(a) $$E 2\pi r = \pi r^2 \left(\frac{dB}{dt}\right)$$

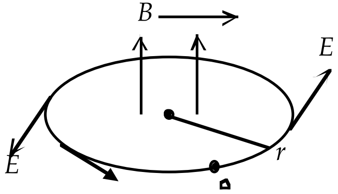
$$E = \left(\frac{r}{2}\right)\left(\frac{dB}{dt}\right)$$

(b) If r remains constant, then: $E = Eq = \left(\frac{r}{2}\right)\left(\frac{dB}{dt}\right)e$ so that $Fdt = \left(\frac{r}{2}\right)\left(\frac{dB}{dt}\right)dt = m_e dv$, or

$$dv = \left(\frac{re}{2m_e}\right)dB$$

$$\int_{v}^{v+\Delta v} dv = \left(\frac{er}{2m_e}\right)\int_0^B dB$$

$$\Delta v = \frac{erB}{2m_e}$$



(c) $$\Delta\omega = \frac{\Delta v}{r} = \frac{eB}{2m_e} = \left(1.6\times10^{-19}\ \text{C}\right)\frac{1\ \text{T}}{2}\left(9.1\times10^{-31}\ \text{kg}\right) = 8.8\times10^{10}\ \text{rad/sec}$$

$$\omega = 2\pi f = \frac{2\pi c}{\lambda} = 2\pi\frac{\left(3.0\times10^{8}\ \text{m/s}\right)}{\left(500\times10^{-9}\ \text{m}\right)} = 3.8\times10^{15}\ \text{rad/sec};\ \frac{\Delta\omega}{\omega} = 2.3\times10^{-5}$$

(d) For the ω_0 line the electrons' plane is parallel to **B**, therefore, the magnetic flux, Φ_B is always zero. This means that **F** and **E** are zero and as a consequence, there is no force on the electrons and there will be no Δv for the electrons. The $\omega_0 + \Delta\omega$ is the case calculated in parts (a)–(c). The $\omega_0 - \Delta\omega$ will have the same magnitude for **F**, **B**, and Δv as in (a)–(c) but the direction will be opposite.