

Extension Worksheet – Topic 8, Worksheet 1

- 1** Outline how interference is used to read information stored on a CD. [3]
- 2** Calculate the pit depth of a CD in which the wavelength of light used to read the CD is 640 nm, explaining your work. [2]
- 3** Information is stored on a CD at a rate of N samples per second. Each sample consists of 32 bits. The playing time of the CD is T seconds. Calculate the storage capacity of the CD, in bits. [2]
- 4** The quantum efficiency of CCD pixel is 80%. The number of photons incident on the pixel per second is 6.8×10^5 . Determine the number of electrons emitted during a time interval of 120 ms. [2]
- 5** The charge deposited in a pixel of capacitance 15 pF is 3.6×10^{-14} C. Calculate the voltage at the ends of the pixel. [1]
- 6** The collecting area of a CCD is 62 mm^2 and contains 8.0×10^6 pixels. The capacitance of a pixel is 22 pF and the quantum efficiency of the CCD is 85%.
 - a** Define quantum efficiency. [1]
 - b** Light of intensity 240 mW m^{-2} and wavelength 540 nm is incident on a pixel of the CCD. Calculate the potential difference that will develop at the ends of the pixel after a time of 35 ms. [6]
 - c** For the CCD in **b** calculate the smallest distance between two points on an object that can just be resolved given that the magnification of the CCD is 2.5×10^{-3} . [3]