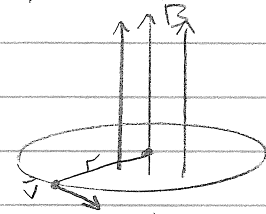
+3/3

$\boxed{32.1}$ we begin with the Larmor formula for the total power radiated by an accelerated charged particle of charge e: (32.2 5)

$$P = \frac{2e^2}{3c^3} a^2$$



For the orbiting particle, $a = \frac{v^2}{r}$

Also, since $\vec{F} = m\vec{a} = \frac{e}{c}(\vec{v} \times \vec{B})$,

$\vec{a} = \frac{evB}{mc}$ (for the circular orbit where $|\vec{v} \times \vec{B}| = vB$.)

$$\Rightarrow a = \frac{v^2}{r} = \frac{evB}{mc} \Rightarrow a = \frac{evB}{mc}$$

Plug this into the Larmor formula: $P = \frac{2e^4 v^2 B^2}{3c^5 m^2}$

The Energy of the particle is $E = \frac{1}{2}mv^2$,

$$P = \frac{2e^4 v^2 B^2}{3c^5 m^2}\left(E \cdot \frac{2}{mv^2}\right) = \frac{4e^4 B^2}{3c^5 m^3} E = \frac{-dE}{dt}$$

So we set

$$\boxed{\gamma = \frac{4e^4 B^2}{3c^5 m^3}} \quad \text{and} \quad \boxed{P = \gamma E} = \frac{-dE}{dt}$$

The solution to the ODE is $E(t) = E(0)e^{-\gamma t}$, where

$1/\gamma = \frac{3c^5 m^3}{4e^4 B^2}$ is the mean lifetime of motion.

Lets convert this to SI units. $B \to \sqrt{\frac{4\pi}{\mu_0}} B$ ✓ $e \to \frac{1}{\sqrt{4\pi\varepsilon_0}} e$ ✓

$$\therefore \frac{1}{\gamma} = \frac{3c^5 m^3}{4e^4 B^2} \frac{\mu_0}{4\pi} (4\pi\varepsilon_0)^2 = \frac{3c^5 m^3}{4e^4 B^2} \mu_0 4\pi \varepsilon_0^2 = \boxed{\frac{3\pi c^3 m^3}{e^4 B^2}\varepsilon_0}$$

Now plug in the given values ($B = 10^4 g = 1T$)

The calculation is done in the attached Mathematica document:

$\boxed{\frac{1}{\gamma} = 2.6 \text{ sec}}$ ✓