

Ohm's law and component characteristics

Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Worksheet

Name: _____ Date: _____ Class: _____

These 20 problems train you to use $V = I \times R$, convert units, read I-V graphs and analyse thermistors, LDRs and diodes. They move from single-step substitutions to data analysis, circuit design and explanation.

The set suits GCSE, IGCSE, O Level and Class 9-10 students. Convert mA, k Ω and M Ω to base units before every calculation.

Level: Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** GCSE P2, IGCSE 4.3

Problem 1 Quantities and units (easy)

Give the unit of each quantity, with its symbol.

1. Current
2. Potential difference
3. Resistance
4. Charge

Problem 2 Finding voltage (easy)

A solar-powered radio in Nairobi has a component of resistance 12 Ω and a current of 0.50 A.

1. Write the equation for potential difference.
2. Calculate the potential difference across the component.

Problem 3 Finding resistance (easy)

A resistor has 9.0 V across it and a current of 0.30 A flowing through it.

1. Rearrange $V = I R$ to make R the subject.
2. Calculate the resistance.

Problem 4 Finding current (easy)

Wanjiru connects a 48 Ω element to a 12 V supply.

1. Rearrange $V = I R$ to make I the subject.
2. Calculate the current.

Problem 5 Unit conversions (easy)

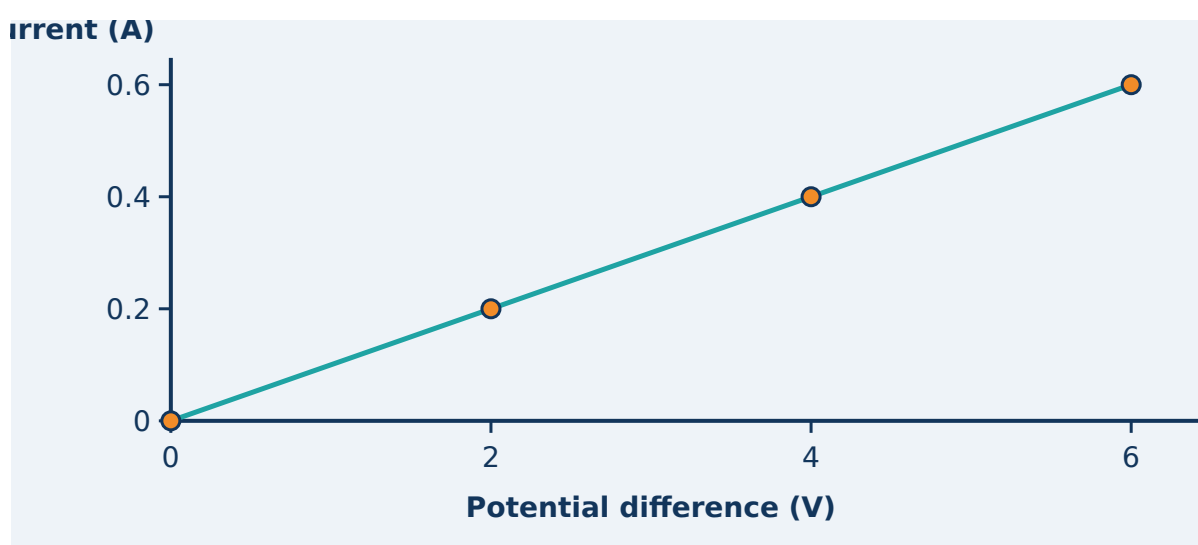
Convert each value to base units.

1. 350 mA to A
2. 4.7 k Ω to Ω
3. 2.2 M Ω to Ω

Problem 6 Reading a resistor graph (easy)

The graph shows an I-V characteristic for a resistor.

1. Read the current when the potential difference is 3.0 V.
2. Calculate the resistance.
3. State what the straight line through the origin shows.



I-V graph for a fixed resistor.

Problem 7 Thermistor resistance (medium)

A thermistor in a school greenhouse in Kampala carries 3.0 mA when connected to 6.0 V.

1. Convert the current to amps.
2. Calculate the resistance in ohms and in kilohms.

Problem 8 Energy from the battery (medium)

Bilal's motorbike battery (12 V) moves 45 C through the lights.

