CALCULATING LABORATORY DILUTIONS

Performance Standard 6B/6D/7A/7C.H

Calculate the dilutions that are required when a specimen is measuring far above or below the typical deviations from the normal, and convert analyzed values back to original sample strengths:

- *Mathematical knowledge*: use ratios and proportional reasoning to convert between dilutions and original sample strengths.
- *Strategic knowledge*: use appropriate strategies to solve the problem.
- *Explanation*: explain completely and clearly what was done and why it was done.

Procedures

1. ***In order to investigate, represent and solve problems using number facts, operations and their properties, algorithms and relationships (6B); solve problems using comparison of quantities, ratios, proportions and percents (6D); measure and compare quantities using appropriate units, instruments and methods (7A); and select and use appropriate technology, instruments and formulas to solve problems, interpret results and communicate findings (7C),*** provide students with sufficient learning opportunities to develop the following skills:
   - Develop, use, analyze and explain methods for solving number sentences or word problems involving proportions with rational numbers.
   - Determine and describe the effects of arithmetic operations with decimals and integers.
   - Determine derived measurements.
   - Solve simple problems involving rates and other derived measurements.

   A large part of the work done in a medical laboratory involves the study of either urine or blood. The use of dilutions in the laboratory is common. As a rule, laboratory machines used for analysis are calibrated to measure a range of values within typical deviations. When a patient's specimen has an analyte that is too high for an analyzer to measure, a dilution is created. Students must know that a dilution is one part of the specimen and one or more parts of a diluent. The analyzed reading from the diluted sample must be multiplied by the number of parts in the dilution in order to convert the units provided by the lab machine to the units required by the doctor. Laboratory workers must perform mathematical functions.
2. Provide each student a copy of the "Calculating Laboratory Dilutions" task sheet and the rubric. Have students review and discuss the task to be completed and how the rubric will be used to evaluate it.
3. Ask students to solve the problems, show their work and explain their reasoning. They should be monitored by the teacher but encouraged to do their own thinking.
4. Evaluate each student's work using all three dimensions of the rubric and its guide to determine the performance level. Use the standard rubric, giving a score for each category for each question. The following answers are provided for your convenience:

(1)	a.	72 mg/dl	b.	1800 mg/24 hours	
(2)	a.	75 mg/L	b.	120 mg/24 hours	
(3)	a.	446 IU	b	.34 IU Heart	c. 8%.
(4)	a.	2 parts diluent	b.	450 mg/dl	
(5)	a.	Dilution is 1/16 of the original strength			b. 9408 IU's.

Examples of Student Work

- **Meets**
- **Exceeds**

Time Requirements

- 30 minutes

Resources

- Copies of the "Calculating Laboratory Dilutions" task sheet
- Calculator
- Mathematics Rubric

NAME _____ DATE _____

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Student Task Sheet

For each of the following situations make the necessary calculations to report the information the doctor needs. Carefully record what you did, and explain why you made each calculation.

1. Urine Creatinine Analysis.

1 part urine
5 parts diluent
Initial machine reading—12 mg/dl
Units doctor wants—mg/24 hours
24 hr. urine volume—2500 ml.

a. What is the test result in mg/dl?

b. What is the test result that will be given to the doctor?

c. Explain why you made each calculation.

2. Urine Sodium Analysis

1 part urine
2 part diluent
Initial machine reading—25mg/L
Units doctor wants—mg/24 hours
24 hr. urine volume—1600 ml.

a. What is the test result in mg/L?

b. What is the test result that will be given to the doctor?

c. Explain why you made each calculation.

3. Creatin Phosphokinase (CPK) Analysis

1 part CPK units in the blood serum
1 part diluent
Initial machine readings:
Total CPK—223 IU
heart portion of CPK—17 IU

a. What is the total CPK test results in IU's?

b. What is the heart portion test result in IU's?

c. What percent is the heart measurement of the total CPK measurement?

d. Explain why you made each calculation.

4. Glucose Analysis

1 part glucose
? part diluent
Linearity of machine is 600
Final test result is 900 mg/dl

a. How many parts of diluent are needed?

b. What is the initial machine reading?

c. Explain why you made each calculation.

5. Lipase Analysis

The lab technician had to dilute the sample 4 times before the sample was within the range the machine will read accurately. The following shows the dilution used for each trial and the final machine reading.

Initial try:	1 part specimen
	1 part diluent
Second try:	1 part initial mixture
	1 part diluent
Third try:	1 part second mixture
	1 part diluent
Fourth try:	1 part third mixture
	1 part diluent

Initial machine reading (fourth try)—588 IU

a. What was the final diluent ratio?

b. What is the value that should be reported as a result of the test?

c. Explain why you made each calculation.

MATHEMATICS RUBRIC

NAME _____ **DATE** _____

- Exceeds standard (must receive a 4 in each area)
- Meets standard (must receive all 3's or a combination of 3's and 4's)
- Approaches standard (must receive all 2's or any combination which may include a 3 or a 4)
- Begins standard (has no 3's or 4's but not all 1's)
- Absent (has all 1's and 0's)

	Mathematical Knowledge	**Strategic Knowledge**	**Explanation**
4	• Wrote the right answer. • Used math words correctly to show understanding of how math works. • Worked it out with no mistakes. • Used the right math words and labeled the answers.	• Identified all the important parts of the problem, and knew how they went together. • Showed all the steps used to solve the problem.	• Wrote what was done and why it was done. • If a drawing was used, all of it was explained in writing.
3	• Knew how to do the problem, but made small mistakes.	• Identified most of the important parts of the problem. • Showed most of the steps used to solve the problem.	• Wrote mostly about what was done. • Wrote a little about why it was done. • If a drawing was used most of it was explained in writing.
2	• Understood a little, but made a lot of big mistakes.	• Identified some of the important parts of the problem. • Showed some of the steps used to solve the problem.	• Wrote some about what was done or why it was done but not both. • If a drawing was used, some of it was explained in writing.
1	• Tried to do the problem, but didn't understand it.	• Identified almost no important parts of the problem. • Showed almost none of the steps used to solve the problem.	• Wrote or drew something that didn't go with the answer. • Wrote an answer that was not clear.
0	• No answer attempted.	• No strategy shown.	• No written explanation.
Score			