SCIENCE CURRICULUM

ACT

ESM PREP

Contents


SOMEWHERE, SOMETHING INCREDIBLE IS WAITING TO BE KNOWN
– Carl Sagan
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INTRODUCTION

The ACT “Science” Test isn’t meant to comprehensively analyze your knowledge of science. More than anything, it tests how *quickly and accurately* you can interpret charts and graphs. It should really be called the ACT “Charts & Graphs” Test. What this means, essentially, is that often the Science Test is not as hard as it looks. Understanding every little aspect of each experiment will not be necessary for achieving a great score, and is something we strongly discourage.

The hardest thing about the ACT Science Test is **timing**. You will need to exercise efficiency with your eyes, learning where to find crucial information quickly. If you take clear note of what the questions are asking for, and you methodically find that information in the charts & graphs presented, you will do great!

On the ACT Science Test, you are given 35 minutes to work through either six or seven passages and answer 40 questions. There are three passage types which can be distinguished based on the number of questions they have and the number of graphs and charts used:

1. ***Data Representation (5-6 questions each)*** - The easiest and simplest of the 3 types. Interpreting data quickly is the most important skill needed to score highly on these passages.

2. ***Research Summary (6-7 questions each)*** - Each passage usually includes two or three related experiments, each clearly marked (Experiment 1; Experiment 2; etc.). Interpreting data is still very important, but now you will have to compare different data sets.

3. ***Conflicting Viewpoints (7 questions each)*** - Usually two or more "experts" offering competing interpretations of a scientific event or phenomenon. Comparing the different viewpoints is most important, and little to no data will be included in the passage. These are essentially reading passages with scientific vocabulary. **Most students should save this passage for last.**

GENERAL STRATEGIES

Data Representation and Research Summary Passages

Data representation and research summary are very similar passage types. In both DR & RS, you should only read the text *as needed*. **Often, you won't have to read the text at all**. You should employ the following steps:

1. Take note of what is being measured on the x & y axes of graphs, and in the columns and rows of tables. Some students like to circle the information on the axes to help them visualize their work. In addition, pay attention to any trends between what is being measured, as knowing the basics trends of each graph and table can help you quickly answer questions later on. This entire step should take no more than ten to fifteen seconds.

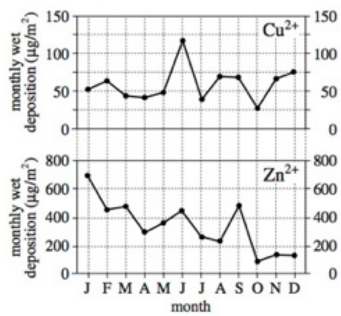


Figure 2

2. Next, proceed directly to the questions, referring back to the graphs and tables as needed. Most times, questions will tell you where to look ("In Figure 1…" ; "According to Study 3 …" ; etc.). If they don't mention a figure or table by name, they will almost always mention one of the variables being measured on a graph or in a table.

3. Only read the text introductions to the experiments if you need to. Some of the harder questions (usually limited to the last one or two questions in research summary passages) might require this -- especially if they are asking questions about "<u>process</u>" or "<u>methods</u>" rather than <u>data</u>. If you are struggling to complete the section in time, NEVER go back into the passage to answer questions. You are better off making a quick, educated guess and moving on. There are much easier questions later in the section, and you want to be sure you get to them!

Conflicting Viewpoints Passages

For the conflicting viewpoints (CV) passage, you'll have no choice but to change your strategy -- here, there are rarely charts and graphs to be found. Instead, you'll find a block of text in which the views of two students or experts are compared. Because this section takes the longest amount of time and most students find it the hardest passage of the test, most students prefer to **save it for last**, regardless of where it shows up among the test's six passages. However, if you are a fast reader and score highly on the ACT Reading Test, you may want to seek out this passage and complete it first.

For CV, your approach should be:

1. Quickly read each student/expert's take on the subject at hand. Ignore the introductory text (before each viewpoint) until a question forces you to read it.

2. As you read, annotate the text.
   a. Mark key differences between the experts' takes if you can spot them.
   b. <u>Note each expert's main idea.</u>

3. Then, proceed to the questions:
   a. Be sure to notice what each question asks - in other words, ask yourself, "is this question about Scientist 1? Scientist 2? both?" and refer back to the text accordingly.
   b. If you annotated, you should be able to find key information quickly.
   c. Many questions will require you to make inferences. Some of these questions might stump you. Use what you know and remember to guess -- there is no penalty for a wrong answer on the ACT.

