Unit 14 · Electrical Circuits

WORKSHEET

Full marks 35

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 35

1 Key words [4]

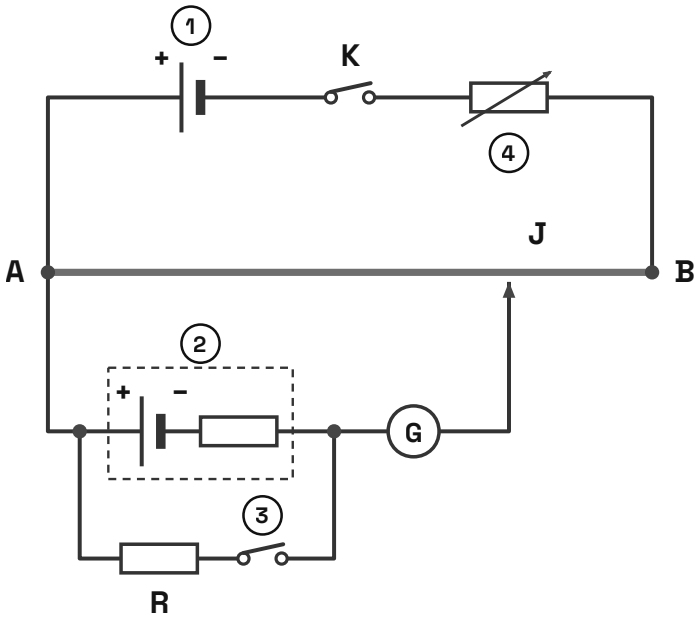
Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

charge	**critical temperature**	**energy**	**junction**	**Meissner effect**	**multiplier**	**null point**
potential gradient	**resistivity**	**shunt**				

A point where three or more wires meet in a circuit is a _____. Kirchhoff's first law follows from the conservation of _____, and his second law from the conservation of _____. In a Wheatstone bridge, the setting at which the galvanometer shows no deflection is the _____. The fall of potential per unit length of a potentiometer wire is its _____. A low resistance joined in parallel with a galvanometer is a _____. The temperature below which a material loses all its resistance is its _____, and the pushing out of a magnetic field from a material when it becomes a superconductor is the _____.

2 Label the diagram [2]

The diagram shows a potentiometer set up to measure the internal resistance of a cell. Write the label that belongs in place of 1 to 4. Each carries 0.5 mark.



1. _____ 2. _____

3. _____ 4. _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. At a junction, currents of 4 A and 1.5 A flow in along two wires, and 3 A flows out along a third. The current in the fourth wire is: [1]

a. 8.5 A out
b. 2.5 A out
c. 2.5 A in
d. 5.5 A in

ii. In a meter bridge, a known resistance of 14 Ω is in the left gap and an unknown resistance in the right gap. The balance point is 35 cm from the left end. The unknown resistance is: [1]

a. 7.5 Ω
b. 4.9 Ω
c. 26 Ω
d. 40 Ω

iii. The sensitivity of a potentiometer can be increased by: [1]

a. using a shorter wire
b. increasing the current in the wire
c. using a longer wire
d. using a driver cell of larger e.m.f.

iv. A galvanometer of resistance 20 Ω gives full-scale deflection for 2 mA. To make it a voltmeter of range 0 to 10 V, the resistance to be joined in series with it is: [1]

a. 5000 Ω
b. 4980 Ω
c. 5020 Ω
d. 0.004 Ω

v. The current through a heater coil is doubled, with its resistance and the time kept the same. The heat produced becomes: [1]

a. the same
b. twice as much
c. four times as much
d. half as much

4 Short answers [6]

Write short answers to the following questions.

a. State the two conditions needed to get a balance point on a potentiometer wire when measuring the e.m.f. of a cell. [2]

b. Why is a meter bridge most accurate when its balance point is near the middle of the wire? [2]

c. A superconductor has zero resistance, but it is more than a perfect conductor. Explain. [2]

5 Long answer [4]

Write a long answer to the following question.

Four resistances P, Q, R and X are joined as a Wheatstone bridge ABCD, with a cell across A and C and a galvanometer across B and D. Using Kirchhoff's laws, show that when the galvanometer shows no deflection, $\frac{P}{Q} = \frac{X}{R}$.

6 Numerical problems [11]

Solve the following problems. Show your working.

a. A cell of e.m.f. 9 V and internal resistance 1 Ω and a cell of e.m.f. 6 V and internal resistance 2 Ω are joined in parallel, + terminal to + terminal, across a 6 Ω resistor. Use Kirchhoff's laws to find the current through each cell and through the resistor. Which cell is being charged? [4]

Answer:

b. A potentiometer wire has a potential gradient of 0.0175 V/cm. A cell balances at 84.0 cm with no other connection. When a resistance of 15 Ω is joined across its terminals, the balance length falls to 70.0 cm. Find i. the e.m.f. of the cell, ii. its internal resistance, and iii. the current it gives through the 15 Ω resistance. [4]

Answer:

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https://science-playground.com/learn/grade-12-physics/electrical-circuits

c. A galvanometer of resistance 40 Ω gives full-scale deflection for a current of 5 mA. Find the shunt needed to make it an ammeter of range 0 to 2 A, and the resistance of the ammeter so made. **[3]**

Answer: _____

7 Think **[3]**

Kushal replaces the wire of a meter bridge with a uniform wire of the same length but half the diameter, of the same material, and keeps the same resistances in the gaps. Does the balance point move? What would happen if, instead, the new wire were thinner over its left half than over its right half?

8 Activity: Kirchhoff's laws on the bench (Activity 14.1) (not marked)

Join a battery and a resistor R_1 in series with two resistors R_2 and R_3 in parallel. Measure the current I through R_1, I_1 through R_2 and I_2 through R_3, and the p.d. across R_1, R_2 and the battery.

I (A)	I_1 (A)	I_2 (A)	V across R_1 (V)	V across R_2 (V)	Battery (V)

Compare I with $I_1 + I_2$, and the battery's p.d. with the p.d.s across R_1 and R_2 added. What do you find?