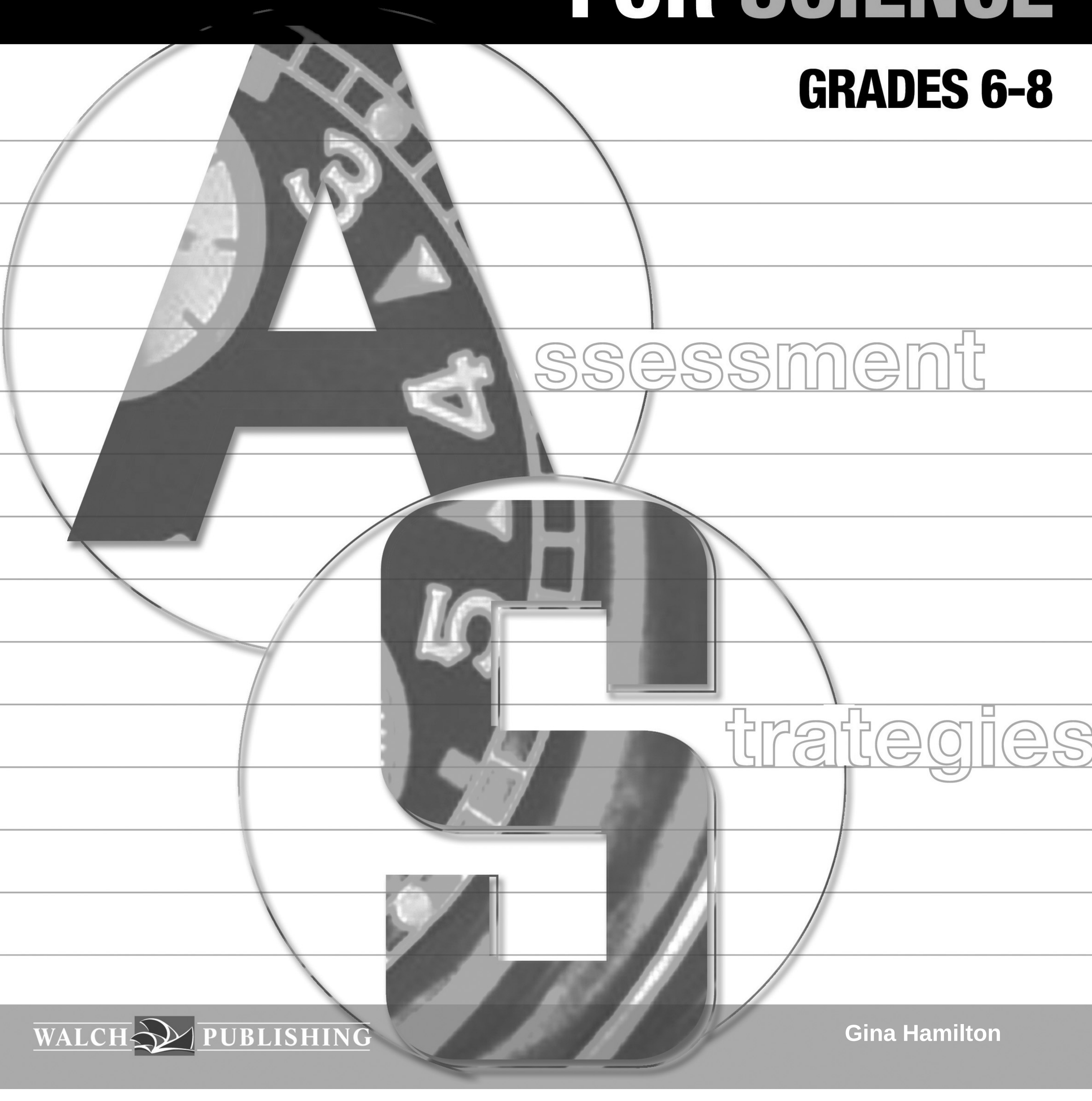
assessment strategies FOR SCIENCE

GRADES 6-8



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WALCH PUBLISHING

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ASSESSMENT STRATEGIES FOR SCIENCE

