

EXAMPLES OF ASSIGNING DEPTH-OF-KNOWLEDGE LEVELS
ALIGNMENT ANALYSIS
CCSSO TILSA ALIGNMENT STUDY
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Level 1 Recall
Recall of a fact, information or procedure

Example 1:1

Grade 8 objective: Read, write, and compare decimals in scientific notation.

This objective is an example of level 1. The highest demand for students to successfully meet this expectation requires them to use recall and use a routine method to convert a decimal to scientific notation.

Example 1:2

Grade 8 objective: Add, subtract, multiply, and divide rational numbers.

This objective is an example of level 1. Students are expected to readily recall the necessary procedures to successfully meet this objective.

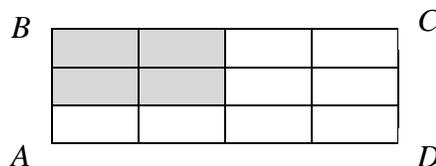
Example 1:3

1. Which of the following numbers, when rounded to the nearest thousand, becomes 27,000?

(a) 26,099 (b) 26,490 (c) 27,381 (d) 27,550 (e) 27,640

This grade 8 item is an example of level 1. Students are required to recall and compare a simple rounding procedure.

Example 1:4



2. In the figure above, what fraction of rectangle *ABCD* is shaded?

(a) $1/6$ (b) $1/5$ (c) $1/4$ (d) $1/3$ (e) $1/2$

This grade 8 item is an example of level 1. Students are required to recognize what is the shaded region compared to the whole region.

Example 1:5

3.

$\begin{array}{r} 121 \\ 13 \\ 32 \\ + 34 \\ \hline \end{array}$	<p>1) 190 2) 200 3) 290 4) N</p>
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This grade 8 item is an example of level 1. Students are required to apply a common and routine procedure to respond.

Level 2 Skills and Concepts
Use information or conceptual knowledge, two or more steps, etc.

Example 2:1

Grade 7 objective: Construct two-dimensional patterns for three-dimensional models, such as cylinders and cones.

This objective is an example of level 2. Although, constructing a two-dimensional pattern of a regular cylinder is expected to be routine (Level 1), it is possible to have a three-dimensional model that would not be as routine. Therefore, the highest reasonable expectation to fulfill this objective could be a Level 2.

Example 2:2

4. A car odometer registered 41,256.9 miles when a highway sign warned of a detour 1,200 feet ahead. What will the odometer read when the car reaches the detour? (5,280 feet = 1 mile)
- (a) 42,456.9 (b) 41,279.9 (c) 41,261.3 (d) 41,259.2 (e) 41,257.1

Did you use the calculator on this question?

- Yes No

This grade 8 item requires students to compute in decimal form the proportion of a mile that is equivalent to 1,200 feet and then add this decimal to the current odometer reading. A clever student could use reasoning skills to successfully work this item. This item requires students to think about what operation or operations to use, what numbers to use, and what conversions to make. These required skills, along with some skill in computation, makes this item a Level 2. There is not enough complexity in this item to be a Level 3.

Example 2:3

5. If each of the counting numbers from 1 through 10 is multiplied by 13, how many of the resulting numbers will be even?

- (a) One (b) Four (c) Five (d) Six (e) Ten

Did you use the calculator on this question?

- Yes No

This grade 8 item is an example of Level 2. Students are required to use properties of multiplication and odd and even numbers. Although for some students this is a routine item, the item requires students to consider more than one concept.

Level 3 Strategic Thinking
Requires reasoning, developing a plan or a sequence of steps, working with some complexity, and considering more than one possible approach and answer.

Example 3:1

Grade 8 objective: Solve two-step linear equations and inequalities in one variable over the rational numbers, interpret the solution or solutions in the context from which they arose, and verify the reasonableness of the results.

This objective is an example of Level 3. The expectation expressed in this objective is that students will not only solve a two-step linear equations, but will also interpret the solution and verify the results. This will require students to do some reasoning in order to interpret the solution and could be fairly complex depending on the context. If students were only required to solve linear equations and verify the solutions, then the expectation would be a Level 2.

Example 3:2

6. This question refers to pieces N , P , and Q .
In Mr. Bell's classes, the students voted for their favorite shape for a symbol. Here are the results.

	Class 1	Class 2	Class 3
Shape N	9	14	11
Shape P	1	9	17
Shape Q	22	7	2

Using the information in the chart, Mr. Bell must select one of the shapes to be the symbol. Which one should he select and why?

