Volumetric Analysis: Oxidation-Reduction

Use the following values of relative atomic masses in answering these questions : H =1, C =12, N=14, O=16, Na =23, S =32, Cl = 35.5, K = 39, Mn = 55, Fe = 56, I = 127

(1.) A 0.15 M Ammonium Iron (II) sulfate solution was made up and used to standardise a solution of potassium permanganate.
$25cm^3$ of the ammonium iron (II) sulfate solution was titrated against the potassium permanganate solution.
The average titration figure was 22.85 $cm^{3..}$
Calculate the concentration of the potassium permanganate solution in;
(a) moles per litre
(b) grams per litre

$$\frac{V_O \times M_O}{n_o} = \frac{V_r \times M_{red}}{n_1}$$

V_O = M_O = n_o = V_r = M_{red} = n_r =

(2) It was found that $25cm^3$ of a solution of iron (Ii) sulfate reacted with $23.45cm^3$ of 0.02M $KMnO_4$
solution.
Calculate the concentration of the iron (II) sulfate solution in:
(a) moles per litre and
(b) grams of crystalline $FeSO_4.7H_2O$ per litre.
What other substance apart from the iron (II) sulfate solution should be added to the conical flask?
Give the reason for adding the other substance.

$$\frac{V_O \times M_O}{n_o} = \frac{V_r \times M_{red}}{n_1}$$

V_O = M_O = n_o = V_r = M_{red} = n_r =

(3) 10.52 g of ammonium iron (II) sulfate crystals, $(NH_{4)})_2SO_4.FeSO_4.6H_2O$ was weighed out, then dissolved in dilute sulfuric acid and the solution made up to $250cm^3$ in a volumetric flask.
$25cm^3$ of this solution reacted with $23.8cm^3$ of a solution of potassium permanganate.
Calculate the concentration of the potassium permanganate solution in:
(a) moles per litre
(b) grams of crystalline $KMnO_4$ per litre.

$$\frac{V_O \times M_O}{n_o} = \frac{V_r \times M_{red}}{n_1}$$

V_O = M_O = n_o = V_r = M_{red} = n_r =

(4) A mass of 6.08 grams of iron(II) sulfate crystals ($FeSO_4.xH_2O$) was dissolved in deionised water which had been acidified with dilute sulfuric acid.
The resulting solution was made up to 250cm^3 in a volumetric flask.
25cm$_3$ of this solution required 21.8cm$_3$ of 0.02 M $KMnO_4$ solution for complete reaction.
(a) Outline the procedure for transferring the crystals to the volumetric flask.
(b) Why was it necessary to acidify the deionised water used to dissolve the crystals?
(c) In carrying out the titration, it was also necessary to add sulfuric acid to the conical flask. What is the reason for this?
What would be observed if sulfuric acid were not added to the conical flask?
(d) Calculate the value of x in the above formula.

$$\frac{V_O \times M_O}{n_o} = \frac{V_r \times M_{red}}{n_1}$$

V_O = M_O = n_o = V_r = M_{red} = n_r =

(5) A mass of 9.80g of ammonium iron (II) sulfate crystals $(NH_4)_2 SO_4$. x H_2O was dissolved in dilute sulfuric acid and the resulting solution was made up to 250cm^3 in a volumetric flask. 25cm^3 of this solution was titrated against 0.021 M $KMnO_4$ solution.
The average titration figure was 23.85cm$_3$,
Calculate the value of x in the above formula.

$$\frac{V_O \times M_O}{n_o} = \frac{V_r \times M_{red}}{n_1}$$

V_O = M_O = n_o = V_r = M_{red} = n_r =

(6) A chemist dissolved 7.84g of ammonium iron (II) sulfate,$(NH_4)_2SO_4$. $FeSO_4.xH_2O$ in dilute sulfuric acid and made up the solution to 250cm^3 with distilled water, 25cm^3 of this solution required 20cm^3 of 0.02 M potassium manganate (VII) (potassium permanganate) for complete reaction according to the equation :
$5Fe^{2+} + MnO_4^- + 8H^+ \rightarrow 5Fe + Mn^{2+} 4H_2O$
(i) Why was dilute sulfuric acid used in making up the iron (II) salt solution?
(ii) Find the concentration, in moles per litre, of Fe^{2+} ions in the solution.

(iii) Find the value of x.

(iv) Show clearly any changes in oxidation numbers which have occurred in the reaction.

$$\frac{V_O \times M_O}{n_o} = \frac{V_r \times M_{red}}{n_1}$$

V_O = M_O = n_o = V_r = M_{red} = n_r =

(7)