1. The ACT “Science” Test

ACT Science is weird. Students who are dealing with it for the first time often find it to be the scariest part of the test. And no wonder! There are strange graphs and charts unlike the ones you normally see in high school science classes. The passages are full of jargon that is probably new to you. And then there’s the time pressure: only 35 minutes to read 7 passages AND answer 40 questions. Coming near the end of an already epicly long test, the Science section may seem as if it were specifically designed to torture the teenage mind.

Fortunately, the ACT Science section is like your crazy uncle Stan: a bit of an oddball, perhaps, but not that bad once you get to know him.

The first thing you should know is that ACT misnamed the Science Test. It should have instead been called the “Science” Test, because you hardly have to know any science to do well on it. There are only 2 or 3 questions on the whole thing that require any kind of knowledge; the rest of the questions are based entirely on the charts, graphs, and passages that are sitting right in front of you. Can you say “open book test”?

Studying for the ACT Science section, therefore, doesn’t involve memorizing the kinematic equations or the periodic table. It involves studying the ACT Science section itself, so that you know it like the back of your hand when the big day comes. Let’s get started.

2. 40 Questions, 35 Minutes, 7 Passages

The ACT Science section is almost as predictable as the Reading section. It is always 35 minutes long. It always has 40 questions. It always has 7 passages. It even always has the same kinds of passages on each section -- Data Representation, Research Summary, and Conflicting Viewpoints -- and each kind of passage always has the same number of questions. There are only two unpredictable things on the Science test: the order of the passages and the order of the questions.

The passages can go in any order. Sometimes you'll get a short passage at the beginning and a long one at the end, sometimes it's the other way round. Sometimes the easiest passage will be the first one, sometimes the last. Similarly, within each passage the questions seem to be randomly ordered (just as they are the Reading section). The first question on a passage might be about the last graph or chart, and vice versa. The last question in a passage will often be a tricky one, but not always.

The moral of the story is that you don't have to do every passage and every question in the order they're written. You should never do hard stuff when there's still easy stuff left to do. This leads us to our first rule of ACT Science (which you may recognize from the Reading test):

ACT Science Rule #1: If a passage or a question seems hard, it probably *is* hard. Skip it for now and come back later if you have time.

It goes without saying (but I'll say it anyway) that if you don't have time to go back to a question, you should just guess on it. There's no guessing penalty so you should never leave any question blank!

3. Three Kinds of Passages

There are three different kinds of passages on the ACT Science section. You will use somewhat different strategies for each, so it's important to be able to tell them apart. Fortunately, that's easy to do. Each kind of passage has a different number of questions.

Data Representation: 3 passages, 5 questions each. It's easy to spot the Data Representation passages. They have the most pictures and the fewest words, and they always have five questions. Even though the charts and graphs may sometimes be confusing, the questions themselves tend to be relatively straightforward. As long as you don't freak out when you see a weird diagram, you should eat these passages up.

Research Summary: 3 passages, 6 questions each. Research Summary passages are also easy to identify. They have a balance between words and pictures, and they have exactly six questions. They have a brief introduction and always describe several contrasting experiments (usually labelled as "Experiment 1", "Experiment 2", etc.). Not only are these passages longer than the Data Representation passages, but they tend to have a handful of hard questions. Don't worry too much, though: there will always be a couple of "gimmes". We'll talk about how to spot those in **Section 11** below.

Conflicting Viewpoints: 1 passage, 7 questions. This passage wins the prize for sticking out like a sore thumb. It tends to have the most words and the fewest pictures, and it always has seven questions. It consist of an introduction followed by the contrasting views of several different scientists. Unlike Data Representation and Research Summary passages, which are chock full of facts, the Conflicting Viewpoints passage is about opinions: none of the scientists is necessarily "right". If you like the Reading section, you will probably do fine here; if you hate the Reading section, you will probably hate the Conflicting Viewpoints passage with a burning passion.

