OCR A A-Level Physics

4.2 Energy, power and resistance

Flashcards

Give the names of each of the following symbols:

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1. Open switch
2. Closed switch
3. Cell (NOT battery)

True or false: Both of these symbols represent resistors:

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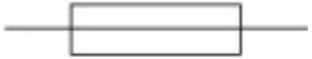

False. The bottom symbol is actually a fuse.

Draw the symbol for a variable resistor.

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What is the name of the component whose circuit symbol is a rectangle with two arrows pointing at it?

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Light Dependent Resistor (LDR).

Should voltmeters be connected in series or parallel?

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Parallel.

What is potential difference? State the units.

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The work done per unit of charge; the difference in potential between to points in a circuit.

Measured in volts.

What does ε represent in electricity?

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Electromotive force (e.m.f).

What is the difference between voltage and emf?

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Voltage is the energy transferred per coulomb across a load resistance.

Emf is the total amount of work done by the battery per coulomb.

Give the equation relating energy transferred to voltage.

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$$W = VQ$$

Where W = work done (energy transferred), V = potential difference, Q = charge.

True or false: The kinetic energy of an electron is equal to its charge multiplied by the voltage.

True or false: The kinetic energy of an electron is multiplied by its charge multiplied by the voltage.

True.

$$\textit{Energy transferred} = eV = \tfrac{1}{2}mv^2$$

What is resistance?

What is resistance?

How difficult it is for current to flow through an appliance.

The potential difference required for each unit of current that flows through a resistor.

$$R=V/I$$

What is the definition of 1 Ohm?

What is the definition of 1 Ohm?

When a resistor is subject to a voltage of 1V and allows a current of 1A through, its resistance is 1 Ohm.

What is meant by an ohmic conductor?

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A conductor that obeys Ohm's law.

What does Ohm's law say? (In words)

What does Ohm's law say? (In words)

The current through an ohmic conductor is directly proportional to the potential difference across it. (ie. resistance doesn't vary with voltage or current).

(This is only true if the temperature is constant.)

What does the gradient of a current potential difference graph represent?

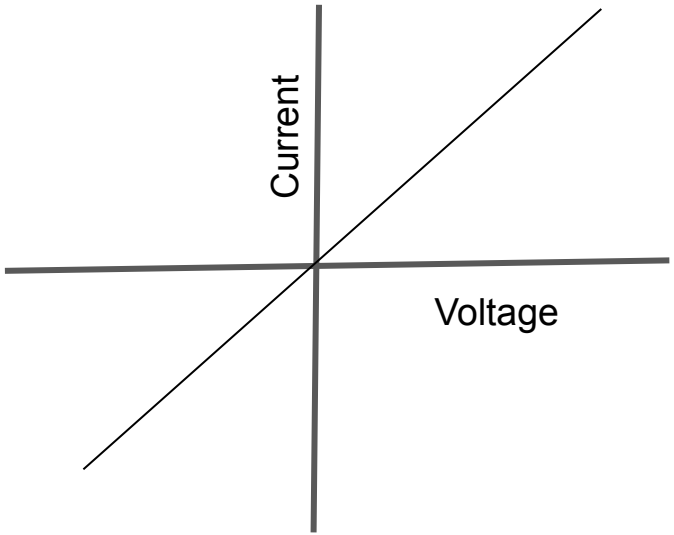
What does the gradient of a current potential difference graph represent?

1/R.

