CHAPTER I
INTRODUCTION

1.1. Background

Learning process starts from the beginning and occurs in every day of human life. Human beings, especially students, learn from their own explorations of the environment (parents, siblings, peers, electronic media, printed media, museums etc.) Consequently, students do not enter the classrooms as blank board, but they enter classrooms with a preexisting knowledge or ideas of science concepts (Gonen and Kocakaya, 2010). These ideas are logical, sensible, and valuable from the students' point of view, strongly held by the students. These ideas may be significantly different from accepted scientific viewpoints or may be same with the true or the scientific explanation (Osborne, 1982; Schoon and Boone, 1998, cited in Ozmen, 2004).

When learning science at school students sometimes relate their prior knowledge to what teacher explains inappropriately, and hence the meanings or concepts they construct are incorrect, incomplete or ineffective to explain the scientific phenomena (Osborne and Wittrock, 1983, cited in Pinarbasi *et al.*, 2009). These inconsistencies between the students' views and the scientifically accepted views are called misconceptions (Ozmen, 2004; Barke *et al.*, 2009), alternative conceptions (Pedrosa and Dias, 2000) (Talanquer, 2006), commonsense reasoning (Talanquer, 2006), preconceptions (Barke *et al.*, 2009), alternative framework (Kuiper, 1994; Maskill and de Jesus, 1997), or naive conception (Reiner *et al.*, 2000) (for simplicity, the term of misconception is used in this thesis.) In general, these misconceptions may be highly resistant to change, and remain intact for many years essentially unaffected by classroom teaching because these are something students believe. If the misconceptions are not corrected, new learning can be encumbered or it might not take place at all (Gonen and Kocakaya, 2010).

Chemistry is sometimes viewed as a difficult subject. It requires students to go between (1) macroscopic representations that describe properties of tangible and visible phenomena in the everyday experiences of learners, (2) submicroscopic (or molecular) representations that provide explanations at the particulate level in which matter is described as being composed of atoms, molecules and ions, and (3) symbolic (or iconic) representations that involve the use of chemical symbols, formulas and equations, as well as every media that symbolize matter (Chandrasegaran *et al*., 2007). Most chemistry teaching operates at the macro (or laboratory) level and the symbolic level, but it's known that many misconceptions in chemistry stem from an inability to visualize structures and processes at the submicroscopic level (Tasker and Dalton, 2006). Submicroscopic (molecular level) views are particularly challenging because students must think about something abstract that cannot be seen. Therefore, many students do not construct appropriate understandings fundamental chemical concepts from the very beginning of their studies (Gabel *et al*., 1987, cited in Erdemir *et al*., 2000). In general, any chemistry teaching that can not relate these three chemistry representation properly will have great possibility to create misconceptions in students and make them cannot fully understand the more advanced concepts that build upon the fundamentals.

Identifying misconception of students is the first step for preventing misconceptions in chemistry. The identification of the students' understandings and misconceptions has been the goal of many of the studies carried out over the last years (Ozmen, 2004). Some of the conceptual areas in which most studies have been conducted are *chemical equilibrium* (Erdemir *et al*., 2000; Sendur *et al*., 2010; Husseini, 2011), *acid-base* (Ross and Munby, 1991; Kousathana *et al*., 2005; Sheppard, 2006), *chemical bonding* (Peterson *et al*., 1986; Coll and Taylor, 2002; Ozmen, 2004; Smith and Nakhleh, 2011), *nuclear chemistry* (Nakibog˘Lu and Tekin, 2006), *atomic orbital and hybridization* (Nakiboglu, 2003), *buffer solution* (Orgil and Sutherland, 2008), *solutions and their components* (Çalık and Ayas, 2005; Pinarbasi and Canpolat, 2003), *colligative properties* (Pinarbasi *et al*., 2009), and *electrochemistry* (Sanger and Greenbowe, 1999; Huddle and White, 2000).

