Unit Q

Hydrogen atom model- Bohr

A) Bohr atom-

1) Has quantized energy levels- specific units of energy. E’ can not exist in between energy levels.
2) Low energy is toward the nucleus. Away is higher.
3) electrons fill in order of energy.
4) Levels are referred to as shells or principal quantum numbers.
   N= 1,2,3,4

B) Quantum mechanical model- based on that electrons behave as waves and location indicated by probabilities.

1) Start with principal quantum number.  1-4 (shell)
2) Shell- e’ with the same energy in one shell are grouped as subshells

   Four types of subshells
   s,p,d,f

   S is lowest in energy ------- f highest
   number of subshells in each shell is equal to the numerical value of that shell.

   Number of e’ per subshell
   s = 2   p = 6   d = 10   f = 14
3) Orbital – region in space around the nucleus in which an electron of certain energy is most likely to be found. Orbitals hold 2 e’ max (can have 0,1,2). Can not know location and velocity simultaneously.

Number of orbitals per subshell

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<tr>
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<th>S</th>
<th>P</th>
<th>d</th>
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<td>orbits</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>7</td>
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Show overhead of orbitals
Shell    orbital type    number of electrons

F(9e’) 1s²2s²2p⁵

1s

2s    2p

3s    3p    3d

4s    4p    4d    4f

O(8e’) 1s²2s²2p⁴
Na(11e’) 1s²2s²2p⁶3s¹
Na(11e’) 1s²2s²2p⁶3s²3p⁶4s²

Look at periodic table to get e’ configuration

Exceptions
Cr Z = 24  [Ar]4s¹3d⁵
Cu Z = 29  [Ar]4s¹3d¹⁰

4) Valence e’ = e’ in outermost energy level.

Valence e’ determine reactivity. Group number refers to the number of valence e’.

Use electronic dot structures.

:\text{:Cl}: \text{:Be} \quad \text{H} \quad \text{:N}:

Show periodic table and different groups. 1A, 2A, 7A , 8A
Metals and non-metals.

D) Trends in the periodic table-
1) Atomic size-
   Get smaller across a period- (left to right)- more protons in nucleus while e’ are at the same quantum number.

   Increase down a group- larger principal quantum number.

2) Ionization energy- energy required to remove one e’ from a neutral element.

   Increases within a period- (left to right) more protons in nucleus while e’ are at the same quantum number.

   Increase up a group- smaller the principal quantum number and closer to protons.

3) Ions- charged species that gain or lose e’.

   Positive ions get smaller. Decrease in principal quantum number.

   Negative ions remain about the same. Same number of protons, same principal quantum number.

E) Periodic table- organized by reactivity.
   1A- alkali metals
   2A- alkaline Earth
   7A- halogens
   8A- Noble gases.

   Hydrogen can be both ways H⁺, or H⁻