Quiz 8 Name:
Chem 311
Fall 2003

You have performed a re-dox titration experiment to measure the concentration of phosphate ion, PO_4^{3-}. The experiment protocol that you are following calls for precipitation of the phosphate by the addition of Mo to form $(NH_4)_3PO_4 \cdot 12MoO_3(s)$, which is washed and dissolved in sulfuric acid forming the Mo^{6+} ion. Then, the solution is passed through a Jones redactor, which reduces the Mo^{6+} to Mo^{3+}. Mo^{3+} is collected in excess Fe^{3+} in 1 M H_2SO_4 forming MoO_2^{2+} (see Table 16-3) and Fe^{2+}. The Fe^{2+} that is formed is titrated with Ce^{4+}. Calculate the $[PO_4^{3-}]$ given that the aliquot of original phosphate solution is 25.00 ml and that the titration required 21.43 ml of 0.1204 M Ce^{4+} to reach the endpoint.

$MoO_2^{2+} + 4H^+ + 3e^- \leftrightarrow Mo^{3+} + 2H_2O$	$E^0 = 0.428$ V
$Zn^{2+} + 2e^- \leftrightarrow Zn(s)$	$E^0 = -0.762$ V
$Fe^{3+} + e^- \leftrightarrow Fe^{2+}$	$E^0 = 0.767$ V
$Ce^{4+} + e^- \leftrightarrow Ce^{3+}$	$E^0 = 1.70$ V

Write balance equations

$$Ce^{4+} + Fe^{2+} \rightarrow Ce^{3+} + Fe^{3+}$$

$$Mo^{3+} + 3Fe^{3+} + 2H_2O \rightarrow MoO_2^{2+} + 3Fe^{2+} + 4H^+$$

$[PO_4^{3-}]$
= (21.43 ml*(0.1204 M)*(1mmol Fe^{2+}/1 mmol Ce^{4+})*(1 mmol Mo^{3+}/3 mmol Fe^{2+})
(1 mmol PO_4^{3-}/12 mmol Mo)(1/25.00 ml) = 0.002867 M PO_4^{3-}