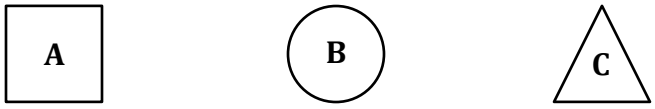
Writing complete explanations for Ranking Tasks (RTs) is something that students repeatedly resist. Rarely is it because of a lack of confidence in the content. Rather, it is almost always due to either procrastination or a lack of attention to detail, or both. Take a close look at the following example.

Description: The figure below shows three shapes, labeled A – C.



Ranking Instructions: Rank the shapes by the number of straight segments in each.

Ranking order: Most 1 A 2 C 3 B Least

Or, each shape has the same number of straight segments. ____ (check here)

Carefully explain your reasoning for ranking this way:

A has four, C has three, and B has none because it's round.

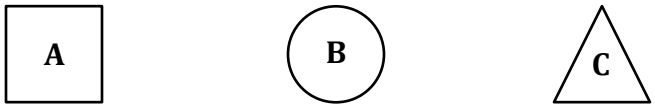
The ranking is correct but the "explanation" earns **no credit**...because *it is not an explanation*. Read it again carefully: *it's simply another way to state the ranking*. The instructions clearly direct one to "explain your reasoning for ranking this way" but there is no reasoning included that explains how the student knew how to rank them this way. *How do you know* that A has four sides? *How do you know* C has three sides? *How do you know* any of this? What is the reasoning that leads to this ranking and what evidence is there to support it?

If this is a revelation to you, you're not alone. Most humans aren't very detail oriented, either because they've been conditioned not to be or they simply believe they don't have the time. But as a popular saying goes, "*If you don't have time to do it properly, you must have time to do it over.*" And most people really do know that in the long run it actually takes less time and is more efficient to slow down, pay close attention, and do it right the first time rather than rush through it, do it poorly, and have to do it over (and possibly over and over...) again, sometimes with dire consequences.

No matter what the task, *always* pause and do a "reality check" when you're finished. Did you check to make sure you actually did what was asked, even if you weren't confident in the result? Take the example above: even if you weren't sure of the correct ranking, did you explain *why* you did what you did, *how you knew* that was the correct order, and indicate the evidence that supports your claims? Unfortunately not. *Did you state the factual information, cite the evidence, and explain the logic behind your train of thought? That is what "reasoning" involves.*

The correct explanation for example above is shockingly simple: *it's shown in the figures*. No kidding. Doesn't that satisfy the criteria? Doesn't that – without any ambiguity whatsoever – indicate to anyone reading it that in order to get that ranking, all the necessary evidence and "processing" they need to do is look at the figure? That, then, fully explains the reasoning necessary to get to that answer. Done.

As you might expect, not all rankings on your RTs will be that simple (but many really are!). Let's look a more complex example.

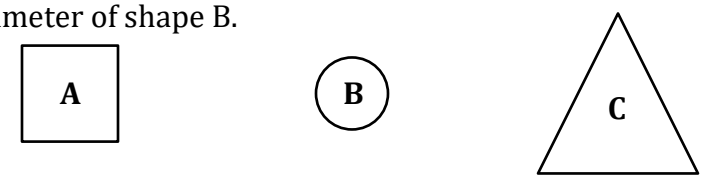
> **Description:** The figure below shows three shapes, labeled A – C. The lengths of the sides of both shapes A and C are all equal. That length is also equal to the diameter of shape B.
>
> 
>
>
> **Ranking Instructions:** Rank the areas of the shapes.
>
> Ranking order: Most 1__A__ 2__B__ 3__C__ Least
>
> Or, each shape has the same area. ____ (check here)
>
> **Carefully explain** your reasoning for ranking this way:
>
> The area formulas are area(square) = length × width, area(circle) = π × radius^2, and area(triangle) = ½ base × height. Let the word "length" represent the length of a side of shape A or C. Now "solve" for the areas: **area(A) = (length)^2** and **area(B) = π/4 (length)^2**. Shape C must first be split into a right triangle and the Pythagorean theorem applied to determine its height: (length)^2 = (height)^2 + (1/2 length)^2. Solving for height and substituting into the area formula gives **area(C) = sqrt(3)/4 × (length)^2**.

Clearly this is *much* more complex and requires much more explanation. In fact, this RT is very nearly the opposite end of the spectrum from that first example: the first one was shockingly simple while this one is quite complex, requiring multiple steps of reasoning to achieve a complete explanation.

