

FROM THE MAKERS OF THE ACT®

THE  
**OFFICIAL**  
**ACT®**

**SCIENCE GUIDE**  
**SECOND EDITION**

A Step-by-Step Guide Outlining the Preparation for the ACT®

**FEATURES**

- Understand the detailed breakdown of each science reporting category
- Learn how to quickly and efficiently read graphs, charts, and data
- Review the science vocabulary section with words you should know to succeed
- In-depth examples of each passage type using official ACT® samples
- Includes 100s of official ACT® questions with answers and explanations

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**ACT**  
SCIENCE GUIDE

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# Introduction

So you want to do well on the ACT science test. That's a good goal to have! Whether you've already taken the test once or are planning to do so in the near or even distant future, this book will help you achieve your goal. There are three major factors that will determine how well you do on the ACT science test:

- Focus
- Effort
- Guidance

You need to be focused and diligent in your studies and preparation for the ACT science test. There is no getting around that. You need to put the time and effort into fully practicing the skills the test will be looking for. If you are reading this guide, it can be assumed that you are focused on achieving your goal of success and that you are willing to put the necessary time and effort into making it happen.

The third factor, guidance, is where this guide comes into play. Guidance is difficult to supply to yourself. Each time you take the ACT science test you don't know what is going to be on it, or the way the questions are structured, or the content that is going to be covered. Maybe you wonder how all science can be distilled down into a test that lasts only 35 minutes and has only 40 questions on it. There are so many facts, figures, formulas, theories, and everything else you've covered in school and have seen elsewhere. The great thing is that you aren't expected to know every single fact, figure, and theory you've ever been taught when taking the ACT science test. This book will provide you with the guidance you need to succeed by telling you what you

need to study, sharing details on how to prepare, and offering a lot of practice questions.

In [chapters 1-3](#), you'll see examples of the three types of passages on the science test. Knowing how to handle and approach each of these passages is essential to accurately getting through the science section in the time allowed. Each passage type presents you with scientific information in a different format: perhaps a series of graphs and tables, a description of an experiment with different trials and results, or several contrasting hypotheses regarding some premise or data set. The examples will provide you with strategies for how to best approach and conquer each passage type.

In [chapters 4-6](#), you're going to see detailed explanations of the three reporting categories on the ACT science test and strategies for how to best approach each one in your studies. A science reporting category is ACT's way of breaking down the science test into smaller, more understandable subsections. Each reporting category is different and focuses on a specific area of science. You'll also be given official ACT science test sample questions tied directly to each reporting category so that you will know exactly what to expect when you take the test.

In [chapter 7](#) you'll get into more specifics about what you should do to review for success on the ACT science test. Remember: you don't need to remember everything you've ever learned in your science classes, just a few specific things. More important is that you need to have a solid overall grasp of the *idea* of science and how to perform and interpret scientific investigations. In this chapter you'll start by exploring what the scientific method is, and then you'll learn how to formulate a hypothesis, design an experiment, draw conclusions from the results, and make predictions based on those results. Again, all of this will be

shown through explanations of official ACT science test sample items.

In [chapter 8](#) you'll get to review how to assess graphs and charts. The chapter starts with the basics of how to read a graph and moves on from there. A major focus is to help you not get overwhelmed by the different kinds of data presented. The chapter will help you learn how to pick out what you need from a graph or chart through provided examples and ignore the excess information given to you. The ACT science test is filled with graphs and charts of all kinds so having a solid understanding of how to read them is absolutely essential.

After reviewing the graphs and charts you'll come to realize just how important and prevalent numbers and measurements are in science. [Chapter 9](#) provides an in-depth review of the major types of measurements and units you might encounter when taking the ACT science test, such as what the metric system is, how prefixes are used, and a detailed discussion of many of the most commonly used SI units. You aren't expected to become an expert on every type of measure and unit. This chapter just helps you gain some familiarity with the measurements you might see on the ACT science test, increasing your confidence when taking the test.

In the same way, understanding and being comfortable with the vocabulary of science is paramount to succeeding on the test. No one resource can prepare you for the number of content-specific terms when reading science material. However, this book will help you become familiar with the most commonly used terms on the ACT science test for each of the major scientific disciplines. It will point out which words are important and which are not. Most important, [chapter 10](#) will show you how to deal with words that you have never seen before and don't know what they

mean. You don't need to understand every term on the test, but you'll want to know how to approach those unknown words. This way, when you encounter a science word you aren't familiar with on the test you won't have to waste time trying to figure out what it means. You'll just be able to keep right on going without any loss of time or focus.

