INKPHYSICS FLASHCARDS

Electricity

Year 12 · 43 cards · fronts and backs

Print double-sided, flipping on the long edge, and each answer lands behind its question. Cut along the card borders.

Definitions in mark-scheme wording, the equations that are not on the AQA data sheet, each lesson's check question, and the misconceptions that lose marks. The same cards run on the website with spaced-repetition scheduling, at inkphysics.co.uk/physics/flashcards.

DEFINITION

Define: Electric current.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

DEFINITION

Define: Potential difference.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

DEFINITION

Define: Resistance.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

DEFINITION

Define: The coulomb.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

RECALL

State the drift speed equation.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

RECALL

State the typical electron drift speed in a copper wire.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

RECALL

Explain why a lamp lights instantly despite slow electron drift.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

SPOT THE ERROR

Say what is wrong with this claim:

The current arrows show which way the electrons go.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

DEFINITION

The work done per unit charge moving between two points: $V = W/Q$, in volts.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

DEFINITION

The rate of flow of charge: $I = \Delta Q/\Delta t$.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

DEFINITION

The charge passing a point in one second when the current is one ampere: 1 C = 1 A s.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

DEFINITION

The ratio of the potential difference across a component to the current through it: $R = V/I$.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

RECALL

Around 10^{-4} m s^{-1}, a fraction of a millimetre per second.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

RECALL

$I = nAvq$, where n is the number of charge carriers per cubic metre, A the cross-sectional area, v the drift speed and q the charge on each carrier.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

SPOT THE ERROR

Conventional current is defined from + to −, a convention fixed before the electron was known. In a metal the charge carriers are electrons, which drift the opposite way.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

RECALL

The electric field is established round the circuit at nearly the speed of light, so electrons everywhere start drifting almost at once.

CURRENT, CHARGE AND THE DIRECTION PROBLEM

DEFINITION

Define: Ohm's law.

CURRENT-VOLTAGE CHARACTERISTICS

DEFINITION

Define: Semiconductor diode.

CURRENT-VOLTAGE CHARACTERISTICS

DEFINITION

Define: Threshold voltage of a diode.

CURRENT-VOLTAGE CHARACTERISTICS

RECALL

State the resistance of an ideal ammeter and an ideal voltmeter.

CURRENT-VOLTAGE CHARACTERISTICS

RECALL

Explain how to read resistance from an I-V characteristic.

CURRENT-VOLTAGE CHARACTERISTICS

RECALL

State the shape of a filament lamp I-V characteristic.

CURRENT-VOLTAGE CHARACTERISTICS

SPOT THE ERROR

Say what is wrong with this claim:

Ohm's law applies to everything.

CURRENT-VOLTAGE CHARACTERISTICS

DEFINITION

Define: Resistivity.

RESISTIVITY AND SUPERCONDUCTIVITY

DEFINITION

A component that conducts in the forward direction only, with very high resistance in reverse.

CURRENT-VOLTAGE CHARACTERISTICS

DEFINITION

The current through an ohmic conductor is proportional to the potential difference across it, provided physical conditions such as temperature stay constant.

CURRENT-VOLTAGE CHARACTERISTICS

RECALL

An ideal ammeter has zero resistance and an ideal voltmeter has infinite resistance.

CURRENT-VOLTAGE CHARACTERISTICS

DEFINITION

The forward potential difference, about 0.6 V, above which a diode conducts with low resistance.

CURRENT-VOLTAGE CHARACTERISTICS

RECALL

A curve through the origin that flattens at larger pds as the heating filament raises its resistance.

CURRENT-VOLTAGE CHARACTERISTICS

RECALL

R is the ratio V/I at the chosen point, never the gradient of a curved characteristic.

CURRENT-VOLTAGE CHARACTERISTICS

DEFINITION

The property of a material given by $\rho = RA/L$: the resistance of a piece of the material of unit length and unit cross-sectional area.