Again, **TIME IS OF THE ESSENCE**. You have only 35 minutes to answer 40 questions, which works out to about six minutes per passage and less than one minute per question. It is best to move through the DR passages in 4-5 minutes each, freeing up extra time for the CV & RS passages.

Ultimately, while the test is about "science" on the surface, it's actually more a test of whether or not students can read charts & graphs (DR & RS) and pick complicated information out of dense text (CV). **Don't worry if science isn't your best subject!** If you read the charts carefully and clearly identify what's being asked in each question, you can score highly, *even if you come in with **zero** knowledge about the sciences.* With practice, you will become increasingly confident in your ability to do this.

EXAMPLE 1: DATA REPRESENTATION

In a lab experiment, a student tested solubility of four compounds: sodium chloride, cerium sulfate, bisodium phosphate, and glucose.

The student controlled the amount of water at 100 mL, varying temperature at 0º C, 20º C, 60º C, and 100º C. The student determined how many grams of each compound would dissolve at each temperature.

As she calculated her results, the student was also interested in observing precipitation, which is when a compound's solubility decreases.

Temp	**Sodium Chloride (NaCl) g**	**Caesium Bicarbonate () g**	**Bisodium Phosphate () g**	**Glucose () g**
0°	42	19.4	14.7	140
20°	41.8	8.62	9.42	197
60°	37.9	3.97	22.6	311
100°	31	.0225	69	501

Figure 1: Solubility at various temperatures, shown in grams dissolvable per 100 ml water

Walkthrough of Questions

When you start, note your columns, rows, and what's measured.

- Columns: various compounds
- Rows: various temperatures
- Measurement: Grams soluble per 100 mL

When we look for trends for each compound, we can quickly see that, as temperature increases, solubility decreases for Sodium Chloride and Caesium Bicarbonate, and increases for Glucose. Bisodium phosphate's solubility decreases initially, and then increases.

Next, skip the text until you need it and head straight to the questions:

1. A student added 15 grams of the following compounds to 100 ml of 0°C water. Which of the following compounds will NOT be fully dissolved?

    A. Bisodium Phosphate
    B. Caesium Bicarbonate
    C. Sodium Chloride
    D. Glucose

The question asks which of the four compounds will NOT fully dissolve at 0°C if we put 15 grams into the sample. Looking at Figure 1, we hone in on the row corresponding to 0° C. We see that at that temperature, 42 grams Sodium Chloride, 19.4 grams Caesium Bicarbonate, 2.1 grams Bisodium Phosphate, and 140 grams Glucose dissolve. We therefore see that <u>one answer choice is not like the others</u>. Only Bisodium Phosphate dissolves less than 15 grams, which means that A is the correct answer.

2. At 20°C, which compound has the greatest solubility?

    A. Bisodium Phosphate
    B. Caesium Bicarbonate
    C. Sodium Chloride
    D. Glucose

This question is much like the first: looking to the row for 20° C, we should look for which compound will dissolve the most. Reading across we see Sodium Chloride will dissolve 41.8 grams, Caesium Bicarbonate 8.62 grams, Bisodium Phosphate 9.42 grams, and Glucose 197 grams. Therefore D is the correct answer, because far more Glucose will dissolve at 20° C than will any of the other compounds.

3. Saturated solutions of the following compounds were prepared at 20°C. Which of the following will precipitate upon cooling to 0°C?

A. Bisodium Phosphate
B. Caesium Bicarbonate
C. Sodium Chloride
D. Glucose

For this question, we can look back to the introductory paragraph to skim for the word "precipitate" - because a quick read through of our tables turns up nothing. When we do, we see that precipitation occurs "when a compound's solubility decreases." So, we need to chart solubility for each compound from 20°C to 0°C.

A. Bisodium Phosphate - 9.42 to 14.7 (increase)
B. Caesium Bicarbonate - 8.62 to 19.4 (increase)
C. Sodium Chloride - 41.8 to 42 (increase)
D. Glucose - 197 to 140 (decrease)

Only **D**, glucose, is less soluble at 0°C than at 20°C. Therefore it is the correct answer.

TIME-SENSITIVE STRATEGY: Again, we want to avoid looking back in the passage if we can. While we may not know what "precipitate" means, but we know that the question is asking us about the difference between compounds at 20°C and 0°C. Because glucose is the only compound that has a different relationship than the other three compounds, it is most likely the correct answer.

4. The labels on two bottles of chemicals from the table are illegible. Which of the following tests could conclusively differentiate between Sodium Chloride and Bisodium Phosphate?

