I. Units

1. List the SI units of measurement for length, mass, time, and temperature.
   meter, kilogram, second, kelvin

2. What is the only base unit that has a prefix, and why is that unit used rather than the bare unit?
   Kilogram; it is used instead of the gram because it is larger and easier to standardize.

3. What is the difference between a base unit and a derived unit?
   Base unit definitions are based on a physical object or process. Derived units use a combination of base units.

4. What are some examples of derived units? What quantity do they measure?
   m/s (speed); g/cm^3 (density); cm^3 (volume); m^2 (area); etc.

5. Which of these samples have the same density? Show all calculations and be sure all numbers have units!

Density Data		
Sample	**Mass**	**Volume**
A	80 g	20 mL
B	12 g	4 cm^3
C	33 g	11 mL

$Density_A = \dfrac{80\ g}{20\ mL} = 4\ g/mL$

$Density_B = \dfrac{12\ g}{4\ cm^3} = 3\ g/cm^3 = 3\ g/mL$

$Density_C = \dfrac{33\ g}{11\ mL} = 3\ g/mL$

B & C both have the same density

6. Density is an intensive property, meaning that it can be used to identify a material. From the table at right, determine the identity of an unknown metal if a sample with mass = 47.4 g increases the volume of water in a graduated cylinder from 8.50 mL to 13.85 mL. (Don't forget you can convert mL to cm^3 for the metal's density.

Table A Densities of Common Metals	
Name	**Density, g/cm^3**
Aluminum	2.701
Iron	7.86
Nickel	8.90
Zinc	7.13
Lead	11.35

V = 13.85 mL – 8.50 mL = 5.35 mL

$D = \dfrac{M}{V} = \dfrac{47.4\ g}{5.35\ cm^3} = \boxed{8.86\ g/cm^3 \Rightarrow Nickel}$

7. What is the mass of an aluminum sample with a volume of 25.9 cm^3? (see density above)

$D = \dfrac{M}{V} \Rightarrow M = D \times V = 2.701\ g/cm^3 \times 25.9\ cm^3 = \boxed{69.96\ g}$

8. What is the volume of a sample of lead with a mass of 194.8 g? (see density above)

$D = \dfrac{M}{V} \Rightarrow V = \dfrac{M}{D} = \dfrac{194.8\ g}{11.35\ g/cm^3} = \boxed{17.16\ cm^3}$

II. Scientific Notation

A. Express in scientific notation:

9. 186,000 mi/s 1.86×10^5 mi/s	10. 0.043 s 4.3×10^{-2} s
11. 3,000,000 km 3×10^6 km	12. 0.0000307 L 3.07×10^{-5} L
13. 19,850 yr 1.985×10^4 yr	14. 0.000000482 m 4.82×10^{-7} m
15. 174,000,000 hr 1.74×10^8 hr	16. 0.00204 mg 2.04×10^{-3} mg
17. −350,000 mm -3.5×10^5 mm	18. −0.00009 kg -9×10^{-5} kg

B. Express in common decimal form:

19. 7.3×10^2 ms 730 ms	20. 5.83×10^{-4} L 0.000583 L
21. 2.41×10^4 J 24,100 J	22. -9.23×10^{-3} mol −0.00923 mol
23. 7×10^{-3} kg 0.007 kg	24. -9.23×10^3 cm −9,230 cm
25. 6.37×10^{-5} kPa 0.0000637 kPa	26. 8.003×10^4 MW 80,030 MW
27. -3.4×10^6 km −3,400,000 km	28. -8.003×10^{-4} s −0.0008003 s

C. Evaluate the following expressions *using your calculator*; write your answer in scientific notation. Remember to use your calculator's [EE] or [EXP] key or [2nd][EE] function. Do NOT use "×10^" and do not use the "×" key *except* to multiply two numbers. Write your answer using proper scientific notation. ***Double–check your answers!***

29. $2 \times 10^{-4} \times 3 \times 10^7$ 6×10^3	30. $3.5 \times 10^2 \times 2 \times 10^4$ 7×10^6
31. $8.1 \times 10^4 \times 3 \times 10^{-2}$ 2.43×10^3	32. $4.3 \times 10^{-4} \times 2 \times 10^{-6}$ 8.6×10^{-10}
33. $3.4 \times 10^{-8} \div 1.7 \times 10^{-3}$ 2×10^{-5}	34. $8.5 \times 10^4 \div 2.5 \times 10^{-11}$ 3.4×10^{15}
35. $\dfrac{5 \times 10^2 \times 8 \times 10^{-4}}{2 \times 10^7}$ 2×10^{-8}	36. $\dfrac{3 \times 10^4 \times 2 \times 10^8}{2 \times 10^{10}}$ 3×10^2
37. $\dfrac{8 \times 10^{-1} \times 1.5 \times 10^2}{2 \times 10^{-1} \times 7.5 \times 10^1}$ 8×10^0	38. $\dfrac{2.5 \times 10^7 \times 4.9 \times 10^{-8} \times 3.2 \times 10^{-1}}{7 \times 10^1 \times 1.6 \times 10^{-3}}$ 3.5×10^0

Note: you must put the *entire* denominator into parentheses if performing a multiplication, addition or subtraction within it.