

Instructions for teachers:

The ACT Science practice allows the students and teacher to break down the figures, examine more carefully what the variables are in each graph, what is being studied, and how everything is measured.

The document is 3 pages (one page for each day of ACT week). You can photocopy the first 2 pages of the document front-to-back and have students keep this paper for the entire week.

The last page can be read out loud, projected on an LCD or an overhead projector, or photocopied. However, it should not be handed out to students until the final day, as many students want to rush into the multiple choice questions.

It is more important that some discussion takes place about the figures rather than rushing through the answers to the questions.

Any feedback on Science ACT practice is appreciated to the science team. Send e-mails to Victor Chen.

DAYS 1-2 of ACT Week

PASSAGE IV

A study was conducted to compare the accuracy of two commercially available swimming pool water testing kits (Kit A and Kit B) in determining the levels of chlorine, bromine, and pH in two different water samples. The water samples were kept at a constant temperature of 72°F throughout the entire study. The results include the ideal level or concentration of each chemical and the readings of each kit for two different 100 milliliter (ml) samples of water (Table 1).

Chemical	Sample 1	Sample 2
Chlorine (in ppm)		
Ideal	1.0–3.0	1.0–3.0
Kit A	2.40	3.4
Kit B	2.10	3.6
Bromine (in ppm)		
Ideal	2.0–4.0	2.0–4.0
Kit A	4.00	3.5
Kit B	3.75	3.35
pH		
Ideal	7.4–7.6	7.4–7.6
Kit A	7.40	6.2
Kit B	7.90	6.7

The pH scale measures how acidic or basic a substance is on a scale of 0 to 14. Lower numbers indicate increasing acidity, and higher numbers indicate increasing alkalinity (basicity). The ideal pH of a swimming pool is near 7.5. The minimum and maximum pH for a standard swimming pool are 7.2 and 7.8, respectively. Most residential swimming pools, however, have a tendency to drift toward a pH of 8.

The pH level of a sample of water has a tremendous impact on the effectiveness of chlorine. Chlorine is used to destroy contaminants and, at higher levels, is capable of having a bleaching effect on colors and a corrosive effect on surfaces. pH levels are tested using *phenol red*, a dark red powder that is added to a sample and will change the color of the water, depending on the pH. The effectiveness of chlorine at different pH is shown in Figure 1, as a percentage of chlorine's effectiveness at destroying harmful contaminants.

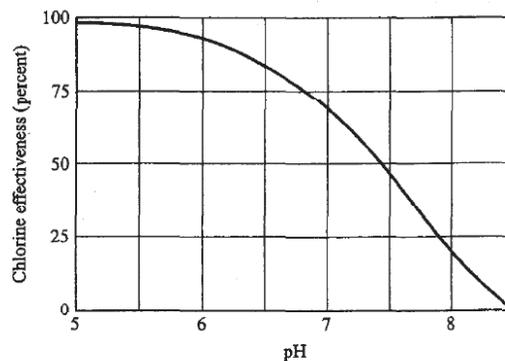


Figure 1

In the ACT Science Section, you will see three “Figures” passages. In these passages, you will usually notice very little text, and a bunch of charts, tables, or graphs.

1. As you look at Table 1, what are the variables? (what is changing in the table? What is the table trying to show?)
2. How are the variables measured? Keep in mind that values can also be represented as percentages.
3. As you look at Figure 1, what are the variables? (what is changing in the figure? what is the figure trying to show?)
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Science ACT Instructions: Graphs and Tables (**IMPORTANT: You do NOT need to know ANYTHING about the science topic to do well on the ACT Science test. The test is purely a reading test that tests your ability to interpret data, graphs, and experiments.**)

In the Science portion of the ACT, you will see 3 passages that include graphs and tables. There is usually a paragraph of text that goes with the passage. **DO NOT READ THE ENTIRE PARAGRAPH!** It takes up too much of your time. Instead, read the first sentence, skim to see if there are any **boldfaced** or *italicized* words that stand out, and then read the last sentence.

Next, read the figure caption (if there is one) and look at the axes to see what is being shown in the figure. Spend a little bit of time examining the figure to get a feel for what is being shown, and then go to the questions. **DON'T BE AFRAID TO MARK UP YOUR PAPER.** Circle what you are trying to find, and underline important information.

