Unit 23 · DC Circuits

WORKSHEET

Full marks 37

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 37

1 Key words [4]

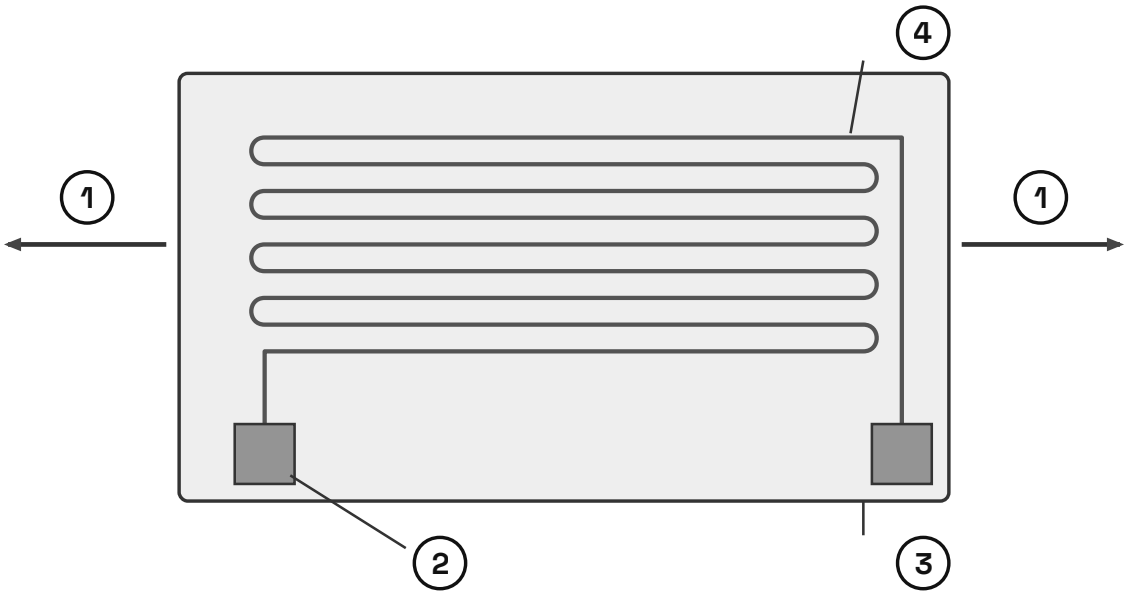
Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

capacitance	**current**	**dielectric**	**divider**	**drift velocity**	**electromotive force**
internal resistance	**Ohm's law**	**resistivity**	**thermistor**		

The rate of flow of charge is electric _____. The average speed at which the free electrons move along a wire is their _____. The energy given to each coulomb by a cell is its _____. A conductor whose current is proportional to the p.d. across it, at constant temperature, obeys _____. A component whose resistance falls as it warms is an NTC _____. The resistance of a piece of a material 1 m long and 1 m^2 in cross-section is its _____. Two resistors in series across a supply, sharing its p.d., make a potential _____. The resistance inside a cell itself is its _____.

2 Label the diagram [2]

The diagram shows a strain gauge. Write the labels that belong 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. A phone charger delivers 1.5 A for 2.0 hours. The charge that flows is: [1]

a. 3.0 C
b. 180 C
c. 1.08×10^4 C
d. 4.8×10^3 C

ii. The I–V graph of a filament lamp bends towards the V axis at high voltage because: [1]

a. the filament obeys Ohm's law
b. the filament's resistance rises as it gets hotter
c. the filament's resistance falls as it gets hotter
d. its internal resistance rises

iii. A cell of e.m.f. 1.5 V gives a terminal p.d. of 1.2 V when a 4.0 Ω resistor is connected to it. Its internal resistance is: [1]

a. 0.25 Ω
b. 1.0 Ω
c. 0.3 Ω
d. 1.2 Ω

iv. A wire is replaced by one of the same metal, twice as long and with twice the diameter. Its resistance becomes: [1]

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

v. In a potential divider of a fixed resistor and an LDR, the output is taken across the LDR. When the room gets darker, the output: [1]

a. rises
b. falls
c. stays the same
d. becomes zero

4 Very short answers [3]

Write very short answers to the following questions.

a. State Ohm's law. [1]

b. What is the unit of resistivity? [1]

c. Why is the terminal p.d. of a cell less than its e.m.f. when it supplies a current? [1]

5 Short answers [6]

Write short answers to the following questions.

a. Distinguish between e.m.f. and potential difference. [2]

b. How does a strain gauge measure how much a material stretches? [2]

c. Why are the lamps in a house wired in parallel and not in series? [2]

6 Long answer [4]

Write a long answer to the following question.

Show that the current in a conductor is $I = nAvq$, where n is the number of charge carriers per unit volume, A the cross-sectional area, v their drift velocity and q the charge on each. Use it to explain why electrons drift faster in a thin part of a wire.

7 Numerical problems [10]

Solve the following problems. Show your working.

a. A heater element is to be made of nichrome wire (resistivity $1.1 \times 10^{-6}\ \Omega$ m) of diameter 0.40 mm. What length is needed for a resistance of 50 Ω? [3]

Answer: _____

b. A potential divider is made of a 10 kΩ resistor and an NTC thermistor across a 9.0 V battery, the output taken across the thermistor. Find the output when the thermistor's resistance is 5.0 kΩ, and say whether the output rises or falls as the thermistor warms. [3]

Answer: _____

c. An electric kettle is rated 1500 W, 230 V. [4]

i. Find the current it draws and its resistance.

ii. Diya's family uses it for 15 minutes a day. At Rs 12 a unit (kWh), what does it cost them in 30 days?

Answer: _____

8 Think [3]

The free electrons in a copper wire drift at only a fraction of a millimeter per second, yet a lamp lights the moment it is switched on. Explain.

9 Activity: The I–V characteristic of a filament lamp (not marked)

Set up a circuit with a variable supply, a small torch bulb, an ammeter in series and a voltmeter across the bulb (the unit's characteristic circuit). Raise the p.d. in steps and read the current.

V (V)	0.5	1.0	1.5	2.0	2.5	3.0
I (A)						
R = V/I (Ω)						

Plot I against V. Does the lamp obey Ohm's law? What happens to its resistance as it starts to glow?