

How to Write an Effective Test

A Brief Guide Last Updated 15 Sept 2024

Purpose: write an effective test for a Science Olympiad Event test

Introduction: Writing a potent and quality test requires the following:

1. A strong understanding of the rules and topics of the event
2. Insight into what types of questions will appear on the test
3. Ability to write questions that are appropriately challenging and require content knowledge and analytical skills

Set your expectations:

Writing a **HIGH QUALITY** test takes 25~30 hours.

Writing a **MEDIUM QUALITY** test will take 15-25 hours.

Writing a **LOW-MEDIUM QUALITY** test will take 10~15 hours.

Writing a **POOR QUALITY** test will take less than 10 hours to write.

Steps to writing a high-quality test

1. Understand the rules

In order to acquire a sufficiently thorough understanding of the rules and topics of the event, you need to read them. 😊

- a. Copy the rules into a Google Doc.
- b. Do a close reading: **highlight**, *star*, underline, annotate!

2. Research

RESEARCH, RESEARCH, RESEARCH.

Work your way through every specific topic that will be tested one by one.

- a. Using the Google Doc you created in step 1a as an outline, capture notes on each topic.

- i. Use and cite reputable sources

1. SOinc is a GREAT place to start

- a. E.g., Review [Event Supervisor Guide and Sample Tests](#)

- ii. Begin by clarifying big ideas and fundamental principles.

1. Consider copying and pasting relevant passages directly into your notes.

2. If you have thorough notes, they can form the basis for the questions you generate in step 5.

- iii. Work your way to more specific [but still key] information.

1. Clarify confusion, read about topics you're unsure about, watch videos, explore!

Use this opportunity to pursue knowledge and whet your appetite for learning.

Your curiosity about the world inspired you to join SCIOLY - enjoy this research and geek out some!

- iv. See [this example](#)

3. Review question examples

After obtaining a general understanding of the topics at hand, look into different types of questions that have been used in past SciOly events and credible resources containing topical questions. The [SciOly Wiki](#), [Khan Academy](#), and other study sites will offer a basis of the types of questions that are used on tests.

- a. Types of questions vary by topic and are often specified in the rules.
- b. Note the [various levels of cognitive demand](#) on participants.
- c. One of the features of the high-quality test is that it MUST be quick to evaluate
 - i. Fill-in-the-blank
 - ii. Diagram labeling or creation
 - iii. Well-written multiple-choice questions
 - iv. Computational questions

4. Determine level of rigor

Determine the length of your test (50 minutes for xx questions). Remember that most events will be completed by two students. Well-prepared teams will divide the test in half. Review the distribution of your questions.

- a. Remember that the ultimate purpose of the test is to distinguish between levels of preparation of participants and to spread the field as widely as possible
 - i. Focus on topics in rules
 - ii. Avoid ties
- b. Easy: 20-25%
 - i. Purpose: distinguish between participants with little and no preparation
 - ii. Types of questions
 1. Definitions
 2. Labeling parts on a diagram
 3. One-step computational questions
 4. General facts
 5. Finding information on charts and graphs
- c. Medium: 40%
 - i. Purpose: distinguish between participants with modest preparation
 - ii. Types of questions
 1. Compare, distinguish, infer
 2. Two-step computational questions (If $Q=mc\Delta T$, solve for ΔT)
 3. Apply general principles to related situations
 4. Analyze information from charts and graphs
- d. Hard: 20-25%
 - i. Purpose: distinguish between well-prepared participants
 - ii. Types of questions
 1. Interpolate and extrapolate
 2. Justify analysis
 3. Apply specific principles to related situations

4. Computational questions with three or more steps
 - a. NOTE: Remember that this is SCIENCE Olympiad, not math. You can write complex computational questions that do not require calculus.
 - b. Briefly review [guidelines for math questions \(from 2022\)](#)
- e. Devilish: 15%
 - i. Purpose: distinguish between geeks
 - ii. Types of questions
 1. Sophisticated evaluation
 2. Apply specific principles to novel situations

It bears repeating: **the tests must be quick to score.**

- Identifying unambiguously correct answers is crucial, particularly if you (the test writer) are not going to be on hand to evaluate correct responses.
- While open-ended and free-response questions yield better insight into test takers' understanding, fairly assessing those questions is a challenge for experienced scorers (never mind inexperienced ones) AND it takes much longer.
 - A multiple choice question: <1 second to grade
 - Fill-in-the-blank or short-response: ~1 - 3 s [if the handwriting is legible]
 - Free-response: 10 - 60+ s

The difference in scoring time is small... until it is multiplied the number of questions by question type by # of participants.

Because the tournament (and scoring) is time-constrained, **strictly limit the overall number of free-response questions in your exam.**

- It is possible to make a high-quality and appropriately challenging test with discrete answers by writing distractors that include the most common misunderstandings of a topic (e.g., AP tests, SAT, etc.)

5. Write and format your questions and answers

- a. Create a new document. Call it *xxx test (for scorers)*
- b. Include a title page
 - i. Tournament
 - ii. Event
 - iii. Author
- c. Include page numbers
- d. Organize questions according to rules, e.g., stations
- e. Consolidate diagrams that require color printing on standalone sheet(s)
- f. Write questions with their answers
 - i. Read [this advice from Vanderbilt](#)
 - ii. Answers MUST be unambiguous, i.e., there must be an obviously correct answer
 - iii. Focus on key ideas and relevant examples; avoid trivia.
 - iv. For multiple choice questions, write high-quality distractors, i.e., wrong choices might be reasonably chosen by a less-well-prepared participant.