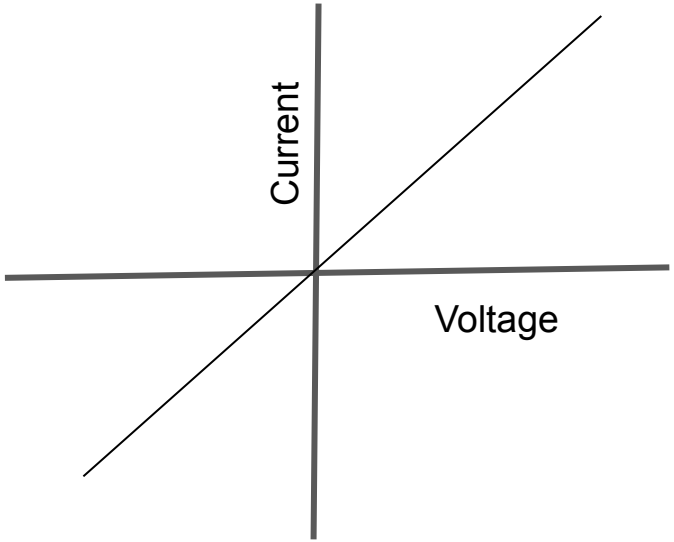
Because the gradient = rise in current/change in potential difference i.e. gradient = I/V.

As resistance= V/I, the gradient = 1/R

Does this graph represent an ohmic conductor?



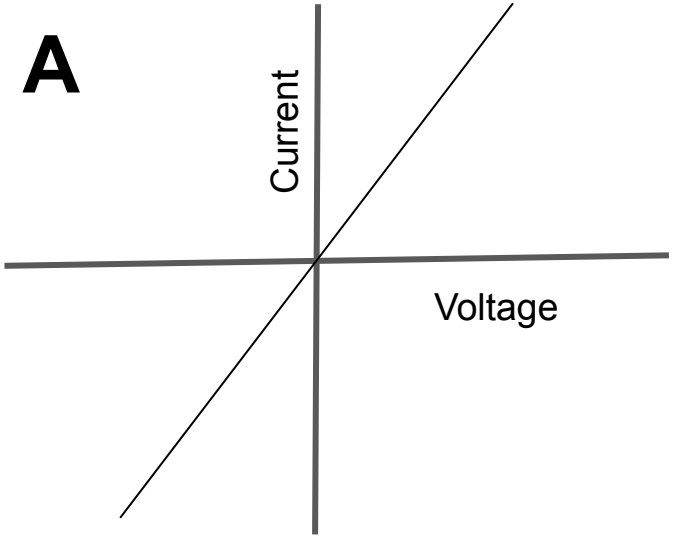
Does this graph represent an ohmic conductor?



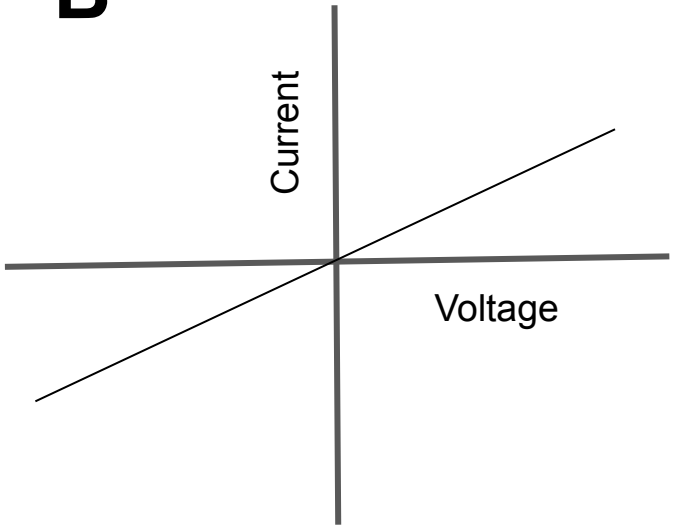
Yes, as the line has a constant gradient and passes through the origin. This shows that voltage is directly proportional to current

Which graph represents a appliance with higher resistance?

