Grade 12 Physical Sciences: Electricity & Magnetism Study Guide

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Free Study Resources for South African Matric Learners

1. Electric Circuits

Ohm's Law:	V = IR
Power:	P = VI = I^2*R = V^2/R
Energy:	E = Pt = VIt (J)
Series R:	R_total = R1 + R2 + R3
Parallel R:	1/R = 1/R1 + 1/R2 + 1/R3
EMF:	emf = V_terminal + I*r (r = internal resistance)

Series vs Parallel

- Series: same current through all; voltages add up; R_total is largest
- Parallel: same voltage across all; currents add up; R_total is smaller than smallest branch
- In parallel: adding more resistors DECREASES total resistance -> increases current from source

2. Electrostatics

Coulomb's Law:	F = k*Q1*Q2/r^2 (k = 9x10^9 N.m^2/C^2)
Electric field E:	E = F/q = kQ/r^2 (N/C)
Potential diff V:	V = W/q (J/C = V)

TIP Electric field lines point FROM positive TO negative. A positive test charge follows the field direction. Denser field lines = stronger field.

3. Electromagnetic Induction

Faraday's Law:	emf = -N * delta_phi/delta_t
Magnetic flux phi:	phi = B*A*cos(theta) (Wb)

AC Generators vs DC Motors

- AC generator: converts mechanical -> electrical energy (slip rings -> AC output)
- DC motor: converts electrical -> mechanical energy (commutator -> unidirectional rotation)
- Lenz's Law: induced current opposes the change in flux that caused it

4. Photoelectric Effect

Plancks equation:	E = hf (h = 6.63x10^-34 J.s)
Threshold frequency:	f_0 = W/h (W = work function)
Max KE of e-:	KE_max = hf - W
Speed of light:	c = f * lambda (c = 3x10^8 m/s)

TIP Intensity of light increases number of electrons ejected, NOT their kinetic energy. Higher frequency -> higher KE of ejected electrons.