

# The Physics of the Mobile Phone

## Sample lesson activities to accompany the mobile phone poster

### 1. Coding and sending waveforms

The graphs A–E overleaf represent parts of signals that need to be sent from one computer to another. Ask your students to read off the voltage level every microsecond, from 0 to 7 microseconds, and then digitise these values by selecting the nearest whole number to the signal level in millivolts. Next, request that students convert the signal levels to a binary number, using the table below to assist them.

Signal level / mV	Digital equivalent
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011
12	1100

Instruct your students to write down the signal as a string of '0's and '1's. Then ask students to place their signal information into an envelope and pass it to a partner to decode. The original signal and the constructed signal can then be compared. Students can be asked to suggest how they could improve the match – for example, by sampling more frequently or having more sampling levels.

Working with graph E will highlight some of the problems involved in reconstructing signals. More graphs can easily be prepared using a spreadsheet.

Students could also communicate with each other using torches or an on/off signal with a laser and fiber optic, to mimic digital communication more closely. Problems of synchronisation and the need for two-way communication will become evident.

To simplify this activity further, students can be supplied with Morse code sheets (available on the Internet) to allow them to send coded messages with light.

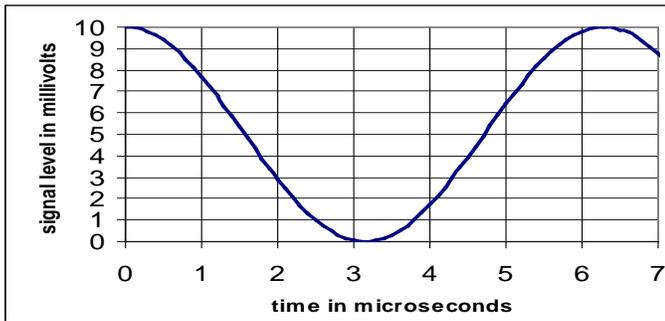
### 2. The uses of lasers

Ask your students to research how many applications of laser technology they can find. As a class, compile a list of those uses. Discuss with the students whether each application relies on laser technology. Could another light source be used instead? Discussion can take place on whether the coherence or monochromatic nature of laser light (or both) are needed for each application.

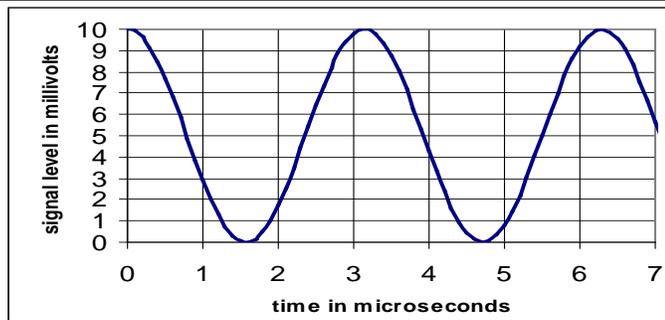
### 3. Making a wavelength chart

Ask your students to match the objects below to the part of the electromagnetic spectrum which has a wavelength of a similar size. You could use graphics of a football field, a hand, an ant, a pinhead, bacteria, a molecule, an atom and a proton, for example. Other objects can easily be substituted if better graphics or other reasons dictate. Students could also produce a poster showing the wavelengths of the different parts of the spectrum, together with the above objects, to help with scale. Your students could also add the uses and properties of the various parts of the spectrum to the poster. See our outreach site for more details: <http://www.phys.soton.ac.uk/outreach/teachers>

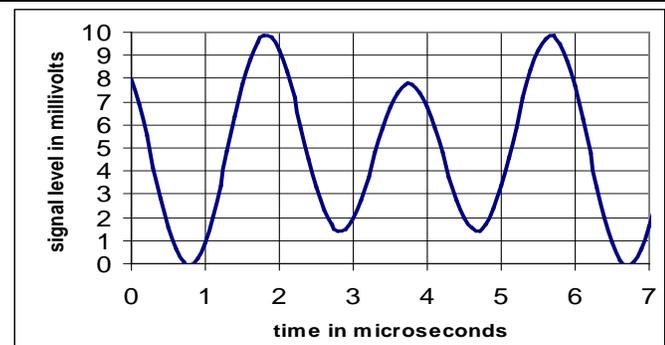
### Coding and sending waveforms



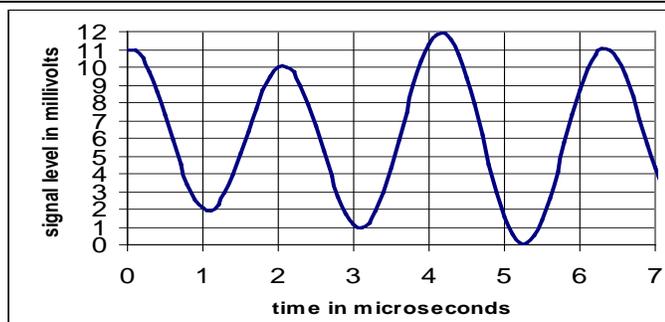
**A**



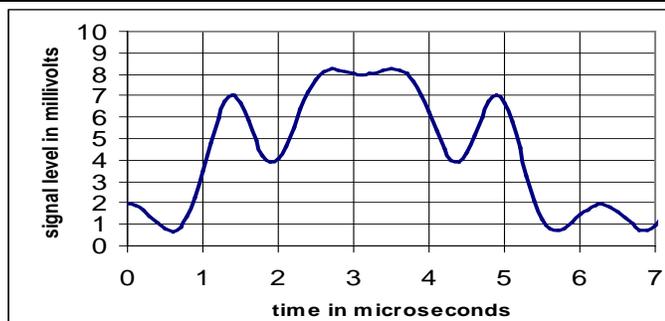
**B**



**C**



**D**



**E**