Problem 8.1

Consider a pure tone at 9000Hz, $x(t) = \cos(2\pi 9000t)$.

(a) $y[n] = \cos(2\pi 9000n/10,000) = \cos(-2\pi 0.1n) = \cos(2\pi 0.1n)$, so $\omega_a = 0.2\pi$ or $\omega_a = -0.2\pi$ are both correct.

(b) It has energy at 
$$\Omega_a = \omega_a F_s = (\pm 0.2\pi \pm 2\pi k) F_s = 2\pi (\pm 1000 \pm 10,000k)$$

for every integer value of $k$.

(c) We want $H(\Omega) = T$ for $-\frac{T}{2} \leq \Omega \leq \frac{T}{2}$, so
$$h(t) = \text{sinc} \left( \frac{\pi t}{T} \right)$$