1. In a Young's double slit experiment using yellow light of wavelength 550 nm the fringe separation is 0.275 mm.

   (a) Find the slit separation if the fringes are 2.0 m from the slit.
   If d is the slit separation and Δy is the fringe separation then $\Delta y = x\lambda/d \;\Rightarrow\; d = x\lambda/\Delta y = 2.0(550 \times 10^{-9})/(0.275 \times 10^{-}3) = 0.004$ m $= 4$ mm

   The yellow lamp is replaced with a purple one whose light is made of two colours, red light of 700 nm and violet light of 400 nm.

   (b) Find the distance between the violet fringes
   $\Delta y = x\lambda/d \;\Rightarrow\; \Delta y = 2.0(400 \times 10^{-9})/0.004 = 2.0 \times 10^{-4}$ m $= 0.20$ mm

   (c) Find the distance between the red fringes
   $\Delta y = x\lambda/d \;\Rightarrow\; \Delta y = 2.0(700 \times 10^{-9})/0.004 = 3.5 \times 10^{-4}$ m $= 0.35$ mm

2. Hobson Ch 13 Exercises 7,9,10,11,12,13 Problems 3,9,10,14
   Exercises

   7. Red since it has a higher frequency
   9. No photons do not, wave packets do unless there is a detector there that collapses it. So wave functions go through.
   10. When you dim it enough you begin to see the dots from individual photons. These collectively form an interference pattern over time.
   11. The energy stays the same
   12. The number of photons increases

   Problems

   3. A red photon. Microwave has frequency about 10^{11} and red about 10^{12}. Since $E = hf$ then a red photon has about 10 times as much energy
   9. Wavelength $= h/mv$ so increasing speed by a factor of 2 decreases the wavelength by $\frac{1}{2}$.
   10. Protons and Neutrons are approximately the same mass and hence the deutron would have half the wavelength of the proton
   14. Wavelength $= (6.64 \times 10^{-34}/(9 \times 10^{-31}) = 7.367 \times 10^{-4}$ m= 0.073 millimeters.

3. Hobson Ch 14 Exercises 31,32,33,34 Problems 4,5
   Exercises

   31. From E5 to E4
   32. E4 to E2 has the greater frequency. E4 to E3 will have the longer wavelength because Wavelength x frequency equals speed and since speed is constant a lower frequency corresponds to a longer wavelength.
   33. E2 to E1 creates the highest frequency of the ones listed. The longest wavelength corresponds to the smallest frequency which is E5 to E4.

34. E5 to E2, E4 to E2 and E3 to E2

Problems

4. $E = hf$ so $f = e/h = (16 \times 10^{-19})/(6.6 \times 10^{-34}) = 2.4 \times 10^{15}$ Hz.
5. $f = (3 \times 10^{-16}/(6.6 \times 10^{-34}) = 4.5 \times 10^{17}$ Hz.