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Experiment :- Determination of water equivalent of a Calorimeter & the heat of solution of KCl.

⇒ **Apparatus required :-** Dewar flask, Stopwatch, KNO_3 KCl and distilled water.

⇒ **Theory :-** Heat produced in the calorimeter is shared by the Calorimeter & its accesories and also by the experimental substance present in it. If heat is produced, and the thermal capacity of the substance & the temperature change are known, we can calculate the water equivalent of the calorimeter.

Water equivalent of the Calorimeter is that weight in gram of water, which would require the same amount of heat as would a Calorimeter to raise its temp. by 1° degree.

Heat of solution is defined as the heat evolved or absorbed in kilocatorie per mole of the solute dissolve in a definite quantity of the solvent

$$KCl + water \longrightarrow KCl(aq)$$

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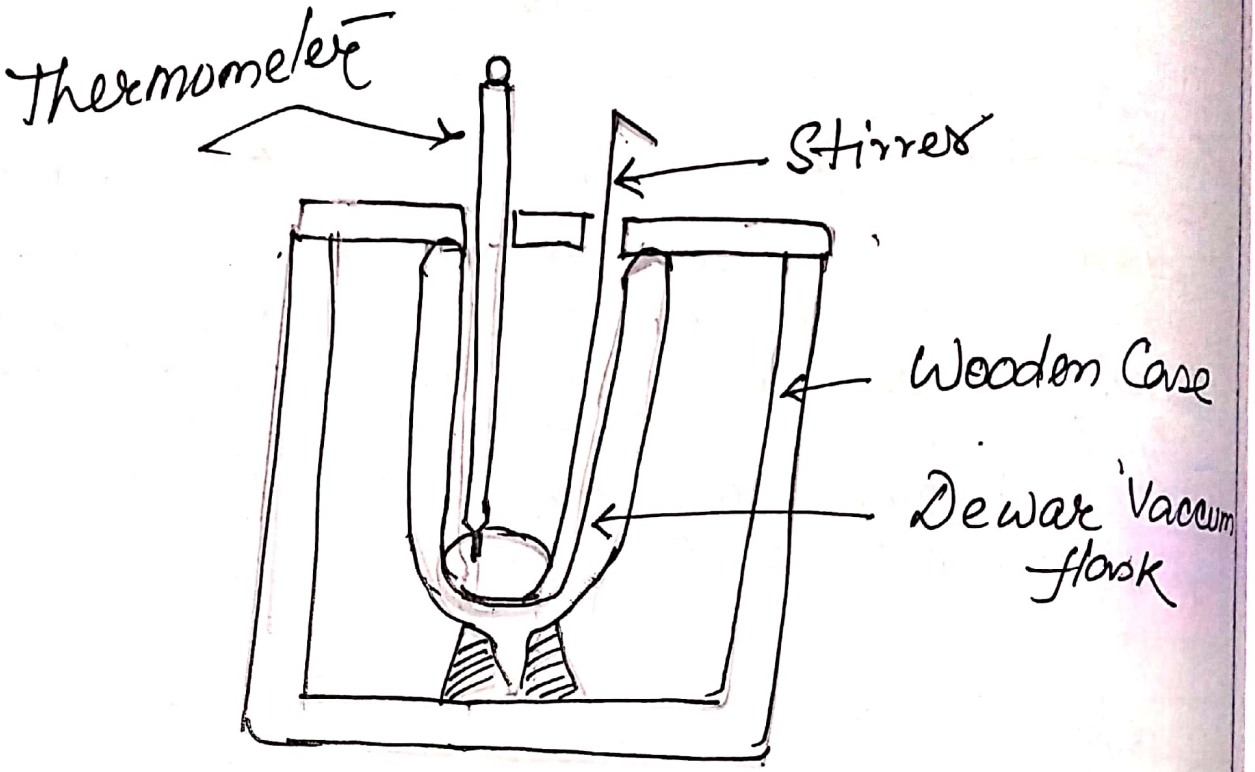

Calorimeter / Dewar Flask.

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Procedure :-

Step – I Dry about 10 gm of KNO_3 at a temp 150°C for an hour. Then weight out accurately 6 gm in a weighing tube ($\frac{1}{18}$ mole of KNO_3)

Step – II Placed 200 ml ($\frac{1}{18}$th of 200 mole of water = 200 gm) of distilled water in a clean & dry Dewar flask as per the diagram

Step III Stirred once in very two seconds and noted the temp. at every half ($\frac{1}{2}$ minute) for 8 minutes. At the 10th minutes transfered the weighted KNO_3 into the flask, with continuous stirring and noting the temp for 10 minutes as usual. Repeated the above experiments for KCl.

Observation table

Observation No.	temp in °C	Observation NO_3	temp in °C	Observation NO_3	temp in °C
1	30	9	30	17	28.5
2	30	10	added KNO_3	18	28.5
3	30	11	29.5	19	28.5
4	30	12	29.5	20	28.5
5	30	13	28.5		
6	30	14	28.5		
7	30	15	28.5		
8	30	16	28.5		

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Calculation :-

From the radiation correction graph curve

$T_1 = 30^\circ C$ $T_2 = 28.5^\circ C$

$\therefore \Delta T = T_1 - T_2 = 30 - 28.5$

$= 1.5^\circ C.$

The water equivalent (W) can be calculated from the principle of calorimeter

Heat gained = Heat lost

$-(200+W)\Delta T = -\frac{Q \times 1000}{18}$ where Q = +8.5 = Heat of solution of KNO_3

$+(200+W)1.5 = +\frac{8.5 \times 1000}{18}$

$(200+W)1.5 = \frac{8.5 \times 1000}{18}$

$W = \left(\frac{8.5 \times 1000}{18 \times 1.5}\right) - 200$

$= \frac{85000}{270} - 200$

$= \frac{8500}{27} - 200$

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$$= \frac{8500 - 5400}{27} = \frac{3100}{27}$$

$$W = 114.81 \text{ gm.}$$

Result:- The water equivant of the calorimeter is 114.81 gm.

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