- The intense yellow light emitted from a sodium street lamp has a wavelength of $\lambda = 590$ nm. The light is emitted when an electron moves from a 3*p* to a 3*s* orbital. What is the energy of (a) one photon and (b) one mole of photons of this light? **5**

The energy of a photon with wavelength λ is given by $E = hc / \lambda$. Hence:

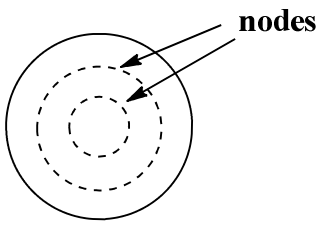
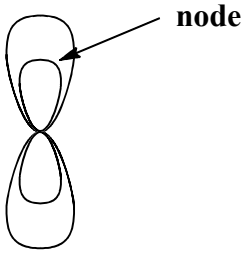
$$E = (6.626 \times 10^{-34}\ \text{J s})(2.998 \times 10^{8}\ \text{m s}^{-1}) / (590 \times 10^{-9}\ \text{m}) = 3.4 \times 10^{-19}\ \text{J}$$

This is the energy per photon. The energy per mole is therefore:

$$E = (6.022 \times 10^{23}\ \text{mol}^{-1}) \times (3.4 \times 10^{-19}\ \text{J}) = 2.0 \times 10^{2}\ \text{kJ mol}^{-1}$$

(a) Answer: **3.4×10^{-19} J**	(b) Answer: **2.0×10^{2} kJ mol^{-1}**

Sketch the shape of a 3*s* and a 3*p* orbital and label any spherical nodes that may be present.

3*s* orbital	3*p* orbital
 **3*s* orbital**	 **3*p* orbital**

What does a node represent?

A node represents the region where there is zero probability of finding the electron.