A



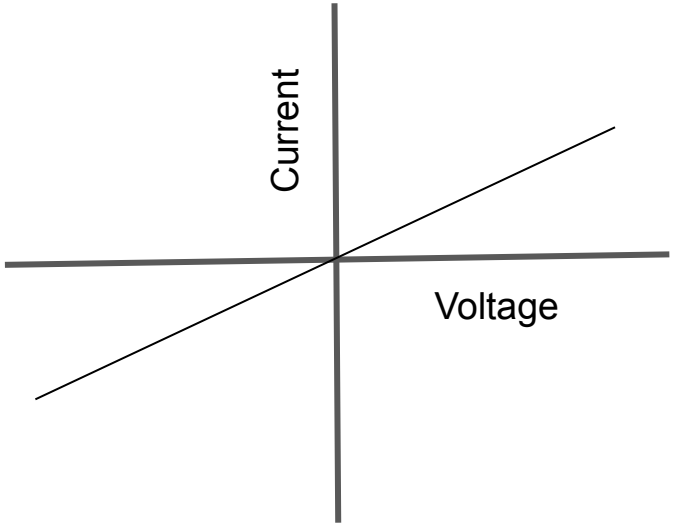
B



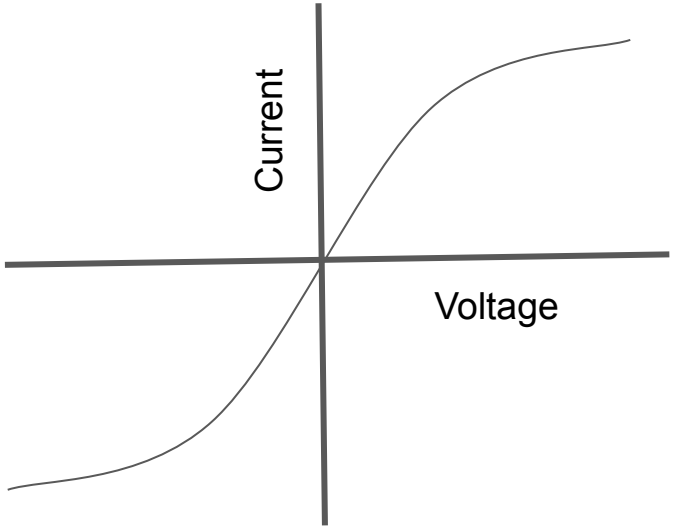
Which graph represents an appliance with higher resistance?

B.

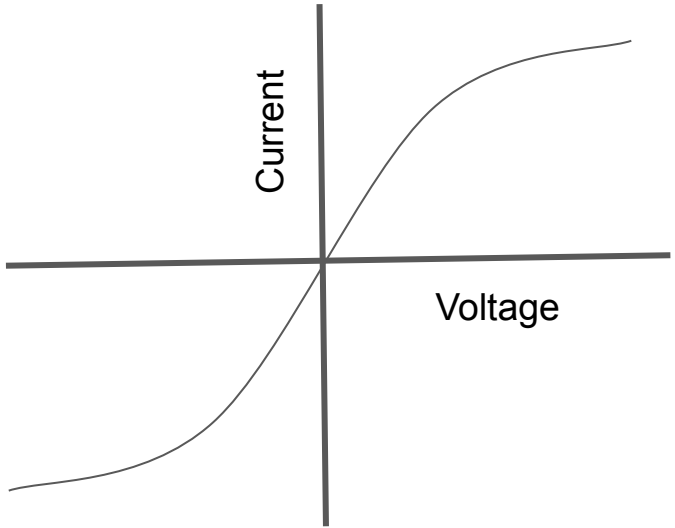
The gradient = 1/R so a smaller gradient means a higher resistance.



What common appliance could this curve represent?



What common appliance could this curve represent?



A filament lamp.

As current increases, resistance increases.

Why does the current increasing on a filament lamp cause an increase in the resistance?

