Statement of Objectives:

① To implement multi-loops electrical circuits.

② To acquire an understanding of the conceptual meanings of the loop and junction.

③ To justify both kirchhoff's junction rule and loop rule.

④ To apply both rules to multi-loop electrical circuits.

Background and Summary:

a) Brief Description of Theory:

- kirchoff's law is used to analyze complex circuits
Junction: (or Branch point) The term refers to any
Loop:- The term refers to any closed path of a circuit such that the point you start with is also the point you end up with
Junction Rule: Algebric sum of all the currents entering and leaving any branch point in a circuit is equal to zero,
Loop rule: Algebric sum of all pointential diff. around a loop in a circuit is equal to zero $\sum \mathcal{E}_i I_i = 0$ -ο(ι)

* To apply the junction rule:
1) choose (B.P) 2) set the direction of the current
3) Apply the junction rule eq.(1)

* To apply the loop rule:
1) $(-Ir)$
2) $(+\mathcal{E})$

c) Brief Description of Experiment and Procedure:

Part I: Two loop circuit with one voltage source:

1) connect the circuit for given resistors.

2) Measure the equivalent resistance Req. with the power supply disconnected.

3) Measure the current through each resistor as $I_1 I_2 I_3 I_4$
and measure the equivalent current Ieq too.

(this is not background)

(p.s)

* we are going to measure the current passing through each resistor, and the voltage across each resistors then verify the Junction rule and loop rule.

① adjust the voltage to 10V.
② connect the circuit as shown in figure (1).
③ Measure I_1, I_2, I_3, I_4 and Ieq.
④ prove the junction Rule at point E and B.
⑤ measure the voltage V_1, V_2, V_3, V_4
⑥ Prove the loop rule at loops ABEF, BCDE and ACDF

Methodology:

a) List of Equipment:

1) Analog wires.
2) wires.
3) Resistors: 470 Ω, 1k Ω, 390 Ω, 560 Ω,
4) Multimeter.

b) Diagrams of the Experimental Setup:

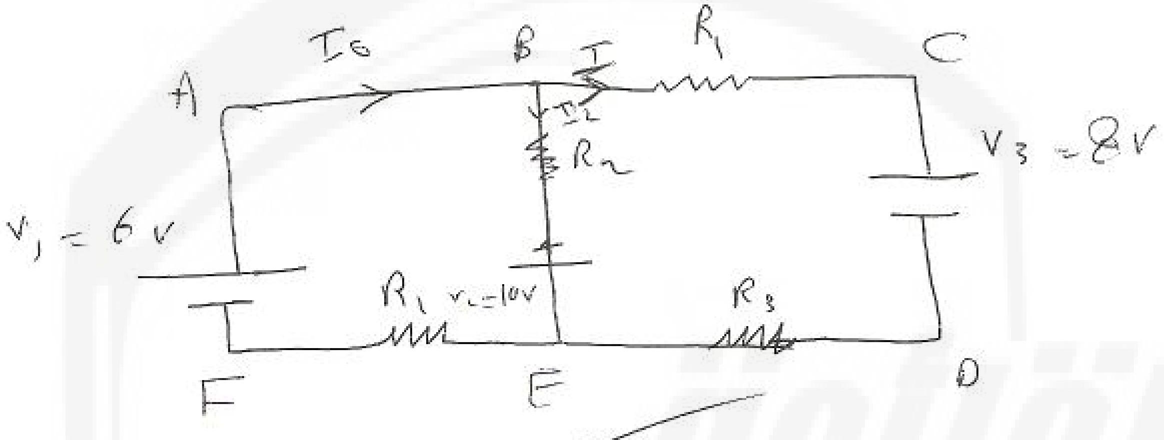

Fig (1)

