Significant figures

Temp of H_2 (K) = °C + 273,2

(22.6)

$$\begin{array}{r} 273.15 \\ +\ 022.6\ ? \\ \hline 295.75 \end{array}$$

Rules of addition / subtraction

In addition or subtraction, any uncertain digit being added or subtracted makes the same digit in the answer not significant.

If the first digit dropped is ≥ 5, the previous digit is rounded up.

295,75 ⟶ 299,8

Since all temperature measurements only have one digit past the decimal point, the constant 273,2 is used.

⟶ $P_{H_2} = P_{atm} - P_{H_2O} - P_{height}$

753,0

only one digit past the decimal

27.9 (3 sigfigs)
× .012 (2 sig figs)
558
2790
.3348

In multiplication, every digit interacts with every digit.

Rules of multiplication/division

The number being multiplied or divided with the least number of sigfigs determines the number of sigfigs in the answer.

<5

moles of H_2

$$n_{H_2} = n_{Mg} = \frac{m_{Mg}}{MM_{Mg}} = \frac{0.0441\ g}{24.305\ g/mol}$$

0.0441 g: 3 sigfigs
24.305 g/mol: 3 sigfigs

Green crystal

Transition metal complex

$$AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$$

$AgCl(s) + 2NH_3(aq) \longrightarrow [Ag(NH_3)_2]Cl(aq)$

complex ion – an ion created by the combination of two or more ions or molecules.

$[Ag(NH_3)_2]^+$ This complex has the same charge as silver itself since the ammonia molecules attached are neutral.

This complex allows silver to be soluble in the presence of chloride.

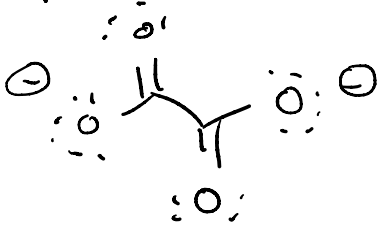
ligand – An ion or molecule that attaches to the central atom in a complex.

iron (III) chloride hexahydrate

$FeCl_3 \cdot 6\,H_2O$

hydrate — A substance containing a fixed number of moles of water as part of its molecular structure.

potassium oxalate monohydrate



$K_2C_2O_4 \cdot H_2O$

$FeCl_3 \cdot 6\,H_2O + K_2C_2O_4 \cdot H_2O \longrightarrow$

$KCl_{(aq)} + \underline{K_w}\underline{Fe_x}\underline{(C_2O_4)_y} \cdot z\,H_2O$

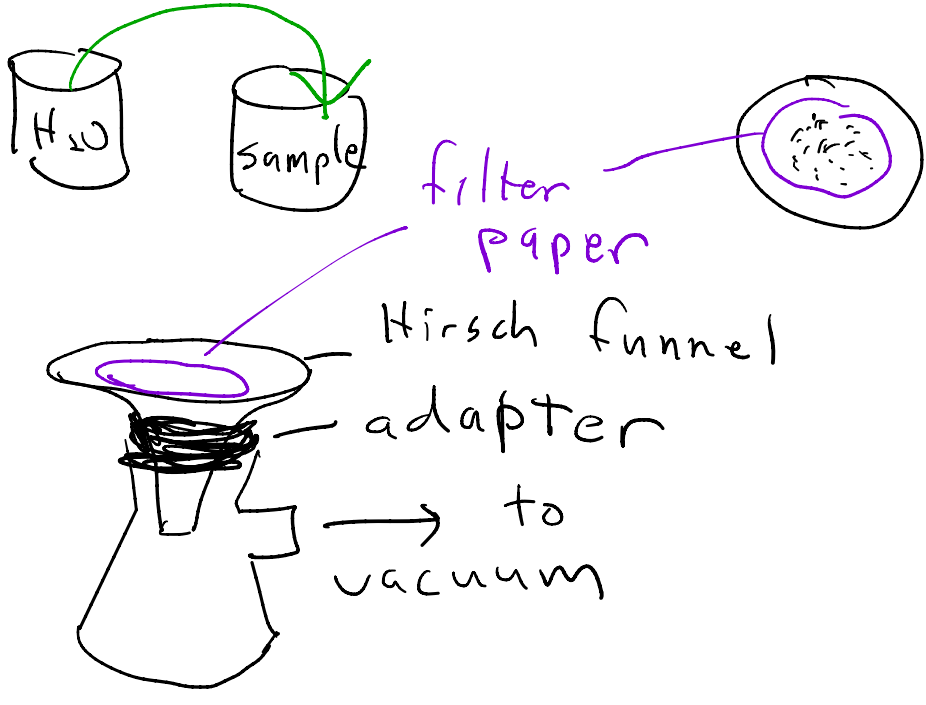
Central oxalate atom (Ligand)

Complex anion

Counter ion – a spectator ion used to balance charge.

Recrystallization – A purification technique in which a substance is dissolved then allowed to crystalize again, leaving impurities behind in solution.

In any real recrystallization, there is a chance the substance may remain soluble even once the temperature is reduced. To prevent loss of product, a minimum quantity of solvent should be used.



Analysis of oxalate

Oxalate can easily decarboxylate under heat or oxidation.

$$2\,\overset{+7}{MnO_4^-}(aq) + 5\,\overset{+3}{C_2O_4^{-2}}(aq) + 16\,H^+(aq) \longrightarrow 2\,Mn^{+2}(aq) + 10\,\overset{+4}{CO_2}(g) + 8\,H_2O(l)$$

Mn: +7 to +2
→ reduced
MnO_4^- was the oxidizing agent

C: +3 to +4
→ oxidized
→ oxalate was the reducing agent

Equivalence point - Reaction of equal moles adjusted for stoichiometry.

Endpoint - The visual observation of the end of the titration (color change)

The endpoint of this rxn is the apperance of the purple color of permanganate. The color occurs because excess permanganate is present, but if the titration is stopped at the last drop, the end point closely matches the equivalence point.

$2\ MnO_4^-(aq) + 5\ C_2O_4^{-2}(aq) + 16\ H^+(aq)$

At the equivalence point, there are two moles of permanganate reacted for every five moles of oxalate.

ratio: $2\ mol\ MnO_4^- : 5\ mol\ C_2O_4^{-2}$

equation: $5n_{MnO_4^-} = 2n_{C_2O_4^{-2}}$

$$5 M_{MnO_4^-} V_{MnO_4^-} = 2 M_{C_2O_4^{-2}} V_{C_2O_4^{-2}}$$

$M_{MnO_4^-}$: given (standardized)

$V_{MnO_4^-}$: measured

$M_{C_2O_4^{-2}}$: goal

$V_{C_2O_4^{-2}}$: measured