

# AQA GCSE PHYSICS 1 (SCIENCE) 2007+ REVISION SHEET 5 of 7

## P1b.5 THE ELECTROMAGNETIC SPECTRUM

### What are the uses and hazards of the waves that form the electromagnetic spectrum?

*Using skills, knowledge and understanding of how science works:*

- to evaluate the possible hazards associated with the use of different types of electromagnetic radiation
- to evaluate methods to reduce exposure to different types of electromagnetic radiation.

*Skills, knowledge and understanding of how science works set in the context of:*

- Electromagnetic radiation travels as waves and moves energy from one place to another.
- All types of electromagnetic waves travel at the same speed through a vacuum (space).
- The electromagnetic spectrum is continuous but the wavelengths within it can be grouped into types of increasing wavelength and decreasing frequency:
  - gamma rays, X-rays, ultraviolet rays, visible light, infra red rays, microwaves and radio waves.
- Different wavelengths of electromagnetic radiation are reflected, absorbed or transmitted differently by different substances and types of surface.
- When radiation is absorbed the energy it carries makes the substance which absorbs it hotter and may create an alternating current with the same frequency as the radiation itself.
- Different wavelengths of electromagnetic radiation have different effects on living cells. Some radiations mostly pass through soft tissue without being absorbed, some produce heat, some may cause cancerous changes and some may kill cells. These effects depend on the type of radiation and the size of the dose.
- The uses and the hazards associated with the use of each type of radiation in the electromagnetic spectrum.
- Radiowaves, microwaves, infra red and visible light can be used for communication.
- Microwaves can pass through the Earth's atmosphere and are used to send information to and from satellites and within mobile phone networks.
- Infra red and visible light can be used to send signals along optical fibres and so travel in curved paths.
- Communication signals may be analogue (continuously varying) or digital (only on and off). Digital signals are less prone to interference than analogue and can be easily processed by computers.
- Electromagnetic waves obey the wave formula:  
wave speed = frequency  $\times$  wavelength

1. Define what is meant by:  
(a) wavelength; (b) frequency
2. Calculate the speed of a wave of wavelength 6 m and frequency 300 Hz.
3. List the main regions of the electromagnetic spectrum in order of: (a) increasing wavelength; (b) increasing frequency
4. For each region of the electromagnetic spectrum:  
(a) give one practical use  
(b) state a means of detection  
(c) state a means of production
5. Which region or regions of the electromagnetic spectrum:  
(a) are for television transmission  
(b) are used by security devices  
(c) cause sun-burn  
(d) are used in radar  
(e) can be used to treat cancer  
(f) are used for heating  
(g) are used by remote controls  
(h) are used in cooking  
(i) can cause blindness  
(j) are used in optical fibres  
(k) are given off by radioactive substances  
(l) is given off by fluorescent lamps  
(m) is used to beam satellite television to our homes  
(n) can be detected on Earth coming from space
6. State four common properties of all electromagnetic waves.
7. List the colours of the spectrum of white light starting with:  
(a) the one of highest frequency  
(b) the one of lowest wavelength
8. How is visible light different from ultra-violet?
9. How do we know that light can travel through a vacuum?
10. Describe, with the aid of a diagram, how the effect of total internal reflection is used in an endoscope
11. With the aid of diagrams explain the difference between digital and analogue signals.
12. Classify the following systems as either 'digital' or 'analogue'  
(a) the sound of music travelling through the air;  
(b) Morse code; (c) optical fibre communication;  
(d) a DVD disc
13. What are the advantages of digital communication?
14. Calculate the wavelength of a radio wave of frequency 100MHz if its speed is 300 000 000m/s.
15. Describe how radio waves can suffer interference.