   A. Mix 10 grams of each sample at 60°C. The one that dissolves is Sodium Chloride.
   B. Mix 30 grams of each sample at 100°C. The one that dissolves is Bisodium Phosphate.
   C. Mix 25 grams of each sample at 60°C. The one that dissolves is Sodium Chloride
   D. Mix each with Caesium Bicarbonate, and the one that creates a reaction is Sodium Chloride.

We need to find a clear way to prove which compound is which. Let's try each answer choice!

A. 10 grams of each sample at 60°C.
- 37.9 grams Sodium Chloride dissolves at 60°C.
- 22.6 grams Bisodium Phosphate dissolves at 60°C.
- Both will dissolve the test amount of 10°C.

B. 30 grams of each sample at 100°C.
- 31 grams Sodium Chloride dissolves at 100°C.
- 69 grams Bisodium Phosphate dissolves at 100°C.
- Both will dissolve the test amount of 30 g.

C. 25 grams each sample at 60°C.
- 37.9 grams Sodium Chloride dissolves at 60°C.
- 22.6 grams Bisodium Phosphate dissolves at 60°C.
- Only Sodium Chloride will fully dissolve the test amount of 25 g.

D. Mix each with Caesium Bicarbonate, and the one that creates a reaction is Sodium Chloride.
- This is a red herring answer. We do not get any information about what will happen if we mix compounds.

The only answer to produce a clearly different result between Sodium Chloride and Bisodium Phosphate is **C**.

5. Suppose we were to test solubility at 200°C. How many grams of Caesium Bicarbonate would we expect to dissolve?

   A. Because Cerium (IV) precipitates with higher temperatures, large amounts of it would dissolve at 200°C.
   B. Because Cerium (IV) precipitates with higher temperatures, very little would dissolve at 200°C.
   C. Because Cerium (IV) precipitates with cooling temperatures, large amounts of it would dissolve at 200°C.
   D. Because Cerium (IV) precipitates with cooling temperatures, very little would dissolve at 200°C.

Looking to our column for Caesium Bicarbonate, we note that as temperature increases, less dissolves. In other words, it precipitates with higher temperatures, eliminating **A** and **C**. Since only .0225 dissolves at 100°C, we would expect even less than that to dissolve at 200°C. Only **B** reflects this.

The important thing is not to stop questioning

– Albert Einstein

EXAMPLE 2: RESEARCH SUMMARY

Methane (CH_4) is a colorless, odorless, tasteless, flammable gas produced whenever organic material is decomposed by bacterial action in the absence of oxygen. The atmosphere contains about 2.2 parts per million (ppm) by volume of Methane. This number is increasing as humans produce more organic waste.

Landfills emit a large quantity of methane as they break down the organic material in garbage. Because methane traps heat in the atmosphere, landfills thus contribute heavily to climate change. In fact, methane is about 9 times as strong as CO_2, and though it dissipates far more quickly than does carbon dioxide, it is more dangerous in the short term. Concerned about these emissions, a student wanted to study the effects of temperature on their quantity. He proposed that landfills in warmer climates would emit more methane.

Experiment 1

A student built four model landfills in 3ft x 5ft x 2ft boxes. He stored these in 3ft glass boxes with solar exposure and then measured the percent of methane in the air after three years. Each model contained different amounts of organic matter.

Temp	**L1 - 35% organic material**	**L2 - 65% organic material**	**L3 - 75% organic material**	**L4 - 4% organic material**
0°C	0.04%	0.07%	0.09%	0.00%
15°C	0.80%	2.50%	6.33%	0.03%
20°C	1.40%	4.92%	8.42%	0.65%
35°C	3.95%	6.25%	10.12%	0.67%

Figure 1: % methane in the air at various temperatures

Experiment 2

The student was also concerned with leachate, or the toxic liquid produced by the breakdown of organic material in landfills. He hypothesizes that a variety of grass, Chryspogon Zizanoides, may reduce leachate in landfills. He tests leachate waste in g/L of soil at 15°C with varying levels of Chryspogon Zizanoides

Time Elapsed	L1 - 1% Chryspogon Zizanoides by volume	L2 - 2% Chryspogon Zizanoides by volume	L3 - 5% Chryspogon Zizanoides by volume	L4 - 0% Chryspogon Zizanoides by volume
2 years	44.7	38	16.6	51.2
1 year	26.1	22.4	13.2	29.3
6 months	15.4	14.3	12.4	16.2
3 months	9.2	9.2	9.1	9.2

Figure 2: leachate in g/L with varying quantities of Chyspogon Zizanoides

Walkthrough of Questions

As with the Data Representation passage, skip the text and only refer back as necessary. First, however, you must note what your two experiments are measuring and jot down any trends you see:

