

Resource Sheet: Claim-Evidence-Reasoning (CER)

Why is CER important?

Scientists make claims all the time, but no one would trust them if they did not have any evidence to back up their claims. Scientific “facts” are actually claims that have been supported with a lot of strong evidence. It may be useful to think of CER like this:

- Claim = What you know
- Evidence = How you know it
- Reasoning = Your thought process

The goal of science and scientists is to make a claim that can be supported by evidence and **to convince others of their claim** (why we need the reasoning). In this class, we are going to practice writing and talking in the CER format so that we can understand how scientists work. Furthermore, CER translates into better argumentation, writing, and critical thinking skills, which you will need in other subjects, college, and your future career.

Claim

A claim is a statement that answers the original question.

Characteristics of a good claim:

- It is clear to the reader what the question was without having to look at the question.
- Uses specific language (avoids vague pronouns like “it” and “that”)

Evidence

Evidence is scientific data (quantitative or qualitative) that supports the claim.

Characteristics of good evidence:

- Directly supports the claim (*relevant* data)
- Data is cited in some or all of the following ways:
 - Cites specific data
(e.g. When the water was 25°C, it took 15 seconds for the tablet to dissolve.)
 - Describes trends in the data
(e.g. As the temperature of the water increased, the time to dissolve decreased.)
 - Compares and contrasts data
(e.g. The tablet took 10 seconds longer to dissolve in the 25°C water than in the 50°C water.)

Reasoning

Reasoning is a justification that connects the evidence to the claim.

Characteristics of good reasoning:

- Uses scientific principles (facts that have already been established)
(e.g. At higher temperatures, molecules have more energy.)
- Allows the reader to easily follow the logic
(e.g. Therefore, at a higher temperature of water, the molecules that make up the tablet had more energy and were able to move away faster from other molecules.)
- Clearly connects back to the claim
(e.g. As a higher temperature of water will allow the tablet to dissolve faster, the best temperature of water to dissolve the tablet will be the hottest temperature that the person can drink.)

Generic Rubric:

	FAR BELOW STANDARD	APPROACHING STANDARD	MEETS STANDARD	EXCEEDS STANDARD
CLAIM	is missing.	is vague and/or incomplete .	is specific and complete .	is specific, complete, and accurate .
EVIDENCE	is missing. OR is all irrelevant .	is relevant but insufficient to support the claim. is <i>sometimes</i> irrelevant.	is relevant and sufficient to support the claim. is <i>rarely</i> irrelevant.	is <i>always</i> relevant and sufficient to support the claim. is all necessary and not in excess .
REASONING	is missing. OR is all irrelevant and/or illogical .	is logical and connects the evidence to the claim. may include <i>some</i> scientific principles and/or justification for why the evidence supports the claim. may not be completely tied back to the claim.	is logical and connects the evidence to the claim. includes scientific principles and/or justification for why the evidence supports the claim. is completely tied back to the claim.	has a flow of logic that is easy to follow and <i>tightly</i> connects the evidence to the claim. includes scientific principles and/or justification for why the evidence supports the claim. is completely tied back to the claim.

Also important for increasing the quality of your writing:

- Use complete sentences.
- Organize your writing.
 - Start a new paragraph when you are moving onto another idea.
 - Use transitional phrases.
(e.g. thus, as a result, on the other hand, however, this means, etc.)
 - Finish discussing one idea before moving onto the next idea.
(e.g. Don't talk about one piece of evidence, move onto another, and jump back to the former piece of evidence.)
- Use academic language.
 - Use the appropriate scientific vocabulary when possible.
(e.g. "high temperature" instead of "hot")
 - Do not abbreviate unless it is a scientific unit or commonly accepted scientific abbreviation.
 - Do not use texting language or slang.
- Write legibly.

Transitional phrases to improve your writing

<p>Contrast</p> <p>In comparison to, but, however, on the contrary, notwithstanding, nevertheless, in spite of, in contrast, yet, on one hand/on the other hand, rather, or, nor, conversely, at the same time, while this may be true.</p>	<p>Similarity or Comparison</p> <p>Similarly, likewise, in like fashion, in like manner, analogous to.</p>
<p>Examples</p> <p>For example, for instance, to illustrate, thus, in other words, as an illustration, in particular.</p>	<p>Addition</p> <p>And, in addition to, furthermore, moreover, besides, than, too, also, both-and, another, equally important, first, second, etc., again, further, last, finally, not only-but also, as well as, in the second place, next, likewise, similarly, in fact, as a result, consequently, in the same way, for example, for instance, however, thus, therefore, otherwise.</p>
<p>Details</p> <p>Specifically, especially, in particular, to explain, to list, to enumerate, in detail, namely, including.</p>	<p>Consequence or Result</p> <p>So that, thus, as a result, consequently, hence, accordingly, for this reason, therefore, so, because, since, due to, in other words, then.</p>
<p>Concession</p> <p>Although, at any rate, at least, still, thought, even though, granted that, while it may be true, in spite of, of course.</p>	<p>Emphasis</p> <p>Above all, indeed, truly, of course, certainly, surely, in fact, really, in truth, again, besides, also, furthermore, in addition.</p>
<p>Time</p> <p>After, afterward, before, then, once, next, last, at last, at length, first/second/etc., at first, formerly, rarely, usually, another, finally, soon, meanwhile, at the same time, during, for a minute/hour/day, most important, later, ordinarily, to begin with, afterwards, generally, in order to, subsequently, previously, in the meantime, immediately, eventually, concurrently, simultaneously.</p>	<p>Space</p> <p>At the left, at the right, in the center, on the side, along the edge, on top, below, beneath, under, around, above, over, straight ahead, at the top, at the bottom, surrounding, opposite, at the rear, at the front, in front of, beside, behind, next to, nearby, in the distance, beyond, in the forefront, in the foreground, within sight, out of sight, across, under, nearer, adjacent, in the background.</p>
<p>Summary</p> <p>Therefore, finally, consequently, thus, in short, in conclusion, in brief, as a result, accordingly.</p>	<p>Suggestion</p> <p>For this purpose, to this end, with this in mind, with this purpose in mind, therefore.</p>