CHAPTER 6

ACT SCIENCE TEST: STRATEGIES AND CONCEPT REVIEW

The ACT Science Test measures the interpretation, analysis, evaluation, reasoning, and problem-solving skills that apply to the study of the natural sciences. The questions require you to recognize and understand the basic concepts related to the information contained within the passages, critically examine the hypotheses developed, and generalize from given information to draw conclusions or make predictions. The ACT Science Test includes seven passages, each followed by four to seven multiple-choice questions, for a total of 40 questions. You will have 35 minutes to complete the ACT Science Test. The content areas found in the passages are Biology, Chemistry, Physics, and Earth Sciences. You do not need to have advanced knowledge of these content areas; you only need to be able to interpret the data as it is presented and understand the scientific method and experimental design. All of the information you need to answer the questions is in the passages. Usually, if you've completed two years of science coursework in high school, you will have all of the background knowledge necessary to understand the passages and answer the questions correctly.

You may have to do some math on the ACT Science Test. You are not, however, allowed to use a calculator. Only basic arithmetic computation will be necessary to answer these questions. You can do math scratch work right on your test booklet.

The ACT Science Test has passages in three basic formats:

1. **Data Representation** These passages are mostly charts and graphs. The questions ask you to read information from them or spot trends within the data presented.
2. **Research Summaries** These passages explain the set-up of an experiment or a series of experiments and the results that were obtained.
3. **Conflicting Viewpoints** These passages are like the Reading Test passages. There are usually two scientists or two students who disagree on a specific scientific point, and each presents an argument defending his or her position while possibly attacking the other, conflicting position.

GENERAL STRATEGIES AND TECHNIQUES

Use the following strategies and techniques to answer the questions on the ACT Science Test more easily.

Prioritize

Given the time limit, you might end up working through only four or five of the seven passages. Choose the passages in the format you like most. If you are having a hard time making sense of the passage that you start with, move on to some less confusing material. The best way to know which passages to do first on test day is to practice ahead of time so that you can recognize the passages that are likely to give you the most points for the time that you put in.

Remember that you will likely see three Data Representation passages, three Research Summary passages, and one Conflicting Viewpoints passage. If charts, graphs, tables, and so on create stress for you, look for the Conflicting Viewpoints passage and start with those questions. If you establish a pattern of success, that is, start out by answering questions correctly and building your confidence, then the remaining passages won't seem so overwhelming.

Think First

Exam Tip
The ACT Science Test is not strictly a science test! It is a critical thinking test, so do not worry if you think you are "not good at science."

Once you have chosen a passage to attack, take a moment or two to understand the main idea or ideas presented before you dig into the questions. Unlike those on the Reading Test, these questions are not likely to add anything to your understanding of the passages. Reading them first will be likely to confuse you. Common sense will help to keep you from being fooled by some of the distractors that are "way off." For instance, if the passage is describing an experiment done with live mammals in a laboratory, and the question asks about temperatures that are likely to result in a certain behavior, you could certainly rule out an answer choice that says, "400° Fahrenheit."

Consider the following example:

Radon gas can seep from the ground into an existing home through many different pathways, such as cracks in the basement floor, drains, sump pumps, or loose-fitting pipes.

Table 1 shows the radon levels in pCi/L for each of three zones, with areas in Zone 1 indicating a High Radon Potential, areas in Zone 2 indicating a Moderate Radon Potential, and areas in Zone 3 indicating a Low Radon Potential.

Table 1

Zone	Radon Level (pCi/L)
3	<2
2	2 to 4
1	>4

1. Studies have shown that existing homes in the same zone can have different radon levels. Are these findings consistent with information presented in the passage?

A. No, because radon levels cannot be measured in existing homes.
B. No, because radon seeps into all homes in the same way.
C. Yes, because the occurrence of radon is very rare.
D. Yes, because radon levels can vary within the same zone.

The correct answer is D. The introductory paragraph and the table both suggest that radon levels can be different—homes with basement cracks might be more likely to have a radon problem than those homes without basement cracks, for example. Logic will tell you that you can eliminate answer choices A and B. Because answer choice C is not supported by details in the passage, it can also be eliminated.

Be "Trendy"

Many of the Science questions reward test-takers who can spot trends in the data presented. When charts or graphs are given, take a moment to figure out which variables are being charted and note any apparent relationships between them. A *direct relationship* is when one variable increases as the other increases. An *inverse relationship* is when one variable decreases as another increases. Sometimes drawing arrows next to the data helps to show a pattern of increase or decrease.

Consider the following example:

The molar heat of fusion (ΔH_{fus}) is the amount of heat necessary to melt (or freeze) 1.00 mole of a substance at a constant pressure.

The following table lists molar heats of fusion, boiling points, and melting points for several elements.

Element	Melting point (°C)	Boiling point (°C)	ΔH_{fus} (kJ/mol)
Calcium	839.00	1,484.00	8.54
Silver	961.92	2,212.00	11.30
Iron	1,535.00	2,750.00	13.80
Nickel	1,453.00	2,732.00	17.46

Note: measured at a pressure of 1 atmosphere (atm).