Introduction

TEST-TAKING SKILLS

Every other year or so, depending on your state, you are required to take a standardized test. The purpose of these tests is to let your state know how well you and students in your school perform on academic subjects the state and federal government believe you should know in your grade. Taking a standardized test, and doing well on it, is a skill that can be acquired and perfected, like any other skill. Working now to perfect these skills will eventually help you as you begin to take the college entrance tests, the SAT and the ACT. This book, and others in this series, will provide you with tips and strategies you need to learn to take tests well.

The person giving the test, usually your teacher, will do everything he or she can to make you more comfortable during the test. Even so, you probably already know that the tests can be a little stressful. They last a long time, and each section is timed. You are not allowed to get out of your chair during the period of the test. However, there are ways to minimize the stress, at least when it comes to answering the questions themselves.

Know what to expect.

Standardized tests usually have four different kinds of questions on the science portion of the tests. State tests differ, but you should prepare for all four kinds of questions.

- The simplest kind is *multiple choice.* In multiple choice, you read the question and choose the best answer out of four, or sometimes five choices.
- The next kind is called *constructed response.* A constructed-response question requires you to write a short answer of one or two words or a simple sentence in response to a question. It may also be a fill-in-the-blank type of question. It may ask you to make a graph or a chart.
- The third kind is called *essay.* In an essay question, you will write a paragraph or two in response to a question.
- The last type, which is only used in science tests, is called *short lab.* With this kind of question, you will be given equipment and told how to perform a short experiment. After the experiment, you will answer questions.

You may also be given the opportunity to do pretests, or practice tests. They will help you to get an idea about what the real test will be like. The samples will also give you a clue about what kinds of content will be on the actual test.

Look at the expected answers once you get the practice tests back. Your wrong answers, especially, will help you figure out how the graders of the real test will mark answers.

By doing practice tests, you will also be familiar with the kinds of questions that may be asked and the form in which they may be asked.

It's your test, organize it the way you want.

Unless you are specifically told otherwise, within each testing period, there is no rule that says you must do the questions in the order they appear. You might choose to do all the multiple-choice questions first, followed by the constructed response, and save the essay question for last. (Short labs are usually done in their own testing period.) Or, you might answer the questions you are relatively sure about quickly, then go back to the things about which you are unsure.

How you organize your test is up to you, but it is best to give it a little thought before you take the test. By taking the practice tests, you can figure out ahead of time what strategy works well for you.

Eliminate obviously wrong answers first.

Especially in multiple-choice questions, there are often answers that you know, or feel strongly, are wrong. You can often get rid of one or two wrong answers quickly. For instance, read the following multiple-choice question:

Question: The Northern Hemisphere experiences summer because

A. Earth is closer to the Sun during the summer.

B. Earth is closer to the Sun during the winter.

C. the Northern Hemisphere does not experience seasons.

D. Earth is tilted, and more of the Sun's energy falls directly on the Northern Hemisphere during the summer.

In this problem, you can easily eliminate choice *C,* because you know the Northern Hemisphere *does* in fact experience seasons. The answer seems to be either *A* or *B* or *D.* Choice *B* is a correct statement.

If you think a little bit more about it, though, choices *A* and *B* are not correct either, because if being close to the Sun caused summer, both the Northern and the Southern Hemispheres would experience summer at the same time, and they do not. Therefore, the best choice is *D*.

Even if you do not know the answer, you can often come up with a rational guess. Most tests mark unanswered questions wrong, so you cannot lose by making your best guess.

What You Will Be Tested On

In your science class, you may be focusing on one area or another at test time. If you are in sixth grade, you might be focusing on ecology, for example. You may not have had any earth and space science in the year you take your test. Some content areas might not have been addressed by the time you have your test. While you cannot prepare for every single possible test question, knowing what to expect in terms of content can help.

