field?

F. Urease activity in leaves is essential for soybean growth.
G. Urease activity in seeds is essential for soybean growth.
H. The soil nutrients make the mutant soybeans grow like the normal strains.
J. Urease is not essential to the growth of soybeans.

13. Which of the nitrogen sources in Experiment 2 served as the control group?

A. Ammonia, because all 3 strains of soybeans can use it
B. Ammonia, because it will inhibit the effects of urease
C. Urea, because it can be broken down by urease
D. Urea, because it cannot be used by Strain 2

14. Mutant strains are most useful in experiments like those in the passage because they:

F. may produce unexpected results.
G. provide a natural, noninvasive way to vary a characteristic.
H. differ from normal strains in unknown, unpredictable ways.
J. can be modified to suit almost any type of research.

15. In studying the metabolic needs of the soybean strains, Experiment 2 was probably more accurate than Experiment 1 because in Experiment 2 the:

A. nutrients in the media were more controlled.
B. nutrients in the soil could not be measured.
C. nutrients in the soil were more controlled.
D. callus was much different from the plants.

16. Suppose a third strain were found that was unable to produce either form of urease. If this strain were subjected to the same procedures as those in the passage, what would be the expected results?

F. Callus would grow on urea and on ammonia; the plant would grow in the field.
G. Callus would not grow on urea but would grow on ammonia; the plant would not grow in the field.
H. Callus would not grow on urea but would grow on ammonia; the plant would grow in the field.
J. Callus would not grow on urea or on ammonia; the plant would not grow in the field.

Passage IV

Asteroid-Impact Theory

The dinosaurs disappeared at the end of the Mesozoic era, about 65 million years ago. The disappearance took place over a very short period of time and was, according to some scientists, triggered by Earth colliding with a large asteroid.

Today, evidence of this collision can be found in the rock record. Geologists have discovered a thin layer of clay containing a high concentration of the element iridium between 2 particular rock layers. This boundary marks the end of the Mesozoic and the beginning of the Cenozoic era. This iridium-rich layer has been identified at the Mesozoic-Cenozoic boundary at many different locations around the world. Iridium, while rare on Earth, is a common substance in meteorites and asteroids.

The asteroid not only supplied the iridium, but its white-hot rock fragments also started fires that engulfed entire continents. The soot from these fires, combined with asteroid and crustal particles that were propelled into the atmosphere, blocked out the Sun's energy. The lack of sunlight halted photosynthesis and caused a decrease in global temperatures. Much of the plant and animal life, including the dinosaurs, could not adapt to the temperature change and died.

Gradual-Extinction Theory

Some scientists disagree with the asteroid-impact theory. They point to evidence that the dinosaurs died out gradually because of a long-term climatic change.

Earth experienced increased volcanic activity 65 million years ago. Not only could Earth's volcanism have produced the iridium, but more important, volcanoes did produce tremendous amounts of carbon dioxide. The increased levels of carbon dioxide in the atmosphere prevented Earth from radiating excess heat back into space, and thus caused a worldwide warming.

The warming of Earth is what caused the dinosaurs' disappearance. After examining dinosaur egg fossils, paleontologists discovered that the eggshells became thinner in at least one species. This was thought to be the result of heat adversely affecting the dinosaurs' metabolism. These thin-shelled eggs, which were easily broken, lowered the survival rate among the offspring and contributed to the eventual extinction of the dinosaurs.

17. Astronomers recently estimated that only 3% of asteroids with orbits that intersect Earth's have been identified. This finding adds support to the asteroid-impact theory by:

- **A.** increasing the likelihood of past Earth-asteroid collisions.
- **B.** showing how little astronomers know about asteroids.
- **C.** proving that iridium-rich asteroids are common in the solar system.
- **D.** showing that many asteroids are too small to be easily identified.

18. A geologist examines a sedimentary rock layer from the Mesozoic-Cenozoic boundary. According to the asteroid-impact theory, the geologist should not expect to find:

- **F.** a high concentration of iridium.
- **G.** a high concentration of soot particles.
- **H.** evidence of great volcanic activity.
- **J.** fossilized plant remains.

19. What do supporters of the asteroid-impact theory assume about the fires started by the white-hot asteroid fragments?

- **A.** They spread quickly and were wide ranging.
- **B.** They removed carbon dioxide from the atmosphere, causing a global cooling.
- **C.** They burned the vegetation, limiting the food supply.
- **D.** They produced high levels of carbon dioxide, causing a global warming.

