Assessment Specifications for Level 3 Physics

"Candidates should show their reasoning clearly and may use numerical working, words, and/or diagrams. Mathematical solutions at the Excellence level will require candidates to show, mathematically, how two phenomena, concepts, or principles are interconnected.

For calculations involving "g", the value will be given as, g = 9.81N kg^{-1} (m s^{-2}).

It is recommended that candidates use standard form in writing numerical answers. The number of significant figures in any answer should be clear and should be consistent with the data in the question.

Answers should be given with an appropriate unit. SI units should be used unless it is more appropriate to include a prefix (milli, kilo, etc)."

Electricity Formulae

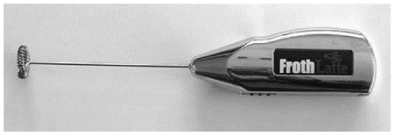
The formulae on the equation sheet are always given in a particular order:

Charges and capacitance(A), resistance (B), inductors(C), AC(D)

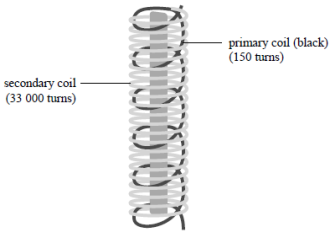
A	$V = Ed$	$\Delta E = Vq$	$E = \frac{1}{2}QV$	$Q = CV$
	$C = \frac{\varepsilon_o \varepsilon_r A}{d}$	$C_T = C_1 + C_2 + \ldots$	$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots$	$\tau = RC$
B	$R_T = R_1 + R_2 + \ldots$	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$	$V = IR$	$P = VI$
C	$\phi = BA$	$\varepsilon = -L\frac{\Delta I}{\Delta t}$	$\varepsilon = -\frac{\Delta \phi}{\Delta t}$	
	$\frac{N_p}{N_s} = \frac{V_p}{V_s}$	$E = \frac{1}{2}LI^2$	$\tau = \frac{L}{R}$	
D				$f_0 = \frac{1}{2\pi\sqrt{LC}}$
				$I = I_{MAX}\sin\omega t$
	$V = V_{MAX}\sin\omega t$	$I_{MAX} = \sqrt{2}\, I_{rms}$	$V_{MAX} = \sqrt{2}\, V_{rms}$	$X_C = \frac{1}{\omega C}$
	$X_L = \omega L$	$V = IZ$	$\omega = 2\pi f$	$f = \frac{1}{T}$

For the following questions, which set of equations would help you best?
Once you have found the correct equation, solve the problem.

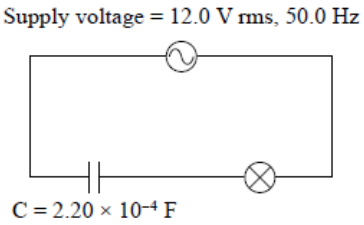
1. At maximum speed the power output of a frother is 4.5 W and this is achieved when the voltage across it is 6.25 V. Calculate the current through the frother when it is operating at maximum speed.



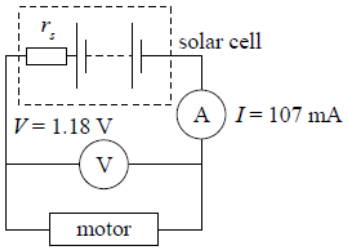
2. In Jessie's car, the primary coil has 150 turns, cross-sectional area of 2.00 x 10^{-3} m^2, and resistance 0.750 Ω. The magnetic field in the primary coil, when it is connected to the 12 V battery, is 4.20x10^2 T. Calculate the flux in the primary coil when it is connected to the battery.



