Chapter 1 – Practice Problems

Command Word Glossary:

convert – perform the following conversion including the showing of work.

state – write the answer from recollection of memory.

calculate – perform the required mathematical procedure.

show – derive (proof) that the answer is what is indicated by showing every step required to obtain the answer.

determine – solve the problem for the indicated quantity.

1. Using the formulae provided, **convert** the indicated derived unit to base units. [5]

A) Watt – Unit of power from $P = \frac{E}{t}$. E is energy, t is time.

B) Volt – Unit of electrical potential from $V = \frac{E}{q}$. E is energy, q is electric charge.

C) Newton – Unit of force from $F = \frac{p}{t}$. p is momentum and t is time.

D) Ohm – Unit of electrical resistance from $R = \frac{V}{I}$. V is electrical potential and I is current.

E) Pascal – Unit of pressure from $P = \frac{F}{A}$. F is force and A is area.

2. **Convert** the following metric quantities to the new quantity indicated. [10]

A) 210 km to m

B) 1 mg to kg

C) 100 cm^2 to m^2

D) 1000 km to μm

E) 10 ps to ns

F) 100 mA to A

G) 2000 pm to nm

H) 1 micrometer to megameter

I) 100,000 cm to Gm

J) 1000 cubic meters to cubic centimeters

3. **State** the order of magnitude of each unit prefix. [5]

A) giga

B) nano

C) micro

D) kilo

E) centi

4. **Calculate** the required conversions. [5]

Hint – 2π radians is equal to 360 degrees which is equal to 1 revolution.

A) 723 kilometers per hour to meter per second.

B) 45 radians per second to degrees per minute.

C) 120 meters per second to kilometers per hour.

D) 70 degrees per second to revolutions per second.

E) 13 kilograms per cubic centimeter to grams per cubic meter.

5. **Show** that each equation is homogeneous or **determine** what power makes the equation homogeneous. [5]

Hint – Remember, an equation is homogeneous if the units on the right hand side are equal to the units on the left hand side. You must convert each quantity to its correct units and simplify the units.

Hint – You might want to look up the base form of certain units like Newtons.

A) $T = \frac{2\pi}{\omega}$ where T (period) is measured in seconds and ω (angular velocity) is measured in radians per second.

B) $F = ILBsin\theta$ where F (force) is measured in Newtons, I (current) is measured in amperes, L (length), B (magnetic field) is measured in Teslas, and θ (angle).

C) $RKE = \frac{1}{2}I\omega^2$ where RKE (rotational kinetic energy) is measured in Joules, I (moment of inertia is measured in kg m^2 and ω (angular velocity) is measured in radians per second.

D) $T = \frac{2\pi\sqrt{m}}{k^n}$ where T (period) is measured in seconds, m (mass) and k (spring constant) is measured in kg s^{-2}. **Determine** the value of n such that the equation is homogeneous.

E) $TKE = \frac{p^n}{2m}$ where TKE (translational kinetic energy) is measured in Joules, p (momentum) is measured in Ns and m (mass). **Determine** the value of n such that the equation is homogeneous.

6. The following measurements are given and their corresponding absolute uncertainties. [5]

$A = 1.0\,m \pm 0.4\,m,\ B = 2.0\,m \pm 0.2\,m,\ C = 2.0\,ms^{-1} \pm 0.5\,ms^{-1},\ D = 0.20\,s \pm 0.01\,s$

Calculate what is required for each expression, including the uncertainty.

A) B - A

B) C x D

C) B / D

D) A^2

E) $(A \times B)^{1/2}$

7. **Determine** the uncertainty of the indicated measurement. [5]

Hint – Fractional uncertainty can be obtained via the equation: $FU = \delta A/A$ where A is the measurement and δA is the absolute uncertainty.

A) The absolute uncertainty of the volume of a bouillon cube of length 2 cm and an uncertainty in its length of 1 mm.

B) The percentage uncertainty of the circumference of a circle of diameter 5 cm and an uncertainty of 1 mm.

C) The fractional uncertainty of the sum of the following currents: 10 A +/- 1 A, 8 A +/- 0.1 A and 13 A +/- 1.1 A.

D) The absolute uncertainty and percentage uncertainty of the measurement, 71 K +/- 0.01.

E) The absolute uncertainty and fractional uncertainty of the measurement, 1000 kg +/- 2%.

8. **Determine** the amount of significant digits. [5]

A) 4649.01

B) 100

C) 0.01

D) 723.010

E) 1840.0

9. **Calculate** the correct value using significant digit rules. [5]

A) 723/1.0

B) 723.1 + 13.27

C) 13 - 0.13

D) 2.00 x 8

E) 101 x 10^2