**Name:** _____ **Date:** _____

## The Metric Sabotage: A 10th Grade Measurement Mission

Calculate derived units and evaluate dimensional consistency to repair a simulated laboratory's data stream before the experiment fails.

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**1. A theoretical propulsion system is measured to produce 450 Newtons of force. Which of the following represents the correct decomposition of this derived SI unit into its fundamental base units?**

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

**2. In a high-precision vacuum experiment, a measurement of 0.0004050 moles of a noble gas contains exactly four significant figures.**

A. True
B. False

**3. An astrophysicist calculates the energy of a photon to be 3.2 x 10^-19 Joules. If this value must be expressed in terms of the Planck constant (h) and frequency (f) where E=hf, what are the derived units of the Planck constant?**

A. $kg·m^2/s^3$
B. $kg·m^2/s$
C. $kg·m/s$
D. $kg·m^2/s^2$

**4. A surveyor measures a tectonic shift as 14.50 mm/year. If this must be converted to the SI base unit for velocity for a global geophysical model, what is the value in m/s?**

A. 4.59 x 10^-10 m/s
B. 4.60 x 10^-7 m/s
C. 1.45 x 10^-5 m/s
D. 1.67 x 10^-12 m/s

**5. You are calibrating a laser with a wavelength of 632.8 nanometers. In scientific notation, how many meters does this represent?**

A. 6.328 x 10^-7 m
B. 6.328 x 10^-9 m
C. 63.28 x 10^-8 m
D. 0.6328 x 10^-6 m

**6. A digital balance indicates a mass of 5.00g for a 5g calibration weight five times in a row. This instrument can be described as both precise and accurate.**

**Name:** _____ **Date:** _____

A. True
B. False

**7. Which of these expressions is dimensionally inconsistent (incorrect) regarding the relationship between displacement (d), velocity (v), acceleration (a), and time (t)?**

A. $d = vt + 0.5at^2$
B. $v^2 = 2ad$
C. t = (2d/a)^0.5
D. $v = at^2$

**8. A resistor has a conductance of 0.025 Siemens (S). Siemens is the SI unit for the reciprocal of electrical resistance (1/Ω). If resistance is measured in Ohms, defined as $kg·m^2·s^{-3}·A^{-2}$, what is the base unit representation of the Siemen?**

A. $kg^{-1}·m^{-2}·s^3·A^2$
B. $kg·m^2·s^{-3}·A^2$
C. $kg·m·s^{-2}·A^{-1}$
D. $s^3/kg·m^2$

**9. The Candela (cd) is a unique SI base unit because it is the only one based on human perception (luminous efficacy) rather than a purely physical constant of the universe.**

A. True
B. False

**10. A volumetric analysis requires 0.50 Liters of a solution. How many cubic centimeters ($cm^3$) does this equate to, and why is this relevant in laboratory measurements?**

A. 50 $cm^3$; it aligns with the volume of a standard beaker.
B. 5.0 $cm^3$; it matches the density of water at STP.
C. 500 $cm^3$; because 1 mL is equivalent to 1 $cm^3$.
D. 5000 $cm^3$; to account for meniscus errors in narrow tubes.