Fermi Problems: Cheat Sheet

SI prefixes

Name	*Order*
giga (G)	10^9
mega (M)	10^6
kilo (k)	10^3
hecto (h)	10^2
deca (da)	10^1
(base)	10^0
deci (d)	10^{-1}
centi (c)	10^{-2}
milli (m)	10^{-3}
micro (μ)	10^{-6}
nano (n)	10^{-9}

SI base units

Name	*Unit*
length	meter (m)
mass	kilogram (kg)
time	second (s)
temperature	kelvin (K)

SI derived units

Name	*Unit*	*Conversion*
volume	liter (L)	dm^3
force	newton (N)	$\mathrm{kg{\cdot}m{\cdot}s^{-2}}$
energy	joule (J)	N·m
power	watt (W)	$\mathrm{J{\cdot}s^{-1}}$
metric ton	ton	1000 kg

Scientific Notation

A number in the form $a \times 10^n$, where $1 \leq a < 10$. The answer we're looking is just the value of $\boldsymbol{n}$.

- The restrictions on a are important! Notably, $720 = 7.2 \times 10^2 \rightarrow n = 2$; correct, not anything else (such as 0.72×10^3; wrong).
- Pay particular attention to single digits! $5 = 5 \times 10^{\mathbf{0}} \rightarrow n = 0$, **NOT** 5×10^1, which is 50(!!)
- For this class, we will **not** take rounding into effect. Namely, 9.999×10^3 will still be answered as $n = 3$, even though this number is essentially 1×10^4.

Useful tips and tricks

- General problem solving technique: **Break it down!**
- The speed of light is approximately 3×10^8 m/s.
- 1 astronomical unit (distance between earth and sun) is approximately 1×10^8 km.
- The mass of an electron is approximately 1×10^{-30} kg.
- 1 calorie, the energy to raise the temp. of 1 g of water by 1 °C, is approximately 4 joules.
- 1 quart is approximately 1 liter. There are 4 quarts in 1 gallon.
- 1 gram of TNT contains approximately 4×10^3 J of energy.
- The conversion between temperature scales is $\begin{cases} \text{Celsius} &= \text{Kelvin} + 273 \\ \text{Fahrenheit} &= 1.8 \cdot \text{Celsius} + 32. \end{cases}$
- Various distance conversions (approximately): $\begin{cases} 1 \text{ mile} &= 1.6 \text{ km} \\ 1 \text{ foot} &= 12 \text{ inches} = 30 \text{ cm} \end{cases}$
- Again, **break it down**.

Have fun!!!