RESISTIVITY AND SUPERCONDUCTIVITY

SPOT THE ERROR

Ohm's law is a special case, not a universal law: only ohmic conductors at constant temperature have current proportional to pd. Filament lamps and diodes do not, so their resistance varies.

CURRENT-VOLTAGE CHARACTERISTICS

DEFINITION

Define: Superconductor.

RESISTIVITY AND SUPERCONDUCTIVITY

DEFINITION

Define: Thermistor (NTC).

RESISTIVITY AND SUPERCONDUCTIVITY

RECALL

State the unit of resistivity.

RESISTIVITY AND SUPERCONDUCTIVITY

RECALL

State the effect of doubling a wire's diameter on its resistance.

RESISTIVITY AND SUPERCONDUCTIVITY

RECALL

Explain why a metal's resistance rises when heated.

RESISTIVITY AND SUPERCONDUCTIVITY

RECALL

State the applications of superconductors.

RESISTIVITY AND SUPERCONDUCTIVITY

RECALL

Explain why an LDR's resistance falls in brighter light.

RESISTIVITY AND SUPERCONDUCTIVITY

SPOT THE ERROR

Say what is wrong with this claim:

A material has a resistance.

RESISTIVITY AND SUPERCONDUCTIVITY

DEFINITION

A semiconductor component whose resistance falls steeply as temperature rises.

RESISTIVITY AND SUPERCONDUCTIVITY

DEFINITION

A material whose resistivity falls to exactly zero when cooled to or below its critical temperature.

RESISTIVITY AND SUPERCONDUCTIVITY

RECALL

The resistance falls by a factor of four, because area scales with diameter squared.

RESISTIVITY AND SUPERCONDUCTIVITY

RECALL

The ohm metre (Ω m), not the ohm per metre.

RESISTIVITY AND SUPERCONDUCTIVITY

RECALL

Very strong electromagnets, as in MRI scanners and maglev, and power cables with no resistive loss.

RESISTIVITY AND SUPERCONDUCTIVITY

RECALL

The lattice ions vibrate with greater amplitude, so the conduction electrons collide with them more often.

RESISTIVITY AND SUPERCONDUCTIVITY

SPOT THE ERROR

Resistance belongs to a particular object and depends on its dimensions: $R = \rho L/A$. Resistivity is the material's own property, the same for any sample of that material.

RESISTIVITY AND SUPERCONDUCTIVITY

RECALL

Absorbed photons free extra conduction electrons, so the number density n rises and the same pd drives a larger current.

RESISTIVITY AND SUPERCONDUCTIVITY

DEFINITION

Define: Kirchhoff's first law.

CIRCUITS AND KIRCHHOFF'S LAWS

DEFINITION

Define: Kirchhoff's second law.

CIRCUITS AND KIRCHHOFF'S LAWS

RECALL

State the combined resistance of resistors in parallel.

CIRCUITS AND KIRCHHOFF'S LAWS

RECALL

State the three forms of electrical power.

CIRCUITS AND KIRCHHOFF'S LAWS

EQUATION · NOT ON THE AQA DATA SHEET

Electrical energy transferred in time t:

E = ?

CIRCUITS AND KIRCHHOFF'S LAWS

SPOT THE ERROR

Say what is wrong with this claim:

Current gets used up on the way round.

CIRCUITS AND KIRCHHOFF'S LAWS

RECALL

Explain why series resistors share the supply pd in the ratio of their resistances.

POTENTIAL DIVIDERS

RECALL

State the range of a potential divider output.

POTENTIAL DIVIDERS

DEFINITION

Round any closed loop the sum of the emfs equals the sum of the pds: conservation of energy.

CIRCUITS AND KIRCHHOFF'S LAWS

DEFINITION

The total current into a junction equals the total current out: conservation of charge.

CIRCUITS AND KIRCHHOFF'S LAWS

RECALL

$P = IV = I^2R = V^2/R$.

