84. (a) Using $X_C = 1/\omega C$ and $V_C = I_C X_C$, we find

$$\omega = \frac{I_C}{CV_C} = 5.77 \times 10^5 \text{ rad/s} .$$

This value is used in the subsequent parts. The period is $T = 2\pi/\omega = 1.09 \times 10^{-5}$ s.

(b) Adapting Eq. 26-22 to the notation of this chapter,

$$U_{E,\text{max}} = \frac{1}{2} C V_C^2 = 4.5 \times 10{-}9 \text{ J} .$$

(c) The discussion in §33-4 shows that $U_{E,\text{max}} = U_{B,\text{max}}$.

(d) We return to Eq. 31-37 (though other, equivalent, approaches could be explored):

$$\frac{di}{dt} = \frac{-\mathcal{E}_L}{L}$$

By the loop rule, $\mathcal{E}_L$ is at its most negative value when the capacitor voltage is at its most positive (V_C). Using this plus the frequency relationship between L and C (Eq. 33-4) leads to

$$\left|\frac{di}{dt}\right|_{\text{max}} = \omega^2 C V_C = 998 \text{ A/s} .$$

(e) Differentiating Eq. 31-51, we have

$$\frac{dU_B}{dt} = Li\frac{di}{dt} \quad .$$

As in the previous part, we use $L = 1/\omega^2 C$. We also use a simple sinusoidal form for the current, $i = I \sin \omega t$:

$$\frac{dU_B}{dt} = \frac{1}{\omega^2 C} I^2 \omega \sin \omega t \cos \omega t$$

where this I is equivalent to the I_C used in part (a). Using a well-known trig identity, we obtain

$$\left(\frac{dU_B}{dt}\right)_{\text{max}} = \frac{I^2}{2\omega^2 C} (\sin 2\omega t)_{\text{max}} = \frac{I^2}{2\omega^2 C}$$

which yields a (maximum) time rate of change (for U_B) equal to 2.60×10^{-3} J/s.