TINY CULPRITS

Rubric and Sample Responses

Question 1

RUBRIC

Score	Description
4	The response demonstrates understanding of rational and irrational numbers. • Student correctly identifies the perimeter of the diagram. (1 point) • Student correctly determines whether the perimeter is a rational or irrational number. (1 point) • Student thoroughly explains or shows how to find the answer. (2 points)

SAMPLE RESPONSE

$p = \pi d$ + length + length

$p = \pi p(1) + 2.5 + 2.5$

$p = \pi + 5$

The cell membrane perimeter is irrational because π is irrational

Question 2

SAMPLE RESPONSE

Cell	Perimeter (micrometers)	Integers
A	$\pi + 3$	6 and 7
B	$0.25\pi + 2$	2 and 3
C	$0.5\pi + 2.5$	4 and 5
D	$0.5\pi + 2$	3 and 4

Question 3

Number line item: 0-7, with 9 ticks between each major tick. Label tags: A, B, C, D Answers: A 6.1; B 2.8; C. 4.1; D 3.6 (autoscored—4 points total)

Question 4

RUBRIC

Score	Description
2	Response demonstrates the ability to evaluate square roots. • Student correctly compares the perimeter of Cell C to $\sqrt{16}$ (1 point) • Student thoroughly explains or shows how to find the answer. (1 point)

SAMPLE RESPONSE

$\sqrt{16} = 4$

Perimeter of Cell C = 4.0708

4.0708 > 4

Question 5

RUBRIC

Score	Description
4	The response demonstrates knowledge that $\sqrt{2}$ is irrational. • Student correctly identifies that the number is irrational and could not be a side length (1 point) • Student thoroughly explains why or why not. (2 points)

SAMPLE RESPONSE

$\sqrt{2}$ is an irrational number, therefore it could not be a length measurement, it is a number where the digits after the decimal place do not terminate or repeat.

Question 6

RUBRIC

Score	Description
2	The response demonstrates the ability to evaluate square roots • Student correctly identifies the cell. (1 point) • Student thoroughly explains or shows how to find the answer. (1 point)

SAMPLE RESPONSE

$\sqrt{8} = 2$

Cell B is closest in area to 2.

Question 7

RUBRIC

Score	Description
2	The response demonstrates an understanding of decimal expansion. • Student correctly expands 4/27 to a decimal. (1 point) • Student clearly explains how to expand a fraction to a decimal. (1 point)

SAMPLE RESPONSE

4.148 or equivalent

Question 8

RUBRIC

Score	Description
1	The response demonstrates an understanding of rational numbers. • Student correctly converts to a fraction.

SAMPLE RESPONSE

$3\frac{4}{11}$

Question 9

RUBRIC

Score	Description
8	The response demonstrates the ability to convert between standard form and scientific notation. • Student correctly converts the mass. (1 point each) • Student thoroughly explains or shows how to find the answer. (1 point each)

SAMPLE RESPONSE

A. 0.000000000056
I moved the decimal point 11 spaces to the left.

B. 4.61×10^{-11}
To make a number with one non-zero leading digit, I moved the decimal point 11 spaces to the right.

C. 0.00000000038
I moved the decimal point 10 spaces to the left.

D. 3.01×10^{-8}
To make a number with one non-zero leading digit, I moved the decimal point 8 spaces to the right.

Question 10

RUBRIC

Score	Description
2	The response demonstrates the ability to choose units for numbers in scientific notation by giving the appropriate unit and a clear explanation.

SAMPLE RESPONSE

The scientist was using micrometers. Kilometers are much larger than meters and cells are much shorter in length than a meter.

Question 11

RUBRIC

Score	Description
3	The response demonstrates the ability to compare numbers in scientific notation. • Student correctly determines how much bigger the mass of cell C is compared to cell A. (1 point) • Student shows or explains how to find the answer. (2 points)

SAMPLE RESPONSE

$3.8 \times 10^{-10} = 0.000000000038$

$5.6 \times 10^{-11} = 0.000000000056$

$0.000000000038 \div 0.000000000056 = 6.7857$

= 6.8 times

OR

3.8/5.6 = 0.67857

-10 — -11 = 1

6.7857×10^{0}

Question 12

RUBRIC

Score	Description
8	The response demonstrates the ability to simplify exponent expressions. • Student correctly simplifies the exponent expressions. (1 point each) • Student thoroughly explains or shows how to find the answer. (1 point each)

SAMPLE RESPONSE

a. 2.5^{7} to multiply like variables (or base numbers) exponents, add the exponents.

b. 2.5^{12} When an exponent is raised to another power, multiply the exponents.

c. $\frac{2.5^{3}}{2.5^{2}}$ To divide like variables with exponents, subtract the exponents.

d. $\frac{(2.5^{9} \cdot 2.5)}{2.5^{7}}$ First add the exponents to find the numerator. Then subtract the denominator exponents from the numerator exponent.

Question 13

RUBRIC

Score	Description
3	The response demonstrates the ability to perform operations with numbers expressed in scientific notation. • Student correctly solves for total mass. (1 point) • Student thoroughly explains or shows how to find the answer. (2 points)

SAMPLE RESPONSE

$5.6 \times 3.32 = 24.192$

$8 + (-12) = -4$

24.192×10^{-4}

2.4192×10^{-3} grams

Question 14

RUBRIC

Score	Description
3	The response demonstrates the ability to perform operations with numbers expressed in scientific notation. • Student correctly solves for total mass. (1 point) • Student thoroughly shows or explains how to find the answer. (2 points)

SAMPLE RESPONSE

$126{,}000{,}000{,}000 = 1.26 \times 10^{11}$

$1.26 \times 4.32 = 5.4432$

$11 + (-12) = -1$

5.4432×10^{-1} grams or 0.54432 grams