

CIE A-Level Physics

24 - Alternating Currents

Flashcards

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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?



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

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

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



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



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$$V_{\text{rms}} = V_0 / \sqrt{2}$$

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

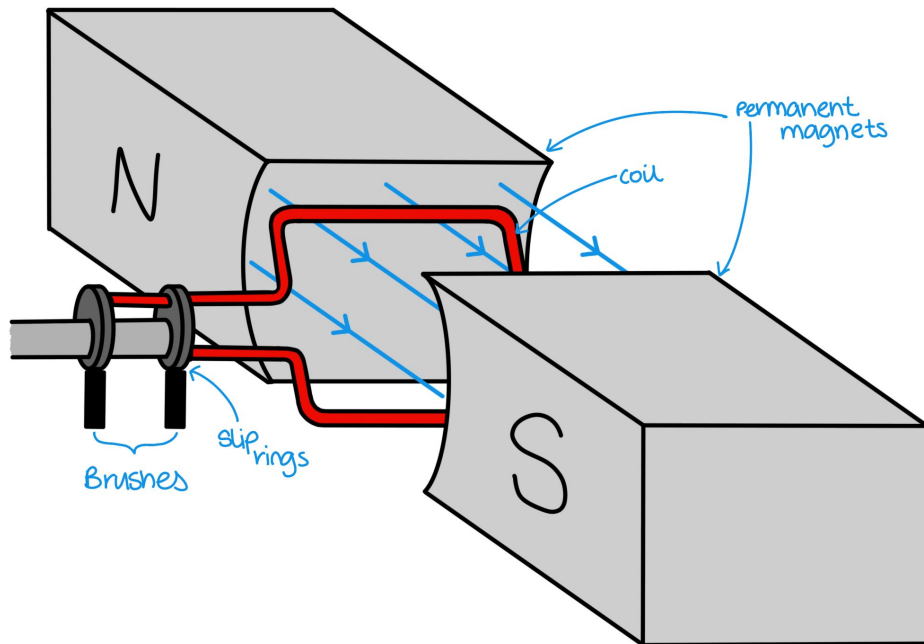


What is the structure of a simple A.C. generator?



What is the structure of a simple A.C. generator?

A rectangular coil which spins in a uniform magnetic field.



How does a simple A.C. generator work?



How does a simple A.C. generator work?

The flux linkage in the coil changes continuously, inducing an alternating current in the coil.

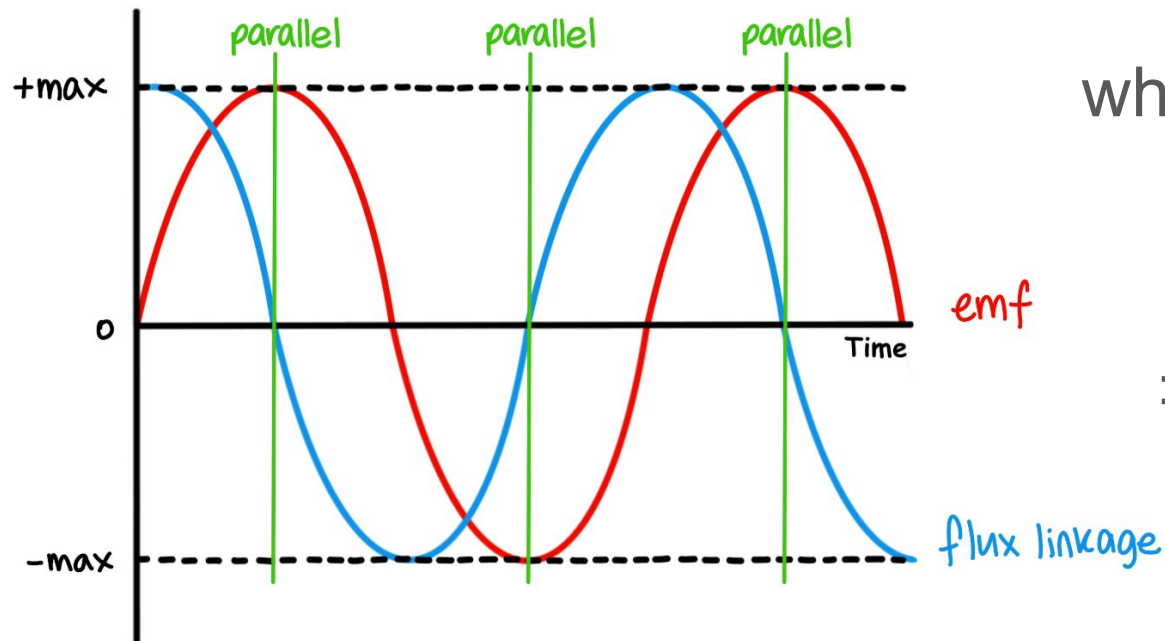
(A and θ change as the coil turns and
$$N\phi = BAN\cos\theta$$
)