20. Both theories presented in the passage cite which of the following factors as contributing directly to the dinosaurs' extinction?

- **F.** High levels of soot and volcanic ash
- **G.** High concentrations of iridium
- **H.** Global temperature change
- **J.** Increased amounts of carbon dioxide introduced into the atmosphere

21. Mass extinctions throughout history often occur in conjunction with drops in the sea level. What would proponents of the gradual-extinction theory have to demonstrate to tie those facts together?

- **A.** Mass extinctions and drops in the sea level are both caused by increased volcanic activity.
- **B.** The greenhouse effect causes lowering of the sea level as well as gradual mass extinctions.
- **C.** With less water available, fires run rampant and destroy the food supply.
- **D.** Drops in the sea level and mass extinctions are caused by the same changes in climate.

22. After examining the 250-million-year fossil record, 2 paleontologists have uncovered evidence suggesting that the rate of species extinctions peaks every 26 million years. Supporters of the asteroid-impact theory would most likely favor which of the following explanations to account for this finding?

- **F.** Some massive object periodically disrupts the solar system, causing comets and asteroids to enter the inner solar system.
- **G.** The tilt of Earth's axis changes every 26 million years, causing long-term climatic changes that lead to mass-extinction episodes.
- **H.** Earth's orbit becomes more elliptical every 26 million years and it travels farther from the Sun, causing periods of global cooling.
- **J.** Earth's global weather patterns change in response to the size of the polar ice caps, plunging Earth into a global cooling pattern every 26 million years.

Passage V

The rate of a chemical reaction is obtained by dividing the amount of a chemical consumed in a reaction by the time in which the chemical is consumed. The rate at which a chemical reaction occurs is dependent on many variables, two of which are the concentration of a chemical in solution and the temperature at which the reaction occurs. In order to determine the effects of concentration and temperature on reaction rates, a chemist studied the following reaction sequence.

$$HCHO + Na_2SO_3 + H_2O \rightarrow NaO_3SOCH_3 + NaOH$$

Reaction 1

$$NaOH + NaHSO_3 \rightarrow Na_2SO_3 + H_2O$$

Reaction 2

While Reaction 1 occurs slowly, Reaction 2 happens instantaneously. Both of the reactions occur in the same solution, so no base (NaOH) is built up in solution until all the $NaHSO_3$ is used. Phenolphthalein, which is also in the solution, will cause the solution to turn pink when a measurable amount of base is present.

Experiment 1

A standard solution of formaldehyde (HCHO) in water was prepared. This solution contained 0.3 mole of HCHO per liter of solution (0.3 M HCHO) and a small amount of phenolphthalein. This solution was diluted further with varying amounts of water and mixed with 10.0 mL of a 0.01 M solution of both Na_2SO_3 and $NaHSO_3$ in water. The time required for the pink color to appear is shown in Table 1.

Experiment 2

The chemist mixed 10.0 mL of the HCHO solution at $\frac{1}{2}$ the original concentration with 10.0 mL of the 0.01 M solution containing Na_2SO_3 and $NaHSO_3$. The temperature of the reaction was varied, and the time required for the pink color to appear is recorded in Table 2.

Table 2

Temperature (°C)	Time required for color change (s)
5°	110
10°	80
15°	58
20°	43
25°	36
30°	30
35°	28
40°	27

Table 1

Trial	Volume of 0.3 M HCHO solution (mL)	Volume of water added to HCHO solution (mL)	Volume of 0.01 M Na_2SO_3 and $NaHSO_3$ (mL)	Time required for color change (s)
1	10.0	0.0	10.0	18
2	9.0	1.0	10.0	20
3	8.0	2.0	10.0	23
4	7.0	3.0	10.0	26
5	6.0	4.0	10.0	30
6	5.0	5.0	10.0	36
7	4.0	6.0	10.0	45
8	3.0	7.0	10.0	60
9	2.0	8.0	10.0	90
10	1.0	9.0	10.0	180

23. In order to display the relationship between concentration and the rate of the reaction more effectively in Experiment 1, the chemist could:

A. construct a bar graph of the concentration of formaldehyde in each trial.
B. plot the HCHO concentration against the time required for the color change.
C. plot the change in Na_2SO_3 and $NaHSO_3$ concentrations in each trial against the HCHO concentrations.
D. produce a table cataloging the differences between the times for the color changes in successive trials.

