HO HW

7.2) $m = 1\,g = .001\,kg$

$\nu = 1\,Hz$

$v_e = 10\,cm/s$

$n = ?$

$\omega = 2\pi\nu$

$E = (n+\frac{1}{2})\hbar\omega = \frac{1}{2} m v_e^2$

$$n = \frac{1}{2}\frac{m v_e^2}{\hbar\omega} - \frac{1}{2}$$

$$= \frac{1}{2}\left[\frac{(.001\,kg)(.10\,m/s)^2}{(6.626\times10^{-34}\,J\text{-}s)(1\,Hz)} - 1\right]$$

$$= 7.5\times10^{27} - 0.5$$

7.3) $k = 2170\,cm^{-1} = \frac{2\pi}{\lambda}$

$m_c = 12\,u$

$m_o = 16\,u$

$C = K = ?$

$\omega = \sqrt{\frac{C}{m}}$

$E = \left(n+\frac{1}{2}\right)\hbar\omega$

$E_{n+1} - E_n = \left(n+\frac{3}{2}\right)\hbar\omega - \left(n+\frac{1}{2}\right)\hbar\omega$

$\Delta E = \hbar\omega$

$\omega = ck$

$= \hbar c k$

$\therefore \hbar c k = \hbar\omega = \hbar\sqrt{\frac{C}{m}}$

$$ck = \sqrt{\frac{C}{m}}$$

$$\boxed{C = mc^2k^2}$$

$$= \left(\frac{m_c m_o}{m_c + m_o}\right)\left(931.5\frac{MeV}{c^2u}\right)c^2 \left(2\pi\left(2170\,cm^{-1}\right)\left(\frac{100\,cm}{m}\right)\right)^2$$

$$= \left(\frac{12\cdot16}{12+16}\,u\right)\left(931.5\frac{MeV}{c^2u}\right)c^2 \left(1.36\times10^6\,m^{-1}\right)^2$$

$$C = 1.2\times10^{16}\,MeV/m^2$$

$$\boxed{C = 118\,eV/A^2}$$