# On alternating current

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## Warm-up problems

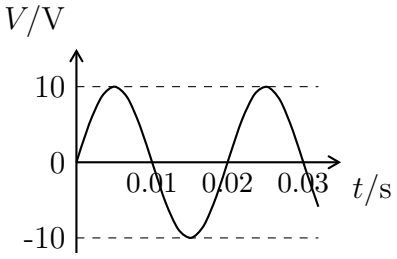
1. (a) How does a.c. differ from d.c.?
   (b) Name a source of (i) a.c., (ii) d.c.
   (c) Name a device which works (i) on d.c. only, (ii) on a.c. only, (iii) equally well on a.c. or d.c.

2. What do the following terms mean when applied to a.c.
   (a) frequency
   (b) peak voltage
   (c) r.m.s. voltage?

3. Draw a graph of current against time for two complete cycles of alternating current of peak value 1 A and frequency 10 Hz. Label your axes and mark a correct scale of values on them. [*You must calculate the time for one cycle in order to mark the axis.*]

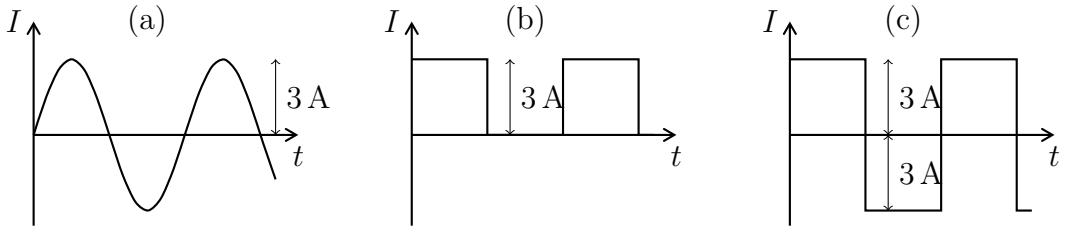
## Regular problems

4. The waveform of an alternating voltage is shown below.




   What is
   (a) the period,
   (b) the frequency,
   (c) the peak voltage,
   (d) the r.m.s. voltage?

5. The diagram below shows three alternating currents of different wave shapes, each of peak (amplitude) value 3.0 A. (a) is a sinusoidal a.c., (b) is a square wave and (c) is a rectangular wave. Calculate the r.m.s. value of the current in each case.




6. A sinusoidal alternating potential difference of which the peak value is 20 V is connected across a resistor of resistance 10 Ω. What is the mean power dissipated in the resistor?

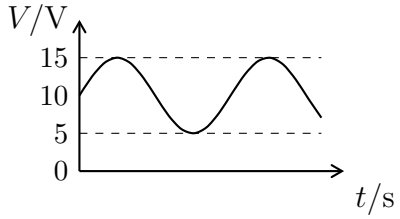
7. An a.c. supply light a lamp with the same brightness as does a 12 V battery. For this a.c. supply, what is

   (a) the r.m.s. voltage,

   (b) the peak voltage?

   (c) What is the power of the lamp, if it takes a (r.m.s) current of 2 A?

8. What value of *steady* direct voltage and *peak* alternating voltage, when added together, would give the varying voltage represented below?




# Extension problems

9. What is the r.m.s. calue of the alternating current which must pass through a resistor immersed in oil in a calorimeter so that the initial rate of rise of temperature of the coil is three times that produced when a direct current of 2 A passes through the resistor under the same conditions?

10. Prove that, for a sinusoidal alternating current $I = I_{\text{peak}} \sin(\omega t)$ passing through a resistor of resistance $R$, the average power dissipated in the resistor is the same as if the resistor had a direct current of $I_{\text{peak}}/\sqrt{2}$ flowing through it. [*Integrate an expression for power over one cycle.*]