

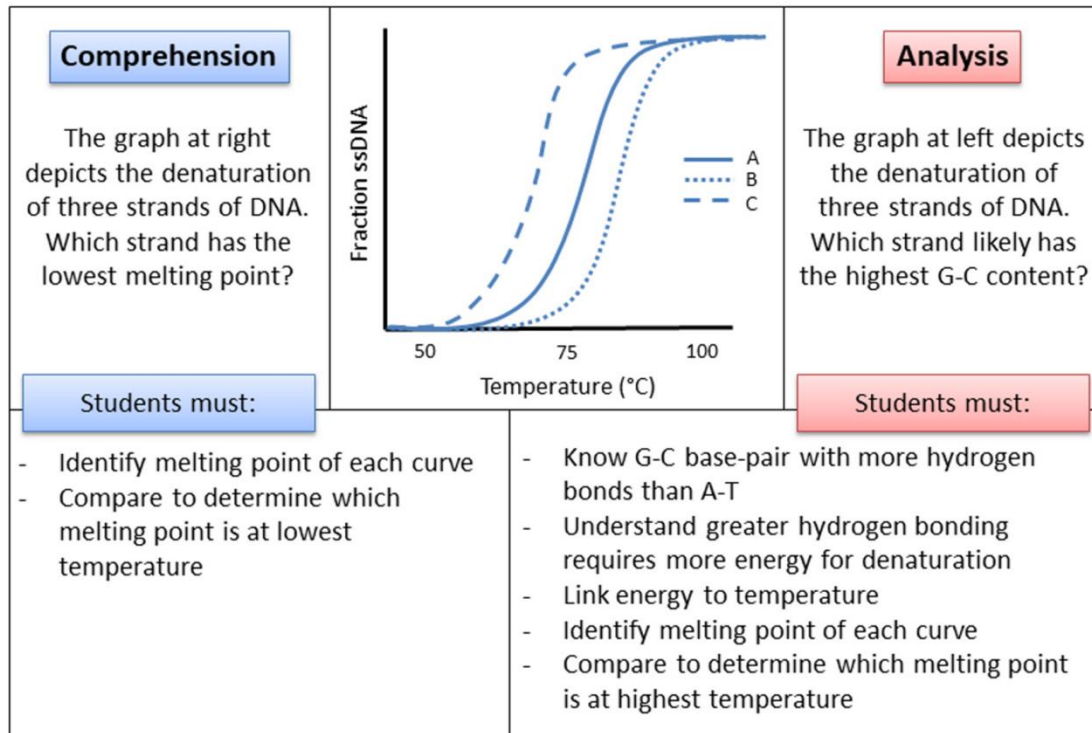
# Supplemental Material

*CBE—Life Sciences Education*

*Arneson et al.*

## Supplemental Materials

**Figure S1.** Certain skills or tasks are not exclusive to one cognitive level. Thus, we found it useful to break down assessment items by listing what a student would have to be able to do or understand in order to successfully answer the prompt. Shown here is a comparison between similar tasks at the Comprehension and Analysis levels with a breakdown of what is required to answer each.



**Figure S2.** Students performed significantly lower on visual, higher order multiple choice questions in 2014. This question, which required students to analyze the sequences based on amino acid properties and determine which would best fit the secondary structure shown, was one such challenging question. Fewer than half of the students were successful.

(2 pts) Which of the sequences below could be the sequence of an amphipathic  $\alpha$  helix?

A. GPAGPAGP  
 B. GNKDRHQE  
 C. VDLNFKMQ  
 D. LFMVAIFVL  
 E. IDELFKQM

n= 122 students
<b>Answered correctly</b>
41%

**Figure S3.** While all short answer questions on the final exam included some type of visual representation, students performed significantly worse on those targeting higher order cognitive skills. This multiple-part prompt requiring students to analyze and evaluate information was, based upon the low success rate, one of the more challenging tasks.

n= 190 students

<b>Answered correctly</b>
44%
14%
34%

a. (2 pts) Based on the data above, describe the dependence of this enzyme's activity on pH.

b. (2 pts) Propose a likely candidate for the functional group with a pKa of 10.2. Would it need to be protonated or deprotonated for the enzyme to be active?

c. (2 pts) Would the group identified in part c be the **nucleophile** or the **general acid-base catalyst**? Briefly explain why you gave that answer.