1. Thomson was able to determine the mass/charge ratio of the electron but not its mass. How did Millikan’s experiment allow determination of the electron’s mass?

Answer: R. Milikan (1909) was able to determine the mass of electron by means of Thompson’s experiment before. He able to determine electron’s mass with oil-drop experiment. The principle of his experiment is balancing forces, between gravitation force and electric forces, in one drop of oil that in the plat of electrode. Knowing the value of electric area, the electric capacity in oil that was fallen can be determine. And then repeat this experiment, he find the value that was measure always multiple from the same number. And the finally, he said that the number of mass of the electron is $9 \times 10^{-9}$ gram and the capacity of electron is $1.602 \times 10^{-19}$ coulomb.

2. How can ionic compounds be neutral if they consist of positive and negative ions?

Answer: Ionic compounds were shaped from some ion if one or group of atoms that has electric capacity, was given or was received one or more electron. Ionic compounds can be neutral because the value of electric capacity in that compound from the atoms was same. For example, ion $H^+$ has one positive electric capacity and ion $Cl^-$ has one negative electric capacity. Two ions was reaction to be HCl compound. That compound was neutral because ion $H^+$ needed one positive electric capacity to be a stable ion; it got that positive electric capacity from ion $Cl^-$. In other side,

3. Rank the following photons in terms of increasing energy: (a). blue ($\lambda=453$ nm), (b) red ($\lambda=660$ nm), and (c). Yellow ($\lambda=595$ nm).

Answer: The rank of increasing energy: red < yellow < blue.

The reason is Max Planck’s hypothesis. He said that all things that radiate light can absorb some energy. And the value of that energy is:

$$E = \frac{hc}{\lambda}$$

From that formula we can rank that light because we can compare between energy and length of light wave. Energy and length of light wave is proportionate reverse. So if the length of light wave was great, the energy would be the less.

4. Are the following quantum number combinations allowed? If not, show two ways to correct them: (a). n=1, l=0, ml=0; (b). n=2, l=2, ml=+1; (c). n=7, l=1, ml=+2; (d). n=3, l=1, ml=-2

Answer: I wil explain one by one that quantum number combinations.

(a) n=1, l=0, ml=0 → 1s

That quantum number combination is possible. Because sub level s is in the first energy level so the principal quantum number is 1. If the principal quantum number is 1, the
angular momentum quantum number will be 0 and the magnetic quantum number is also 0.

(b) \( n=2, l=2, m_l=+1 \) \( \rightarrow \) 2d^9
 That quantum number combination is impossible. Because sub level d can’t be filled by 9 or 4 electrons.

(c) \( n=7, l=1, m_l=+2 \) \( \rightarrow \) 7p^10
 That quantum number combination is impossible, because sub level p can’t be filled by more than 6 electrons. The magnetic quantum number of that combination number should -1, 0, or +1.

(d) \( n=3, l=1, m_l=-2 \) \( \rightarrow \) 3p^1
 That quantum number combination is possible, but that is not correct. Because sub level p only has angular momentum quantum number 1, that causes the magnetic quantum number only can be filled by number -1, 0, and +1.

5. Write a full set of quantum numbers for the following: (a). outermost electron in an Li atom; (b). The electron gained when a Br atom becomes a Br^- ion; (c). The electron lost when a Cs atom ionizes; (d). the highest energy electron in the ground-state B atom

Answer:
(a) outermost electron in an Li atom
 Atom Li has the outermost electron with configuration 2s^1. And the full set of quantum numbers is \( n=2, l=0, m_l=0 \)

(b) The electron gained when a Br atom becomes a Br^- ion
 Atom Br has the outermost electron with configuration 4s^2 4p^5. But if a Br atom becomes a Br^-, the configuration will be change into 4s^2 4p^6. So the full set of quantum number is \( n=4, l=1, and m_l=+1 \)

(c) The electron lost when a Cs atom ionizes
 Before a Cs atom ionizes, it has configuration (Xe) 6s^1. But when it ionizes, it will lost one outermost electron, so the configuration will be 5s^2 5p^6, so the full set of quantum number is \( n=5, l=1, and m_l=+1 \)

(d) The highest energy electron in the ground-state B atom
 Atom B has the highest energy in the ground state that in the furthest in the nucleus. The configuration is 2p^5. So the full set of quantum number is \( n=2, l=1, and m_l=-1 \)

6. Write the condensed ground-state electron configuration of these transition metal ions, and state which are paramagnetic: (a). Mo^3+; (b). Au^+; (c). Mn^2+; (d). Hf^2+

Answer:
(a) Mo, has electron configuration (Kr) 4d^5 5s^1. If Mo becomes Mo^3+ the electron configuration will be (Kr) 4d^5.

\[ \uparrow \uparrow \uparrow \uparrow \uparrow \]

From that we know that Mo^{3+} is paramagnetic because it has unpaired electron

(b) Au, has electron configuration (Xe) 5d^{10} 6s^1. If Au becomes Au^+ the electron configuration will be (Xe) 5d^{10}.

\[ \uparrow \uparrow \uparrow \uparrow \uparrow \]

From that we know that Au^+ is diamagnetic because it doesn’t have unpaired electron
(c) Mn, has electron configuration (Ar) 3d\(^5\) 4s\(^2\). If Mn becomes Mn\(^{2+}\) the electron configuration will be (Ar) 3d\(^5\)

\[ \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow \]

From the orbital diagram above we know that Mn\(^{2+}\) is paramagnetic because it has unpaired electron.

(d) Hf, has electron configuration (Rn) 6d\(^2\) 7s\(^2\). If Hf becomes Hf\(^{3+}\) the electron configuration will be (Rn) 6d\(^2\)

\[ \uparrow \uparrow \uparrow \uparrow \]

From the orbital diagram above we know that Hf\(^{3+}\) is paramagnetic because it has unpaired electron.

7. There are some exceptions to the trends of first and successive ionization energies. For each of the following pairs, explain which ionization energy would be higher: (a). IE\(_1\) of Ga or IE\(_1\) of Ge; (b). IE\(_2\) of Ga or IE\(_2\) of Ge; (c). IE\(_3\) of Ga or IE\(_3\) or Ge; (d). IE\(_4\) of Ga or IE\(_4\) of Ge

Answer:
(a) IE\(_1\) of Ga < IE\(_1\) of Ge, because Ge has one more electron in the outer, that causes Ge need more ionization energy to release electron.

(b) IE\(_2\) of Ga < IE\(_2\) of Ge, the radius of Ge is less than radius of Ga, that make Ge ionization energy is greater than ga ionization energy

(c) IE\(_3\) of Ga < IE\(_3\) of Ge, same reason with before answer

(d) IE\(_4\) of Ga < IE\(_4\) of Ge, same reason with before answer

8. For single bonds between similar types of atoms, how does the strength of the bond relate to the sizes of the atoms? Explain scientifically.

Answer:
The size of atom is influence by shielding effect and electronegativity. Electronegativity is atom’s relative ability to attract a pair of electron. Electronegativity is proportionate reverse with distance of atom. Thus, if atom’s electronegativity is big, the size of atom will be little. So the strength of single bond will be little too.

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