In [chapters 11](#) and [12](#), you're provided with a large set of ACT science test questions. Each question provides a thorough breakdown of the solution. This section will prove invaluable because each question is tied directly to the specific reporting category and provides detailed solutions. Practice is essential to success in any endeavor in life, and test taking is not any different, so use these questions to prepare yourself for the ACT science test.

You definitely want to pick up the other ACT subject guides, and you'll eventually want to take at least one full-length practice exam from *The Official ACT Prep Guide*, but this is a good start for the science. You can and will succeed with your goal of doing well on the ACT science test. You provide the focus and the effort, and this book will provide the guidance. So read on and let's get started.

# **Chapter 1: Data Representation Passages**

This chapter is the first of three that focuses on the different passage types found on the ACT science test. It initially discusses passages briefly and then focuses on the data representation passage type. The chapter provides some basic suggestions and tips for how to best approach the data representation section. It then walks you through an official ACT sample data representation passage while providing guidance on what is important to focus on in each passage.

## **Passages on the ACT Science Test**

There are three types of passages that you are going to encounter in the ACT science section. Each passage type presents some information in a different format that you will need to use to answer the questions. These passages are usually a combination of written description and graphical information. The written portion usually informs you, the test taker, about the data represented in the passage and can provide descriptions of experiments or differing scientific viewpoints. This graphical information might be in the form of one or more graphs, tables, or charts.

In general, science passages can be a bit intimidating to students if they are not totally comfortable with science as a subject. As the test taker it is your job to analyze all of the information in the passage and figure out the answer. The questions require critical thinking and the ability to see trends and predict future results based on the information presented, all while making sure you don't get bogged

down in one confusing passage or question and your time doesn't run out.

The ACT science test measures your ability to understand and interpret scientific experiments and results. It is not asking you to remember the meaning of vocabulary words or specific topics. It is important to remember that if you need to understand a scientific concept presented to you in a test passage on the ACT science test it will be explained to you somewhere. Either the passage itself will provide you with the meaning and understanding necessary to use the information or it will be provided in the question asking about a specific piece of information.

Before getting into the specifics of each passage type there are a few general pieces of advice about how to best approach the passages on the ACT science test.

### ***Tip 1: Approach the Science Test with the Right Mind-Set***

**First, you need to have the right mind-set for the ACT science test.** Know that you will face some challenging questions in each passage and will probably see some very specific science concepts that you might not have heard about before. You might find some of the graphs intimidating and challenging to understand at first glance, more so than in other sections of the ACT. In the other ACT sections you will see paragraphs of words, numbers, and equations all separately, but in the science section you'll see all that information combined together into one passage. It is what makes science unique. Have the mind-set that you are not going to let anything make you feel ill at ease.

### ***Tip 2: Have a Strategy for Answering Science Passages***

**Second, you want to have the right approach to dealing with passages on the ACT science test.** What is the right approach? It is a general plan for how you are going to deal with the passages and questions you see to best succeed when you take the test. For some other sections of the ACT test, you have may have heard that the best way to approach each section is by jumping around from question to question, answering all of the simple ones first or perhaps reading each question first before you even look at the passage provided for those questions. This can prove useful in other sections and is not bad advice, but it is not the best approach for the science test specifically.

Why isn't it the right way to go about taking the ACT science test? Most of the experiments and data are complex and not something simple that you can easily glance at and have an in-depth understanding of. If you skip reading the passage on the science test you are just going to be wasting your time. Each question is going to ask you for specifics about the passage you see; it isn't asking about themes or broad strokes. If you read the questions first you are just going to end up going back and reading, and re-reading, the passage for each and every question. It isn't going to be an efficient use of your time.

Instead, actually read the passage first. You don't need to study it in grand detail but a good initial reading will go a long way to helping you work through the science test faster. Get an initial idea about what the passage is covering, what data are presented, and what research method is used. The better initial idea you have, the easier and faster it will be to answer each question. Once you have the initial knowledge about the passage, you'll be able to read each question and have a good idea of where you should look to find the specific information you need. Your general approach to each passage should be to read it and underline important terms or other information that you

think will be useful and relevant to the questions. If you are taking the online version be sure to use the annotation tools to their fullest extent and actually make some notes in the passage. Don't go overboard though; you'll end up with the entire passage underlined, which won't help you easily find the important details to answer the questions.