24. Which of the following trials in Experiment 1 had the same concentration of HCHO as in all the trials of Experiment 2 ?

F. Trial 2
G. Trial 4
H. Trial 6
J. Trial 8

25. If Reaction 1 was found to be exothermic (heat producing), how could Experiment 1 be modified to examine *only* the effect of concentration on reaction rate?

A. The concentration of formaldehyde could be increased.
B. A different method could be used to determine the color change.
C. The temperature of the solution could be set to a constant temperature.
D. The temperature of the solution could be increased.

26. The fastest rate of reaction in Experiment 1 occurred when the:

F. time for the color change to occur was greatest.
G. concentration of NaOH was greatest in the reaction mixture.
H. concentration of HCHO was smallest in the reaction mixture.
J. concentration of HCHO was greatest in the reaction mixture.

27. The function of phenolphthalein in both experiments was to:

A. signal when the $NaHSO_3$ was gone.
B. signal when the NaOH was gone.
C. cause the HCHO solution to react.
D. slow down the rate of reaction.

28. Which of the following experiments would most likely produce more information about other variables that affect the rate of these reactions?

F. Conducting Experiment 1 with smaller amounts of phenolphthalein
G. Conducting Experiment 1 with larger concentrations of HCHO
H. Adding NaOH to the HCHO solution in Experiment 1
J. Varying the concentrations of Na_2SO_3 and $NaHSO_3$ while keeping the HCHO concentration constant

Passage VI

In a study of velocity and kinetic energy, a cart was tested in 9 different trials. The cart carried different masses down 3 ramps of different inclinations. Table 1 shows the mass carried by the cart, the height from which it was released, and the distance it rolled to get to the end of the ramp. The table also lists the speed and kinetic energy of the cart as it reached the bottom of the ramp.

Table 1

	Trial	Mass (kg)	Height of release (m)	Speed (m/s)	Kinetic energy (joules)	Distance rolled (m)
Ramp 1	1	1	2	6.3	20	4
	2	2	4	8.9	80	8
	3	4	8	12.6	320	16
Ramp 2	4	1	4	8.9	40	4.6
	5	2	8	12.6	160	9.2
	6	4	16	17.9	640	18.4
Ramp 3	7	4	8	12.6	320	11.3
	8	4	16	17.9	640	22.6
	9	4	32	25.0	1,260	45.3

kg = kilograms
m = meters
s = seconds

29. Which of the following pairs of trials supports the conclusion that the distance rolled on each ramp is directly proportional to the height of release?

A. Trials 2 and 3
B. Trials 2 and 5
C. Trials 2 and 8
D. Trials 5 and 8

30. Which of the following variables was a constant in Trials 2 and 5 ?

F. Height
G. Mass
H. Speed
J. Kinetic energy

31. Doubling both the mass of the cart and the height from which it is released changes the kinetic energy by a factor of:

A. $\frac{1}{4}$.

B. $\frac{1}{2}$.

C. 2.

D. 4.

32. Which of the following relationships between mass and kinetic energy is indicated by the data for Trials 3 and 5 ?

F. Mass is inversely proportional to kinetic energy.
G. Mass is directly proportional to kinetic energy.
H. Mass squared is proportional to kinetic energy.
J. Mass is directly proportional to kinetic energy squared.

33. What kinetic energy would be calculated if the cart had carried 8 kg and had been released from a height of 16 m on Ramp 1 ?

A. 400 joules
B. 640 joules
C. 960 joules
D. 1,280 joules

34. The data indicate that compared to Ramp 2, Ramp 1 is:

F. smoother.
G. higher.
H. steeper.
J. less steep.

Passage VII

Astronomers believe that stars develop from the condensation of interstellar gas clouds (IGCs) that are initially hundreds or even thousands of times more massive than the Sun. Two astronomers discuss the star formation process in these clouds.

Astronomer X

Star formation begins when large fragments of a gas cloud collapse. Each of these fragments typically contains hundreds of times more gas than exists in an individual star. This collapse occurs when the gravitational attraction between the gas particles overcomes the sum of all outward forces. When collapsing gas particles in each fragment close together, local regions of high density are created. These localized regions in turn collapse as separate entities called *protostars*. The collapse of a protostar begins with the inward movement of particles from the exterior of the protostar. Its collapse stops when outward forces, especially forces that result from the heating of the gas being compressed, balance the gravitational force. This brings a small region of the original cloud into equilibrium and a new star into a stable form.

