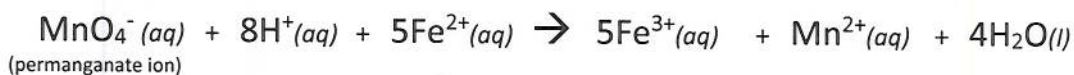


Name \_\_\_\_\_ Finding the % iron in an iron(II) compound problem set



1. Find the % (by mass) of iron in each of the following iron II-containing compounds:

a.  $\text{Fe}(\text{NH}_3)_2 (\text{SO}_4) \cdot 6\text{H}_2\text{O}$  14.2 %

b.  $\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$  28.1 %

c.  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  20.1 %

2. A 0.500 gram sample of an iron II-containing ionic compound is dissolved in distilled water and sulfuric acid. The sample is titrated with 10.20 mL of 0.025 M  $\text{KMnO}_4$  until a light pink color persists.

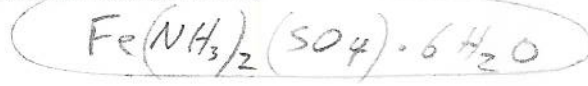
a. What is the % iron in the compound?

$$\frac{0.025 \text{ mol MnO}_4^-}{1000 \text{ ml solution}} \times 10.20 \text{ ml solution} = 0.000255 \text{ mol MnO}_4^-$$

|                         |                           |
|-------------------------|---------------------------|
| $5 \text{ mol Fe}^{2+}$ | $55.85 \text{ g Fe}^{2+}$ |
| $1 \text{ mol MnO}_4^-$ | $1 \text{ mol Fe}^{2+}$   |

$$\frac{0.0712 \dots \text{ g Fe}^{2+}}{0.500 \text{ g sample}} \times 100 = 14.2 \%$$

b. The compound is most likely which one of the three shown above in # 1?



3. A 0.300 gram sample of an iron II-containing ionic compound is dissolved in distilled water and sulfuric acid. The sample is titrated with 14.40 mL of 0.015 M  $\text{KMnO}_4$  until a light pink color persists.

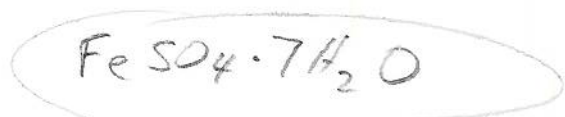
a. What is the % iron in the compound?

$$\frac{0.015 \text{ mol MnO}_4^-}{1000 \text{ ml solution}} \times 14.40 \text{ mL solution} = 0.000216 \text{ mol MnO}_4^-$$

|                         |                           |
|-------------------------|---------------------------|
| $5 \text{ mol Fe}^{2+}$ | $55.85 \text{ g Fe}^{2+}$ |
| $1 \text{ mol MnO}_4^-$ | $1 \text{ mol Fe}^{2+}$   |

$$\frac{0.0603 \dots \text{ g Fe}^{2+}}{0.300 \text{ g sample}} \times 100 = 20.1 \%$$

b. The compound is most likely which one of the three shown above in # 1?





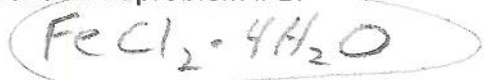
4. A 0.65 gram sample of an iron II-containing ionic compound is dissolved in distilled water and sulfuric acid. The sample is titrated with 26.20 mL of 0.025 M  $\text{KMnO}_4$  until a light pink color persists.

a. What is the % iron in the compound?

$$\frac{0.025 \text{ mol MnO}_4^-}{1000 \text{ ml solution}} \times 26.20 \text{ mL solution} = 0.000655 \text{ mol MnO}_4^- \times \frac{5 \text{ mol Fe}^{2+}}{1 \text{ mol MnO}_4^-} \times \frac{55.85 \text{ g Fe}^{2+}}{1 \text{ mol Fe}^{2+}} = 0.1829 \dots \text{ g Fe}^{2+}$$

$$\frac{0.1829 \dots \text{ g Fe}^{2+}}{0.65 \text{ g sample}} \times 100 = 28.1\%$$

b. The compound is most likely which one of the three shown in problem #1?



5. What volume (in mL) of 0.025 M  $\text{KMnO}_4$  will be required to oxidize all the iron II ions in a 0.50 gram sample of  $\text{Fe}(\text{NH}_3)_2 (\text{SO}_4) \cdot 6\text{H}_2\text{O}$ ?

$$\frac{14.2 \text{ g Fe}^{2+}}{100 \text{ g Fe}(\text{NH}_3)_2 (\text{SO}_4) \cdot 6\text{H}_2\text{O}} \times 0.50 \text{ g} = 0.071 \text{ g Fe}^{2+} \times \frac{1 \text{ mol Fe}^{2+}}{55.85 \text{ g Fe}^{2+}} \times \frac{1 \text{ mol MnO}_4^-}{5 \text{ mol Fe}^{2+}} = 0.000254 \dots \text{ mol MnO}_4^-$$

|                                      |              |         |                                    |
|--------------------------------------|--------------|---------|------------------------------------|
| $0.000254 \dots \text{ mol MnO}_4^-$ | 1 L solution | 1000 mL | = 10.2 mL $\text{KMnO}_4$ solution |
| $0.025 \text{ mol MnO}_4^-$          | 1 L          | 1 L     |                                    |

6. What volume (in mL) of 0.025 M  $\text{KMnO}_4$  will be required to oxidize all the iron II ions in a 0.40 gram sample of  $\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$ ?

$$\frac{28.1 \text{ g Fe}^{2+}}{100 \text{ g FeCl}_2 \cdot 4\text{H}_2\text{O}} \times 0.40 \text{ g} = 0.1124 \text{ g Fe}^{2+} \times \frac{1 \text{ mol Fe}^{2+}}{55.85 \text{ g Fe}^{2+}} \times \frac{1 \text{ mol MnO}_4^-}{5 \text{ mol Fe}^{2+}} = 0.000402 \dots \text{ mol MnO}_4^-$$

|                                      |              |         |                                    |
|--------------------------------------|--------------|---------|------------------------------------|
| $0.000402 \dots \text{ mol MnO}_4^-$ | 1 L solution | 1000 mL | = 16.1 mL $\text{KMnO}_4$ solution |
| $0.025 \text{ mol MnO}_4^-$          | 1 L          | 1 L     |                                    |

7. What volume (in mL) of 0.025 M  $\text{KMnO}_4$  will be required to oxidize all the iron II ions in a 0.35 gram sample of  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ ?

$$\frac{20.1 \text{ g Fe}^{2+}}{100 \text{ g FeSO}_4 \cdot 7\text{H}_2\text{O}} \times 0.35 \text{ g} = 0.07035 \text{ g Fe}^{2+} \times \frac{1 \text{ mol Fe}^{2+}}{55.85 \text{ g Fe}^{2+}} \times \frac{1 \text{ mol MnO}_4^-}{5 \text{ mol Fe}^{2+}} = 0.0002519 \dots \text{ mol MnO}_4^-$$

|                                       |              |         |                                    |
|---------------------------------------|--------------|---------|------------------------------------|
| $0.0002519 \dots \text{ mol MnO}_4^-$ | 1 L solution | 1000 mL | = 10.1 mL $\text{KMnO}_4$ solution |
| $0.025 \text{ mol MnO}_4^-$           | 1 L          | 1 L     |                                    |