The shape Mr. Bell should select: _____

Explain:

This grade 8 item is an example of Level 3. To successfully solve this activity, a student is required to consider different ways that could be used to consider the votes (total votes or votes by class). The student then has to give a rationale for what response is selected. The student is required to do reasoning and consider alternative solutions.

Example 3:3

This question requires you to show your work and explain your reasoning. You may use drawings, words, and numbers in your explanation. Your answer should be clear enough so that another person could read it and understand your thinking. It is important that you show all of your work.

7. Julie wants to fence in an area of her yard for her dog. After paying for the materials to build her doghouse, she can afford to buy only 36 feet of fencing.

She is considering various different shapes for the enclosed area. However, she wants all of her shapes to have 4 sides that are whole number lengths and contain 4 right angles. All 4 sides are to have fencing.

What is the largest area that Julie can enclose with 36 feet of fencing?

Support your answer by showing work that would convince Julie that your area is the largest.

This grade 8 activity from NAEP is an example of Level 3. A student is required to do what has become a standard assessment activity. The extensive wording of the problem can be distracting and creates a problem with the source-of-challenge. However, how the problem is stated does require the student to do some interpretation to understand what is being asked and to give an argument. The depth-of-knowledge level for this activity would be 3* (the asterisk for source of challenge).

Level 4 Extended Thinking **Requires an investigation, time to think and process multiple conditions of the problem.**

Example 4:1

Grade 8 objective: Develop generalizations of the results obtained and the strategies used and apply them to new problem situations.

This grade 8 objective is an example of Level 4. Developing generalizations could require significant reasoning. Then to apply strategies and solution processes to new problem situations could require students to think about a multiple of conditions and to do some investigation. Not all activities that could be considered meeting this expectation would be a Level 4, but because at least some could be this objective is rated as Level 4.

Example 4:2

8. **NEW CUBES**

Your school is planning a casino night to raise funds to construct a wall aquarium in your school. As a mathematics student, you are given the job of developing a dice game for this event. A regular pair of "number dice" consists of two cubes, each with its faces numbered 1 through 6. Often dice games are played by rolling the two dice and then finding the sum of the two numbers turned upward.

- A. Show that, with a regular pair of number dice, the probability of rolling a sum of 7 is greater than the probability of rolling any other sum.

You decide to call your casino game "New Cubes." To make it interesting, you decide to construct new dice that have different numbers on their faces than regular dice. Here is how you will construct them:

- Only the single digits 0 through 9 can be used.
- Any digit can be used more than once.
- When the dice are rolled, every sum from 4 to 14 must be possible and no other sums can occur.
- The two dice do not have to be identical.

- B. What numbers would you put on the 6 faces of each of the two dice so that the above conditions are met?

Die 1: _____

Die 2: _____

- C. Which sum(s) do you think would turn up most frequently if your New Cubes were rolled 1000 times?

Explain why.

This grade 10 performance assessment activity developed by the Wisconsin Department of Public Instruction has multiple parts, requires students to apply their understanding of probability in a novel way, and expects the students to provide an argument. The time students are expected to complete the full activity is from 15 to 20 minutes. Students are expected to read at the level used in the problem so excessive reading is not a source-of-challenge issue. This activity is a Level 4. It should be noted that most on-demand assessments will not allow students to spend 15 to 20 minutes on an activity and do not have Level 4 activities.

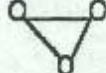
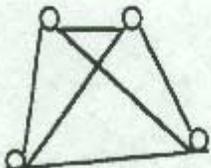
Example 4:3

9. CONNECTING NODES

Melinda and Harvey are teaching assistants at the University of Wisconsin in Milwaukee. One day they posed a problem called Connecting Nodes for their classes to solve.

- A node is just like a point.
- Each node is connected with every other node only once.
- A connection can be straight or curved.
- Connections can cross each other without creating a node.
- Any single connection has only two nodes on it, one at each end.
- Find the number of connections existing between nodes, no matter how many nodes there are.

The diagram below illustrates the number of connections that exist between the first four nodes.

Diagram	Number of Nodes	Number of Connections
	1	0
	2	1
	3	3
	4	6

- How many connections will there be if there are 50 nodes? _____
- Explain in detail how you determined your answer.
- Write a generalization to find the number of connections for n nodes.

This grade 10 performance assessment activity developed by the Wisconsin Department of Public Instruction, similar to item 8, has multiple parts and requires students to extend a pattern, make a generalization, and explain their thinking. An activity that only requires students to extend a pattern would be a Level 2 or Level 3, depending on the complexity of the pattern. However, since this requires students to develop a generalized term for the pattern and to explain their reasoning, the activity is a Level 4.