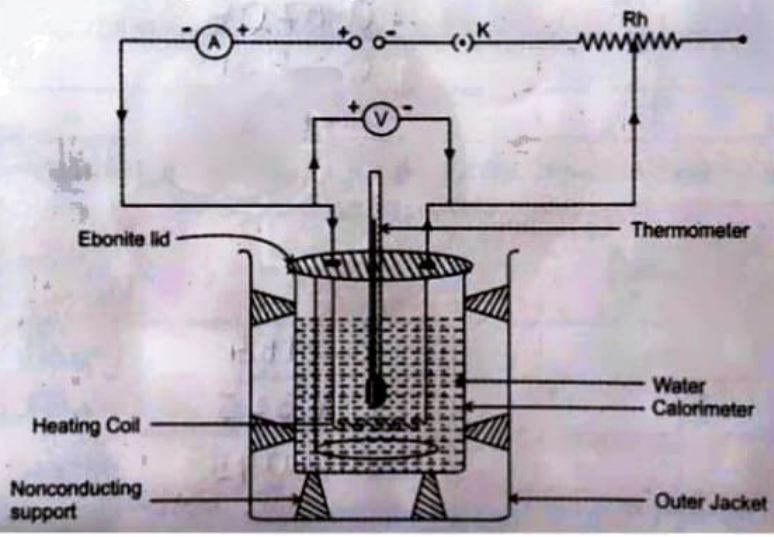
# ACTIVITY NO. 5
# 'J' BY ELECTRICAL METHOD

**Aim :** ' J' by electrical method.

**Apparatus :** Calorimeter with stirrer, heating coil, DC Power supply, ammeter ,voltmeter, rheostat, thermometer, stopwatch, weight box, connecting wires etc.

**Circuit Diagram :**




E : D C Power supply, K : Plug key,
Rh: Rheostat, A : Ammeter, V : Voltmeter,
S : Stirrer

**Formula:**

1. Work done, $W = V I t$
2. Heat gained by the calorimeter with stirrer and water, $H = (m_c c_c + m_w c_w)(\theta_2 - \theta_1)$
3. Mechanical equivalent of heat, $J = \frac{W}{H} = \frac{V I t}{(m_c c_c + m_w c_w)(\theta_2 - \theta_1)}$

**Procedure:**

1. Weigh the empty calorimeter with stirrer.
2. Fill the calorimeter to about two-thirds of its volume with water and weigh it again.
3. Immerse the coil into the water in the calorimeter. Insert the thermometer, stirrer through the slots provided in the lid, into the calorimeter. Place the calorimeter on the non conducting supports inside the outer jacket.
4. Connect the circuit as shown in the figure above. Adjust the rheostat to position of maximum resistance.
5. Note the initial temperature ($\theta_1$) of the water in the calorimeter.
6. Pass current in the circuit and adjust the rheostat so that desired current (I) passes in the coil.
7. Note the potential difference , (V) across the coil.
8. Pass a steady current I through the coil for time t so that the temperature of the water rises by 10°C.
9. Note the final temperature ($\theta_2$) of the water.

**Observations :**

1. Mass of the empty calorimeter with stirrer, $m_c$= 28.5 g.
2. Mass of the calorimeter with stirrer and water, m= 128.5 g.
3. Hence mass of water = $m_w$ = m – mc = 100 g.
4. Initial temperature of the water, $\theta_1$ = 33 °C.
5. Final temperature of the water, $\theta_2$ = 37 °C.
6. Potential difference across the coil, V = 0.5 Volts.
7. Current through the coil, I = 0.1 A.

8. Specific heat of material of calorimeter and stirrer, $C_c$ = ....0.1.... $\frac{cal}{gram\ 0_C}$ (given)

9. Specific heat of water , $C_w$ = ....1..... $\frac{cal}{gram\ 0_C}$ (given)

**Calculations:**

$$J = \frac{W}{H} = \frac{VIt}{(m_c c_c + m_w c_w)(\theta_2 - \theta_1)}$$

$$= \frac{2 \times 1 \times 96}{(28.5 \times 0.1 \times 100 \times 1)(37.33)^2}$$

$$= 4.14\ J/cal.$$