Phys 2020, Spring 2008
Hints Gone Wild #14 – The Best of Spring Break

Q29.26 You know how to find the energy of a photon. The energy of the atom changes by the same amount.

29.3 Use Balmer's formula but with 3 in place of 2:

$$\lambda = \frac{91.18 \text{ nm}}{\left(\frac{1}{3^2} - \frac{1}{n^2}\right)}$$

29.4 The notation for an atom/ion is ${}^{A}Z^{\text{charge}}$. The element name gives the atomic number Z (see periodic table page A3 if needed) and $A = Z + N$. The charge tells how many electrons are missing from the usual Z electrons for the neutral atom.

29.16 Use the formulae for r_n and v_n,

$$r_n = n^2 a_B \qquad v_n = \frac{v_1}{n} \quad \text{where} \quad v_1 = 2.19 \times 10^6 \, \tfrac{\text{m}}{\text{s}}$$

Get the electron's kinetic energy from its speed.

Q29.28 Angular momentum in the H atom is quantized in a simple way, with

$$L_n = n\hbar$$

Solve for n (the orbit number) and then find E_n.

$c = 3.00 \times 10^8 \, \frac{\text{m}}{\text{s}}$ $\quad h = 6.626 \times 10^{-34}$ J·s $\quad \hbar = 1.06 \times 10^{-34}$ J·s $\quad 1$ u $= 1.66 \times 10^{-27}$ kg

$$\lambda f = c \qquad E = E_0 + K \qquad \lambda = \frac{h}{p} \qquad E_n = \frac{h^2}{8mL^2} n^2 = n^2 E_1 \qquad f_{\text{photon}} = \frac{\Delta E}{h}$$

$$\Delta x \Delta p_x \geq \frac{h}{2\pi} \qquad \lambda = \frac{91.18 \text{ nm}}{\left(\frac{1}{m^2} - \frac{1}{n^2}\right)} \qquad A = Z + N$$

$$a_B = \frac{4\pi\epsilon_0 \hbar^2}{me^2} = 5.29 \times 10^{-11} \text{ m} \qquad r_n = n^2 a_B \quad n = 1, 2, 3, \ldots$$

$$E_1 = \frac{1}{4\pi\epsilon_0} \frac{e^2}{2a_B} = 13.60 \text{ eV} \qquad E_n = -\frac{E_1}{n^2} \quad n = 1, 2, 3, \ldots$$