1. For each of the 9 hydrogen orbitals with n = 3 draw a set of x, y, z coordinate axes and then a sketch of the orbital. Show the phase of each orbital by shading.

2. Without looking at the tables write down the electronic configurations of the following atoms. You can look at a periodic table to find the element.
   a. Ca(20)   b. Ni(28)   c. In(49)   d. Zr(40)   e. Te(52)   f. Cs(55)
   g. Au(79) (gold’s configuration is an exception to the rules. What do you think it is?)

3. Consider the following trend in atomic radii (in pm): Fe (156), Ru (178), Os (185). They are all in the same group but Fe is a first-row, Ru is a second-row and Os is a third-row transition element.
   a. Why the radii of Ru and Os are almost identical?
   b. Why do they differ from Fe a lot?

4. How many radial node and how many planar nodes are in each of the following orbitals?
   a. 5f   b. 3d   c. 7s   d. 6p

5. Let’s talk about ionization energy now. We have learnt in the last work-shop that it is different from the work-function of an element.
   a. Define ionization energy.
   b. Explain the following trend in IE (kJ/mol):
      B (800.6), C (1086.5), N (1402.3), O (1313.9).

6. The halogens show the following periodic trend in electron affinity (kJ/mol):
   F (-328), Cl (-349), Br (-324), I (-295). We can see that Cl, Br, & I follow a trend.
   a. How can you rationalize the trend?
   b. Why does F not follow the trend?
7. Chromium (Cr) has 24 electrons and copper (Cu) has 29 electrons.
   a. Write the electronic configurations of (i) Cr & (ii) Cu.
   b. Explain the reason behind writing the configuration this way.