

# Graveney School Year 11 Physics Checklist

## P5 Satellites Communications, Waves & Optics

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### satellite communications

- Signals are transmitted using microwaves to orbiting artificial satellites and then retransmitted back to Earth.
- Microwaves are sent as a thin beam because they only diffract by a small amount due to their short wavelength.
- Radio frequencies below 30MHz are reflected by the ionosphere.
- Above 30GHz, rain, dust and other atmospheric effects reduce the strength of the signal due to absorption and scattering;
- Recall the wave patterns produced by a plane wave passing through different sized gaps.
- State that maximum diffraction occurs when the wavelength equals the size of the gap.
- Long wave radio waves have a very long range because they diffract around hills and over the horizon.
- Longwave radio waves carry signals by amplitude modulation (AM).
- For the reception of radio and TV programmes:
  - \* an aerial is needed for radio signals;
  - \* a 'dish' is needed for satellite TV signals.

### nature of waves

- Recognise that when waves overlap there are:
  - \* areas where the waves add together;
  - \* areas where the waves subtract from each other.
- State that interference results in:
  - \* louder and quieter areas in sound;
  - \* bright and dark areas in light.
- Describe the interference of two waves in terms of reinforcement (constructive) and cancellation (destructive interference) of the waves.
- **Explain that the number of half wavelengths in the path difference for two waves from the same source is:**
  - \* **an odd number for destructive interference;**
  - \* **an even number for constructive interference.**
- Electromagnetic waves are transverse waves and so can be plane polarised.
- Polarisation is used in the application of Polaroid

sunglasses.

### refraction of waves

- Refraction occurs due to a change in the wave speed.
- When the wave speed decreases (air into glass ) the wave bends towards the normal and vice versa.
- **A change in speed causes a change in wavelength**
- **Use the equation:**
- **refractive index = speed of light in vacuum / speed of light in medium**
- The dispersion of white light into the spectrum of white light happens when light is refracted.
- Blue light is deviated more than red light.
- Blue light slows down more than red light.
- **Blue light has a higher refractive index than red light.**
- Spectrum of white light: red, orange, yellow, green, blue, indigo, violet.
- **Use Snell's law:**
  - $n = \sin i / \sin r$
- Total internal reflection can only occur when light travels from a medium with a higher refractive index (glass) into a medium with a lower refractive index (air) and the angle of incidence is greater than the critical angle.
- **Use the equation:**
  - $\sin c = n_r / n_i$

### optics

- Light incident on a convex lens (converging lens) parallel to the axis passes through the focal point.
- 'Fat' lenses have short focal lengths.
- Explain how real inverted images are produced by cameras and projectors (**using ray diagrams**).
- Explain that virtual images (eg. magnifying glass) cannot be projected onto a screen but are the right way up (**using ray diagrams**).
- **Explain how to find the position and size of the real image formed by a convex lens by drawing suitable ray diagrams.**
- **Use the formula for magnification:**
  - **magnification = image size / object size**

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"I'll just have to ask my general practitioner to keep me alive a bit longer."

Peter Higgs on visiting CERN in 2008

