Phys. Lab 2

Dr. Ishaq Musa

Experimental No. (4) THE POTENTIOMETER: InternalResistance of a Test Cel

OBJECTIVE: To calibrate a one meter slide wire potentiometer using a standard cell and then to use this potentiometer to measure the emf of a test cell. The terminal voltage of the same test cell is then measured as different load resistors are connected across the test cell and these data are used to determine the internal resistance of the test cell.

EMF & Terminal Voltage

• An electric circuit needs a battery or a generator to produce current – these are called *Sources of "Electromotive Force" or EMF.*

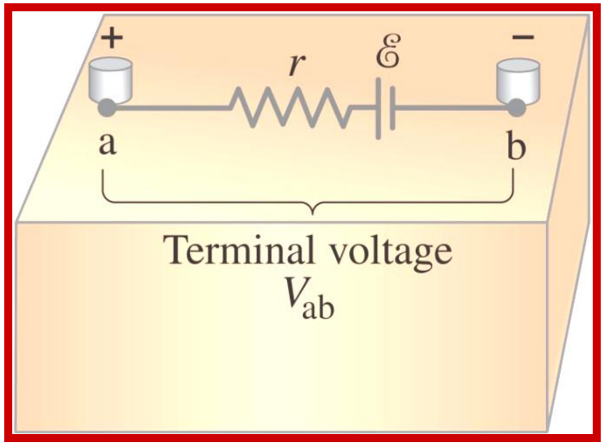
• It is important to remember that, despite its misleading name,

EMF is a VOLTAGE source!

It is NOT a FORCE!!

• A battery is a nearly constant voltage source, but it does have a small internal resistance r, which reduces the actual voltage from the ideal EMF:

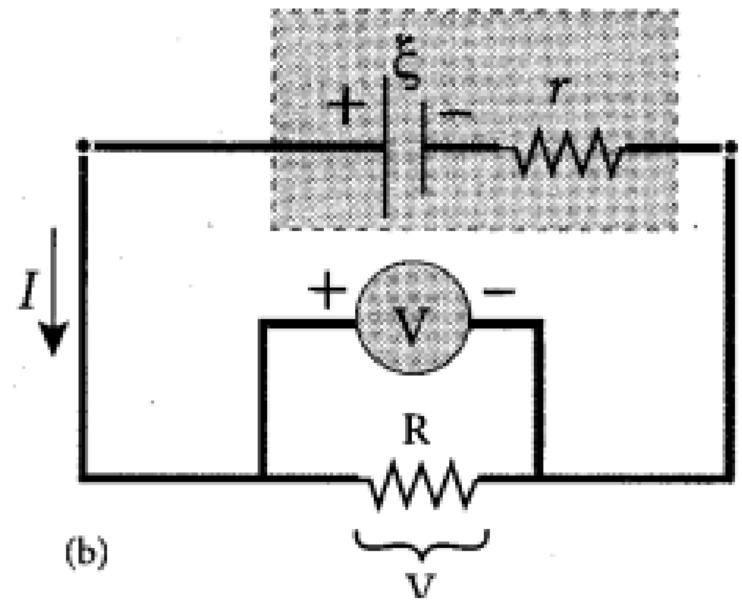
$$V_{ab} = \mathcal{E} - Ir.$$



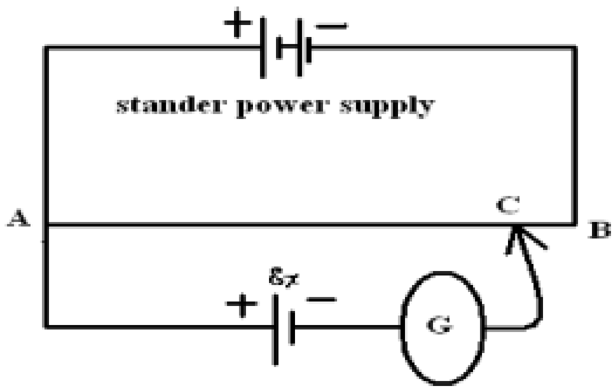
$$V = \xi - Ir$$

$$IR = \xi - Ir$$

$$I = \xi / (R + r)$$

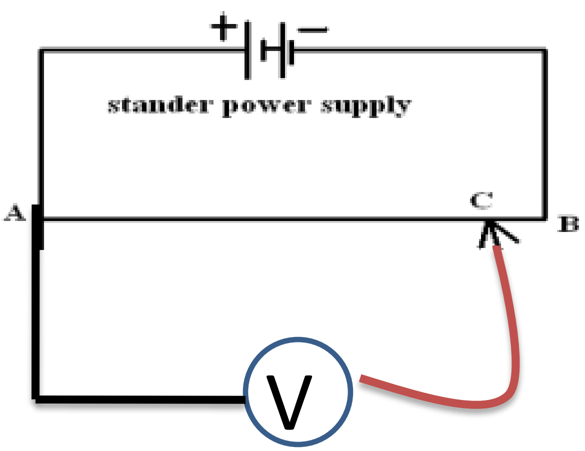


Part I : Find Ex with reference Es



1- Calibration (How???)