You should always identify what kind of passage you're dealing with before you start working on it. This is so important that it deserves to be our next rule:

ACT Science Rule #2: Identify each passage before you start doing it by counting the number of questions it has. Data Representation passages have 5 questions, Research Summary passages have 6 questions, and the Conflicting Viewpoints passage has 7 questions.

4. URGENT MESSAGE: DO NOT READ

What is the number one mistake that students make on the ACT Science section? Go ahead, take a guess. I'll wait.

If you said, "they actually read the passages", then I like the cut of your jib! You should never, EVER read an ACT Science passage before looking at the questions. In fact, let's make that a rule:

ACT Science Rule #3: Go straight to the questions before you look at the passage.

In an ideal world -- one where you had as much time as you wanted to do the Science test -- this wouldn't be the case. You would take as long as you liked to read the passage, highlighting important or difficult terms. You would only attempt the questions once you thoroughly understood the scientific issue being discussed.

In the real world, that's just not possible. You hardly have enough time to answer the questions, let alone read the passage. You will almost certainly run out of time if you read the passage before looking at the questions. And, what's more, you don't even *need* to read the passages. They are full of complicated terms and weird-looking data, some of which you won't even use. There are sometimes entire charts or tables which aren't mentioned in the questions! It would be just plain silly to spend time figuring out stuff that won't help you earn points on the test.

Here's a better strategy: go straight to the questions. If it's a Data Representation (the one with 5 questions), just jump right into the first question. If it's an Research Summary (the one with 6 questions) or Conflicting Viewpoints (the one with 7 questions) passage, you'll want to make a "question map" and identify the "research goal" or "disputed point" before you attempt any of the questions. (You'll learn all about "question maps", "research goals", and "disputed points" in **sections 9 and 10** below.)

5. Okay, I'm Not Reading the Passage -- So What Now?

Underline, underline, underline. You must underline the key numbers and words in every question. Track your underlined terms down in the passage and figures, and underline them there, too. This nit-picky attention to the details is how you compensate for not reading the passage. ACT Science questions, as you will see, are amazingly literal. Once you've tracked down all the words and numbers mentioned in the question, the answer will usually be staring you in the face.

ACT Science Rule #4: Underline key terms on every question. Track these down in the passage and figures.

What are the "key terms" that you should underline? Any and all numbers. Anything that tells you where to look for the answers, such as "Figure 1" or "Table 2." Any proper (capitalized) nouns. Also, anything that looks like a variable (i.e. temperature, mass, etc.) or a unit (i.e. degrees Celsius, kilograms, etc.). Any words that indicate how something is changing, such as "increasing" or "decreasing". Pretty much anything that's not "filler", really. Here's an example:

1. Based on the passage and Table 1, as Substance Q's temperature increases, what happens to its specific heat?

Now, here's the same question with the key terms underlined:

1. Based on the passage and Table 1, as Substance Q's temperature increases, what happens to its specific heat?

It may seem kind of weird to underline most of the words in the question. But this method is the best way to ensure that you won't get a question wrong because of some trivial detail that you accidentally overlooked. Once you have tracked down all those terms, the question will usually solve itself -- unless it's one of the difficult ones that we'll talk about in **section 11** below.

6. It's All in the Timing

The ACT Science section gives you 35 minutes to do 7 passages. It seems like the timing should be pretty simple, then. Just spend about 5 minutes on each passage, and you'll be fine -- right?

Not quite. First of all, the passages have different numbers of questions. A data Representation passage (5 questions each) won't take as long as a Research Summary (6 questions) or Conflicting Viewpoints passage (7 questions). Moreover, a tricky passage may soak up a bit more time than one that you understand right away. The only thing that is absolutely certain is that you should never spend more than *6 minutes* on any passage. If you do spend more than 6 minutes on a passage, you'll find it very difficult to complete the rest of the test under the time limit. And it's not worth spending a lot of time on a hard passage -- you can tell it's hard since it's taking you so long to finish -- when there's probably an easier one on the next page. So, let's make the six minute time limit a rule:

ACT Science Rule #5: Never spend more than six minutes on any passage.