Figure 1:

Columns*: four different landfills with different % organic material*
Rows*: temperatures*
Measurement*: % methane in the air*
Trends*: % methane increases with temperature, and decreases when % organic material decreases.*

Experiment 2:

Columns*: four different landfills with different % Chyspogon Zizanoides*
Rows*: time elapsed*
Measurement*: leachate in g/L*
Trends*: Leachate increases over time*

1. According to Experiment 1, which of the following produces the most methane?

   A. L1 at 20°C
   B. L3 at 15°C
   C. L4 at 0°C
   D. L2 at 35°C

First, note that we are told to look to Experiment 1, so look to Figure 1. Next, note what the question asks: which produces the most methane? This is as simple as reading the table:

A. L1 at 20°C produces 1.40% methane air content.
B. L3 at 15°C produces 6.33% methane air content.
C. L4 at 0°C produces 0.00% methane air content.
D. L2 at 35°C produces 6.25% methane air content.

Therefore, **B** is the correct answer because 6.33% is the highest number of the four.

2. Do the results from Experiment 1 support the hypothesis that landfills in warmer climates produce more methane?

   A. Yes, because methane production increased as temperature increased.
   B. Yes, because waste containing high volumes of organic material is clearly shown to produce higher quantities of methane.
   C. No, because relatively little methane is produced by the landfills at 0 C.
   D. No, because methane production decreased as temperature increased.

Again, we look to Experiment 1. When we do, we see that as temperature increases, each of the four landfills produces more methane. While **B** and **C** are true, they do not answer the question. **D** is the opposite of what we see. Therefore, the answer must be **A**.

3. The student notes landfills in the following locations:

City	Average Temp.
Rochester, NY	48
Phoenix, AZ	75
Kansas City, KS	53
Charleston, WV	55

If a company that hopes to MAXIMIZE methane emissions for capture and re-use wanted to build a landfill, which of the following would be the best location to do so?

A. Rochester, NY
B. Phoenix, AZ
C. Kansas City, KS
D. Charleston, WV

Note that we are asked to maximize methane emissions. We know from the last question - or from looking at the table again - that methane emissions are maximized at higher temperatures. Therefore, we would want to build a landfill in the hottest location to maximize methane emissions. This means choice **B**, Phoenix, is the correct answer. If we are unsure, we know that maximizing (and minimizing) usually involves a number at the extreme end of a data set. So we could confidently eliminate the two answer choices in the middle of our temperature range (C and D)

4. Which of the following is NOT strongly implied by the results of Experiment 1?

   A. Methane largely remains in the ground at temperatures at or below freezing.
   B. Plastics and other inorganic waste produce little methane.
   C. Landfill methane emissions have been exaggerated.
   D. Landfills with more organic content will produce more methane.

Again we look to Experiment 1. Note that we are looking for which answer choice is NOT implied by the data. Moving through the answer choices:

A. Methane largely remains in the ground at temperatures at or below freezing.

- Freezing = 0°C
- At this temperature, methane in the air is 0.00%.
- This answer choice is **true**.

B. Plastics and other inorganic waste produce little methane.

- We see that L4, which has very little organic content (4%), produces very little methane.
- This supports this answer choice, so it is **true**.

C. Landfill methane emissions have been exaggerated.

- We see no evidence of this answer choice.
- It may be true, but it is not in any way implied by the data.
- Therefore we cannot conclusive call this answer true, so let's call it **not verifiable**.

D. Landfills with more organic content will produce more methane.

- We see that landfill 3, with the most organic content (75%) produces the most methane at every temperature.
- This shows that this answer choice is **true**.

All answer choices are verifiably true except for **C**, making it the correct answer.

5. Which of the following correctly states the relationship between temperature and the production of leachate?

A. As temperature increases, leachate production increases.
B. As temperature increases, leachate production decreases.
C. Net change in leachate production increases more quickly as temperature increases.
D. The information provided is insufficient to determine the relationship between temperature and production of leachate.

We must realize here that we are now dealing with leachate production. This means we must look to Experiment 2 and Figure 2. However we do not see any information about temperature in experiment 2. This means we do not know anything about the relationship of temperature and leachate production. This rules out **A, B**, and **C.** Only answer choice **D** accounts for our lack of information, and it is therefore correct.