Astronomer Y

Stars develop when small fragments of gas clouds collapse. Calculations show that when fragmentation occurs, the fragments that form stars are much smaller in mass and size than mature stars. Thus, stars develop from isolated collapses of relatively small masses and volumes of the large IGC called *cold cores*. A cold core collapses because of its own gravity. However, the collapse originates at the center, and outer material is incorporated later. The central region of the cold core collapses rapidly. Its collapse is stopped by outward forces that develop when the gas heats up. The protostar then gravitationally attracts the outer layers of the cold core together until the cold core is completely transformed into a star. At early stages in the development, the outer layers of the cold core are so thick that they prevent the core's light from escaping into space. Only after the outer layers have been incorporated into the star does the hot, young star become visible.

35. In order to best test Astronomer Y's theory, how should a computer simulation look with respect to the density and temperature of a gas?

- **A.** Similar to an IGC, to see if collapse begins at the center
- **B.** Similar to a theoretical cold core, to see if and how it collapses
- **C.** Both higher than an IGC, to see if it adjusts to typical IGC values
- **D.** Similar to a typical young star, to see if it will emit light through the gas in a typical IGC

36. Which of the following physical actions or properties most directly causes heating of a protostar?

- **F.** Gravitational forces from other IGCs
- **G.** Pressure from the surrounding gas
- **H.** Light from distant stars
- **J.** Gas atoms that strike each other as the protostar collapses

37. Which of the following hypotheses would Astronomer Y most likely make if a new star suddenly appeared in an IGC ?

- **A.** A cold core has incorporated its outer layers.
- **B.** A collapsing fragment of gas has become dense enough to begin shining.
- **C.** Reflected light from our Sun is seen bouncing off the IGC.
- **D.** The force of gravity has joined several fragments of a collapsing cloud.

38. If Astronomer X is correct, which of the following is most likely to initially occur when 2 IGCs in which no stars are forming collide?

- **F.** Cold cores form near the boundary of the collision.
- **G.** Cold cores form far from the boundary of the collision.
- **H.** Individual stars will collapse near the boundary of the collision.
- **J.** Large volumes of gas will collapse together near the boundary of the collision.

39. Is the observation by Astronomer X that almost all young stars are found in clusters consistent with the theory of Astronomer Y ?

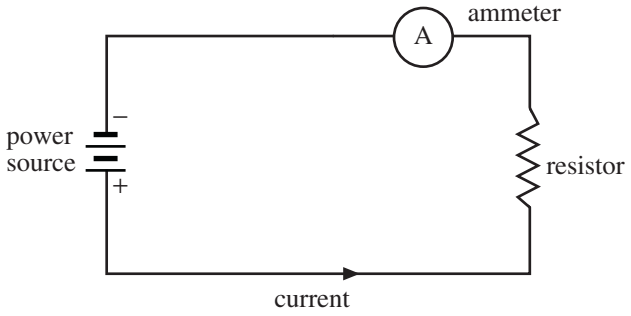
- **A.** Yes; the subfragments of fragments of the cloud that form stars are physically close to each other.
- **B.** Yes; the gas cloud where individual stars form is a relatively compact object.
- **C.** No; the stars, once formed, drift away from each other.
- **D.** No; cold cores pull in all material close to them.

40. If Astronomer X is correct, the density of a newly forming star, over time, should be predicted to:

- **F.** decrease forever.
- **G.** decrease until it reaches a fairly constant value.
- **H.** increase until it reaches a fairly constant value.
- **J.** remain constant.

Passage VIII

A student studied the relationship between the current, voltage, and resistance in a direct current circuit. To obtain the results presented in Figure 1 and Table 1, the student constructed the circuit shown below.



The student used 3 resistors and different amounts of voltage to generate Table 1. The current was read from the ammeter.