That's the only hard and fast timing rule on the Science section. Past that, it comes down to feel. The Data Representation (5 question) passages will probably take you a little less than 5 minutes on average, whereas the Research Summary (6 question) and Conflicting Viewpoints (7 question) passages will probably take a bit more than 5 minutes. As long as the average is around 5 minutes, you will be fine.

If the time pressure is still driving you insane even after a lot of practice, please take a look at the next section.

7. “Sacrificing” a Passage (optional)

Alright. So let’s say that you do your first timed Science practice section and you run out of time before you even get to the last passage. Or, you manage to make it through the whole thing, but you make tons of mistakes because you’re so rushed. Both of these are bad news on the ACT Science section. You don’t want to run out of time before the end, because you almost certainly had to guess on some easy questions in the last passage. And you don’t want to make lots of careless errors (duh). If either of those descriptions fits you, then you might be one of the students who should “sacrifice” a hard passage.

When you sacrifice a passage, you declare: “this passage is the hardest and most time-consuming one for me. It’s not worth my time, so I will guess on all its questions. I will divide up the time I would have spent on this passage among the other passages.” You have more time to spend on the other passages, so you make fewer silly mistakes. You make sure that you get to do all the easier passages and questions while avoiding the harder ones. It’s a win-win if you find the time pressure on the Science section really intense.

Which passage should you skip? If you really hate the Conflicting Viewpoints (7 question) passage, as many students do, then by all means skip that one. If you’re okay with the Conflicting Viewpoints passage, then I would suggest that you skip whichever one of the Research Summary (6 question) passages seems the most confusing. You should probably never skip a Data Representation (5 question) passage because they tend to be quicker and easier.

A reminder: once you’ve got a strategy, the way to make it work is to practice it on some actual ACT Science sections. Practice it until your strategy feels natural, and your score will naturally rise.

8. Data Representation Passages

The Data Representation passages are the three passages that have 5 questions each and lots of charts and graphs. As you may remember, my recommendation is that you should go straight to the questions without even glancing at the passage. As long as you are underlining like crazy in each question, you should be able to track down the answers even if you have no idea what's going on.

When underlining in a question, pay special attention to phrases such as "Figure 1" or "Table 2" that tell you where you're likely to find the answer. Then track down the key terms and numbers that you've underlined in the charts and graphs, and underline or circle them there, too. The charts and graphs can often be strange-looking and complicated, so make sure that you're looking at the right place.

If a chart or graph really has you stumped, you can try labelling the independent variables (i.e. what is varied by the scientist) and dependent variables (i.e. what the scientist measures). Some of the more complicated graphs may have several of each. Sorting them out may help you understand what's going on. No matter how complicated the figure, everything that takes place can be divided up into independent and dependent variables.

That's your basic strategy for Data Representation passages. Here are a few other things to watch out for:

Increase/Decrease: If a question asks you about what happens when something increases or decreases, make a note in the margin of the question. For example, on this question:

1. Based on the passage and Table 1, as Substance Q's temperature increases, what happens to its specific heat?

you should make a note like: "T↑ SH?" When you track down the temperature of Substance Q in Table 1, you'll know exactly what to pay attention to: what happens to specific heat as temperature increases. You'd be surprised, but a simple note such as this can really help you focus on what you'll need to solve the question.

Vocabulary: Here are a few key terms that often come up on the ACT Science section. If you've ever taken a science course, then you've learned these at some point.

Independent variable: The input. What the scientist varies or manipulates in order to see what effect it has on the dependent variables in the experiment.

