Therefore

$$\frac{dv}{dt} = -\frac{B^2}{m}\frac{b^2}{c^2}\frac{v}{R}$$

b)

$$\begin{cases} \dfrac{dv}{dt} = -\dfrac{v}{\tau} \\ v(0) = v_0 \\ \tau \equiv \dfrac{mc^2 R}{B^2 b^2} \end{cases}$$

$$v(t) = v_0 e^{-t/\tau}$$

c)

$$\Delta x_{TOT} = \int_0^\infty v(t)\,dt = \left[-v_0 \tau e^{-t/\tau}\right]_0^\infty = v_0 \tau = \frac{v_0 m c^2 R}{B^2 b^2}$$

d) The energy dissipated in the resistor is

$$W = \int_0^\infty I^2(t) R\,dt = \int_0^\infty \frac{B^2 b^2}{c^2 R} v^2(t)\,dt =$$

$$= \frac{B^2 b^2}{c^2 R}\left[-v_0^2 \frac{\tau}{2} e^{-2t/\tau}\right]_0^\infty = \frac{B^2 b^2}{c^2 R} v_0^2 \frac{\tau}{2} = \frac{1}{2} m v_0^2 = K$$

Energy is conserved ✓