CIRCUITS AND KIRCHHOFF'S LAWS

RECALL

Always less than the smallest individual branch resistance.

CIRCUITS AND KIRCHHOFF'S LAWS

SPOT THE ERROR

Current is not used up: charge is conserved, so the current returning to the battery equals the current leaving it. What is transferred round the circuit is energy per coulomb, the pd.

CIRCUITS AND KIRCHHOFF'S LAWS

EQUATION · NOT ON THE AQA DATA SHEET

$\mathbf{E = IVt}$

CIRCUITS AND KIRCHHOFF'S LAWS

RECALL

From zero up to the full supply pd, set by the ratio of the resistances.

POTENTIAL DIVIDERS

RECALL

The same current flows through both, so each pd $V = IR$ is proportional to its resistance.

POTENTIAL DIVIDERS

RECALL

State the assumption behind the potential divider equation.

POTENTIAL DIVIDERS

DEFINITION

Define: Light-dependent resistor (LDR).

POTENTIAL DIVIDERS

RECALL

State how the potential varies along a uniform current-carrying wire.

POTENTIAL DIVIDERS

EQUATION · NOT ON THE AQA DATA SHEET

Potential divider output:

V_{out} = ?

POTENTIAL DIVIDERS

SPOT THE ERROR

Say what is wrong with this claim:

The battery decides the voltage across each component.

POTENTIAL DIVIDERS

DEFINITION

Define: Electromotive force.

EMF AND INTERNAL RESISTANCE

DEFINITION

Define: Internal resistance.

EMF AND INTERNAL RESISTANCE

DEFINITION

Define: Terminal potential difference.

EMF AND INTERNAL RESISTANCE

DEFINITION

A component whose resistance falls as the light intensity falling on it rises.

POTENTIAL DIVIDERS

RECALL

That the output draws negligible current. A load across the output sits in parallel with that resistor and drags the output below the value the ratio promises, unless the load resistance is far larger than the divider resistances.

POTENTIAL DIVIDERS

EQUATION · NOT ON THE AQA DATA SHEET

$V_{out} = V_{in} \times (R_2)/(R_1 + R_2)$

POTENTIAL DIVIDERS

RECALL

It falls at a steady rate along the wire, so the pd across any part of it is proportional to the length of that part.

POTENTIAL DIVIDERS

DEFINITION

The energy transferred to each coulomb of charge passing through a source: $\varepsilon = E/Q$.

EMF AND INTERNAL RESISTANCE

SPOT THE ERROR

The battery fixes only the total pd across the series chain. The same current flows through each resistor, so each takes a share of the pd proportional to its resistance.

POTENTIAL DIVIDERS

DEFINITION

The potential difference across a source's terminals: $V = \varepsilon - Ir$, equal to the emf when no current flows.

EMF AND INTERNAL RESISTANCE

DEFINITION

The resistance inside a source, in which energy is dissipated whenever the source drives a current.

EMF AND INTERNAL RESISTANCE

RECALL

Explain how to find emf and internal resistance from a V-I graph.

EMF AND INTERNAL RESISTANCE

RECALL

State the short-circuit current of a cell.

EMF AND INTERNAL RESISTANCE

SPOT THE ERROR

Say what is wrong with this claim:

A 1.5 V battery gives you 1.5 volts.

EMF AND INTERNAL RESISTANCE

RECALL

With the terminals shorted, $R = 0$ and the current takes its maximum value $I = \varepsilon/r$.

EMF AND INTERNAL RESISTANCE

RECALL

The intercept on the V axis is the emf and the gradient is $-r$.

EMF AND INTERNAL RESISTANCE

SPOT THE ERROR

A 1.5 V cell gives each coulomb 1.5 J, but some is dissipated in the cell's internal resistance, so the terminal pd $V = \varepsilon - Ir$ is below 1.5 V whenever current flows.

EMF AND INTERNAL RESISTANCE