**Solution to Week 3**

 **Marathon problem**

E(H-like atom) = -2.178\*10-18Z2/n2 J, Z= proton count for 1-electron atom

ΔE= -2.178\*10-18\*Z2\*(1/ni2 -1/nf2) J

**H atom calculation**

For Z=1, ni =5, nf =2 (the blue H emission line near 435 nm):

 ΔE= -2.178\*10-18\*12(1/52 -1/22) J = 4.574\*10-19 j

**He+ atom calculations**

For Z=2 (the He+ species), ni =4, we want to find the nf most closely connected to the above energy of H’s `blue’ emission line. To estimate nf it is convenient to set up an equality as below and solve for nf

ΔE = 4.575\*10-19 = -2.178\*10-18\*Z2\*(1/ni2 -1/nf2) J

=-2.178\*10-18\*22\*(1/42 -1/nf2) J

 = -8.712\*10-18 \*(1/16 -1/nf2) J

Dividing through by -8.712\*10-18 we obtain:

4.575\*10-19 = 1 - 1 = 0.0625 - 1

-8.712\*10-18 16 nf2 nf2

-0.0525 = 0.0625 - 1

 nf2

-0.0525-0.0625 = -1

 nf2

 0.115 = 1

 nf2

**nf = (1/0.115)1/2 = 2.95 ~ 3**