These are the content areas your test will cover:

- Science as inquiry
- Earth and space science
- Life science
- Physical science

This book will cover subject areas on which you will probably be tested. Within each, you will be given special strategies for answering questions, as well as tips to think about for each strategy.

You will see all four kinds of science questions—multiple choice, constructed response, essay, and short lab. Many of the strategies will work on all the types of problems you will see on your test.

Chapter 4

PHYSICAL SCIENCE

In the physical science portion of your test, you will find issues related to both physics and chemistry. These questions will deal with the fundamental laws that govern physical and chemical behavior in the universe. Most likely, the problems will be very specific and not open to much interpretation, unlike the problems in some of the other areas of the test.

Here are the topics on which you will likely find questions:

- Properties and Changes
- Motion and Forces
- Energy and Transfers

Properties and Changes

You may expect to see problems on issues such as density, boiling/freezing/melting points, solubility, and the differences between physical and chemical changes. You may see a question on specific gravity. You may see a problem or two related to how to measure a small amount of a substance for a chemical experiment. You may find a couple of questions about types of chemical reactions.

Strategy **Memorize the basics, and keep in mind general trends.**

While it is unlikely you will be expected to remember most formulae or facts, a few important facts kept in mind will help you here. One is the formula for finding density. The formula is simple—density is equal to the mass of an object divided by its volume, or $d = m/V$. You can expect to use the density formula in a number of different ways, solving for each variable.

Here is a question on acceleration:

Question: Sally fired off a model rocket. Her rocket had instruments on board that could tell her how fast the rocket was traveling at any point in its flight. After one second in the air, the rocket was traveling 10 km/hr. After two seconds, the rocket was moving 20 km/hr. After three seconds, the rocket was traveling 30 km/hr. What was the acceleration of the rocket?

- **A. 10 km/s^2**
- **B. 20 km/s^2**
- **C. 30 km/s^2**
- **D. 40 km/s^2**

To solve this problem, look at the data. We can see a constant change in speed from second to second. What is the change in speed? It is 10 km/s. Therefore, the acceleration is 10 km/s^2. The correct answer is *A*.

Another issue related to motion is momentum. All matter in motion has momentum. The amount of mass, multiplied by the velocity of an object, is its momentum. If you are running on a path in the park at the rate of 10 km/hr, and you have a mass of 50 kg, your momentum is 500 kg/km/hr.

Remember that momentum is always conserved. In a collision, an object can transfer momentum to another object. For instance, let's say you are bowling, and you roll your bowling ball down the lane. It has mass and velocity and, therefore, momentum. When it strikes the pins at the end of the lane, some of that momentum is transferred to the pins, and they fall. Striking the pins slows the ball a little, because it transfers some of its momentum. Since it cannot lose its mass, it must lose its velocity.

Here is the kind of momentum question you might see:

Question: A boxcar with a mass of 10,000 kg is pushed along a nearly frictionless track at 5 m/s. It strikes a second motionless boxcar of the same mass, and they couple. What will happen to the two boxcars?

- **A. They will come to a dead stop.**
- **B. They will travel down the track at 5 m/s.**
- **C. They will travel down the track at 2.5 m/s.**
- **D. They will travel down the track at 10 m/s.**

tip! You can probably visualize such an event taking place. Use your memory of such experiences to help you find the correct answer.

In this case, we know that the boxcars are the same mass, so we can remove mass from consideration for now. One boxcar has velocity, and therefore, momentum. The other is not moving, and therefore, its momentum is zero. When the two cars collide, the momentum of the first car must be conserved. However, because the mass of the system doubles, the velocity must decrease by half. Therefore, *C* is the correct answer.

Understanding momentum helps you understand the property of inertia as well. Inertia is a property of all matter. Newton's first law deals with inertia.

Here is a question about predicting an outcome based on Newton's first law.

Question: Newton's first law says that an object at rest tends to remain at rest unless acted upon by an outside force. An object in motion tends to remain in motion unless acted upon by an outside force. You wish to fly a kite, but the wind is calm. What will you have to do to get the kite to fly?