Let's go through it. Since we are given that the length of the square's and triangle's sides are all equal and also equal to the circle's diameter, we could probably just guess that the square's area is larger. We might even guess that the circle's area is larger than the triangle. But *that still doesn't explain our reasoning* and definitely doesn't give a reader the confidence to believe that our answer could be correct – it's based on guessing and assumptions. **Assumptions are not evidence.** Okay...so upon what facts, evidence, and logic did we base that guess? We cannot simply say that we looked at the figure: *it does not state that the shapes are drawn to scale*. That's an assumption. **Assumptions are not evidence.**

Suppose the figures had been drawn as follows.

Description: The figure below shows three shapes, labeled A – C. The lengths of the sides of both shapes A and C are all equal. That length is also equal to the diameter of shape B.



Ranking Instructions: Rank the areas of the shapes.

Ranking order: Most 1____ 2____ 3____ Least

Or, each shape has the same area. ____ (check here)

Carefully explain your reasoning for ranking this way:

_____

_____

_____

Notice how *this does not change the answer.* The original ranking (A, B, C) is still correct. But looking only at the figure will not give this answer! Simply looking at the figure will, in fact, result in an *incorrect* answer since *the figures are not drawn to scale*. The only way we know how to determine the correct ranking is to take into account the length information given and then estimate relative areas for comparison, as we previously showed.

There is a lot of information to take into account here that isn't obvious: we have to find the formulae for the areas of a square, triangle, and circle; we must use the Pythagorean theorem to find the triangle's height; then we have to explain how to determine their areas. If we do not include all of this information, the explanation is not complete. We have to cite a lot of pieces of information and evidence and then explicitly link them together to formulate a complete explanation.

Here is another example, specific to astronomy and earth science. When you use the phrase "things rise in the east and set in the west" or "because the sky will have appeared to move about a quarter of a turn in six hours" you can't just assume that's understood. **Assumptions are not evidence.** Even someone who *does* understand what you're referring to can still ask "But why?" and expect you to explain *how* you "just know" these things. You must explicitly state that the Earth rotates in a particular direction on its axis once in about 24 hours. This justifies not only the direction of objects' apparent motions in the sky (east-to-west) but also the timeframe for daily motion. There's nothing else that explains *why* objects must rise in the east or how we would know that six hours is about a quarter of a turn. Now...why the Earth rotates at all, why it's that direction instead of the opposite one, and why one rotation is about 24 hours aren't necessary to understand the apparent daily east-to-west motions of objects through our sky or how long that takes. So none of that is necessary for the given example.

Remember to ***always operate from the standpoint that you're trying to explain and justify the response to someone who has seen all the same information and evidence as you (Lecture Tutorial, readings, etc.) but still genuinely doesn't grasp the concept*** and has one or more holes in his/her/their understanding. It's kind of like answering a child that keeps responding "But why?" to everything you say. Sure, sometimes they do it just to be annoying(!). But remember that children have no "filter" and little to no experience with or context for developing their mental models. Usually when you get the repeated "But why?" it's because you still have not actually given an evidence-based reason. You still haven't gotten all the way down to the "root" cause(s) or most basic information that gives the child a reason to believe. If you had, he/she/they would have been able to connect some of the dots and then either be satisfied with the explanation or *ask a different question* (that leads to any remaining holes in the understanding).

Keep this principle in mind as you work through the RTs during the term. Successful students repeatedly practice their explanations, get help when they need it, and ultimately master this skill. You have access to multiple help sessions, discussion boards, the STEM Center, etc. Do not hesitate to use any and all resources available to you. If you don't, you're only sacrificing your own understanding (and possibly any associated grades).

IMPORTANT: Many of the RTs have multiple rankings on a single task, e.g. a single RT might have parts A, B, and C, each requiring a separate ranking and explanation. *It is critical that each explanation stand alone as an independent explanation!* That is, part C's explanation cannot say something like "refer to part A, then…" That explanation does not stand alone since it requires the explanation for part A to be complete. If you want to use the information from part A in the explanation for part C, just copy and paste it there. Then continue to finish the explanation for part C. Any explanation that does not stand alone will not earn full credit.

Make sure you also refer to the grading rubric for any exercise that you turn in for credit as there could be additional helpful information contained therein.