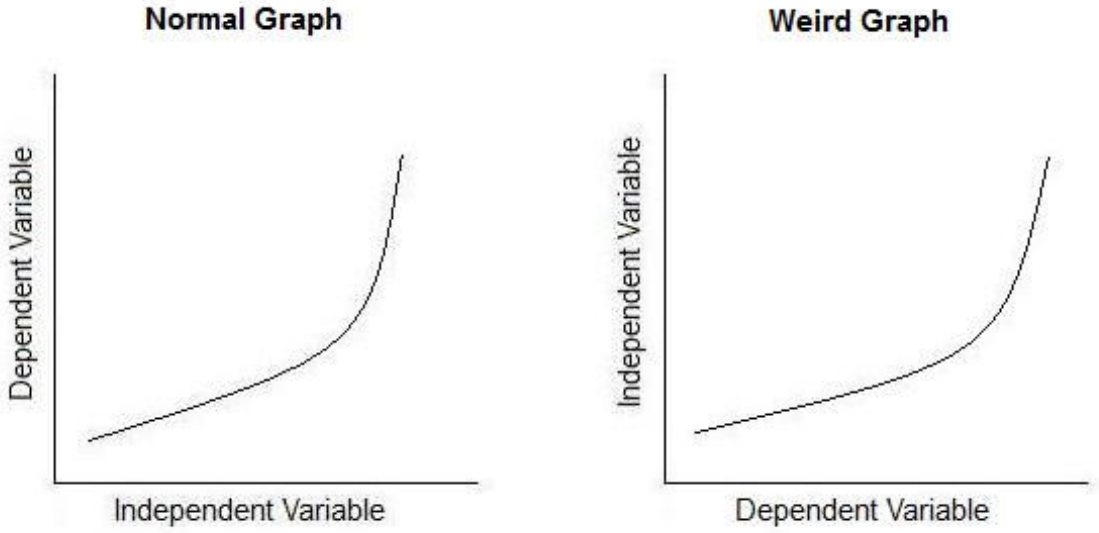
Dependent variable: The output. What the scientist observes or measures to see whether it is affected by changes in the independent variable.

Control: Something that the scientist holds constant throughout an experiment. It may sometimes be used as a baseline value to which the other variables are compared.

Extrapolation: Making an educated guess about what will happen past the edge of the known data. For example, you might need to continue a line on a graph past the last data point in order to make a prediction.

Interpolation: Making an educated guess about what will happen in between two data points. For example, if a question asks you about what happens when *X=1.5*, but the chart only provides information on *X=1* and *X=2*, you would have to split the difference between those two values to answer the question.

When the *IV* is *Y* and the *DV* is *X*: Sometimes graphs on the ACT will be really peculiar-looking. One of the most common examples of this is when they put the Independent Variable on the Y-axis and the Dependent Variable on the X-axis. Here are two examples that will show what I mean:

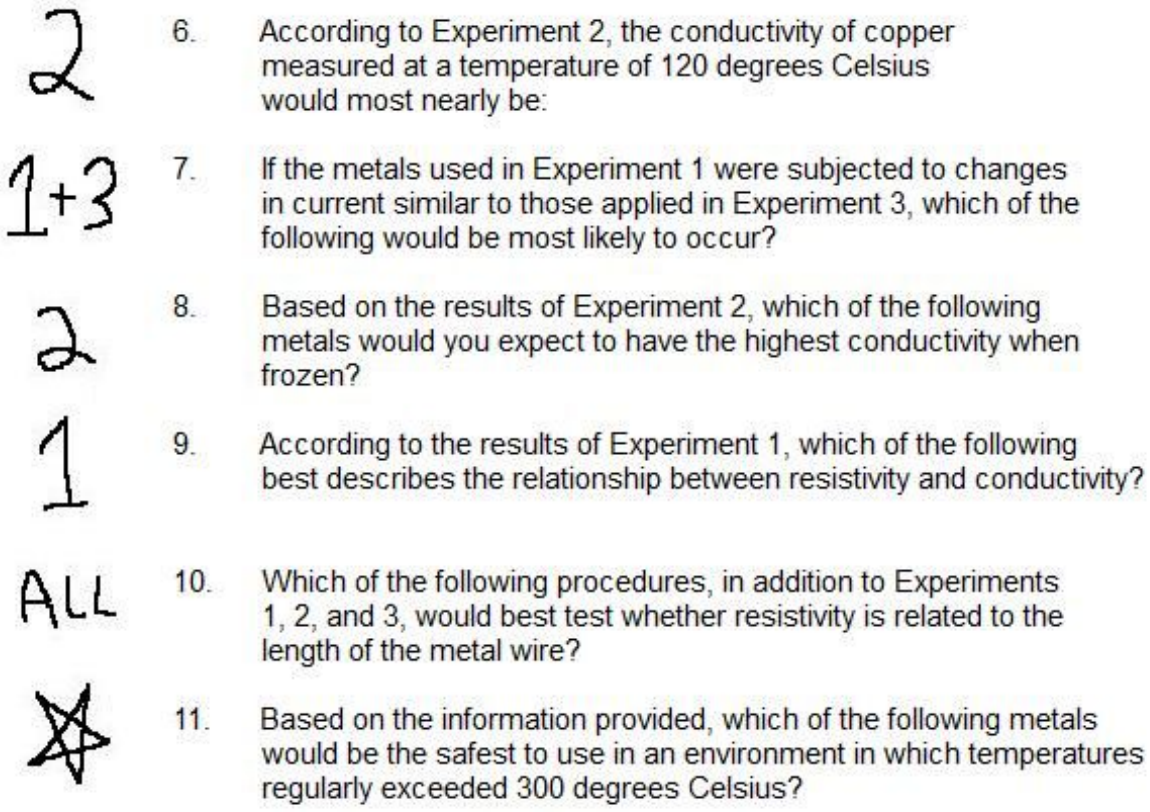


In the graph on the left, when the scientist changes the X-axis variable, the Y-axis variable is affected. That's how it usually works. Piece of cake! But in the graph on the right, the situation is reversed: there, the scientist is changing the Y-axis variable and measuring the X-axis variable. This might seem like a minor difference, but it can have a major impact when you're trying to figure out what's going on in the graph and you're under time pressure.

You are most likely to see the weird kind of graph when a passage deals with *depth* (i.e. it's about stuff in the ocean or underground) or *altitude* (i.e. it's about what happens in the sky or in space).

9. Research Summary Passages

Research Summary passages are the three passages that have 6 questions each and several different "experiments". Again, skip the passage. And once you get started on the questions, your basic strategy will be similar to what you do on Data Representation passages: lots and lots of underlining. But before you start tussling with the first question on a Research Summary passage, you want to make a "question map". Here's what a question map looks like:



A question map, as you can see, is a way of grouping the questions you come across on a Research Summary passage. Next to each question you write the number of the experiment(s) to which it refers; if you can't tell which experiment a given question refers to, just draw a star or circle the question number.

Why should you do this? Because ACT throws the Science questions at you in a truly random, mixed-up order. That order is rarely the best order in which to do them. You want to focus on one experiment at a time. Only tackle the questions about multiple experiments once you've taken care of all the individual ones. In the example above, you might begin with Question 4, since it's about Experiment 1. Alternatively, you could start with Questions 1 and 3, since they both deal with Experiment 2. It's up to you. The most important thing is that you divide and conquer the questions, saving the more complicated ones for the end. (Of course, if

you really get stuck on a question, or it's obviously one of the difficult ones that we'll discuss in **section 11**, it's always okay to skip it.)

ACT Science Rule #6: Make a question map on Research Summary and Conflicting Viewpoints passages. Do the questions about individual experiments/scientists before you do the ones about multiple experiments/scientists.

Identify the Research Goal: Once you've made your question map, you can either start tackling the questions right away, or you can identify the "research goal". The research goal is like the main point of the whole passage. It tells you why the scientists decided to do these particular experiments.