Each of the passage types is unique in its own way, and they all present their own unique challenges when reading them and answering the questions associated with them. As you read these first three chapters there will be some specific tips about how to initially read each passage type and what you should be looking for when you make that first read through. Plus you will see an in-depth description of an official ACT science sample passage and a breakdown of all the questions that go along with that type of passage.

## **What You Can Expect from a Data Representation Passage**

The first type of passage that we will be looking at is data representation. As you can probably guess this section involves looking at data and interpreting meaning from that data. The passages will generally consist of charts, graphs, tables, and diagrams presenting data to you. There will usually be some amount of scientific text that goes along with the data providing any necessary background information you might need to understand and interpret the information represented.

Something you'll want to do before proceeding with any passage is to make sure you are able to recognize which type of passage it is. Make sure that you do not get a data representation passage type confused with a research summaries passage type. They can look similar in that both sometimes have graphs or tables displayed throughout the

passage. The key difference between the two is that the research summaries passages contain a focused description of an experiment or multiple experiments instead of a more general description of a scientific concept or process. If you see a mention of multiple trials or of multiple experiments you are definitely looking at a research summaries passage and not a data representation passage.

Remember when approaching a data representation passage that you are not expected to understand everything it is talking about. There is a chance that you will look at this background information and have little to no knowledge of the exact scientific information it is talking about. You don't need to be an expert on whatever topic it might be discussing, not even close. The data representation passages will provide you with all the information you need to understand and correctly interpret the graphs and tables you see in any given passage. You simply need to be able to read it in a timely fashion and use the information provided to you in the appropriate way to answer the questions.

The next thing you need to remember is to not get overwhelmed when you first look at each of these passages. There is a lot of information shown to you in these passages, and the graphs and tables can look very intimidating at first glance. You don't need to use all of this information. The ACT is not expecting you to take it all in and divine meaning from each and every piece of data you see. You are going to be asked specific questions about the data and it is going to be up to you to focus on those questions and determine the best answer to each of them. If you can stay focused on the goal and not get overwhelmed by the avalanche of data you see in each passage then you will be fine.

With that in mind, before getting into the examples, we suggest you focus on performing a few specific steps each time you encounter a data representation passage.

- **First, read through whatever background information is presented in the passage.** When you are reading this passage make sure that you don't get bogged down by words or phrases that you don't fully understand. Just get through it so you have a general idea about the data the passage is referring to. There are usually going to be at least one or two scientific terms or names in each of these passages that you might not know. Don't be worried about them yet. If they are truly important more information will be provided as you read the passage. Don't spend a large amount of time trying to figure out what a particular word means. You'll want to conserve your time when you do the science section, so you want to make sure your actions are always focused and forward thinking.
- **Second, look at each graph, table, or data representation and determine how each is labeled.** Once you have identified the name or title of each graph and how it will be referred to in the questions circle it, underline it, or do whatever you need to make it stand out in your mind. The questions in the ACT science section regularly make reference to the graphs and tables found in the passages by a specific name. Usually it is Figure 1, Figure 2, and so on; however, there can be different names associated with each graph or table. No two passages are exactly alike in that regard. It is vitally important when you are reading the questions associated with the passage that you know which graph is being referred to in the discussion. This will help you save time and stay

focused on exactly the information you need to answer each question.

- **Third, look at the graphs and tables and try to make some meaning out of the data you see.** The better your understanding of the data before you tackle the questions, the better off you will be when it comes to problem-solving and reasoning. This is not to say that you should take a long time and thoroughly study each graph in detail. It simply means that you should look at each graph or table and try to get a general idea about what it is saying. Look at each axis and see what it represents, how it is labeled, and what units it uses to show the data. Each of these pieces of information is important, and overlooking it can lead to you potentially to not fully understanding a relationship the graph might be trying to show. (If you need to brush up on how to read graphs and identify what axis is what, make sure you look at [chapter 8](#), which covers graph reading in detail.) Once you've identified how the data are being represented you should try to make some meaning out of the data. Try to determine what type of relationship each graph or table is showing in regards to the data. At the most basic level this could be an increase shown on one axis and a corresponding increase or decrease on the other axis. Perhaps as one value increases there is a corresponding decrease in another. This can be challenging because each graph is different. Make sure you spend your time wisely and don't get bogged down in trying to create a trend or meaning where there simply might not be one. Take a quick look, get a general idea of the graph, and move on to the questions.