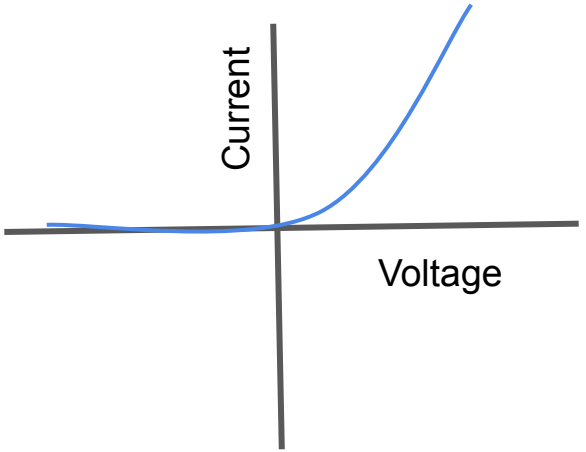
Why does the current increasing on a filament lamp cause an increase in the resistance?

- The flow of current causes collisions between the electrons and the metal lattice.
- These collisions increase the temperature (vibration) of the lattice.
- As the temperature increases, more collisions occur, causing the resistance to increase.

What is a diode?

What is a diode?

A diode is a appliance that only allows current to flow in one direction.



What is a Light Dependent Resistor (LDR)?

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A semiconductor that is sensitive to light: as the light intensity increases the resistance decreases.

How does a thermistor work?

How does a thermistor work?

Similar to a LDR, but as the temperature increases, the resistance decreases.

(Note - thermistors that work in this way are called negative temperature coefficient (NTC) thermistors).

What is resistivity?

What is resistivity?

The resistivity is a property of a metal which shows how easy or difficult it is for current to flow in the material (at a specific temperature).

$$\rho = RA/L$$

Where ρ = resistivity, R = resistance, A = cross-sectional area, and L = length.

Describe an experiment to determine the resistivity of a metal.

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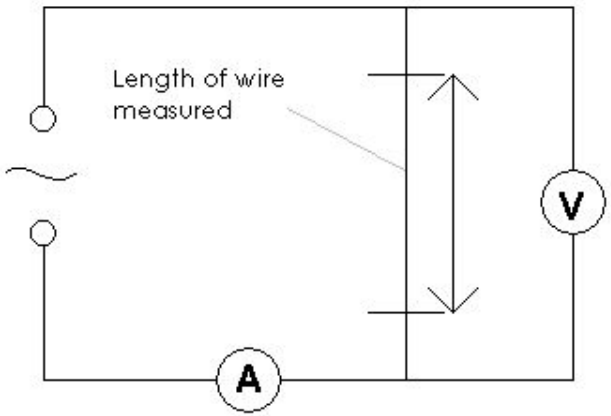

- Measure the diameter of your wire using a micrometer.
- Use this to calculate the area
- - Set up circuit as shown
- Vary the length and record the voltage and current for each length
- Use R=V/I to work out the resistance
- Plot a graph of resistance against the length
- The gradient = resistivity ÷ area
- Rearrange to work out resistivity

True or false: The resistivity of both metals and semiconductors increases with temperature.

True or false: The resistivity of both metals and semiconductors increases with temperature.

False.

The resistivity of a metal increases with temperature because as the metal ions heat up they vibrate more and the electrons bang into them and slow down. Some semiconductors get less resistive as temperature increases, because supplying energy actually causes more charge carriers to be released, so current can flow more easily.

What is power? State the unit.

What is power?

The rate of energy transfer.

Measured in J/s or Watts (W).

Give an equation for power in terms of current and voltage.

Give an equation for power in terms of current and voltage.

$$P=VI$$

Is a kilowatt-hour (kWh) a unit of power, potential difference or energy?

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Energy because it's a unit of power multiplied by time.

Why do electricity companies use ‘units’ (kWh) rather than joules or watts?

Why do electricity companies use ‘units’ (kWh) rather than joules or watts?

Joules and Watts are both so small that everyone would use tens or hundreds of millions of them each month - it’s impractical to have such large numbers used.

How much would this customer pay for their daily electricity if the cost is 15p per unit?

Morning

Evening

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Morning

Evening

Units used = 3563-3543 = 20

Total cost = units x price = 20 x 15p = 300p = £3