How do emf and flux linkage vary in a simple A.C. generator? (graphs)



How do emf and flux linkage vary in a simple A.C. generator? (graphs)



EMF is \pm maximum when the coil is parallel to the field lines, whereas $N\phi$ is \pm maximum when the coil is 90° to the field lines.



What is rectification?



What is rectification?

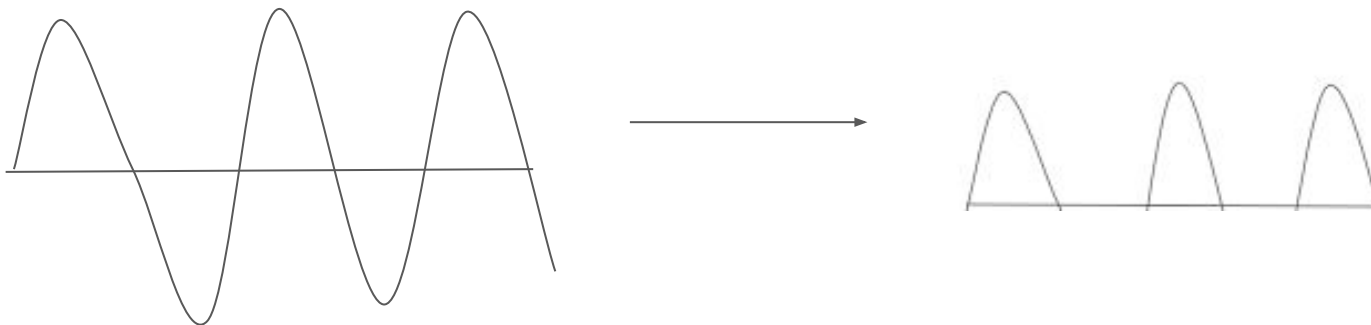
Rectification is the process of converting AC to DC.



What is Half-Wave Rectification?



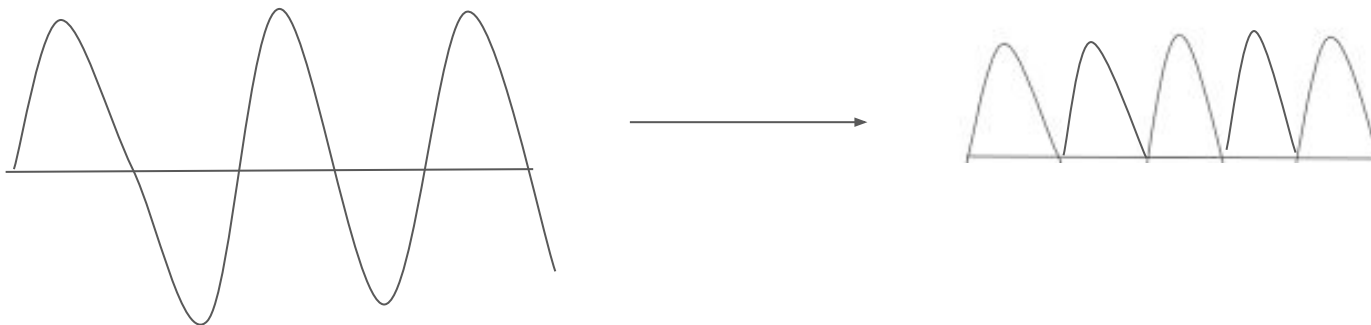
What is Half-Wave Rectification?



