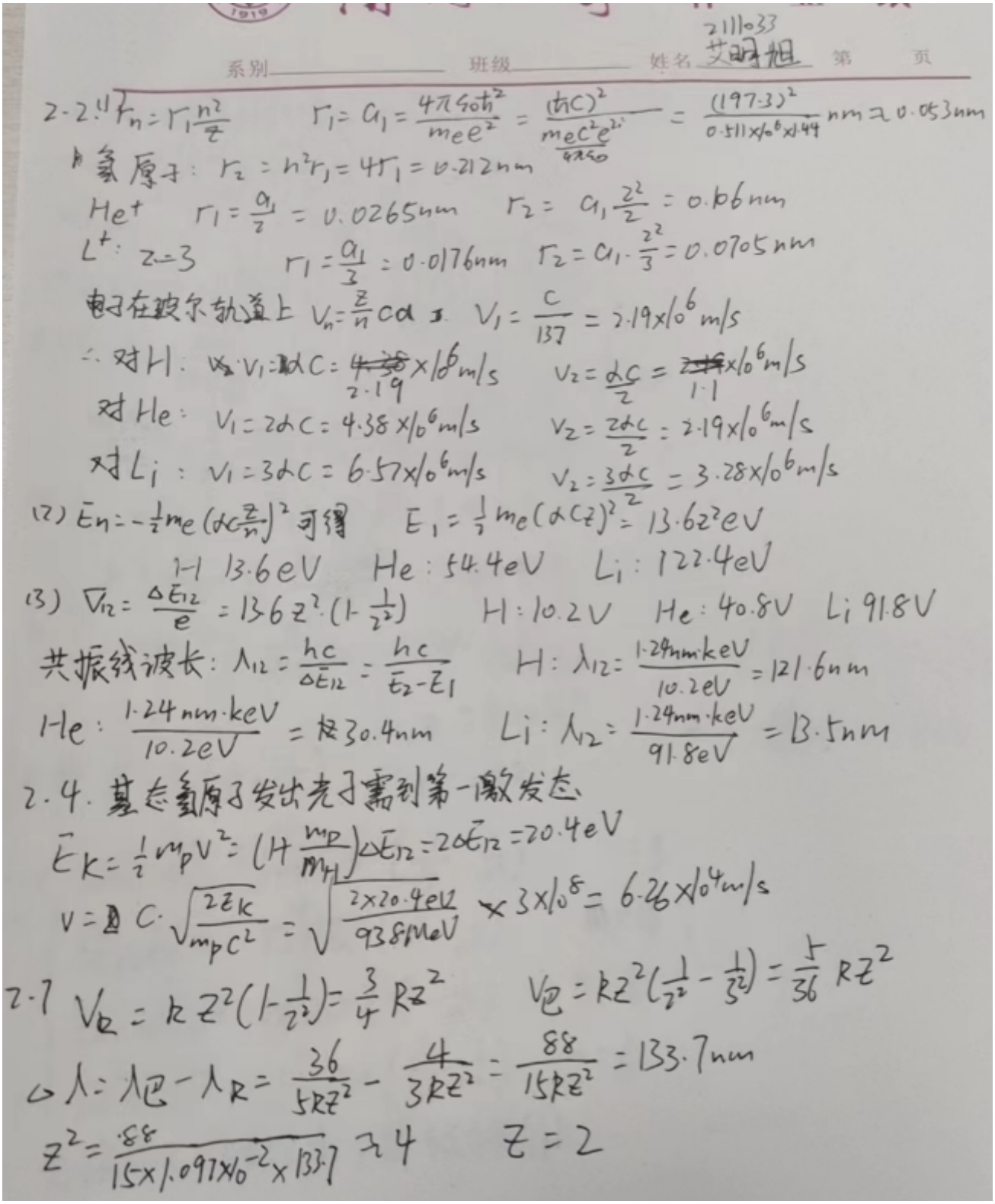
原子物理第二次作业

> **学号：2111033 姓名：艾明旭



2.10 (1) μ子类似H原子 由 $\mu=\frac{207m_eM}{207m_e+M}=\frac{207\times1836}{207+1836}m_e=186.0m_e$

$r_1=\frac{4\pi\varepsilon_0\hbar^2}{186.0m_ee^2}=\frac{a_1}{186.0}=\frac{0.053}{186}=2.85\times10^{-4}nm$

(2) $E_1=-\frac{1}{2}\cdot\mu\cdot(\alpha c\frac{Z}{1})^2=-186\times13.6eV=-2.53\times10^3eV$

(3) $\lambda=\frac{hc}{\Delta E}=\frac{hc}{E_\infty-E_1}=\frac{1.24\times10^3nm\cdot eV}{2.53\times10^3eV}=0.49nm$

2.11 $\because R_A=\frac{R_\infty}{1+\frac{m_e}{M_A}}$ $\therefore\frac{R_H}{R_D}=\frac{1+\frac{m_e}{m_D}}{1+\frac{m_e}{M_H}}=0.999728=\frac{1+\frac{0.00020m_e}{M_H}}{1+\frac{m_e}{M_H}}$

$\therefore\frac{M_H}{m_e}=\frac{0.499528}{0.000272}=1836.5\approx1.8\times10^3$

8.1 $\Delta E=E_2-E_1=13.6-3.4=10.2eV$

$p=\frac{E}{c}=\frac{10.2eV}{c}$ ~~$v=\frac{hc}{\lambda}$~~ $v=c$

8.8 $mw^2r=\frac{e^2}{4\pi\varepsilon_0r^2}$ $w=\sqrt{\frac{e^2}{4\pi\varepsilon_0mr^3}}$ $r=\frac{4\pi\varepsilon_0\hbar^2}{m_ee^2}=a_1=0.053nm$

$n=4.1\times10^{16}$ $E=-\frac{e^2}{4\pi\varepsilon_0r}=-13.6eV$

8.18 $\frac{1}{\lambda}=R(\frac{1}{2^2}-\frac{1}{n^2})$ $R_{He^+}=4R$

$\frac{1}{164.05\times10^{-9}}=\frac{4}{1.097\times10^7}(\frac{1}{4}-\frac{1}{n^2})$ $n=3$

$\frac{1}{121.52\times10^{-9}}=\frac{4}{1.097\times10^7}(\frac{1}{4}-\frac{1}{n^2})$ $n=4$

$\frac{1}{102.45\times10^{-9}}=\frac{4}{1.097\times10^7}(\frac{1}{4}-\frac{1}{n^2})$ $n=5$

$\frac{1}{102.53\times10^{-9}}=\frac{4}{1.097\times10^7}(\frac{1}{4}-\frac{1}{n^2})$ $n=6$

方法可以将其线制于能级跃图上