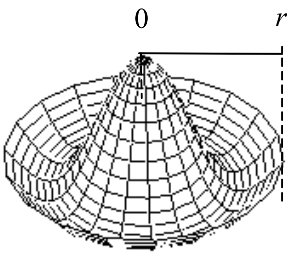
CHEM1101 Problem Sheet 3 (Week 3)

1. Calculate the velocity and the wavelength of an electron with a kinetic energy of 100. eV. (Note that kinetic energy = $p^2/(2m)$ with p = momentum and m = mass.)

2. Calculate the largest energy gap between any two *adjacent* energy levels in He^+ using the expression below for the energy level of an electron with quantum number n in a hydrogen-like atom.

$$E_n = \frac{-E_R Z^2}{n^2} \quad \text{where } E_R = 2.18 \times 10^{-18}\ \text{J}$$

3. Sketch the radial part of the 2-D waveform shown below on the axes provided, and identify the nodes. '0' denotes the centre of the drumhead and '*r*' the perimeter.



4. Complete the table below by filling in the quantum numbers that describe the following atomic orbitals. The 4*d* orbital has been completed as an example.

Orbital	n	l	m_l
4*d*	4	2	-2, -1, 0, 1, 2
1*s*			
3*p*			
5*d*			

5. Sketch the lobe representations of a 2*p* and a 3*p* orbital.

6. Write out the electron configurations for the following elements in the two formats shown for aluminium.

e.g. Al $[Ne]3s^23p^1$ [Ne] ↑↓ ↑

(a) O

(b) Ga

(c) Fr