a. $Q = 35$

b. $\zeta = \dfrac{1}{2Q} = \dfrac{1}{70} = 0.0143$

c. $f_n = 2.5 \text{ KHz}$

d. $m = 100 \mu g = (100 \times 10^{-6})(1 \times 10^{-3}) = 1 \times 10^{-7} \text{ Kg}$

$\omega_n = 2\pi f_n$

$\omega_n^2 = \dfrac{k}{m}$

$k = m \omega_n^2 = m(2\pi f_n)^2 = 1 \times 10^{-7}(2\pi(2500))^2 = 24.67 \text{ N/m}$

e. $\dfrac{c}{m} = \dfrac{\omega_n}{Q}$

$c = \dfrac{m \omega_n}{Q} = \dfrac{m 2\pi f_n}{Q} = \dfrac{(1 \times 10^{-7}) 2\pi (2500)}{35} = 4.49 \times 10^{-5} \text{ Kg/s}$

f. input amplitude $= 0.2 \mu m$

$\text{output amplitude} = (\text{input amplitude}) \left| T(j\omega t) \right|_{\omega_N}$

$\qquad = (\text{input amplitude}) Q$

$\qquad = (0.2 \mu m)(35)$

$\qquad = 7 \mu m$

g. if $x(t) = X_0 \sin(\omega t) \rightarrow$ displacement

$\dot{x}(t) = X_0 \omega \cos(\omega t) \rightarrow$ velocity

$\ddot{x}(t) = -X_0 \omega^2 \sin(\omega t) \rightarrow$ acceleration

$\left| \ddot{y}(t) \right| = Q \ddot{x}(t)$

$\omega = \omega_n$

$\left. \ddot{y}(t) \right|_{max} = Q X_0 \omega_n^2 = 35(2 \times 10^{-7})(2\pi 2500)^2 = 1727 \text{ m/s}^2$

$\left. \ddot{y}(t) \right|_{max} = \dfrac{1727}{9.8} = 176 \text{ G's}$

h. $\dfrac{\omega_n}{Q} = \dfrac{2\pi f_n}{Q} = \dfrac{2\pi(2500)}{35} = 448.8\ s^{-1}$

$\omega_n^2 = (2\pi f_n)^2 = (2\pi 2500)^2 = 2.47 \times 10^8\ s^{-2}$

$T(s) = \dfrac{\frac{\omega_n}{Q}s + \omega_n^2}{s^2 + \frac{\omega_n}{Q}s + \omega_n^2} = \dfrac{448.8s + 2.47 \times 10^8}{s^2 + 448.8s + 2.47 \times 10^8}$

Sample M-file:

```
%Transmissibility M-file for HW #3
clear all;
format compact;
format long;

Q=35
fn=2500

for i=1:5000,
    f(i)=i;
    T(i)=sqrt((1+(i/(Q*fn))^2)/((1-(i/fn)^2)^2+(i/(Q*fn))^2));
end

plot(f,T)
```


Transmissibility Vs. Frequency