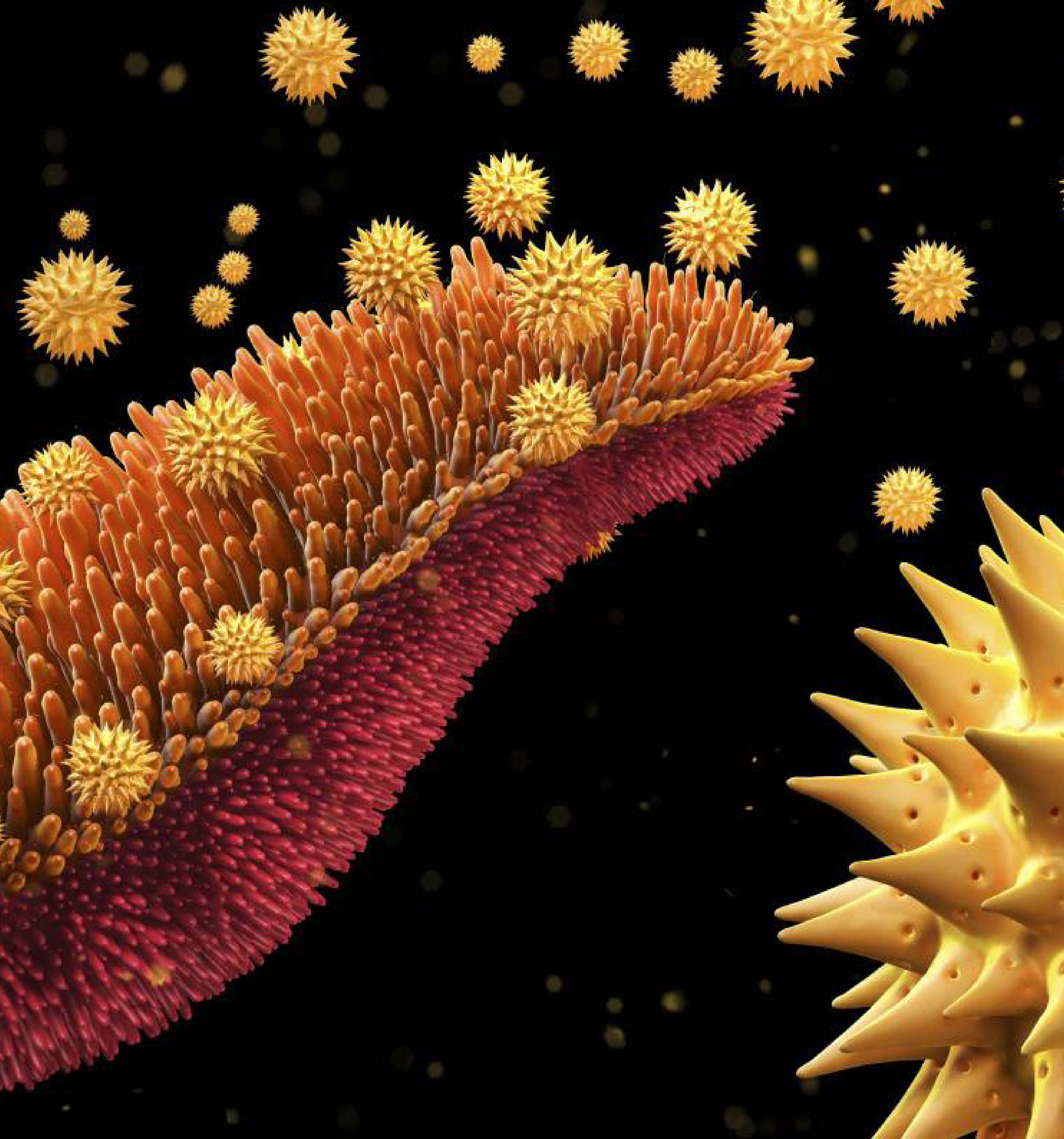
6. The results of Experiment 2 MOST strongly imply which of the following?

A. Leachate production is immediately reduced by the presence of Chryspogon Zizanoides.
B. Leachate production is unaffected by the presence of Chryspogon Zizanoides.
C. Leachate production is significantly reduced by Chryspogon Zizanoides, but this relationship takes time to form.
D. Leachate production is a function of the quantity of heavy metals in the soil.

First we note to look to experiment 2. Next, we note that the first three answer choices trace the relationship between leachate production and the presence of Chryspogon Zizanoides in the sample. Answer choice D, which notes a relationship between leachate and heavy metals in the soil, has no basis in the data, so it can be eliminated. When we look to the figure to chart this relationship, we note that L3 (with highest percentage of Chryspogon Zizanoides) clearly produces the least methane after at least one year has elapsed. However, we note that after the shortest amount of time - at 3 months elapsed - methane production appears to be unaffected by Chrypsogon Zizanoides. There is therefore a lag time before it affects methane production. This means that answer choice **C** is correct.

