Friday Worksheet **Name:**

…….

Volumetric 7

Tellurite TeO_2 (M = 159.6 g mol^-) is often used in the manufacture of optical fibres and is found naturally in ore samples.

The amount of tellurite in an ore sample can be determined by reaction with acidified dichromate where TeO_2 is converted into H_2TeO_4 and $Cr_2O_7^{2-}$ is converted into Cr^{3+}.

A 1.085 g ore sample containing tellurite is dissolved in acid. The resulting solution was then reacted with 50.00 mL of 0.03089 M $K_2Cr_2O_7$ to form H_2TeO_4. The amount of unreacted $Cr_2O_7^{2-}$ ions in the above reaction was then determined by titrating the solution with 0.0520 M $Fe(NO_3)_2$ solution. An average titre of 20.00 was required to reach the end point. The equation for this reaction is

$6Fe^{2+}(aq) + Cr_2O_7^{2-}(aq) + 14H^+(aq) => 2Cr^{3+}(aq) + 6Fe^{3+}(aq) + 7H_2O(l)$

a) i) write the half equation for the oxidation of TeO_2

$2H_2O(l) + TeO_2 => H_2TeO_4 + 2H^+ + 2e$

ii) write the half equation for the reduction of $Cr_2O_7^{2-}$

$6e + 14H^+(aq) + Cr_2O_7^{2-}(aq) => 2Cr^{3+}(aq) + 7H_2O(l)$

iii) Balance the chemical equation below by writing the coefficient of each chemical species in the space provided.

3 $TeO_2(s)$ + *1*$Cr_2O_7^{2-}(aq)$ + *8*$H^+(aq)$ => *3*$H_2TeO_4(aq)$ + *2*$Cr^{3+}(aq)$ + *1*$H_2O(l)$

b) Calculate the amount, in moles, of excess dichromate ion.

$n(Fe^{2+}) = 0.0520 \text{ X } 0.020 = 1.04 \text{ X } 10^{-3}$

$n(Cr_2O_7^{2-}) = 1.04 \text{ X } 10^{-3} / 6 = 1.73 \text{ X } 10^{-4}$

c) Calculate the amount, in moles, of dichromate that reacted with the tellurite

$n(Cr_2O_7^{2-})_{in\ excess} = 1.73 \text{ X } 10^{-4}$

$n(Cr_2O_7^{2-})_{supplied} = 0.03089 \text{ X } 0.0500 = 0.001544$

$n(Cr_2O_7^{2-})_{reacted} = 0.001544 – 0.000173 = 0.00137$

d) Calculate the mass of tellurite in the ore sample.

$n(TeO_2) = 3 \text{ X } n(Cr_2O_7^{2-})_{reacted} = 3 \text{ X } 0.00137 = 0.00411$

$mass(TeO_2) = 0.00411 \text{ X } 159.6 = 0.656 \text{ g}$