A. You cannot get the kite to fly at all.

B. You can put a longer tail on the kite.

C. You can shorten the string of the kite.

D. You can run, creating a "wind" for the kite.

D is correct. The kite in this case requires a force to move. Since a natural force is unavailable, you will have to provide the force yourself if you want the kite to fly.

Newton's second law is a little trickier. Newton's second law is sometimes referred to as $F = ma$, where F is force, m is mass, and a is acceleration. The law says that the acceleration of an object is directly proportional to the net force acting on the object, in the direction of the force, and is inversely proportional to the mass. Let's say you and your friends decide to play tug-of-war. Ten students stand on one side of the rope, and only two stand on the other side. What is likely to happen? The acceleration of the rope will take place in the direction of the ten students. Their force (which is their mass times their acceleration) will pull it in their direction. The two students on the other side simply do not have enough mass to make the rope accelerate in their direction, even if they are pulling with all of their might.

Now, say the numbers are split more evenly—six on one side and six on the other. If your friends are similarly massive, the rope might not accelerate much at all. The force in this case would simply be the mass of the two groups.

Here is a question on Newton's second law:

Question: You are trying to pull a puppy along the street on his leash. The puppy wants to go in the other direction. Your mass is 60 kg, and the puppy's mass is 2 kg. Who is likely to prevail? Why?

Even though the puppy might be able to accelerate a little faster than you can, your mass is overwhelming. You have the greater force. Therefore, you will prevail.

Newton's third law is quite well known. For every action, there is an equal but opposite reaction. Every time you hit a tennis ball, you feel a slight recoil in your hand. It might even sting a little. That is because at all times, there is a pair of forces at play. The tennis ball acts upon you through the tennis racket, but its mass is much less than yours, so the ball flies through the air and you do not.

Here is a question on Newton's third law:

Which of the following is a good example of Newton's third law?

A. the recoil of a rifle

B. the bounce of a basketball

C. taking a swimming stroke and propelling forward through the water

D. all of the above

In all of the cases, the pair of forces is equal but opposite based on acceleration and mass. Therefore, *D* is the best answer.

Another question that will most likely come up addresses the difference between scalar and vector quantities. A scalar quantity is a number without a direction. A bag has a certain number of oranges in it; that number is a scalar quantity. A vector, on the other hand, is a number with a direction to it. So, while 7 km/hr is a scalar quantity, 7 km/hr in the direction of Chicago, Illinois, is a vector quantity.

Velocity, then, is a vector, while speed is a scalar quantity. Because velocity is a vector, anything that velocity is written into—for instance, acceleration or momentum—is also a vector.

Here is a typical vector/scalar question:

Question: Which of the following is a vector quantity?

- **A. the number of liters of soda in a bottle**
- **B. the number of kilometers in a race**
- **C. the number of kilometers per hour from New York to Boston**
- **D. the number of eggs in a basket**

Only *C,* which is a velocity, is a vector.

Finally, you will probably be asked about the acceleration due to Earth's gravitational pull. That quantity, *g,* is 9.8 m/s^2, and it applies equally to every object on Earth or in orbit around Earth.

Here is a question that relates to Earth's gravitational field:

Question: A ball is dropped from a tower that is 50 meters tall. How many seconds will it take for the ball to strike Earth?

- **A. a little less than three seconds**
- **B. a little more than five seconds**
- **C. ten seconds**
- **D. one second**

If you do the math, you will see that the answer is *A,* a little less than three seconds. In the first second, the ball has accelerated to 9.8 m/s. In the next second, the ball, already traveling at 9.8 meters per second, adds another 9.8 meters per second, making its current velocity 19.6 meters per second. In the third second, the ball, already traveling at 19.6 meters per second, adds another 9.8 meters per second, making its velocity 29.4 meters per second at the end of the third second. When you add up those three velocities, you end up with 58.8 meters traveled at the end of three seconds. Since the building is only 50 meters tall, the total trip will take a little less than three seconds.