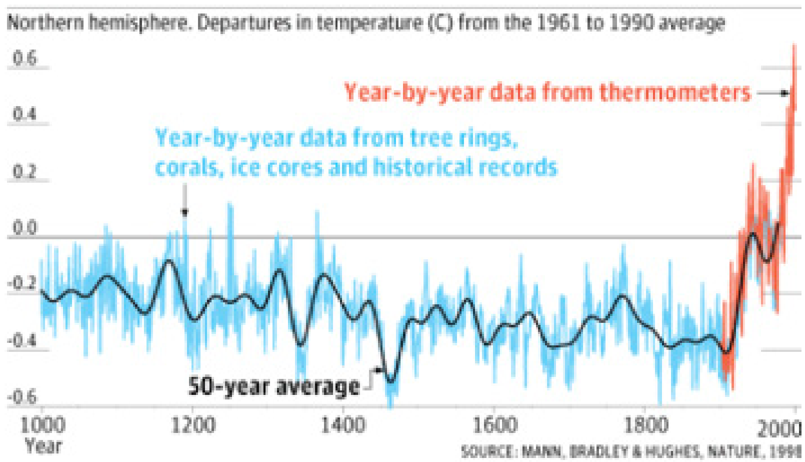
MEN LOVE TO WONDER, AND THAT IS THE SEED OF SCIENCE

– Ralph Waldo Emerson



EXAMPLE 3: CONFLICTING VIEWPOINTS

Since the early 1990s scientists have come to a consensus on global warming. If we observe the global average temperatures from the beginning of the Industrial Revolution to today, we can see an increase of about 1 degree C. According to our models of past climates, this is the most rapid climate change in the history of planet Earth.



Student 1

Climate change is occurring, and the evidence overwhelmingly supports the conclusion that it is man-made. Today, carbon particles per million particles of air (parts per million, PPM) have broken 400 PPM, a level not seen since the Pliocene Era, when sea levels and temperatures were far higher than they are today. This carbon comes mostly from burning fossil fuels including petroleum and coal. 400 PPM is far beyond the "safe" equilibrium for life on Earth, and the problem is only getting worse.

Some studies have shown a pause in global warming since 1990, and this has caused some to question whether climate change is actually occurring. However, if a pause in the rise of surface temperatures has been observed, it is not because the Earth is not warming. Rather, it is because the oceans have acted as a heat sink, absorbing warmth which then plummets to its depths. This heat trapping was precipitated by a sudden shift in northern Atlantic salinity, making water saltier and denser. Eventually this heat will distribute throughout the ocean, melting the ice caps.

Though we need to understand the Earth's various feedback loops more confidently, we can see that most of these feedback loops will exacerbate climate change. One such loop is the acidification of the ocean, which will have untold effects on currents and make the water less suitable for marine life. Another is the melting of the permafrost. When it melts, it releases thousands of years' worth of stored energy in the form of methane. This induces rapid climate change, more serious than pollution because methane traps heat about 9 times as effectively as does.

Student 2

Climate change is occurring, but we are still unsure about various feedback loops in the climate system. Until we understand these feedback loops further, we will not be able to accurately predict future temperature rise. The climate changes because of the "greenhouse effect," the process by which carbon dioxide in the atmosphere traps heat and warms the Earth. Though carbon PPM has recently surpassed 400, far above pre-Industrial Revolution levels of 350 ppm, we can't call any measurement "safe" or "unsafe" until we move from models to observations and learn how Earth responds.

While evidence suggests the climate has warmed over the last 150 years, warming has slowed dramatically over the last ten years. There are several explanations for this slowdown. The first is natural climate fluctuations, of which the weather phenomena El Niño and La Niña in the Pacific are the most important. The second is that radiation from the sun has been weaker than predicted in the past few years, counteracting global climate change.

Perhaps systems like El Niño and La Niña are permanently affected by changing climates. If they change to produce cooler weather, they constitute an example of what we could consider a positive feedback loop, a form of "self-regulation." We don't know for sure how many of these self-regulating systems Earth has.

Walkthrough Of Questions

1. According to Figure 1, the Earth experienced a "mini Ice Age" around which of the following years?

   A. 1250
   B. 1450
   C. 1750
   D. 1950

For this question, we are told to look directly toward Figure 1. We are asked about a "mini Ice Age" which sounds like cold weather. If we look to the graph, the minimum temperature was recorded between 1400 and 1500. Therefore B, 1450, is the best answer choice.