These are, of course, just a basic guide for how you can best approach each data representation passage. No two

are exactly alike, and each passage presents its own unique and interesting challenge. The most important thing you can do is to not get overwhelmed by what you see. Focus on the data in front of you and what it is trying to show you, nothing more.

## **Trying Your Hand at a Data Representation Passage**

Now that we've covered some basic tips it is time to tackle an official ACT science data representation passage. In the following section you will see a data representation passage along with the entire question set that goes with the passage. First there will be a detailed breakdown of the passage itself. You'll see a discussion related to the concept it covers along with a basic analysis of the graphics associated with the passage.

After that you will see the entire question set associated with this passage. Each question will be discussed in detail, and you will be provided with the thought process explaining how you should go about solving each question. This will go into more depth than simply explaining which answer choice is right and wrong. Instead there will be a discussion of what the question is looking for, what you should know in advance, and what information you can pick up from the question itself. Each question will also have a detailed breakdown of the correct answer and how you can reach that answer the fastest.

So, now take a moment and read the sample passage to yourself and answer the sample questions that follow it. Look at the graphs and the relationships they show. Try to determine the answers before moving on and looking at the analysis provided. In any of these sections it is always important that you read each question and sample passage

thoroughly before moving on to the analysis presented here. Simply seeing someone tell you the right answer or explanation to an idea or concept is not as useful if you have not considered the material yourself first.

### ***Example Passage and Questions***

## Passage XIV

Tiny marine organisms build shells from *calcite* ( $\text{CaCO}_3$ ) dissolved in seawater. After the organisms' death, the shells sink. Some shells dissolve before they reach the seafloor, but some form layers of *calcareous ooze* ( $\text{CaCO}_3$ -rich sediment). Figure 1 shows how seawater's degree of saturation with respect to  $\text{CaCO}_3$  and the rate at which  $\text{CaCO}_3$  dissolves change with depth. The  $\text{CaCO}_3$  compensation depth (CCD) represents the depth beneath which  $\text{CaCO}_3$  dissolves faster than it precipitates. Figure 2 shows typical depths at which various seafloor sediments are found. Figure 3 shows the percent coverage for two seafloor sediments in three oceans.