5 volt



Find the calibration factor :

C.F = 5 Volt / 100 cm

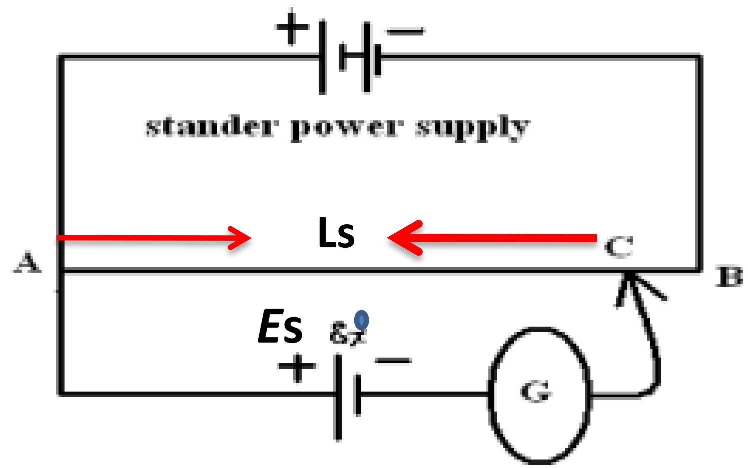
C. F = 0.05 V/ cm

$E_s = V_{a\text{-}c} = C.f \ X \ L_s$ ----------- 1

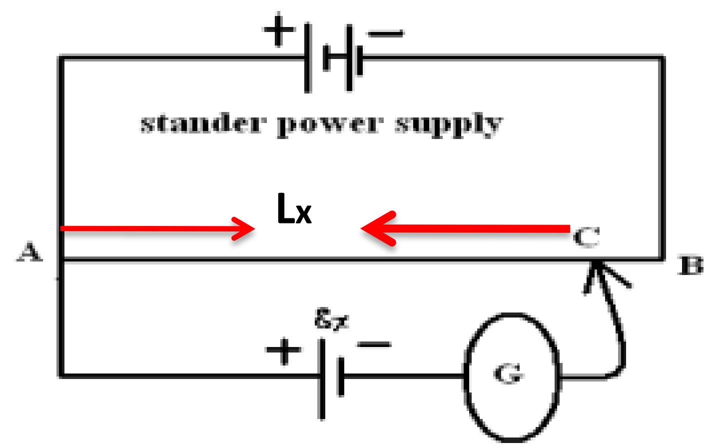
Example:

Ls = 30 cm

Es = 0.05 (V/cm) X 30 cm = 1.5 Volt



$E_x = V_{a\text{-}c} = C.f \ X \ L_x$ -----------2



1 divid 2

$$E_s / E_x = L_s / L_x$$

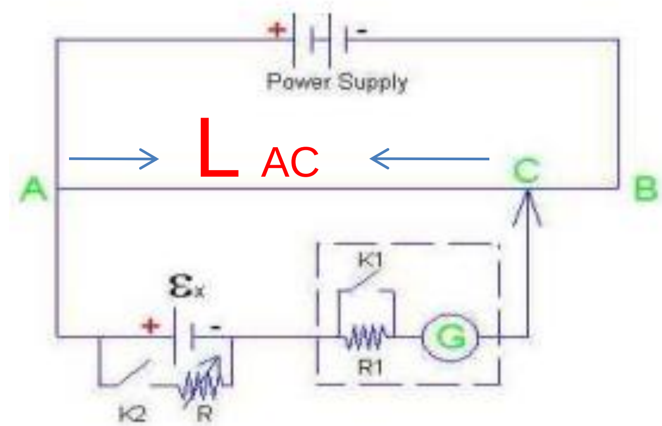
$$E_x = E_s \left(L_x / L_s \right)$$

Part 2: Find E_x with variable resistor

When K_1 and K_2 closed

$$V = E_x - I * r_{in},$$

$$V_{a\text{-}c} = V = E_x - I * r_{in},$$



$$V_{a\text{-}c} = C.f \times L_{AC}$$

R = 15Ω L_{AC}=.............. V_{AC}=............ I=$\frac{V_{AC}}{R}$............

R =............ L_{AC}=.............. V_{AC}=............ I=$\frac{V_{AC}}{R}$............

R =............ L_{AC}=.............. V_{AC}=............ I=$\frac{V_{AC}}{R}$............

R =............ L_{AC}=.............. V_{AC}=............ I=$\frac{V_{AC}}{R}$............

R =............ L_{AC}=.............. V_{AC}=............ I=$\frac{V_{AC}}{R}$............

R =............ L_{AC}=.............. V_{AC}=............ I=$\frac{V_{AC}}{R}$............

R =............ L_{AC}=.............. V_{AC}=............ I=$\frac{V_{AC}}{R}$............