- v. For free-response questions, provide scoring guide
 1. +2 points for xxx response
 2. +1 point for yyy response
- vi. Highlight answers
- vii. See [this example](#) NOTE: some formatting was changed when the file was converted from Word into Doc
- g. Assign points.
 - i. Each event has a particular distribution of points so look to the event rules to make sure they align.
 1. For example, Forensics usually has evidence, powders, chromatography, and reasoning sections each set to a certain percentage of the total points.
- h. Assign tiebreakers
 - i. Make a note on title page
 - ii. Make a note next to tiebreaker questions
- i. In most cases, tests will be printed. If someone besides you is paying for printing your documents for competition, try to consolidate all figures that need to be printed in color on a separate sheet(s), ideally in a separate document.

6. Make a participant-facing copy of questions

When you are done editing the test, make a copy and name it *xxx test (for participants)*.

- a. Unhighlight answers, change the text for free-response answers white, and otherwise prepare the document to print and distribute.
- b. See [this example](#) NOTE: some formatting was changed when the file was converted from Word into Doc

7. Create the answer key

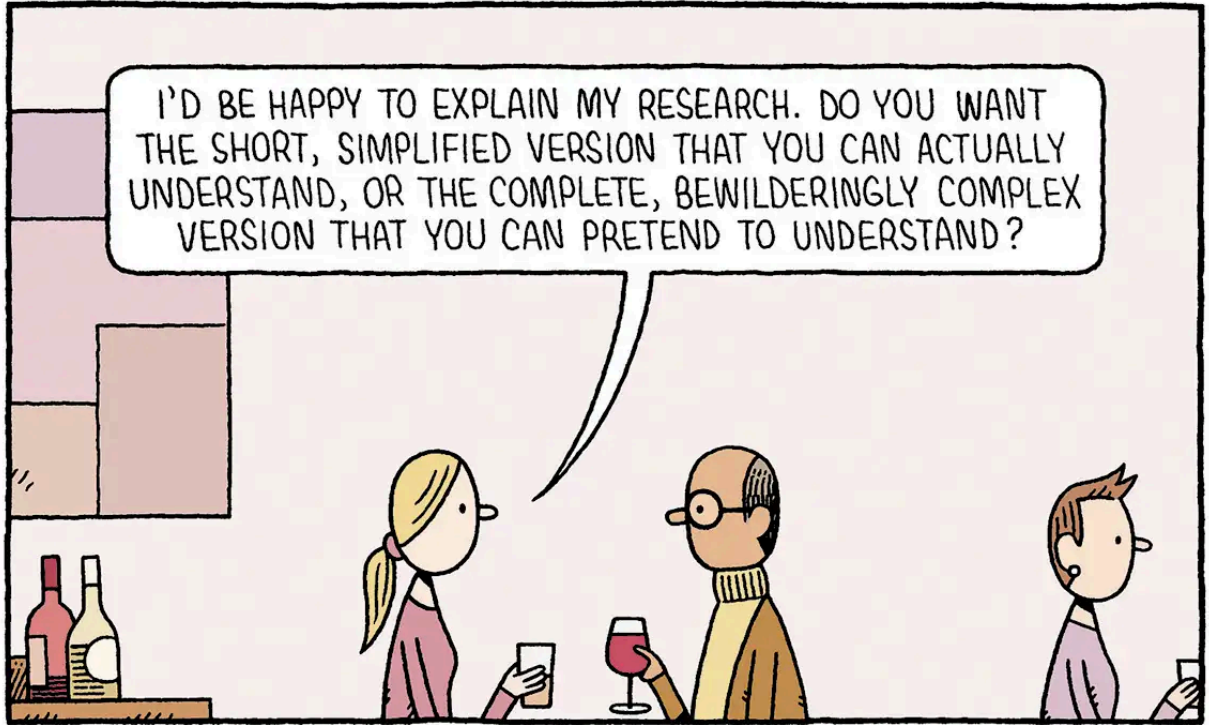
- a. It bears repeating (again): the tests must be quick to score.
- b. Make a new document, call it *xxx answer key*
- c. This document will be used by scorers for quick scoring.
- d. Format the answer key so that participants can write their responses on 1 - 2 sheets
- e. Include answers and scoring guide (as applicable)
 - i. Consider writing the answers using red text or highlighting to ensure that you know to hide that information for the participants' answer sheet (see item 8 below)
- f. Indicate tiebreakers
- g. See [this example](#) NOTE: some formatting was changed when the file was converted from Word into Doc

8. Create the answer sheet

- a. When you are done editing the answer key, make a copy and call it *xxx answer sheet*
- b. This document will be used by participants to summarize their answers.
- c. Hide the answers by, for example, changing the text white
- d. See [this example](#) NOTE: some formatting was changed when the file was converted from Word into Docs

9. Submit the documents

- a. Coordinate with the tournament director or their designee to submit the questions, answer key, and answer sheet.
- b. If there are special printing instructions, let the tournament director know.



TOM GAULD for NEW SCIENTIST