Mains UK

If the current constantly changes direction it is called alternating current, or ac. Mains electricity is an alternating supply. The UK mains supply is about **230V**. (RMS)

It has a frequency of 50 cycles per second or 50 Hertz, which means that it changes direction 50 times a second.

Frequency Calculations

If Mains frequency is **50 Hz** one cycle lasts **1/50 sec**

Hence we can say that

0.02s = time period T

$1/T = f = 1/ 0.02s = 50s^{-1}$

$50s^{-1} = 50Hz$

Easy way to think is more cycles per second is a higher frequency. Use the X-Scale for time and add it up to form a complete cycle. i.e. 1ms/div is 1×10^{-3}s per 1cm block.

Peak to RMS

When we talk about AC Voltage or Current it changes as a sinewave. This means that it is not steady and you cannot use normal V=IR equations. So we convert it from that to the "rms" or "DC" equivalent in terms of power or energy delivery.
This means we can compare the two and then do normal circuit calcs.

Mains Peak and RMS

The AC supply goes from ±325V as a peak but we class this as only 230V D.C or RMS equivalent as there is a conversion formulae.

RMS voltage or Current = Peak voltage or Current / √2
You can think of it as being scaled down as RMS is always less than Peak.

Circuit Calculations

If you have the peak voltage you must convert to RMS before you use the normal equations i.e.
Peak Voltage (V_o) **= 5V**
so RMS Voltage = **5V/√2 = 3.5V**.

Then if we put 5V peak across a 4W resistor the RMS current would be
3.5V / 4W = 0.88A (RMS Current)

Power and AC

We can also see from the idea that RMS voltage or Current = Peak voltage or Current / √2 so if Power = Voltage x Current…

$$P_{rms} = V_{rms} \times I_{rms}$$
$$= V_o/\sqrt{2} \times I_o/\sqrt{2}$$
$$= P_o/2$$

So the RMS power is half that of the Peak power. Which also makes sense as V and I are lower!

Timebase

On an oscilloscope the time base is a scale for the voltmeter. It means that when switched on you can see changes to V with time.

This allows us to see a sinewave or decay of a capacitor. If turned off you only see a dot with DC or a vertical line with AC.

Voltage Scale

The vertical axis on an oscilloscope shows you the PD across whatever you connect it to.

It is a simple way of comparing traces and can be scaled to enable you to better see a result. We can also use an oscilloscope to see peaks of sound which arrive a distance or time apart and work out their speed.

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