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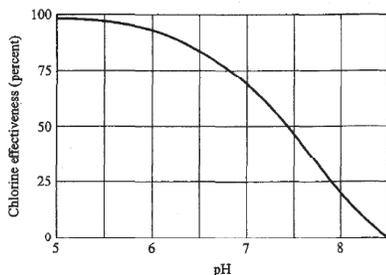


Figure 1

1. Circle where would you go to find information about the concentration of chlorine in Sample 2. What can you say about the concentration of chlorine in Sample 2?
2. Box in where would you go to find information about the concentrations of chlorine and bromine in both Samples 1 and 2? What can you say about the levels of chlorine and bromine in Samples 1 and 2?
3. Underline where would you go to find information about what Kit A indicates about Sample 1. What does Kit A say about the water from Sample 1?
4. Another water sample was tested using Kit B. The results indicate that the effectiveness of the chlorine in the sample was just above 80%. What is the estimated pH level of the water sample? Use a star to indicate where you would go to get this information.
5. According to Figure 1, as pH increases, what happens to the presence of harmful contaminants?

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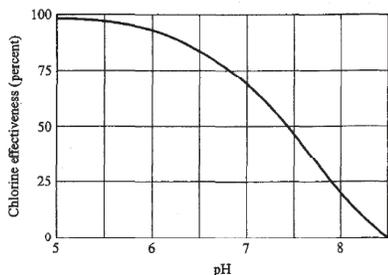


Figure 1

- Which of the following statements best describes the effectiveness of the chlorine in Sample 2?
 - F. The concentration of chlorine in Sample 2 is at an ideal level.
 - G. The concentration of chlorine in Sample 2 may be corrosive to surfaces.
 - H. The concentration of chlorine in Sample 2 is too weak to destroy contaminants.
 - J. The Sample 2 reading of chlorine from Kit A was higher than the reading from Kit B.
- Which of the following statements is best supported by the results of the study?
 - A. The water in Sample 1 only has ideal levels of both chlorine and bromine.
 - B. The water in Sample 2 only has ideal levels of both chlorine and bromine.
 - C. The water in both Sample 1 and Sample 2 has ideal levels of both chlorine and bromine.
 - D. The water in neither Sample 1 nor Sample 2 has ideal levels of both chlorine and bromine.
- The readings from Kit A of Sample 1 indicate that:
 - F. the water from Sample 1 is probably balanced and safe.
 - G. the water from sample 1 is probably harmful to swimmers.
 - H. bromine levels are difficult to accurately measure.
 - J. Kit B is inferior to Kit A in measuring pH.
- Another water sample was tested using Kit B. The results indicate that the effectiveness of the chlorine in the sample was just above 80%. What is the estimated pH level of the water sample?
 - A. 5.0
 - B. 6.5
 - C. 7.5
 - D. 8.0
- According to Figure 1, as pH increases:
 - F. the presence of harmful contaminants is most likely low.
 - G. the presence of harmful contaminants is mostly not affected.
 - H. the presence of harmful contaminants is mostly likely high.
 - J. the presence of harmful contaminants cannot be detected.

Open-ended Answers:

1. As you look at Figure 1, what are the variables? (what is changing in the figure? what is the figure trying to show?)
2. How are the variables measured? Keep in mind that values can also be represented as percentages.
3. As you look at Figure 2, what are the variables? (what is changing in the figure? what is the figure trying to show?)
4. How are the variables measured? Keep in mind that values can also be represented as percentages.

Multiple Choice Answers

1. The best answer is G. The passage states that high levels of chlorine are capable of having a corrosive effect on surfaces. The chlorine levels in Sample 2 are too high to fall into the ideal range, so it can be inferred that the water from Sample 2 may be corrosive.
2. The best answer is A. According to Table 1, both the chlorine and bromine levels were within the ideal range for Sample 1, regardless of which kit was used. However, for both Kit A and Kit B, chlorine levels for Sample 2 were above the acceptable levels.
3. The best answer is F. According to Table 1, the results from the tests on Sample 1 all fall within the ideal range, which most likely means that the water is balanced and safe for swimmers, answer choice F.
4. The best answer is B. To answer this question, look at Figure 1. Find the point just above 80% on the y-axis and move to the right until you reach the line. Once you reach the line, move down until you arrive at the x-axis. The point on the x-axis that corresponds to this point on the line is a pH of 6.5, answer choice B.
5. The best answer is H. According to the passage, Figure 1 shows the effectiveness of chlorine at different pH as a percentage of chlorine's effectiveness at destroying harmful contaminants. The figure indicates that at a pH of 5, chlorine is 100% effective, while at a pH of 8, chlorine is less than 25% effective. This information best supports the statement that, as pH increases, the presence of harmful contaminants is most likely high.