The research goal is always located in the introductory paragraph(s). Sometimes it will be very detailed and specific:

> *The researchers hoped to identify how changes in metal type, temperature, and current affected the measured conductivity and resistivity in wires of a given length.*

At other times, it may be frustratingly vague:

> *Two experiments were conducted to investigate the behavior of light.*

In either case, underlining the research goal will help you understand how the different experiments fit together.

10. The Conflicting Viewpoints Passage

The Conflicting Viewpoints passage is the one that has 7 questions and is usually chock full of text. There will be two, three, or four dissenting opinions on a particular scientific topic. Although you can skip over the passage, you will (alas!) eventually have to do some reading. As on the Research Summary passages, you should begin by making a question map. Once you've done that, your next step is to identify the "disputed point".

The Disputed Point: Why is it called a Conflicting Viewpoints passage? Because there is some point on which the scientists disagree. This disputed point will be mentioned somewhere in the introduction -- usually one of the last few sentences -- and it is basically the point of the whole passage. The disputed point is underlined in this example:

> *When an earthquake occurs, it is typically centered on or near a* fault line*. A fault line is a surface fracture or discontinuity in a volume of rock. Two scientists debate the origins of one such geological displacement: the San Andreas Fault in western California.*

Even if you don't understand any of the technical mumbo-jumbo about "surface fractures" and "volumes of rock", at least you know what the passage is going to be about: the origin of the San Andreas Fault.

Read Actively: Once you've made your question map and underlined the disputed point, it's time to do some reading. Don't just wade into the passage blindly, though: come armed with a question. Choose one of the questions related to the first scientist's viewpoint, do your usual underlining, and then read the introduction and that scientist's passage with your question in mind. If you come across any of the underlined terms from the question you selected, underline them as well.

Once you've got your first question answered, you'll probably have an easier time with the remaining ones that deal with that scientist. After you've finished Scientist 1's questions, repeat the process with the remaining scientists. Only tackle the questions that refer to multiple scientists once you've finished all of the individual questions (though if a question seems very hard to you, it's always okay to skip it).

11. Difficult Question Types

Alright, alright. Even though I've spent the last dozen pages going on about how the ACT Science section is not that scary, it's true that you'll find a few genuinely difficult questions on the test. Although each student has her own personal order of difficulty, most students would agree that the question types listed below are tougher than average. It's always okay to skip them at first when you spot them. Do them only if you have some extra time left after finishing the rest of the questions on that passage. If you run out of time, you can guess on them with a clean conscience -- after all, they're hard questions, and they're not worth any more points than the easy ones.

Hypothetical Questions: These are the "what if" questions. They might use phrases such as "suppose that...", propose entirely new experiments, or have key terms that you can't track down in the passage. They require not only a good understanding of the passage's content, but the ability to apply that to a new situation and predict what will happen. Here's an example:

12. Corrosion is the gradual destruction of a metal by chemical interaction with its environment. It is known that iron corrodes when exposed to H2O. Suppose that the scientist wanted to determine whether the data gathered in Experiment 3 were affected by the corrosion of the copper wire used. She should test how the conductivity of copper is affected by:

This question has all the tell-tale marks of a hypothetical question. It uses the phrase "suppose that". It proposes a new experiment to determine the effect of corrosion on the conductivity of copper. And it provides the definition of a new term ("corrosion") that is probably not mentioned in the accompanying passage. Even though this question technically deals with a single experiment (Experiment 3), it is best saved for the end because of its complexity.

Purpose Questions: These are the "why" questions. They may ask why the experimenter did something or what purpose some part of the experimental design served. In real life, the experimenter would be expected to explain clearly and in detail why he did what he did. On the ACT Science section, they purposely withhold explanations so that they can ask you tricky questions. Yes, those ACT test-writers can be jerks sometimes.

The answer to a purpose question will never be directly stated in the passage. It is something that you must infer from the context. That's part of what makes these questions frustrating. Here's an example:

13. Why did the scientist use copper wire in Experiment 2 instead of iron wire?

If you think you'll find the answer to this question directly stated in Experiment 2, think again. You would need to track down the words "copper" and "iron" in the other parts of the passage in

order to piece together an understanding of the situation. It is this uncertainty about where to find the answer that makes these questions harder than the average "look it up" sort of question.