1. According to the table, as the energy required to melt 1.00 mole of the given elements increases, the melting points:
   - **A.** increase only.
   - **B.** decrease only.
   - **C.** increase then decrease.
   - **D.** neither increase nor decrease.

The correct answer is C. The passage states that, "The molar heat of fusion (ΔH_{fus}) is the amount of heat necessary to melt (or freeze) 1.00 mole of a substance at a constant pressure." According to the table, as the molar heat of fusion increases, the melting point increases from calcium, to silver, to iron, then decreases for nickel. By noticing a trend in the data, the question becomes easier to answer correctly.

Don't Let Them Scare You with Complex Vocabulary

There will certainly be language on the Science Test that is new to you. Don't be worried by words that you have never seen before. The ACT usually defines terms that are absolutely essential to your understanding. You can answer questions about some terms without even knowing exactly what they mean as long as you focus on the overall idea of the passage. Never spend time trying to

figure out how to pronounce any of the unfamiliar terms that you run across. This is simply a waste of time and energy.

Consider the following example:

The order *Lepidoptera* includes butterflies and moths. Table 1 is a key for identifying some *Lepidoptera* in North America.

Table 1

Step	Trait	Appearance	Result
1	Body	Slim	Go to step 2
		Fuzzy	Go to step 3
2	Upper Side of Wings	Orange with black markings	*Agraulis vanillae*
		Yellow with markings	Go to step 4
3	Upper Side of Wings	Brown	Go to step 5
		Yellow	Go to step 7
4	Underside of Wings	Silver markings	Go to step 6
		Green marbling	*Anthocharis cethura*
5	Hindwings*	Pronounced spot on wings	Go to step 8
		No pronounced markings	*Citheronia sepulcralis*
		10–15 cm	*Antheraea polyphemus*

* The hindwings are the pair of wings farthest from the head of the butterfly.

1. Table 1 is used to identify animals that belong to which of the following groups?

A. Birds
B. Reptiles
C. Insects
D. Mammals

The correct answer is C. You are given that "The order *Lepidoptera* includes butterflies and moths. Table 1 is a key for identifying some *Lepidoptera* in North America." Because butterflies and moths are not birds, reptiles, or mammals, they must be insects. Even though you might never have seen the word *Lepidoptera* before, you can still correctly answer the question because the term is defined for you.

The rest of this chapter will provide an overview of the Scientific Method, a brief review of basic scientific concepts, an introduction to the types of questions you will see on the ACT Science Test, and sample questions with explanations.

THE SCIENTIFIC METHOD

The Scientific Method is the process by which scientists attempt to construct an accurate representation of the world. This process is fundamental to scientific

investigation and acquisition of new knowledge based upon actual physical evidence and careful observation. The Scientific Method is a means of building a supportable, documented understanding of our world.

The Scientific Method includes four essential elements:

1. Observation
2. Hypothesis
3. Prediction
4. Experiment

Exam Tip
The passages included on the ACT Science Test have been written with the Scientific Method in mind. You can often use common sense along with a basic understanding of the process to answer many of the questions.

During the **observation** phase, the experimenter directly observes and measures the phenomenon that is being studied. Careful notes should be taken and all pertinent data should be recorded so that the phenomenon (the thing observed) can be accurately described.

The experimenter then generates a **hypothesis** to explain the phenomenon. He or she speculates as to the reason for the phenomenon based on the observations made and recorded.

Next, the experimenter makes **predictions** to test the hypothesis. These predictions are tested with scientific experiments designed to either prove or disprove the hypothesis. The Scientific Method requires that any hypothesis either be ruled out or modified if the predictions are clearly and consistently incompatible with experimental results.

If the **experiments** prove the hypothesis, it may come to be regarded as a *theory* or *law of nature*. However, it is possible that new information and discoveries could contradict any hypothesis at any stage of experimentation.

Experimental Design

When scientists design experiments to test their hypotheses, they have to be careful to avoid "confounding of variables." This means that they have to isolate, as much as possible, one variable at a time so that they can reveal the relationships between the variables, if any. An **independent variable** (manipulated by the experimenter) is under the control of the scientist. As the scientist changes the independent variable, it is hoped that the **dependent variable** (observed by the experimenter) will change as a result, and that a relationship can be established. A **control** is an element of the experiment that is not subjected to the same changes in the independent variable as the **experimental** elements are. For instance, if we want to find out how the consumption of sugar impacts the fatigue level of ACT takers, we would need at least a few ACT takers who do not consume any sugar so that we can measure the "baseline" or "natural" fatigue level of ACT takers for comparison to the group who consumes sugar. If there were no control group, we wouldn't be able to say for sure that sugar has any impact on the fatigue level of ACT takers. If all of the test-takers consumed sugar, and if all of them were sleepy, we would face a confounding-of-variables situation because the sleepiness could be caused by any other factor that the group had in common, like the ACT itself!

Exam Tip
Sugar *does* cause increased fatigue levels after the initial "sugar buzz" wears off. It is best to avoid it before your ACT exam.

Some of the ACT Science Passages refer to "studies" rather than experiments. An experiment is an artificial situation that is created by the researcher. A study is characterized by careful, documented observation. Nevertheless, studies can include some of the elements of experiments, such as control groups.