Unit Conversions III

1 Astronomical Unit = 1.0 AU = 1.49 x 10^8 kilometers
1 Parsec = 3.26 Light years = 3 x 10^{18} centimeters = 206,265 AU
1 Watt = 10^7 ergs/sec
1 Star = 2 x 10^{33} grams

1 Yard = 36 inches	**1 meter = 39.37 inches**	**1 mile = 5,280 feet**
1 Liter = 1000 cm3	**1 inch = 2.54 centimeters**	**1 kilogram = 2.2 pounds**
1 Gallon = 3.78 Liters	**1 kilometer = 0.62 miles**	

Problem 1 – Convert 11.3 square feet into square centimeters.

Problem 2 – Convert 250 cubic inches into cubic meters.

Problem 3 – Convert 1000 watts/meter^2 into watts/foot^2

Problem 4 – Convert 5 miles into kilometers.

Problem 5 – Convert 1 year into seconds.

Problem 6 – Convert 1 km/sec into parsecs per million years.

Problem 7 - A house is being fitted for solar panels. The roof measures 50 feet x 28 feet. The solar panels cost \$1.00/cm^2 and generate 0.03 watts/cm^2. A) What is the maximum electricity generation for the roof in kilowatts? B) How much would the solar panels cost to install? C) What would be the owners cost for the electricity in dollars per watt?

Problem 8 – A box of cereal measures 5 cm x 20 cm x 40 cm and contains 10,000 Froot Loops. What is the volume of a single Froot Loop in cubic millimeters?

Problem 9 – In city driving, a British 2002 Jaguar is advertised as having a gas mileage of 13.7 liters per 100 km, and a 2002 American Mustang has a mileage of 17 mpg. Which car gets the best gas mileage?

Problem 10 – The Space Shuttle used 800,000 gallons of rocket fuel to travel 400 km into space. If one gallon of rocket fuel has the same energy as 5 gallons of gasoline, what is the equivalent gas mileage of the Space Shuttle in gallons of gasoline per mile?

Problem 11 – The length of an Earth day increases by 0.0015 seconds every century. How long will a day be in 3 billion years from now?

Problem 12 – The density of matter in the Milky Way galaxy is 7.0 x 10^{-24} grams/cm^3. How many stars are in a cube that is 10 light years on a side?

Problem 13 – At a speed of 300,000 km/sec, how far does light travel in miles in 1 year?

Problem 1 – 11.3 x (12 inches/foot)x(12 inches/foot) x (2.54 cm/1 inch)x(2.54 cm/1 inch) = **10,500 cm^2**

Problem 2 – 250 $inch^3$ x (2.54 cm/inch)^3 x (1 meter/100 cm)^3 = **0.0041 m^3**

Problem 3 – 1000 watts/$meter^2$ x (1 meter/39.37 inches)^2 x (12 inches/foot)^2 = **93.0 watts/ft^2**

Problem 4 – 5 miles x (5280 feet/mile) x (12 inches/foot)x(2.54 cm/inch)x(1 meter/100 cm) x(1 km/1000 meters) **= 8.1 km**

Problem 5 – 1 year x (365 days/year)x(24 hours/day)x(60 minutes/hr)x(60 seconds/minute) = **31,536,000 seconds.**

Problem 6 – 1 km/sec x (100000 cm/km)x(3.1 x 10^7 seconds/year) x (1 parsec/ 3.1 x 10^{18} cm) x (1,000,000 years/1 million years) = **1 parsec/million years**

Problem 7 - A) Area = 50 feet x 28 feet = 1400 ft^2. Convert to cm^2: 1400 x (12 inch/foot)^2 x (2.54 cm/1 inch)^2 = 1,300,642 cm^2. Maximum power = 1,300,642 cm^2 x 0.03 watts/cm^2 = **39.0 kilowatts**. B) 1,300,642 cm^2 x $1.00 /$cm^2$ = **$1.3 million** C) $1,300,000 / 39,000 watts = **$33.3 /watt**.

Problem 8 – Volume of box = 5 x 20 x 40 = 4000 cm^3. This contains 10,000 Froot Loops, so each one has a volume of 4,000 cm^3/10,000 loops = 0.4 cm^3/Loop. Converting this into cubic millimeters: 0.4 cm^3 x (10 mm/1 cm)^3 = **400 mm^3/Loop**.

Problem 9 – Convert both to kilometers per liter. Jaguar = 100 km/13.7 liters = 7.3 km/liter. Mustang = 17.0 x (1 km/0.62 miles) x(1 gallon/3.78 liters) = 7.25 km/liter. **They both get similar gas mileage under city conditions**.

Problem 10 – 400 km x (0.62 miles/km) = 248 miles. Equivalent gallons of gasoline = 800,000 gallons rocket fuel x (5 gallons gasoline/1 gallon rocket fuel) = 4,000,000 gallons gasoline, so the 'mpg' is 248 miles/4000000 = 0.000062 miles/gallon or **16,130 gallons/mile**.

Problem 11 – 0.00015 sec/century x (1 century/100 years) x 3 billion years = 4,500 seconds or 1.25 hours. The new 'day' would be 24h – 1.25 = **22.75 hours long**.

Problem 12 –First convert to grams per cubic parsec: 7.0 x 10^{-24} grams/cm^3 x (3.1 x 10^{18} cm/parsec)^3 = 2.0 x 10^{32} grams/pc^3. Then convert to Stars/pc3: 2.0 x 10^{32} grams/pc^3 x (1 Star/2 x 10^{33} grams) = 0.1 Stars/pc^3. Then compute the volume of the cube: V = 10x10x10 = 1000 light years^3 = 1000 light years^3 x (1 parcsec/3.26 light years)3 = 28.9 Parsecs^3. Then multiply the density by the volume: 0.1 Stars/pc^3 x (28.9 Parsecs^3) = **3.0 Stars in a volume that is 10 light years on a side**.

Problem 13 – 300,000 km/sec x (3.1 x 10^7 sec/year) = 9.3 x 10^{12} km. Then 9.3 x 10^{12} km x (0.62 miles/km) = **5.7 trillion miles**.