1. Write the equation for the energy transferred.
2. Calculate the energy.

Problem 9 Charge and energy in a lamp (medium)

A lamp works at 6.0 V and carries a current of 0.50 A for 2.0 minutes.

1. Calculate the charge that flows.
2. Calculate the energy transferred to the lamp.

Problem 10 Filament lamp data (medium)

Mei in Singapore records readings for a filament lamp.

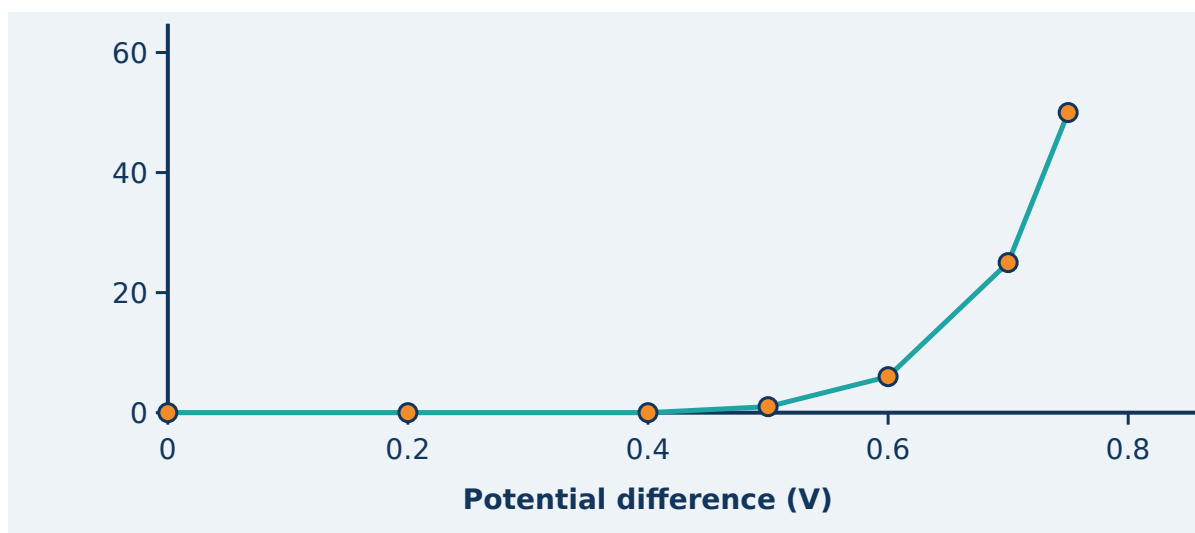
V (V)	1.0	2.0	3.0	4.0	5.0
I (A)	0.10	0.18	0.24	0.29	0.33

1. Calculate the resistance at each voltage (to 1 decimal place).
2. Describe how the resistance changes.
3. Explain why.

Problem 11 A diode in a phone charger (medium)

Diego in Texas studies the forward graph of a diode. It carries 50 mA at 0.75 V.

1. State the voltage below which the diode carries almost no current.
2. Calculate the resistance at 0.75 V.
3. State the current when the diode is connected in reverse.



Forward I-V graph of a diode.

Problem 12 LDR street lamp (medium)

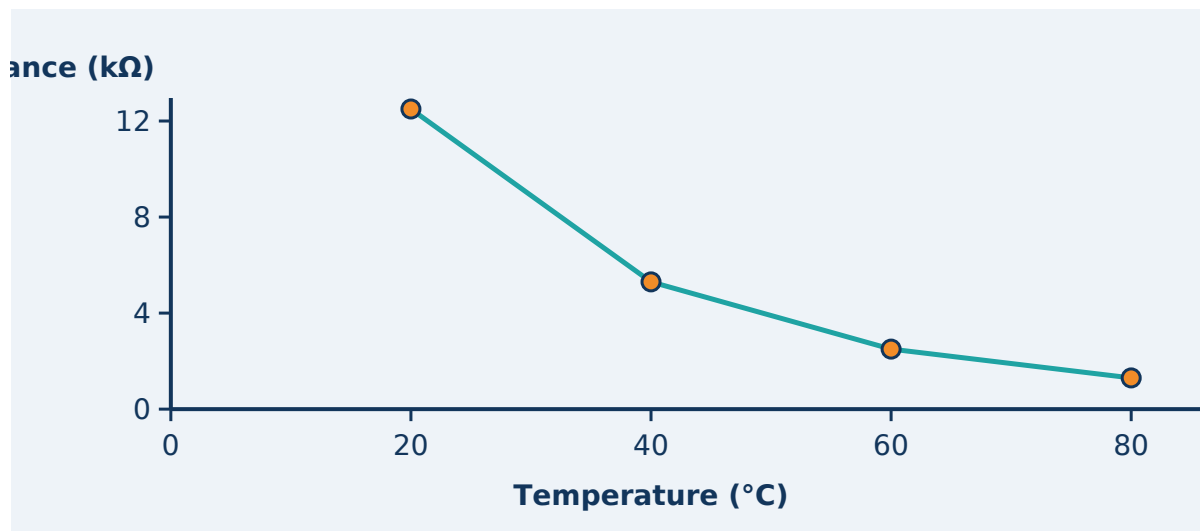
A street lamp controller in Accra uses an LDR across a 4.0 V supply. Its resistance is 200 Ω in daylight and 50 k Ω at night.