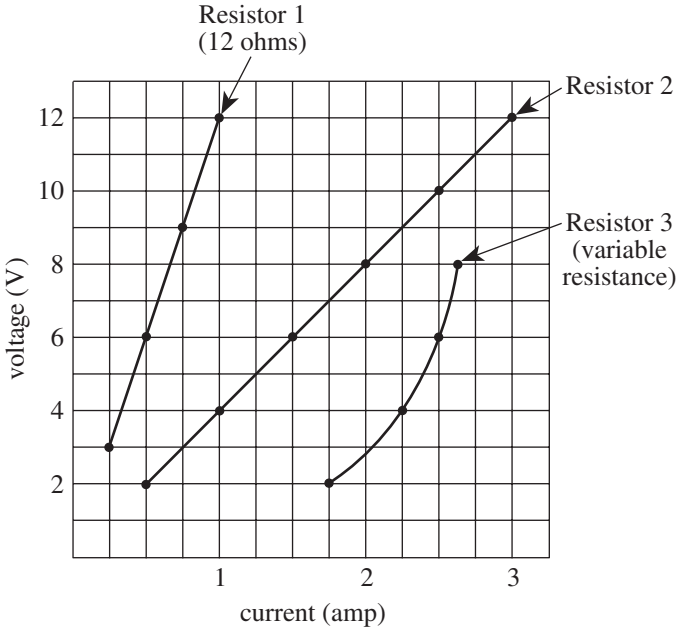


Figure 1

To obtain the results in Table 1, a 5-ohm resistor (Resistor 4) was used and the voltage was varied. The current was measured and the power was then calculated.

Table 1

Trial	Voltage (V)	Current (amp)	Power (W)
1	5.0	1.0	5.0
2	10.0	2.0	20.0
3	15.0	3.0	45.0
4	20.0	4.0	80.0
5	25.0	5.0	125.0

41. According to Figure 1, when 6 V were applied to Resistor 1, the current was:

A. 0.50 amp.
B. 0.75 amp.
C. 1.50 amp.
D. 2.25 amp.

42. If a headlight uses 150 W and the car's battery produces 12 V, what is the current in the circuit?

F. 1.25 amp
G. 5.25 amp
H. 12.50 amp
J. 25.00 amp

43. If a trial had been performed using Resistor 3 and 12 V, the current would have been:

A. 1.25 amp.
B. 1.75 amp.
C. 2.25 amp.
D. 2.80 amp.

44. Based on the results of Table 1, power equals:

F. voltage divided by current.
G. current squared.
H. current plus voltage.
J. voltage times current.

45. If the voltage in the circuit used to generate Table 1 were set at 12.5 V, the power would most nearly equal:

A. 12.5 W.
B. 31.2 W.
C. 37.5 W.
D. 57.5 W.

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY GO BACK AND CHECK YOUR WORK.

Correct Answers for Sample Science Test Questions

Sample Passage 1
Cavity-nesting Birds Study
Biology

Question #	Correct Answer	Content Category
1	C	Analyzing
2	H	Generalizing
3	D	Generalizing
4	F	Analyzing
5	B	Analyzing
6	H	Understanding

Sample Passage 2
Applied Force and Different Masses
Physics/Mechanical

Question #	Correct Answer	Content Category
7	B	Generalizing
8	J	Analyzing
9	A	Analyzing
10	J	Analyzing
11	B	Analyzing

Sample Passage 3
Soybean Plant Experiments
Botany

Question #	Correct Answer	Content Category
12	J	Generalizing
13	A	Understanding
14	G	Analyzing
15	A	Analyzing
16	H	Generalizing

Sample Passage 4
Asteroid Impact vs. Extinction Theories
Physical Science/Geology

Question #	Correct Answer	Content Category
17	A	Analyzing
18	H	Understanding
19	A	Understanding
20	H	Analyzing
21	D	Generalizing
22	F	Generalizing

Sample Passage 5
Chemical Reaction Experiments
Chemistry

Question #	Correct Answer	Content Category
23	B	Understanding
24	H	Understanding
25	C	Analyzing
26	J	Analyzing
27	A	Analyzing
28	J	Generalizing

Sample Passage 6
Velocity and Kinetic Energy
Physics/Mechanical

Question #	Correct Answer	Content Category
29	A	Analyzing
30	G	Understanding
31	D	Analyzing
32	G	Analyzing
33	D	Generalizing
34	J	Analyzing

Sample Passage 7
Astronomer X vs. Astronomer Y
Physical Science/Astronomy

Question #	Correct Answer	Content Category
35	B	Analyzing
36	J	Understanding
37	A	Analyzing
38	J	Generalizing
39	B	Analyzing
40	H	Generalizing

Sample Passage 8
Current, Voltage, and Resistance
Physics/Electrical

Question #	Correct Answer	Content Category
41	A	Understanding
42	H	Generalizing
43	D	Generalizing
44	J	Generalizing
45	B	Generalizing