Knowledge Questions: It may seem shocking: two or three times per test you will actually be expected to know some Science in order to answer a question. The nerve of these people! There's no need to relearn the periodic table or the kinematic equations, though. The "Science" you need to know will almost always be fairly simple and general.

You can spot these questions by the presence of key terms that are defined neither in the passage nor the question. Here's an example:

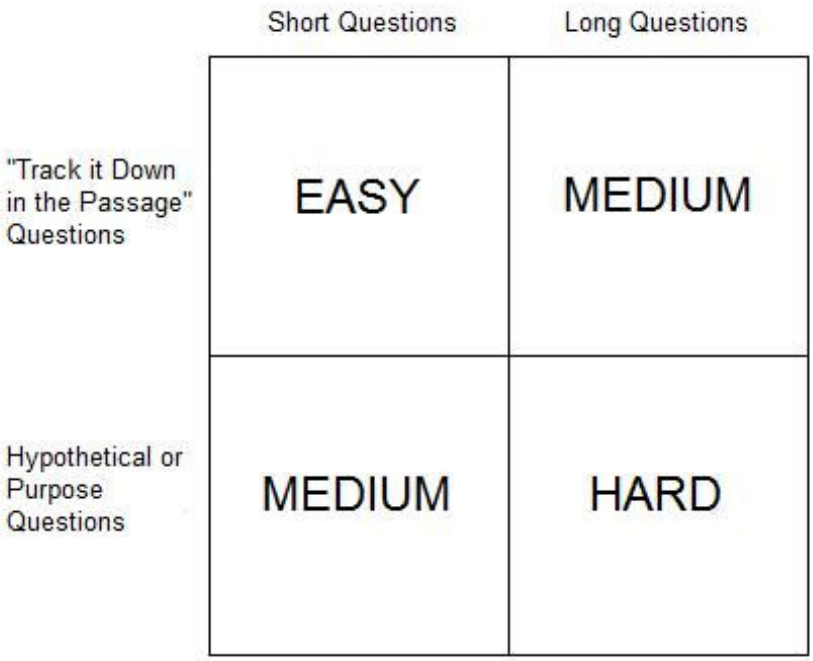
14. Which of the following methods of heat transfer occurred between the ends of the copper wire used in Experiment 2?

I. Conduction
II. Convection
III. Radiation

You might have learned about these terms in physics class. They describe the three main ways in which heat transfer occurs. Conduction is the transfer of heat through the molecules within an object or in directly adjacent objects (as when you touch a hot stove). Convection is the transfer of heat from one place to another through a liquid or gaseous medium (as when hot air rises). Radiation is the transfer of heat through photons or light waves (as when you hold your hand near a light bulb and your hand feels hot).

If you know these definitions, the question will be easy as pie. If you don't, just take a guess and move on. Take comfort in the fact that there are at most two or three questions on the whole test that require this kind of outside knowledge. You have bigger fish to fry than this minor question type.

The ACT Science Difficulty Matrix: We've seen that some Science questions types (specifically, "purpose" and "hypothetical" questions) tend to be harder. We can make another generalization, which is that long questions -- ones with a lot of key terms to look up or with fancy pictures in them -- tend to be more difficult than short ones. When we combine these two generalizations, we can make a chart that will help you tell at a glance how hard a Science question is likely to be: a kind of Punnett square for question difficulty, if you will. So, without further ado, here is your ACT Science Difficulty Matrix:



As you can see, questions that are both short and just require you to track down key terms in the passage tend to be easy. Questions that are long and ask “what if?” or “why?” tend to be hard. There will be some questions, too, that are in the middle. If you find yourself getting stuck on questions without knowing why, the Science Difficulty Matrix can provide you with a simple way to identify and avoid the harder questions.