1. Calculate the current in daylight.
2. Calculate the current at night.
3. State how many times larger the daytime current is.

Problem 13 Thermistor graph (medium)

The graph shows how the resistance of a thermistor changes with temperature. The thermistor is connected across a 6.0 V cell.

1. Read the resistance at 40 °C and at 80 °C.
2. Calculate the current at each temperature.
3. Describe the trend.



Resistance of a thermistor at four temperatures.

Problem 14 Resistance of wires (medium)

A 1.0 m length of nichrome wire has a resistance of 4.0 Ω.

1. State the resistance of 3.0 m of the same wire.
2. State the resistance of 3.0 m of a wire of the same material with double the cross-sectional area.

Problem 15 Spot the errors (medium)

Kofi wrote four statements. Correct each one.

1. "An ammeter is connected in parallel."
2. " $R = I \div V$."
3. "A thermistor's resistance increases when it is heated."
4. "A diode conducts equally in both directions."

Problem 16 Gradient of an unknown resistor (hard)

Chiamaka in Lagos records readings for an unknown resistor.

V (V)	1.0	2.0	3.0	4.0	5.0
I (mA)	21	40	61	79	101

1. Calculate the gradient of an I-V graph (in mA per V) using the first and last points.
2. Calculate the resistance.
3. State whether the resistor is ohmic and give a reason.

Problem 17 Thermistor and fixed resistor (hard)

A fire alarm circuit has a thermistor and a fixed $1.0\text{ k}\Omega$ resistor in series across a 6.0 V supply. At $40\text{ }^{\circ}\text{C}$ the thermistor is $5.3\text{ k}\Omega$; at $80\text{ }^{\circ}\text{C}$ it is $1.3\text{ k}\Omega$.

1. Calculate the total resistance and the current at $40\text{ }^{\circ}\text{C}$.
2. Calculate the same two quantities at $80\text{ }^{\circ}\text{C}$.
3. Calculate the potential difference across the fixed resistor at each temperature and explain how the alarm can use it.

Problem 18 Hot and cold lamp (hard)

A 12 V car lamp draws 0.50 A when it is lit. A multimeter on the ohm range, with the lamp cold, reads $3.0\text{ }\Omega$.

1. Calculate the resistance when the lamp is lit.
2. Calculate the current at the instant of switching on, when the filament is still cold.
3. Explain why lamps usually fail when they are switched on.

Problem 19 Plan a light investigation (hard)

Bilal wants to find how the resistance of an LDR depends on the distance from a lamp.

1. Name the independent, dependent and two control variables.
2. Describe how to measure the resistance using a voltmeter and an ammeter.
3. Suggest how to present the results and one safety precaution.

Problem 20 Mystery components (hard)

Three components are tested. Their readings are shown.

Component	V (V)	I (A)	V (V)	I (A)	V (V)	I (A)
P	2.0	0.10	4.0	0.20	6.0	0.30
Q	2.0	0.20	4.0	0.30	6.0	0.36
R	2.0	0.05	4.0	0.15	6.0	0.40

1. Calculate the resistance of each component at each voltage.
2. Identify which is an ohmic resistor, which is a filament lamp and which is a thermistor that is warming up.