TRANSITION METALS (D)

A sample of hydrated iron(II) sulfate, $FeSO_4.nH_2O$, was analysed using potassium manganate(VII). 6.482 g of hydrated iron(II) sulfate was dissolved in water and made up to 250 cm^3 in a volumetric flask. 25 cm^3 samples were acidified using dilute sulfuric acid and then titrated against 0.01960 mol dm^{-3} potassium manganate(VII) requiring a mean of 23.70 cm^3 (using concordant titres).

a Why could dilute hydrochloric acid not be used to acidify the reaction?

some $KMnO_4$ would oxidise the hydrochloric acid to chlorine (1)

b What are concordant titres?

titres within 0.1 cm^3 (1)

c During the titration, all readings from the burette were taken from the top of the meniscus. Explain why.

cannot see the bottom due to the dark colour (1)

d Why does it not matter that these readings were all taken from the top of the meniscus?

finding the difference in volume and so it is fine as we read it the same way each time (1)

e What would have happened to the mean titre if the volumetric flask had been filled up so that the top (rather than the bottom) of the meniscus was on the line? Explain your answer.

solution would have been more concentrated than it should have been
so titre would have been greater (2)

f Calculate the relative formula mass of the hydrated iron(II) sulfate, and then the value of ***n***. Give your answers to the appropriate number of significant figures.

mol $KMnO_4$ = $0.01960 \; x \; \frac{23.70}{1000} = 4.645 \; x \; 10^{-4}$

mol Fe^{2+} in flask = $5 \; x \; 10 \; x \; 4.645 \; x \; 10^{-4} = 0.02323$

M_r of $FeSO_4.nH_2O$ = $\frac{6.482}{0.02323} = 279.1 = 279 \; (3sf)$

n **= $\frac{279.1 - 151.9}{18.0} = 7.066 = 7 \; (\text{nearest integer})$** (4)