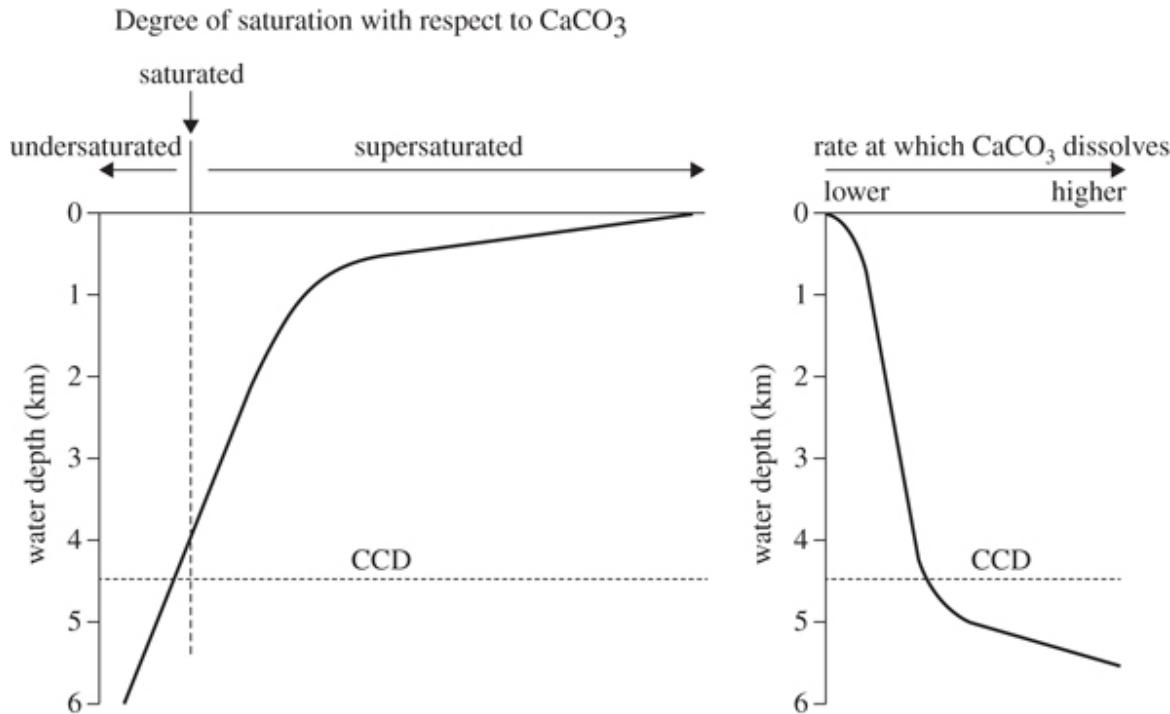


Figure 1

Figure 1 adapted from J. Andrews, P. Brimblecombe, T. Jickells, and P. Liss, *An Introduction to Environmental*

Chemistry. ©1996 by Blackwell Science, Ltd.

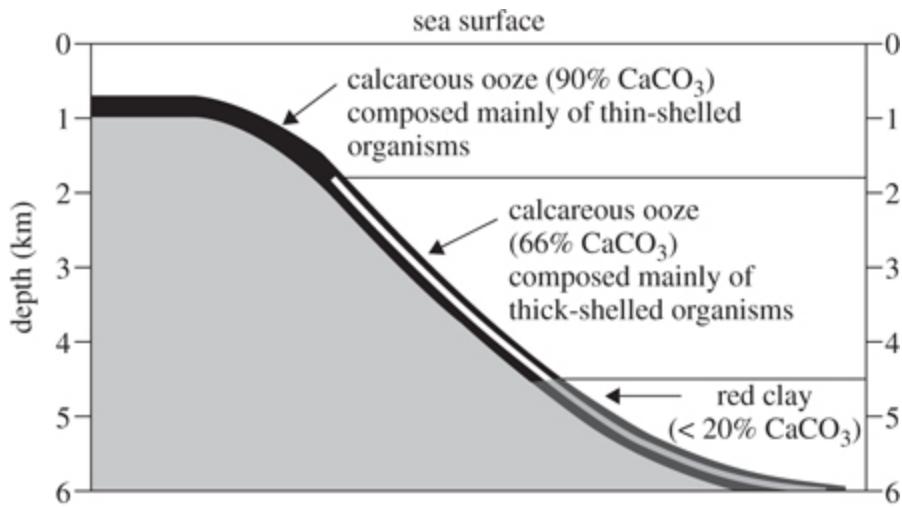


Figure 2

Figure 2 adapted from M. Grant Gross, *Oceanography*, 6th ed. ©1990 by Macmillan Publishing Company.

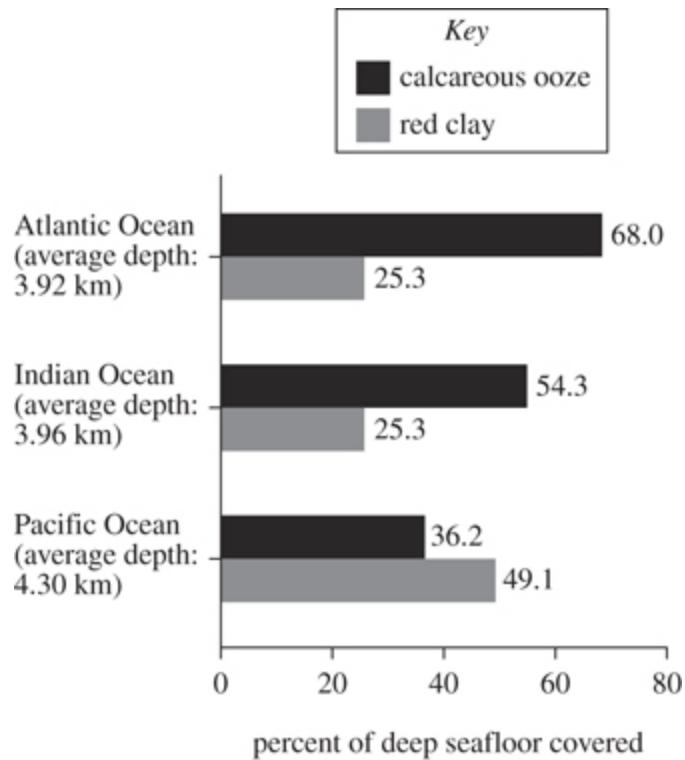


Figure 3

Figure 3 adapted from Harold Thurman, *Introductory Oceanography*. ©1991 by Macmillan Publishing

Company.

