

Adkins 3.1 (2)

Find the work required to charge a capacitor to charge Q .

The work required to move a charge dq across a potential difference V is given by

$$dW = V dq \quad (i)$$

At any instant in time, as a capacitor is being charged, the potential difference across the capacitor plates is related to the amount of charge already on the capacitor plates by

$$V = q/c \quad (ii)$$

where c is the capacitance, usually measured in Farads.

Plugging this into eq. (i) and integrating from $q=0$ to $q=Q$

$$\int dW = \int_0^Q \left(\frac{q}{c}\right) dq$$

$$W = \frac{1}{2c} Q^2$$