a) $He^+ \rightarrow$ 1 electrão $\rightarrow 1s^2 \rightarrow$ A

b) $E_1 = -\frac{13.6 \cdot 2^2}{1^2} = -54.4\,eV \rightarrow K_e = 54.4\,eV \rightarrow$ C

c) $\Delta x \, \Delta p \gtrsim h$

$K_e = \frac{1}{2}\frac{p^2}{m} \rightarrow \frac{\Delta K_e}{\Delta p} = \frac{p}{m} \Leftrightarrow \Delta p = \Delta K_e \frac{m}{p}$

$\Delta x \, \Delta K_e \frac{m}{p} \gtrsim h \Rightarrow \Delta x \gtrsim h \cdot \frac{p}{m} \cdot \frac{1}{\Delta K_e} \rightsquigarrow \Delta x \gtrsim h \cdot \frac{\sqrt{2 K_e m}}{m} \cdot \frac{1}{\Delta K_e} = \frac{h}{\Delta K_e} \cdot \sqrt{\frac{2K_e}{m}} \Rightarrow$ B

$p = \sqrt{2 K_e m}$

d1) $f_\gamma = 2.5 \times 10^{15}\,Hz$

$\Delta E \nearrow \rightarrow f \nearrow \rightsquigarrow$ A

d2) B

d3) $W_0 = 3.8 \times 10^{-19}\,J$

$K_e = E_\gamma - W_0 = hf - W_0$

$K_e = \frac{1}{2} m_e v^2 = \frac{1}{2}\frac{p^2}{m_e} \Leftrightarrow \sqrt{K_e \cdot 2 \cdot m_e} = p$

$\lambda = \frac{h}{p} = \frac{h}{\sqrt{2(hf - W_0) m_e}} = 4.3 \times 10^{-10} \rightarrow$ B