### **Sample Question 1**

Assume that the Arctic Ocean seafloor has an average depth of 4.9 km. According to Figures 2 and 3, the Arctic Ocean seafloor is most likely covered with:

- F.** calcareous ooze only.
- G.** nearly the same areas of calcareous ooze and red clay.
- H.** a greater area of calcareous ooze than of red clay.
- J.** a greater area of red clay than of calcareous ooze.

### **Sample Question 2**

The data in Figure 2 support which of the following statements about the relative thickness of marine organism shells and the depths at which calcareous oozes composed of those shells are found? Calcareous oozes formed mainly from thick-shelled organisms are found:

- A.** at shallower depths than those formed mainly from thin-shelled organisms.
- B.** at greater depths than those formed mainly from thin-shelled organisms.
- C.** over the same depth range as those formed mainly from thin-shelled organisms.
- D.** in the same areas of a given ocean as those formed mainly from thin-shelled organisms.

### **Sample Question 3**

$\text{CaCO}_3$  often precipitates out of seawater in areas where the seawater is shallow (less than 1 km deep). According to Figure 1, this most likely occurs because seawater in those locations:

- F.** is undersaturated with respect to  $\text{CaCO}_3$ .
- G.** is saturated with respect to  $\text{CaCO}_3$ .
- H.** is supersaturated with respect to  $\text{CaCO}_3$ .
- J.** contains no  $\text{CaCO}_3$ .

#### **Sample Question 4**

According to Figure 1, above what maximum depth is seawater supersaturated with respect to  $\text{CaCO}_3$ ?

- A.** 3.0 km
- B.** 3.5 km
- C.** 4.0 km
- D.** 4.5 km

#### **Sample Question 5**

Figure 1 shows that the rate at which  $\text{CaCO}_3$  dissolves increases the most between which of the following depths?

- F.** Between 3.5 km and 4.0 km
- G.** Between 4.0 km and 4.5 km
- H.** Between 4.5 km and 5.0 km
- J.** Between 5.0 km and 5.5 km

## **Analyzing the Example Passage and Questions**

Now that you have read the passage and have given some thought to what you see let's begin our analysis.

This passage discusses calcite ( $\text{CaCO}_3$ ) saturation in the ocean at various depths. It provides you with some background information on the process by which calcite dissolves, and it makes mention of small marine organisms that use the calcite to build their shells. As we've mentioned you are not expected to know what calcite is or how it dissolves in the ocean at various depths. You just need to look at the data presented and interpret it as the questions require. Everything you need to know to answer the questions that go along with this passage is presented in the passage itself.

There are a few specific scientific vocabulary words that you could potentially get hung up on if you don't fully understand them. Specifically, in this passage there are several mentions of *dissolving*. If you have no idea what *dissolving* means (a solid breaking apart in a liquid to form a solution) this could present a problem. The passage also clearly uses the chemical formula,  $\text{CaCO}_3$ , and the name of calcite interchangeably. The great thing about this passage though is that nowhere does it require or expect you to understand what the chemical formula means beyond simply being used as an identifier for calcite. You just have to recognize that  $\text{CaCO}_3$  is being used as an identifier and nothing more.

After the paragraph with the background information, this passage then provides you with three figures that show data regarding calcite and its ability to dissolve at different depths. Let's talk about each figure now and see what information each is trying to show you:

- **Figure 1** shows you two line graphs dealing with calcite dissolving. The graph on the left shows you the level of calcite saturation at various depths. It shows clearly that the saturation of calcite is much greater near the ocean surface compared to deeper waters. The graph on the right shows you the rate calcite dissolves at different ocean depths. It shows clearly that calcite dissolves faster as you move deeper in the ocean. These graphs can be a little tricky due to the fact that the zero, the origin point, is on the top left instead of the bottom left. This makes sense though when you consider the fact that these graphs are representing ocean depth and zero should be on top in that case. However, this inverts the graph compared to the way you traditionally are taught and shown graphs in school. Do not let this bother you. Carefully look at each axis and each graph and find the meaning and the relationship shown.

