

WJEC A-Level Physics

4A: Alternating Currents

Flashcards

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What happens when you move a straight conductor through a magnetic field?



What happens when you move a straight conductor through a magnetic field?

The electrons experience a force pushing them to one end of the conductor creating an emf across the conductor. The rod obeys Faraday's law - it is changing flux as it moves through the field hence an EMF is induced.



What would be the EMF produced when rotating a coil at a constant rate in a magnetic field?



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$$V = BAN\omega \sin(\omega t)$$

Where ω is the angular velocity of the rotating coil.



What is the magnitude of the power dissipated in a resistor?



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I^2R or VI



What is the current and voltage for AC? What is the peak current and voltage?



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$$I = I_0 \sin \omega t \text{ peak is } I_0$$

$$V = V_0 \sin \omega t \text{ peak is } V_0$$



What is the magnitude of the power dissipated in a resistor?



What is the magnitude of the power dissipated in a resistor?

$$I^2R \text{ or } VI \text{ or } V^2/R$$



How can you work out the rms value from the peak value? What does the rms value mean for an AC current?



How can you work out the rms value from the peak value? What does the rms value mean for an AC current?

$$V = V_0/\sqrt{2}$$

The rms value is the effective value of a varying AC current. It is the equivalent to a constant DC supply.

$$V_{\text{rms}} = \sqrt{\frac{1}{n} (V_1^2 + V_2^2 + \dots + V_n^2)}$$



What is the reactance X_L of an inductor?



What is the reactance X_L of an inductor?

When an AC voltage is applied to an inductor it has the reactance $X_L = V_{\text{rms}} / I_{\text{rms}}$ and the current is ωL .



What is the reactance X_L of a capacitor?



What is the reactance X_L of a capacitor?

When an AC voltage is applied to a capacitor it has the reactance

$X_C = V_{\text{rms}}/I_{\text{rms}}$ and the current is $1/\omega C$.



What is a phasor?



What is a phasor?

A phasor is a rotating vector with frequency, f of the AC. The length is the rms value of a current or a pd or the resistance or reactance.



What is impedance?



What is impedance?

The impedance is $Z = V_{\text{rms}} / I_{\text{rms}}$ when an AC pd is applied to a combination of resistance and capacitance or inductance.



Derive an expression for the resonance frequency of a RCL series circuit.



Derive an expression for the resonance frequency of a RCL series circuit.

$$\omega L - 1/\omega C = 0$$

$$\omega L = 1/\omega C$$

$$\omega^2 = \sqrt{1/LC}$$

$$\omega = 2\pi f \text{ so } f = 1/2\pi\sqrt{1/LC}$$

At resonance no reactance so $X_L = -X_C$ so all impedance Z is resistance so

$$I_{\max} = V/R$$



What is the Q factor of a RCL series circuit?



What is the Q factor of a RCL series circuit?

$Q = 2\pi f_0 L / R$ where f_0 is the resonant frequency.

This is a measure of how sharp the resonance curve is, the bigger this is, the sharper the curve is.

