# Chapter 4 − Problems 50, 56

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50. The Vanadium (V) ion in a .5000[g] sample of ore is converted to $VO_2{}^+$ ions. The amount of $VO_2{}^+$ in solution can be determined by reaction with an acid solution of $KMnO_4$. The balanced equation for the reaction is (1). What is the mass percent of vanadium in the ore if 26.45[mL] of .02250[M] permanganate solution is required to complete the reaction? (2)

$$5\,VO^{2+} + MnO_4{}^- + 11\,H_2O \longrightarrow Mn^{2+} + 5\,V(OH_4)^+ + 2\,H^+ \tag{1}$$
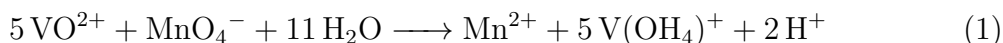
$$26.45[\text{mL}] \rightarrow .02645[\text{L}]$$
$$.0225 \cdot .02645 = .000595[\text{mol}_{MnO_4{}^-}] \rightarrow .002975[\text{mol}_{VO^{2+}}]$$
$$.002975 \cdot 51 = .1517[\text{g}_V] \tag{2}$$
$$\%_V = \frac{.1517}{.5} \cdot 100\% = 30.3\%$$

56. Laws passed in some states define a drunk driver as one who drives with a blood alcohol level of .10% by mass or higher. The level of alcohol can be determined by titrating blood plasma with potassium dichromate according to the equation: (3). Assuming that the only substance that reacts with dichromate in blood plasma is alcohol, is a person legally drunk if 38.94[mL] of .0723[M] potassium dichromate is required to titrate a 50.0[g] sample of blood plasma? (4)

$$16\,H^+ + 2\,Cr_2O_7{}^{2-} + C_2H_5OH \longrightarrow 4\,Cr^{3+} + 2\,CO_2 + 11\,H_2O \tag{3}$$
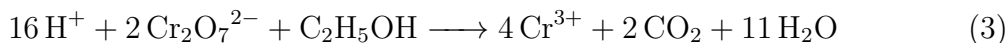
$$38.94[\text{mL}] \rightarrow .03894[\text{L}]$$
$$.0723 \cdot .03894 = .00281[\text{mol}_{Cr_2O_7{}^{2-}}] \rightarrow .00141[\text{mol}_{C_2H_5OH}]$$
$$.00141 \cdot 46 = .0649[\text{g}_{C_2H_5OH}] \tag{4}$$
$$\%_{C_2H_5OH} = \frac{.0649}{50} \cdot 100\% = .129\%$$
$$\text{Yes, the person is legally drunk}$$