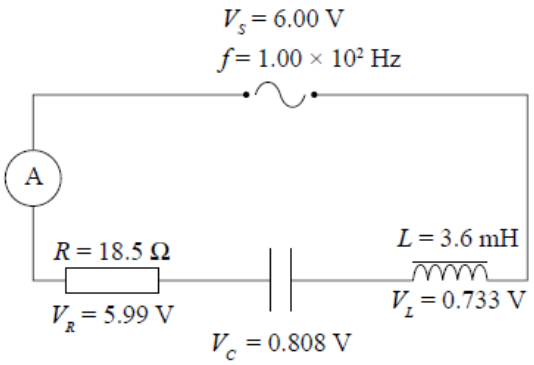
3. What is the angular frequency of a 12.0 V rms 50 Hz power supply?



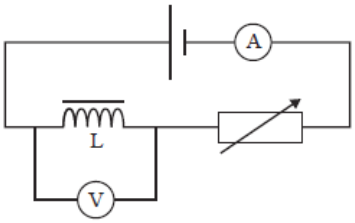
4. Tui and Richard connect the solar cell to a voltmeter with no other components and find the voltage is 8.06 V. Then they connect the solar cell to the motor. They measure the voltage across the terminals of the cell to be 1.18 V, and the current to be 107 mA. Calculate the internal resistance of the solar cell.



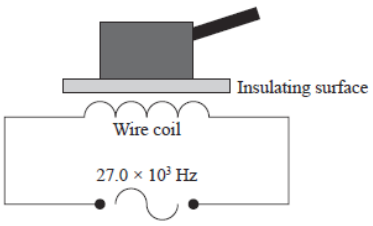
5. As part of the security measures at a political meeting, a portable metal detector has been installed. The detector includes an AC supply, producing an r.m.s voltage of 6.00 V at a frequency of 100 Hz. Calculate the peak voltage of the AC supply.



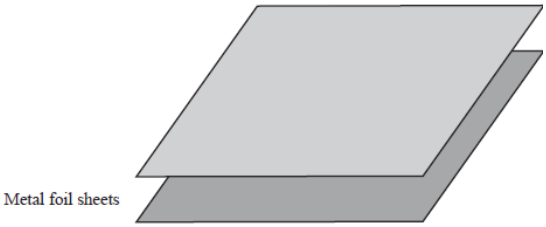
6. The inductor, L, in the circuit models the coil of wire under a road. The resistance of the rheostat is changed so that the current in the circuit drops steadily from its maximum value of 1.62 A to 0.13 A in 1.2 s. While the current is dropping, the voltmeter reads 4.0 mV. Calculate the inductance of the inductor.



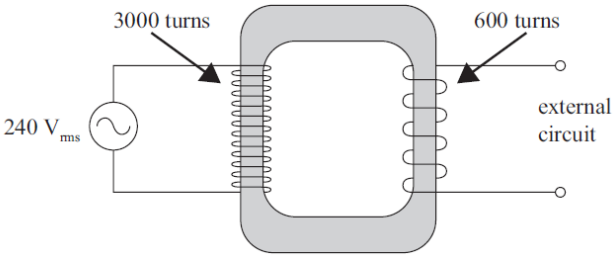
7. Sam has an induction cooker with inductance of 1.30 mH. What is the reactance of the coil if the frequency of the alternating current is 27.0 x 10^3 Hz.



8. The capacitor in the induction cooker has a capacitance 1.65 x 10^{-8} F. Sam wanted to make a capacitor of this capacitance using two metal foil sheets. The two sheets of foil are separated by a layer of air 1.00 x 10^{-4} m thick. The permittivity of free space = 8.84 x 10^{-12} Fm^{-1}. Calculate the area of the foil sheets that Sam should use.



9. A transformer shown has 3000 turns in its primary coil, and 600 turns in the secondary coil. A 240 V_{rms} AC power supply is connected across the primary coil. The secondary coil is connected to an external circuit. Calculate the rms voltage across the external circuit.



10. When the capacitor in the circuit is fully charged, it carries a charge of 8.60 × 10^{-3} C. Calculate the energy stored in the capacitor when it is fully charged.