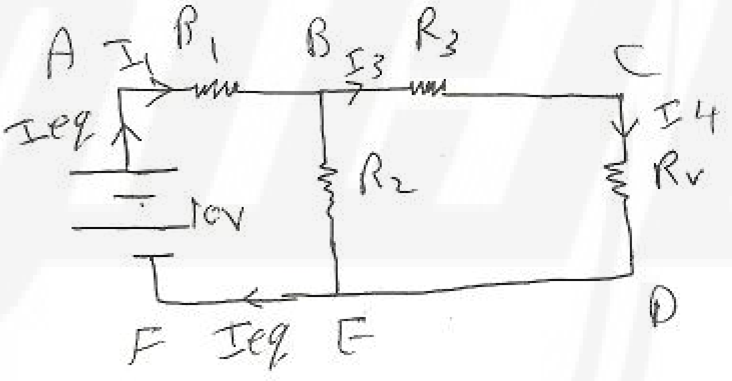

Fig (2)

c) *Detailed Description of the Experimental Procedures:*

part I: Two loop circuit with one voltage Source :-

1) Using the given four resistors ($R_1 = 560\ \Omega$, $R_2 = 1\ K\Omega$, $R_3 = 470\ \Omega$, $R_4 = 390\ \Omega$), connect the circuit as show in figure 2.

2) Measure the equivalent resistance Req with the power supply disconnected Record the data in table (1).

3) Measure the current through each resistors as I_1, I_2, I_3, I_4 and measure the equivalent current Ieq too. Record the data in table (1).

* We are going to measure the current passing through each resistor, and the voltage across each resistors then verify the junction rule and loop rule.

~~for part II~~ ? . .

5

d) Statement of Error Sources:

1) Wrong in Reading

2) wrong in connection.

3) The Voltameter giving wrong numbers.

4) The difference between calculating measured devic

5) Fixed wires connection may cause this difference.

Data and Analysis of Results

a) Data tables, Sample calculations, and Error Analysis:

title? −0.25

* Verify the junction B&E

For B.p (B),

$I_1 = 9.71$, $(I_2 + I_3) = 4.51 + 5.20 = 9.71$ (mA)

therefore, $I_1 \approx I_2 + I_3$

For B p (E)

$I_2 + I_4 = 4.51 + 5.21 = 9.72$

therefore, $I_2 + I_4 = 9.72 \simeq I_{eq}$ (mA)

Is the junction rule verified, yes!

verify the loop rule ABEFA & BCDEB

For the loop ABEFA, calculate

$I_1 R_1 = (9.71)(551 \times 10^{-3}) = 5.35$

$I_2 R_2 = 4.51(988 \times 10^{-3}) = 4.455$

$+\mathcal{E} - I_1 R_1 - I_2 R_2 = 10 - 9.71(551 \times 10^{-3})$

$- 4.51(988) \times 10^{-3} = 0.195 \simeq 0$

For the loop BCDEB

$I_2 R_2 = 4.455$, $I_3 R_3 = 2.418$, $I_4 R_4 = 2.01$

$+ I_2 R_2 - I_3 R_3 - I_4 R_4 = 0.027 \simeq 0$

is the loop rule verified? yes!

Data table

Req (Ω)	Ieq (mA)	I_1 (mA)	I_2 (mA)	I_3 (mA)	I_4 (mA)
100Ω	9.72	9.71	4.51	5.20	5.21

6

Discussion and Conclusions:

a) Statement of Results and Comparison with Accepted Values:

for (B.p) F 8

$I_{eq} = 9.72 (mA)$

$+\varepsilon - I_1R_1 - I_2R_2 = 0.195 \simeq 0$

for the loop BCDEB

$I_2R_2 - I_3R_3 - I_4R_4 = 0.027 \simeq 0$

$\varepsilon_i = 0$ $\varepsilon v_i = 0$

$I_1 = 9.71 mA$

$I_2 + I_3 = 9.71$

$I_1 - I_2 - I_3 = 0$

$I_{eq} = 9.72 (mA)$

$I_2 + I_4 = 9.72$

$I_{eq} - I_2 - I_4 = 0$

b) Discussion of Possible Methods to Reduce Uncertainties:

1) writing the right reading.

2) waking the right connections.

3) The Voltameter giving the reading.

c) Statement of General Conclusion:

* Kirchhoff's law :

* Junction :- The term refers to any point where three or more circuit element meet.

* Loop :- The ~~terms~~ terms refers to any closed path of a circuit such that the point ~~you~~ start with is also the point you end up ~~with~~.

* Reference :

Laboratory Manual & General Phys. lab II phy. 107 & 127.