[We will ignore CP violation in this problem, so several statements here are approximate.]

$K^0 (= d\bar{s})$ and $\bar{K}^0 (= \bar{d}s)$ are produced by strong interaction. Since strong interactions conserve strangeness, $K^0$ and $\bar{K}^0$ decay by weak interaction. In fact, $K^0$ and $\bar{K}^0$ don't even have well defined masses & lifetimes because they are not eigenstates of the weak hamiltonian. Instead, states

$$|k^0_\pm\rangle \equiv \frac{1}{\sqrt{2}} \left( |k^0\rangle \mp |\bar{k}^0\rangle \right)$$

(a) Show that $|k^0_\pm\rangle$ are orthonormal.

(assume $\langle k^0 | k^0 \rangle = \langle \bar{k}^0 | \bar{k}^0 \rangle = 1$ & $\langle k^0 | \bar{k}^0 \rangle = 0$)

(b) Express $|k^0\rangle$ and $|\bar{k}^0\rangle$ in terms of $|k^0_\pm\rangle$.

(c) Compute the fraction of $|k^0_+\rangle$ in $|k^0\rangle$.

(i.e. $|\langle k^0_+ | k^0 \rangle|^2$).

The states $k^0_\pm$ evolve with masses $m_\pm$ and lifetimes $\tau_\pm$:

$$|k^0_\pm(t)\rangle = e^{-i m_\pm t/\hbar} e^{-t/2 \tau_\pm} |k^0_\pm(0)\rangle$$
(d) Find the $K^0_\pm$ survival probability, i.e. $|\langle K^0_\pm(t)|^2$

Let us say that we produced a $K^0$ at $t=0$.
(but not a $K^0$) i.e. $|K^0(0)>=1$ & $|\bar{K}^0(0)>=0$
(c) Compute $|K^0_\pm(0)>$ (Very easy!) 
(b) Compute $|K^0_\pm(t)>$ (Very easy!)
(g) Compute $|K^0(t)> \& |\bar{K}^0(t)>$ (Very easy!)
(h) Define $\Delta m = m_- - m_+$. Assume $\mathcal{T} \to \infty$ and calculate $|\langle K^0(t)||^2 \& |\langle \bar{K}^0(t)||^2$. Observe that the $\bar{K}^0$ component is nonzero (\& came out \& $K^0$ !)
(i) Sketch $|\langle K^0(t)||^2$ as a function of $t$ assuming $\tau = 10^{-10}$ seconds and $\frac{\hbar}{\Delta m} = 2 \times 10^{-10}$ seconds