Unit 3

Know how to convert numbers from scientific notation into numbers written in ordinary notation and vice versa.

Write the following numbers into correct scientific notation:

a) 1023 = **1.02×10^{3}**
b) 0.00000054 = **5.4×10^{-7}**
c) 125.89 = **1.26×10^{2}**
d) 568941 = **5.69×10^{5}**
e) 0.000593 = **5.93×10^{-4}**
f) 4897×10^{3} = **4.90×10^{6}**

Write the following numbers into regular/standard notation:

a) 1.25×10^{3} = **1250**
b) 0.000034×10^{-2} = **0.00000034**
c) 4.53×10^{6} = **453000**
d) 165.89×10^{2} = **16589**
e) 9.573×10^{-4} = **0.0009573**
f) -2.36×10^{-6} = **-0.00000236**

Solve the following scientific notation problems – remember to use the rules for multiplying and dividing scientific notation!

a) $4.00 \times 10^{4} \times 2.00 \times 10^{2}$ = **8.0×10^{6}**
b) $1.50 \times 10^{6} \div 3.00 \times 10^{5}$ = **$0.5 \times 10^{1} = 5.0$**

Know the formula for percentage error and how to use it.

a) What is the formula for percentage error?

% error = $\frac{accepted - experimental}{accepted} \times 100$

remember this should be in absolutes and always have a positive error value

b) Calculate the percent error of an experiment if you calculate the density of gold to 20.13 g/mL but the true (accepted) value is 19.32 g/mL

% error = $\frac{19.32\frac{g}{ml} - 20.13\frac{g}{ml}}{19.32\frac{g}{ml}} \times 100 = 4.19$ % error

Know the difference between fission, fusion, and radiation.

a) What happens during fission? **The splitting of a larger atom, into smaller atoms (in nuclear power plants)**

b) What happens during fusion? **The combining of 2 smaller atoms, into a larger atom**

c) Give an example where fusion is happening. The **Sun**
d) List the symbols for alpha particles__**$^{4}_{2}He$** ___, **gamma particles**_**$^{0}_{0}\gamma$** __, **and beta particles**__**$^{0}_{-1}B$**
e) List the symbols from most penetrating to least penetrating. **Gamma, Beta, Alpha**

Know how to balance nuclear equations.

a) Complete & balance the following nuclear reactions. **Label the type of radiation (alpha, beta, gamma, electron capture, positron emission)**

b) The alpha decay of iridium-174 **$^{174}_{77}Ir \rightarrow {}^{4}_{2}He + {}^{170}_{75}Ir$**

c) The beta decay of plantinum-199 **$^{199}_{78}Pt \rightarrow {}^{0}_{-1}B + {}^{199}_{79}Au$**

d) $^{214}_{83}Bi \rightarrow {}^{0}_{-1}\beta$ + __**$^{214}_{84}Po$** ___
e) $^{230}_{90}Th \rightarrow {}^{4}_{2}\alpha$ + ___**$^{226}_{88}Ra$** __
f) $^{239}_{92}U + {}^{0}_{-1}\beta \rightarrow$ _**$^{239}_{91}Pa$** _
g) _**$^{238}_{92}U$** ___ $\rightarrow {}^{4}_{2}\alpha + {}^{234}_{90}Th + 2\,{}^{0}_{0}\gamma$

Know how to calculate frequency, wavelength, and energy.

a) What is the formula for wavelength?

λ ⍰ v = c

wavelength ⍰ frequency = speed of light

b) What is the formula for energy?

E = h ⍰ v

energy = Planck's constant ⍰ frequency

c) Can you solve for energy, if provided wavelength? Explain what you would do.

Yes, you would first use the provided wavelength and divide speed of light by wavelength to solve for frequency. Then you'd take the answer for frequency and plug it into the energy equation, by multiplying frequency by Planck's constant, to solve for energy.

d) A laser emits light at the frequency of 4.74×10^{14} sec^{-1}. What is the wavelength of the light?

$\lambda = \frac{3.00 \times 10^{8} \frac{m}{s}}{4.74 \times 10^{14} sec^{-1}} = 0.633 \times 10^{-6} = 6.33 \times 10^{-7}$ **meters**

e) The blue color of the sky results form the scattering of sunlight by air molecules. The blue light has a frequency of about 7.5×10^{14}Hz. What is the wavelength?

$\lambda = \frac{3.00 \times 10^{8} \frac{m}{s}}{7.5 \times 10^{14} Hz} = 0.4 \times 10^{-6} = 4.0 \times 10^{-7}$ **meters**

f) The laser used to read information from a compact disk has a wavelength of 780 nm. What is the energy associated with this radiation? (1 nm = 1×10^{-9} m)

$v = \frac{3.00 \times 10^{8} \frac{m}{s}}{7.80 \times 10^{-7} m} = 0.385 \times 10^{15}$ sec^{-1} $E = (6.626 \times 10^{-34}$ J⍰s$)$ $(0.385 \times 10^{15}$ $sec^{-1})$ $= 2.55 \times 10^{-19}$ J

g) How are wavelength and frequency related?

Wavelength and frequency are inversely related/proportional to each other. When one goes up the other goes down, and vice versa.

h) How do you measure the wavelength? Frequency?

Wavelength is measured from peak to peak (crest to crest) of the wave. Frequency is measured by how many times the wave or crest passes a point in time.