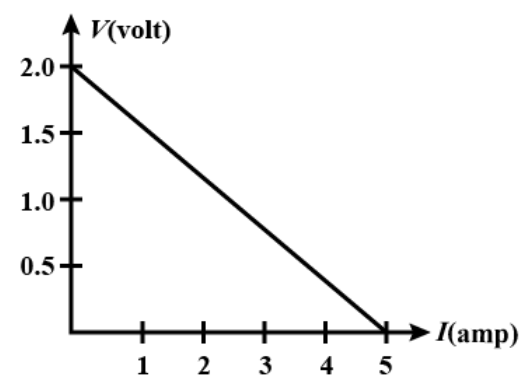
R =............ L_{AC}=.............. V_{AC}=............ I=$\frac{V_{AC}}{R}$............

R =............ L_{AC}=.............. V_{AC}=............ I=$\frac{V_{AC}}{R}$............

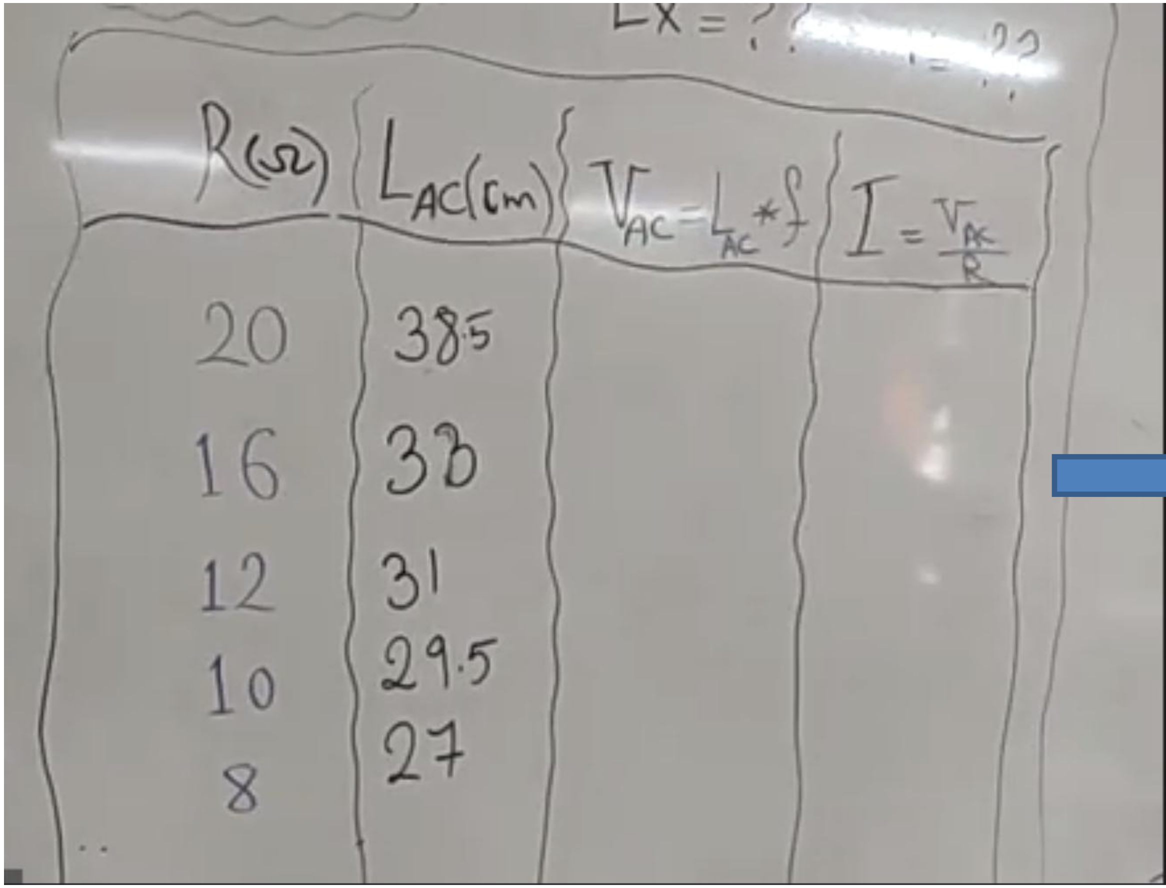
Plot V_{AC} Vs. I.

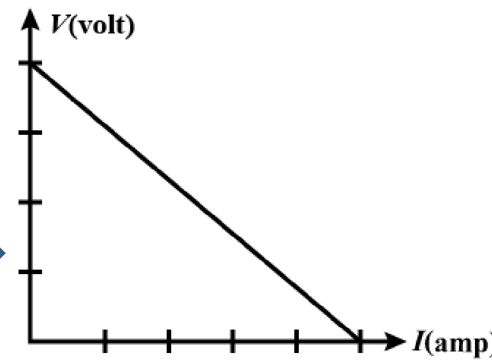
Slope = - r_{in}, r_{in}=..................

Intercept= E_x, E_x=...................



Data of Experiment





Sample calculation :

V_{ac} = C,f * L_{AC} = 0.05 V/cm * 38.5 = 1.92 volt

I = 1.92 / 20 = 96 mA