7-22 Since $F(x,t) = \frac{k}{x^2} e^{-t/\tau}$ & $F = -\frac{\partial U}{\partial x}$

$$U(x,t) = \frac{k}{x} e^{-t/\tau}$$

$$\therefore\ L = T - U = \frac{1}{2} m\dot{x}^2 - \frac{k}{x} e^{-t/\tau}$$

Hamiltonian:

$$H = p_x \dot{x} - L = \dot{x}\frac{\partial L}{\partial \dot{x}} - L$$

$$= \dot{x} \cdot m\dot{x} - \frac{k}{x} e^{-t/\tau}$$

But $H = H(q, p)$

$$p_x = \frac{\partial L}{\partial \dot{x}} = m\dot{x} \quad \text{so}$$

$$H = \underbrace{\frac{p_x^2}{m}}_{\left(\dot{x}\frac{\partial L}{\partial \dot{x}}\right)} - \underbrace{\left(\frac{1}{2}\frac{p_x^2}{m} - \frac{k}{x} e^{-t/\tau}\right)}_{L}$$

$$= \frac{p_x^2}{2m} + \frac{k}{x} e^{-t/\tau}$$ = total energy because U does not depend on velocity.

But – the total energy is <u>not</u> conserved because H contains the time explicitly.