As mentioned above, there are some topics that chemistry students find more difficult to understand. One of those topics is acid-base chemistry. The topic of acids and bases is dense with concept and requires an integrated understanding of many areas of introductory chemistry, such as the particulate nature of matter, molecular kinetic theory, the nature and composition of solutions, atomic structure, ionization, ionic and covalent bonding, symbols, formulae and equations, chemical equilibrium, and collision theory (Sheppard, 2006). Many students rely on formulas and use their calculators without thinking. Students often gain knowledge of acid-base concepts through memorization. Students are also unable to remember what they had memorized because the topics hadn't actually been learned (Lin *et al*., 2004).

Several published studies have investigated students' conceptions of acid-base chemistry (Huang, 2003; Sheppard, 2006; Schmidt and Chemie, 2007; Cartrette and Mayo, 2010; Chaiyapha *et al*., 2011; Rahayu, 2011). Sheppard (2006) found that students had considerable difficulty with acid-base chemistry, were unable to describe accurately acid-base concepts, such as pH, neutralization, strength, and the theoretical descriptions of acids and bases. Chaiyapha *et al*. (2011) also reported that many students also exhibited misconceptions for several concepts, consisting of electrolytic and non-electrolytic solution, ion in acid and base solutions, acid and base theory, dissociation of strong and weak acids and bases, dissociation of water, and neutralization. Given these reported issues, it seems likely that students have difficulty with understanding what is happening in submicroscopic and symbolic terms even in macroscopic term of acid-base chemistry.

Therefore, based on the condition described above, the researcher chose the research entitled **Analyzing of Students' Misconceptions on Acid-Base Chemistry at Senior High Schools in Medan**. The aim of this research was to investigate students' misconceptions about acid-base chemistry at senior high schools in Medan.

1.2. Problem Identification

Based on the background, some problems have been identified as the following.

1. Teaching methods implemented tended to not relate between macroscopic, submicroscopic, and symbolic level in chemistry properly.
2. The complext and abstract nature of chemistry potentially create misconceptions.
3. Students tended to gain knowledge of acid-base concepts by memorizing the generalization of concepts in acid-base chemistry.

1.3. Scope of Research

In order to keep this research became more focused and directed; researcher limited the problems as the following.

1. In this research, study was limited to the investigation of students' misconception in Senior High Schools.
2. This study was limited to XI grade students in Senior High Schools in Medan.
3. This study was limited to the unit of acid-base chemistry topic.

1.4. Problem Statement

To give the direction of this research, the problem statements in this research were formulated as the following.

1. What misconceptions did students acquire about acid-base chemistry at Senior High Schools in Medan?
2. How much was the percentage of students' misconceptions about acid-base chemistry at Senior High Schools in Medan?

1.5. Research Objectives

The objective of this research was to identify High School students' misconceptions in concepts of acid-base chemistry and to determine which misconceptions in basic chemistry concepts causing difficulties in learning the concepts of acid-base chemistry. The specific objectives that have been achieved in this research were the following.

1. Identifying students' misconceptions about acid-base chemistry at Senior High Schools in Medan.
2. Investigating the percentage of students' misconception about acid-base chemistry at Senior High Schools in Medan.

1.6. Research Significances

This study was expected as the following.

1. This study was expected as reference about students' misconception on acid-base chemistry in development of curriculum and teaching method.
2. This study was expected to be an input and information in improving the quality of teaching and learning chemistry especially about acid-base chemistry in Senior High Schools.
3. For researcher, this research was expected as consideration material in conducting teaching and learning process by identifying students' misconceptions.

1.7. Operational Defenitions

Operational defenition of the keywords used in this thesis are presented as the following.

1. Concept is an abstraction that represents thoughts, ideas, senses, notions, believes or entities in order to describe categories or classes of entities and events.
2. Conception is personal interpretation or mental representations of a concept.
3. Misconception is any conceptions that are in disagreement or different with currently accepted scientific view.