14. D.C. Circuits

The Potentiometer

1. Uses a null-deflection method

2. Positive terminals of cells being compared must be connected to the same point as

positive terminal of driving cell or else no balance point can be found.

3. Current must be steady.

4. Galvanometer should be very sensitive and protected by a large series resistance from the high currents that would otherwise flow through it when in off-balance situations. The shorting key is left open until an approximate balance has been found. The key is then closed, to short out the protective resistance and allow the full current to flow through the galvanometer so that an accurate balance point can be found.

Questions

1. Why is it desirable for the internal resistance in the power mains to be as low as possible? Ans: A low internal resistance will result in an insignificant decrease in the terminal p.d. across the mains when additional appliances are connected in parallel. This ensures that potential difference across each appliance remains steady so that they operate normally.

2. Explain why the setup is not suitable for measuring an e.m.f. of a few millivolts. Ans: The balance length will be in the order of 10^{-3m} . In using a metre rule to measure this balance length, the uncertainty of L is 0.1cm and this means that the percentage uncertainty of L will be extremely high, hence the setup is not suitable.

Benefits/Advantages of the Potentiometer

- No errors introduced by internal resistance of the cell as no current flows through the cells at balance point
- Potentiometer more accurate than voltmeter which has a finite resistance and draws a current from the cell, thus lowering the terminal p.d. of the cell when connected across it (potentiometer can be seen as a voltmeter with infinitely high resistance)
- Does not depend on accuracy of an instrument reading as it relies on null-deflection method





Finding the internal resistance



Comparison of resistance