What is Full-Wave Rectification?



What is Full-Wave Rectification?



How can the peak emf of an A.C. generator be increased?



How can the peak emf of an A.C. generator be increased?

1. Increase the speed of rotation.
2. Increase the magnetic flux density of the field.
3. Increase the cross-sectional area of the coil.
4. Increase the number of turns on the coil.



What is the purpose of a transformer?



What is the purpose of a transformer?

Transformers change the peak value of an alternating PD to a different value.

Step-up transformers increase it, step-down transformers decrease it.



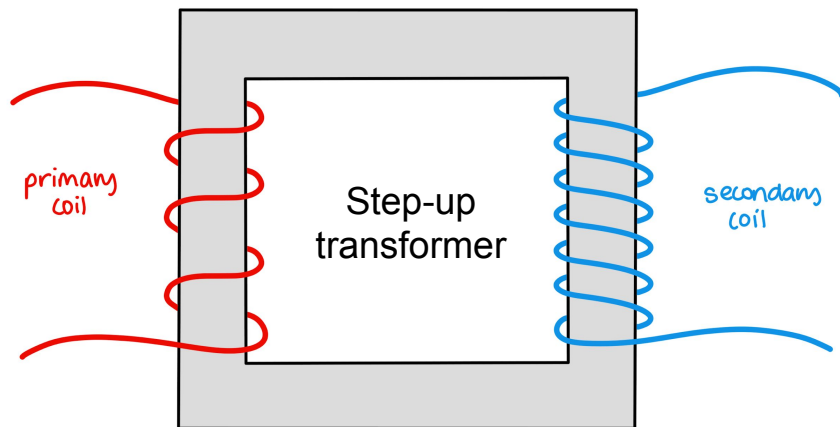
Describe the structure of a simple transformer.



Describe the structure of a simple transformer.

Two coils – primary coil and secondary coil – wrapped around the two sides of a laminated iron ring. For a step-up, there are more turns on the secondary coil.

For a step-down, there are more turns on the primary coil.



How does a transformer work?



How does a transformer work?

An alternating current is passed through the primary coil, which induces an alternating magnetic field in the iron core. This, in turn, induces an alternating emf in the secondary coil.



Give the formula that relates the number of turns with the potential difference of each coil.



Give the formula that relates the number of turns with the potential difference of each coil.

$$V_s / V_p = N_s / N_p$$

V = potential difference

N = number of turns

_p = primary coil

_s = secondary coil



For an ideal transformer (100% efficient),
give the formula relating potential
difference and current in both coils.



For an ideal transformer (100% efficient), give the formula relating potential difference and current in both coils.

If efficiency = 100%, power in the primary coil = power in the secondary coil. This means $I_p V_p = I_s V_s$. Rearranging this gives $I_p / I_s = V_s / V_p$ (which is also the same as N_s / N_p).



What role do transformers play in the National Grid?



What role do transformers play in the National Grid?

Step-up transformers are used to increase the voltage (and decrease current) before the electricity travels long distances. This is to reduce energy lost as heat due to resistance in the wires as the electricity passes through.



Describe an experiment to investigate
the relationship $V_s / V_p = N_s / N_p$.



Describe an experiment to investigate the relationship

$$V_s / V_p = N_s / N_p.$$

Vary the number of turns on each of the coils and measure the peak potential difference of each one every time. Then use the values to prove the relationship between potential difference and number of turns. It is better to use an oscilloscope than a voltmeter for an alternating pd since it is easier to see the peak value.



How can you investigate the efficiency of a transformer?



How can you investigate the efficiency of a transformer?

Measure the current in each coil with an ammeter and a variable resistor. The variable resistor is used to vary the current at a constant pd.

Use the formula $P_{\text{out}} / P_{\text{in}} \times 100\%$ (or $I_p V_p / I_s V_s \times 100\%$) to calculate the efficiency of the transformer.

