ELECTRICAL SYSTEMS

PHYSICS LEVEL 3

Study Checklist

If you've picked up this checklist, congrats! You've begun the first step in a system of resources designed to help you through the Electrical Systems external. To make the most of this, we suggest you sit down, grab a pen, and mark any points that you're feeling a little unsure of. Then, create a subject audit using our template, or refer to the page numbers to find the section in our walkthrough guide to help you out!

RESISTORS IN DC CIRCUITS

- ☐ I can define the term 'electromotive force', in terms of potential difference [TBC]
- ☐ I can calculate the electromotive force using ε=V+Ir [TBC]
- ☐ I can discuss the importance of the internal resistance of a cell, and explain how the "voltage" of a battery or cell decreases [TBC]
- ☐ I can describe both Kirchhoff's Current Law AND Kirchhoff's Voltage Law [TBC]
- ☐ I can apply both of Kirchhoff's Circuit Laws to calculate the current or voltage across components [TBC]
- ☐ I can state the equations which represent both Kirchhoff's Current Law AND Kirchhoff's Voltage Law [TBC]

CAPACITORS IN DC CIRCUITS

- ☐ I can describe the basic structure of a capacitor [TBC]
- ☐ I can state the function of a capacitor in an electrical circuit [TBC]
- ☐ I can explain how the structure of a capacitor gives it its function [TBC]
- ☐ I can explain the effect a dielectric material has on the capacitance of a capacitor [TBC]
- ☐ I can state the symbols AND units for capacitance, permittivity, relative permittivity, vacuum permittivity, area and distance [TBC]
- ☐ I can calculate the capacitance, permittivity, area or distance using the formula: C=ε A/d [TBC]
- ☐ I can calculate the capacitance, relative permittivity, vacuum permittivity, area or distance using the formula: C=ε_0 ε_r A/d [TBC]
- ☐ I can calculate the electric field strength, voltage or distance using the formula: E=V/d [TBC]
- ☐ I can state some of the practical roles a capacitor has in an electrical circuit [TBC]
- ☐ I can calculate the total capacitance of multiple capacitors in parallel [TBC]
- ☐ I can calculate the total capacitance of multiple capacitors in series [TBC]
- ☐ I can describe how capacitors charge up and discharge, and how this makes them useful in a circuit [TBC]
- ☐ I can calculate the time constant (τ) of a capacitor, using the resistance and capacitance [TBC]
- ☐ I can describe what the value of the time constant tells us about the charge/discharge of a capacitor [TBC]
- ☐ I can calculate the energy stored in a capacitor [TBC]

INDUCTORS IN DC CIRCUITS

- [ ] I can describe the magnetic flux, and state the direction it travels in, relative to the north and south pole of a magnet [TBC]
- [ ] I can describe the flux density in terms of magnetic flux [TBC]
- [ ] I can state the symbols AND units of magnetic flux, flux density and area. [TBC]
- [ ] I can calculate the magnetic flux or flux density using the formula: $\Phi=BA$ [TBC]
- [ ] I can describe "electromagnetic induction" [TBC]
- [ ] I can explain, in detail, how electricity can be generated using electromagnetic induction [TBC]
- [ ] I can use the "Right Hand Thumb" rule to state the direction of a magnetic field from the direction of positive charge current flow [TBC]
- [ ] I can use the "Right Hand Slap" rule to state the direction of induced current from the direction of movement and the direction of the magnetic field [TBC]
- [ ] I can calculate the electromotive force from the change in magnetic flux using the formula: $\varepsilon=-\Delta\Phi/\Delta t$ [TBC]
- [ ] I can explain how "self-inductance" occurs, and how the structure of an inductor gives it its function [TBC]
- [ ] I can discuss the concept of "back EMF" [TBC]
- [ ] I can state "Lenz's Law" [TBC]
- [ ] I can describe the basic structure of an inductor [TBC]
- [ ] I can describe the function of an inductor [TBC]
- [ ] I can state the symbol AND unit for inductance [TBC]
- [ ] I can calculate the time constant (τ) of an inductor, using the resistance and inductance [TBC]
- [ ] I can describe what the value of the time constant tells us about the change in current caused by an inductor [TBC]
- [ ] I can calculate the energy stored in an inductor [TBC]
- [ ] I can describe the basic structure of a transformer [TBC]
- [ ] I can describe the function of a transformer [TBC]
- [ ] I can explain the difference between a "step-down" transformer and a "step-up" transformer [TBC]
- [ ] I can discuss why transformers are not quite 100% efficient, and how energy loss in transformers occurs [TBC]
- [ ] I can calculate the number of primary coils, number of secondary coils, primary voltage and secondary voltage using the formula: $N_p/N_s = V_p/V_s$ [TBC]

AC CIRCUITS

- [ ] I can describe the flow of charge in a direct-current (DC) circuit [TBC]
- [ ] I can describe the flow of charge in an alternating-current (AC) circuit [TBC]
- [ ] I can compare the behaviour of resistors in AC and DC circuits [TBC]
- [ ] I can compare the behaviour of capacitors and inductors in AC and DC circuits [TBC]
- [ ] I can define the "reactance" of AC circuits [TBC]
- [ ] I can calculate the reactance of a capacitor and the reactance of an inductor [TBC]
- [ ] I can calculate the peak voltage from the root mean square voltage [TBC]
- [ ] I can calculate the peak current from the root mean square current [TBC]
- [ ] I can define the "frequency" and "period" of an AC circuit [TBC]
- [ ] I can define the "impedance" of an AC circuit [TBC]
- [ ] I can calculate the impedance of a circuit [TBC]
- [ ] I can describe a phasor [TBC]
- [ ] I can draw a phasor diagram for current and voltage in AC capacitative and AC inductive circuits [TBC]
- [ ] I can discuss "resonance" and its importance, and explain when the resonant frequency occurs [TBC]