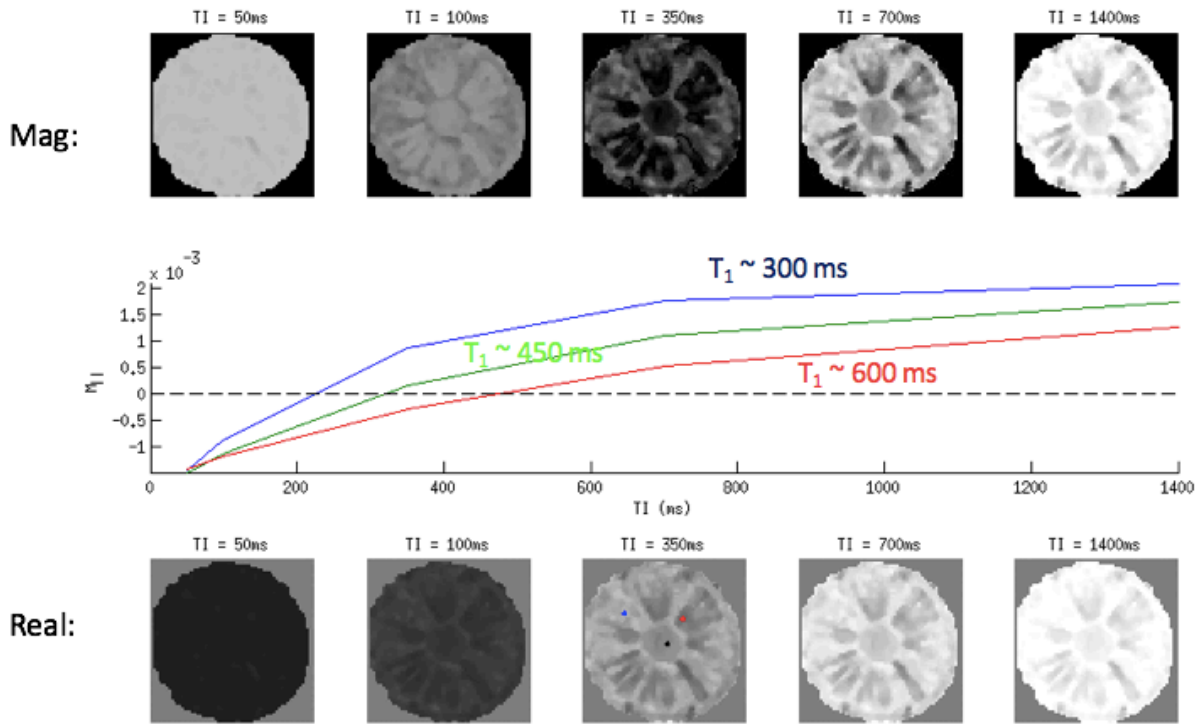**HW6: Answer Key**

1) *What is different about the top and bottom rows of images? (1 sentence)*

The top row (magnitude reconstruction of data) is the absolute value of the bottom row (real-valued reconstruction).

2) *What inversion time would you use to null the signal from the "tissue" with T_1 = 450ms?*

Something like 300 ms. To solve for it quantitatively, use the equation describing the T_1 recovery curve:

Basic equation: $\quad\quad\quad\quad\quad$ $M = M_0(1-2e^{-t/T_1})$
Signal is nulled when M=0: $\quad$ $0 = M_0(1-2e^{-t/450})$
For convenience, set M_0=1: $\quad$ $0 = 1-2e^{-t/450}$
Solve: $\quad\quad\quad\quad\quad\quad\quad$ $2e^{-t/450} = 1$
$\quad\quad\quad\quad\quad\quad\quad\quad\quad$ $e^{-t/450} = 0.5$
$\quad\quad\quad\quad\quad\quad\quad\quad\quad$ $-t/450 = \ln(0.5)$
$\quad\quad\quad\quad\quad\quad\quad\quad\quad$ $-t/450 = -0.69$
$\quad\quad\quad\quad\quad\quad\quad\quad\quad$ $t = 312$ ms

3) *What would be the appropriate inversion time for nulling the signal from the "green tissue" if it only had half as much water in it (half the proton density)?*

Changing the amplitude of the curve does not change the rate of decay, so the inversion time would be the same (350 ms).

On the other hand, in the real world, lowering the proton density means lowering the water content … and usually higher water content is associated with longer T_1. So reduced PD (M_0) is likely associated with longer T_1 and longer inversion time for nulling … but this was just a theoretical/mathematical question.