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When Decimals Drift: A 9th Grade Measurement Integrity Quiz

Navigate 10 demanding scenarios involving dimensional analysis and uncertainty to ensure structural integrity in engineering and laboratory research.

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1. An aerospace engineer calculates the tolerance of a turbine blade. If the measurement is 15.050 mm, how many significant figures are present, and what does the final zero imply regarding the instrument used?

A. 4 significant figures; the instrument only measures to the hundredths place.
B. 5 significant figures; the instrument has precision to the thousandths place.
C. 3 significant figures; trailing zeros after a decimal are placeholders.
D. 5 significant figures; the instrument has an accuracy error of 0.001.

2. Using dimensional analysis, a chemist must convert a reaction rate of 5.0 micrograms per millisecond (μg/ms) into kilograms per second (kg/s). The final value is:

A. 5.0 x 10^-3 kg/s
B. 5.0 x 10^-6 kg/s
C. 5.0 x 10^0 kg/s
D. 5.0 x 10^-9 kg/s

3. In a high-precision lab, a series of measurements that are highly clustered together but far from the theoretical 'true' value are considered to have high accuracy but low precision.

A. True
B. False

4. In the derivation of derived units, which of the following correctly expresses the SI derived unit for Force (Newton) in terms of SI base units?

A. kg · m / s
B. kg · m^2 / s^2
C. kg · m / s^2
D. g · cm / s^2

5. A thermal scientist measures a change in temperature as 25.0 degrees Celsius. To utilize this in an ideal gas law equation requiring SI base units, the value must be converted to:

A. 298.15 Kelvin
B. 248.15 Kelvin
C. 77.0 Fahrenheit
D. 298.15 Candela

6. While calibrating a pipette, a technician finds it consistently delivers 0.02 mL more liquid than intended. This is an example of what type of error, and how should it be addressed?

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A. Random error; it can be reduced by taking the average of many trials.
B. Systematic error; it should be corrected by recalibrating the equipment offset.
C. Human error; the technician must be replaced to ensure better optical alignment.
D. Parallax error; the technician is reading the meniscus from the wrong angle.

7. The 'mole' is an SI base unit used to measure the luminous intensity of a chemical substance.

A. True
B. False

8. A cube has a side length of 2.0 cm. When calculating the volume in cubic meters (m^3) for an introductory physics report, which conversion factor sequence is required?

A. Multiply by (1 m / 100 cm)
B. Multiply by (1 m / 100 cm)^2
C. Multiply by (100 cm / 1 m)^3
D. Multiply by (1 m / 100 cm)^3

9. When multiplying 3.22 m by 2.1 m, the product displayed on a calculator is 6.762. Following the rules of scientific measurement and significant figures, the final answer should be recorded as:

A. 6.76 m^2
B. 6.8 m^2
C. 7 m^2
D. 6.762 m^2

10. In the SI system, the kilogram is unique because it is the only base unit defined by a physical artifact rather than a fundamental physical constant.

A. True
B. False