2. How do the two students most significantly differ in their view of what causes warming?

   A. Student 1 views warming over a longer time scale than does Student 2.
   B. Student 1 questions the efficacy of models, while Student 2 does not.
   C. Student 1 considers feedback loops as certain contributors to warming, while Student 2 believes that some of these feedback loops might counteract warming.
   D. Student 2 does not believe that human-caused climate change is occurring, while Student 1 does.

Now we get to the meat of this section: comparing viewpoints. Let's start with A. Student 1 mentions the Plioscene Era as a long-past reference point, but Student 2 doesn't mention an early boundary for his or her consideration of climate change. Let's move forward. For B, our descriptions are switched. If we look toward the text, it is Student 2 who actually questions models' efficacy, and it is Student 1 who does not. Watch out for answers that seem right but are actually logically backward, like this one. For C, we see that Student 1 considers only negative feedback loops, while Student

2 considers feedback loops that may slow climate change, such as the weakening of El Nino. Therefore this is the correct answer. D sounds right, but it states its case too strongly. While Student 2 wants to avoid jumping to climate conclusions, he or she still believes that human-caused climate change is occurring to some degree.

3. What can most reasonably be inferred about Student 1?

A. Student one is skeptical of PPM measurements.
B. Student one is skeptical of the global warming pause.
C. Student one believes in the promise of geoengineering solutions to global warming.
D. Student one is less alarmed by climate change than Student 2.

Again we must move through the answers one-by-one, and that's why this section takes time. For most of its questions, there is no easy cross-reference to make with charts. Choice A suggests that Student 1 is skeptical of PPM measurements, but he/she never suggests as much. Choice B suggests that Student 1 is skeptical of the global warming pause, which we do see clearly when he/she states, "if a pause in the rise of surface temperatures has been observed, it is not because the Earth is not warming." This is the best answer. Choice C suggests that Student 1 favors geoengineering solutions, but we see no such evidence. Choice D suggests that Student 1 is less alarmed by climate change than Student 2, but in fact it is Student 2 who is less alarmed.

4. Which of the following conclusions, if true, would most likely undermine the argument of Student 2?

A. El Niño and La Niña were shown to be weak from 1995-2005.
B. 85% of observed feedback loops are likely to exacerbate warming.
C. The atmosphere of Venus is shown to be 95.6% .
D. Many scientists question the validity of solar radiation measurements.

Taking notes in the margins, we hopefully noted that Student 2 is more skeptical of climate modeling than Student 1, in particular because he/she questions the depth of our understanding of feedback loops.

The money quote: “we are still unsure about various "feedback loops" in the climate system. Until we understand these feedback loops further, we will not be able to accurately predict future temperature rise.” Near the end of the essay he/she considers the idea of “positive feedback loops,” which actually heal the Earth. So we are looking here for some finding that would undermine such confidence in positive feedback loops. Only **B** does that - if 85% of observed feedback loops make warming worse, we can’t put much faith in positive feedback loops winning out and smoothing the problem of warming over. Answers C is irrelevant and D has only passing relation to any of Student 2’s comments. Answer A seems appealing, perhaps, but Student 2 never argues for the opposite: that La Nina and El Nino were particularly strong in that timeframe.

5. According to Student 1, what accounts for the global warming pause?

A. The gradual acidification of the ocean as it warms
B. The melting permafrost
C. The absorption of heat by the ocean
D. Increased solar activity

Here we can scan Student 1’s essay for the word pause. It is found in the following line, “However, if a pause in the rise of surface temperatures has been observed, it is not because the Earth is not warming. Rather, it is because the oceans have acted as a heat sink, absorbing warmth which then plummets to its depths.“ This sounds exactly like choice **C**, which makes that the correct answer.

6. About which of the following do Student 1 and Student 2 most strongly agree?

A. It is impossible to ever determine how much climate change will affect the Earth.
B. Models can predict coming developments with near-perfect accuracy.
C. Climate systems on Earth are linked in numerous, complex ways.
D. A carbon prevalence of 450 PPM has clearly predictable implications.

Here we can use process of elimination. We know that Student 2 questions models and believes we cannot make accurate predictions. This is enough to rule out choices B and D. We know that Student 1 believes predictions are accurate. This is enough to rule out choice A. Therefore, we are left with choice C, which correctly posits that both students believe that Earth is linked in numerous, complex ways through various feedback loops.

7. While Earth has been shown to warm dramatically according to Figure 1, which of the following could call its results into question?

A. Historical evidence of a "Mini Ice Age"
B. Widespread disagreement over how to gauge temperature from coral and tree ring readings.
C. Temperature readings in C instead of K.
D. A five-year period of slight cooling.