Another potential issue here is your understanding of the term *saturation*. If you have no idea what *saturation* means this graph might be of very little use to you. If you are struggling with any term, a suggestion is to look at whatever other information is provided to you. If you look at the other two figures you should be able to make a connection to the idea that as depth increases the level of calcite dissolved decreases. This should give you a clue that saturation is a measure of how dissolved or concentrated something is in a solution. Are you required to go to this level of analysis in each passage and figure? No, you aren't, but it's included here to show you that there is almost always a path to discovering meaning in each passage. Even if there is a word or two you don't understand there is almost always a way to figure it out from the information given to you if you will truly need it.

- **Figure 2** shows a graph that provides detail on the concentration of calcareous ooze at different depths of the ocean. Figure 2 clearly shows how the concentration of calcareous ooze is higher at lower depths. As you progress deeper into the ocean Figure 2 shows how the percentage of calcareous ooze decreases, and toward the bottom it shows that you mainly begin to observe red clay. It also shows a pattern that as depth increases the shell thickness of organisms in the ooze increases.
- **Figure 3** shows a comparison of the seafloor covered by calcareous ooze and red clay in three of the four oceans throughout the world. You'll notice that red clay is not mentioned in the paragraph above the graphs at all, yet it appears in Figure 2 and also in Figure 3. You should notice a clear relationship between the Atlantic Ocean and the Indian Ocean in terms of their similar depths. This corresponds to a similar distribution of seafloor coverage in regards to calcareous ooze when compared to red clay.

The hope is now, after a detailed look at each figure, you can see a very real and distinct relationship shown by each graph in the passage: that as the ocean depth increases, the amount of calcite dissolved in water, as represented by the calcareous ooze, decreases. That should be the major take away from your initial reading of this passage. Beyond that you shouldn't perform any more analysis without first approaching the questions associated with the passage. Next we will look at a few official ACT sample questions associated with this passage in detail and discuss how to best answer each one.

### **Sample Question 1**

Assume that the Arctic Ocean seafloor has an average depth of 4.9 km. According to Figures 2 and 3, the Arctic Ocean seafloor is most likely covered with:

- F.** calcareous ooze only.
- G.** nearly the same areas of calcareous ooze and red clay.
- H.** a greater area of calcareous ooze than of red clay.
- J.** a greater area of red clay than of calcareous ooze.

This question refers to Figures 2 and 3 in the passage. It clearly tells you those are the two figures you should be looking at when answering this question. It presents you with a data point about the depth of the Arctic Ocean and asks you to determine from the figures what the probable composition of the seafloor is based on that depth.

First look at Figure 2. According to the question the Arctic Ocean has an average depth of 4.9 km. According to the graph in Figure 2 this should correspond to a low concentration of calcareous ooze (below 20%). It tells you that in this range you have red clay present. You can also look at Figure 3 and see a trend from the three oceans regarding their depth and their seafloor composition. The first two oceans, the Atlantic and the Indian, both show a higher concentration of calcareous ooze compared to red clay. They also share a similar depth. As you move deeper into the Pacific Ocean the concentration shifts toward there being more red clay than calcareous ooze. Because the average depth listed for the Arctic Ocean is shown to be lower than the Pacific Ocean you can extrapolate the

seafloor coverage of the Arctic will be even more heavily weighted toward red clay.

This question illustrates that sometimes there are multiple pathways to the solution you need. Either one of the figures shows the data you need to determine the answer. For the sake of time, once you've established your answer with confidence, move to the next question. There is no need to check both Figures 2 and 3 if you are able to determine the correct answer by simply looking at one of them. **The correct answer is J.**

### **Sample Question 2**

The data in Figure 2 support which of the following statements about the relative thickness of marine organism shells and the depths at which calcareous oozes composed of those shells are found? Calcareous oozes formed mainly from thick-shelled organisms are found:

- A.** at shallower depths than those formed mainly from thin-shelled organisms.
- B.** at greater depths than those formed mainly from thin-shelled organisms.
- C.** over the same depth range as those formed mainly from thin-shelled organisms.
- D.** in the same areas of a given ocean as those formed mainly from thin-shelled organisms.

Sample question 2 asks you to specifically look at Figure 2. It doesn't require you to look at any other figure or the introductory paragraph. When you see a question that is straightforward like this be sure you don't overthink it and