We are looking for information that will undermine Figure 1, which shows dramatic warming since 1900. Choice A confirms what we see - a mini Ice Age around 1450. Choice C is irrelevant - regardless of what scale we use, temperature readings should be shown to increase over time. Choice D is also irrelevant - we know that climate may occasionally cool for a brief time as the Earth adjusts to its new realities, but that the trend is certainly toward warming. This leaves only answer choice B, and indeed, if scientists widely disagreed on how to gauge temperatures from coral and tree ring readings - in other words, if they widely disagreed on how to measure temperatures from past climates, their conclusions about long-term warming might be thrown into doubt.

ACT SCIENCE TEST SECTION OVERVIEW

TP

KEY RESOURCES:

ACT Science Curriculum
ACT Science Quizzes

BASICS:

40 Questions in 35 minutes
Average time per passage:
If section has 6 Passages – 5:50
If section has 7 Passages – 5:00

Passage types:
Data Representation – Questions only require data analysis.
Research Summaries – Questions require data analysis or evaluating the setup of the experiment itself.
Conflicting Viewpoints – Questions require you to compare ideas and theories of various scientists or students.

GENERAL STRATEGY (DATA REPRESENTATION AND RESEARCH SUMMARIES):

1. Quickly (less than 30 seconds) review each table and/or figure in the passage to:
    a. Locate keywords – usually found on axes, keys, units and column headers.
        i. If you don't know the meaning of a keyword, quickly find its definition in the text (usually italicized).
    b. Determine general trends of data – how does the y-axis change as the x-axis increases? How do columns in tables compare to each other?
2. Read each question carefully to determine, in your own words, what it's asking you to find.
    a. As you read a question, use the keywords mentioned in the question or answer choices to locate specific data in the appropriate table or figure.
3. If you know where to find the answer to a data interpretation question, then focus on finding the correct answer. If you are not sure, eliminate wrong answer choices based on the information you can locate and the relationships you can find in the data.
4. If you can't eliminate enough answer choices, circle the question in your booklet, and use your instincts and scientific knowledge to select an answer and move on.

GENERAL STRATEGY (CONFLICTING VIEWPOINTS):

1. Scan the introduction to define any key terms. Circle any proper nouns and/or numbers.
2. Read each viewpoint to determine the main idea(s). Circle any proper nouns and/or numbers.
    a. Once you read a viewpoint, try to keep its main idea in your head to compare to each successive viewpoint.
3. Read each question carefully to determine, in your own words, what it's asking you to find.
4. Use your knowledge of the passage and general scientific knowledge to eliminate wrong answer choices.
    a. Use proper nouns and numbers to locate specific information whenever possible.
    b. Do NOT go back into the passage if you don't know what you are looking for.
5. If you can't eliminate enough answer choices, circle the question in your booklet, and use your instincts and scientific knowledge to select an answer and move on.

EXTRA TIPS:

1. Don't read the text – it may be difficult to resist, but reading the text in Data Representation and Research Summaries passages is a waste of time. You should only look back in the text to define a key term on a table or graph, or to scan for an answer for questions about an experiment's procedure.
2. Embrace your uneasiness – when you don't read the text in passages, you may feel a bit insecure about your level of understanding. Don't! Trust your interpretation of the data, common sense, and outside scientific knowledge when answering even the toughest of questions.
3. Weed through the wordiness – the ACT will constantly ask rather simple questions in extremely complex and wordy language, or insert new information in a question to distract you from what they are really asking. Your ability to simplify questions to simple relationships is critical to your score.
4. Use both hands – use the index finger of your non-writing hand to zero-in on the appropriate data as you read questions in Data Representation and Research Summaries passages.
5. Use the answer choices – keywords in the answer choices are just as helpful as keywords in the question. If you don't see a keyword in the question, you are likely to find one in the answer choices. Units are especially common in answer choices, and can be extremely helpful!
6. Focus on reasoning – Many questions ask you to choose between two options (such as Yes/No) and give the correct reasoning behind your choice. Evaluate the reasoning first to eliminate wrong answers, as the reasoning is almost always based on the data.
7. Remember what you've learned in science class – the ACT will not try to trick you by including false scientific principles in passages. Therefore, you can use your previous scientific knowledge to help you in a pinch. Some of the most important concepts to know are photosynthesis, cellular respiration, parts of an atom, pH, and kinetic-molecular theory.
8. Look for shared keywords –a keyword present in more than one table or figure is extremely important, as it allows you to find even more relationships in the data. Many of the more difficult questions on the test are centered around shared keywords. correctly is hugely important. Remember how certain key words translate into mathematical terms.