CHAPTER I
INTRODUCTION

1.1 Background

The most important aspect that students should bring to their classes are their conceptions. According to Rezkia & Unaida (2022) concept is an idea, object, or event that can help a person in understanding a new problem faced. Each student has different ways to get their own conception. Because students develop they concepts in their minds as a result of their schoolwork or daily activities (Kaniawati et al., 2019). Students' prior knowledge or preconceptions while beginning new learning have a significant impact on their success when studying specific topics. Students get concept of information about the things around them which are usually used to create an understanding from the student perspectives. Because of that students may have the correct or incorrect concept from scientific conceptions since they have different experiences in get that.

When the students' express ideas or beliefs about a scientific topic that differ from the scientifically accepted understanding, these differences are referred to as misconceptions. Misconceptions occur when students hold alternative explanations, ideas, or mental models that do not align with the current scientific knowledge or theories. Misconceptions can emerge for various reasons. Sometimes, students develop their own interpretations based on their personal experiences, cultural influences, or incomplete understanding of scientific concepts. In other cases, misconceptions may arise due to common misconceptions perpetuated in popular media or incomplete or inaccurate instruction.

Febriani (2018) describes that one of the example science topics that students have trouble in learning is chemistry that because has abstracts concepts especially with the acid-base topic, which can make it difficult to learn about this topic and can occur misconceptions of students. One of example topic in acid and base that students' have misconception is in differentiate acid and base solution based the ion (Rusmini, 2020). Students opted for CH_3COOH as a basic solution due to its OH- ion presence. These students believed that a substance containing H+ is acidic, whereas a substance containing OH- is bases.

Learning acid and base is not just important for students' conception in school. It also important for students learning the acid and base, because in our daily life have a lot of acid and base solution that we use for household needs (Agustina, 2018). By learning this topic the students can differentiate the acid and base, and understand what they can do with acid and base solution. After students see the important for learning acids and bases in daily life directly, they can more understand about the concept because they can see the contextual result of their learning.

So, misconceptions in science can be attributed to students' ideas drawn from real-world experiences or informal education that are incorrectly structured and give rise to the wrong interpretation of a scientific concept. Misconceptions are a fundamental issue that usually leads to misunderstanding and misconstruction to students in learning process. Due to the deep integration of misconceptions within students' existing knowledge framework, the process of shifting these misconceptions from incorrect to accurate comprehension could prove to be demanding and arduous (Samsudin et al., 2018). So as a teacher should recognize students' misconception earlier to make students don't have continuing misconceptions.

When pinpointing misconceptions, the most convenient method for educators to employ with students is diagnostic test (Iriyadi et al., 2022). Diagnostic test can help the teacher differentiate between students who have misconceptions and those who don't understand the concept (Juliani et al., 2021). The main role of misconceptions in science is to barrier students from learning science since frequently, these barriers hinder their ability to establish accurate concepts that form the basis for more advanced educational progress. However, it might be challenging to identify students' difficulties, especially misconceptions, using a standard tool like multiple-choice questions (Habiddin & Page, 2019).

Multiple-choice tests, while useful for assessing certain aspects of knowledge, may not be sufficient to gauge students' understanding of complex chemical ideas, particularly when it comes to identifying misconceptions or alternative concepts One-dimensional assessment tools like multiple-choice tests have limitations in

providing a comprehensive view of students' understanding. They often focus on factual recall and may not capture the depth of understanding or critical thinking required in chemistry. Such tests might lead to guessing or selecting the closest option without a genuine understanding of the underlying concepts.

Misconceptions and alternative concepts can be quite subtle and challenging to detect using simple assessment methods. These alternative ideas might seem plausible to students and lead them to select incorrect answers, giving a false impression of their understanding. To address these limitations, educators should use a variety of assessment techniques that encourage higher-order thinking skills and deeper comprehension. Performance-based assessments, open-ended questions, problem-solving tasks, and hands-on experiments are some examples of more effective tools to evaluate students' understanding in chemistry. These methods allow students to demonstrate their knowledge, reasoning abilities, and problem-solving skills more accurately.

Additionally, incorporating formative assessments throughout the learning process can help educators identify and address misconceptions in real-time. This ongoing assessment and feedback process can provide valuable insights into students' progress and understanding, allowing for timely interventions and tailored instruction. By adopting a multifaceted approach to assessment, educators can gain a more comprehensive view of students' understanding of chemical ideas, including the identification of misconceptions and alternative concepts. This, in turn, supports effective teaching strategies and promotes meaningful learning experiences in the field of chemistry.

To more thoroughly assess students' understanding and scientific concepts, a diagnostic instrument is preferred. Employing diagnostic assessments both prior to and following instruction can aid educators in identifying the misconceptions students encounter during the learning process (Diani et al., 2019). Teachers can construct suitable learning objectives by analyzing the level of understanding of their students. Multiple choice questions, interviews, and open-ended questions are all part of diagnostic testing. Numerous variations of diagnostic tests in multiple-choice format exist, encompassing basic multiple-choice tests, two-tiered multiple-choice tests, three-tiered multiple-choice tests, and four-tiered multiple-choice tests

(Soeharto, 2019).

A multiple-choice question with one accurate key and three irrelevant responses makes up the first level. Multiple-choice questions on the second level incorporate the confidence level in addition to the prior responses. The third tier of diagnostic tests comprises multiple-choice questions that incorporate a confidence level and require students to provide their rationales or opinions for the selected answer choices. The third level of multiple choice is multiplied by the students' comfort level in providing reasons for their selections to create the fourth level.

Four-tier multiple choice tests are one kind of diagnostic exam. A modification of the three-tier diagnostic exam, this assessed by asking students to choose one of three answers from a list of options while also providing an explanation of their decision. Researchers commonly employ four-tier tests for diagnostics, as they have demonstrated greater effectiveness compared to other assessment methods (Kaltakci-Gurel et al., 2017). This study indeed aimed to examine students' misconceptions concerning the topic of acids and bases. By identifying and understanding these misconceptions, teachers can gain valuable insights into students' thought processes and knowledge gaps. This information can then be utilized to develop and implement innovative teaching methods that specifically target and address these misconceptions.

By tailoring instruction to address students' misconceptions, teachers can effectively bridge the gap between students' existing understanding and the scientifically accepted conceptsThis could encompass the creation of teaching approaches, exercises, and evaluations that actively challenge and rectify misconceptions, encourage conceptual transformation, and cultivate a more profound grasp of the subject of acids and bases. Innovative teaching methods can include a variety of approaches, such as inquiry-based learning, concept mapping, hands-on experiments, multimedia resources, and formative feedback. These methods aim to actively engage students, encourage critical thinking, and provide opportunities for reflection and revision of misconceptions.

Furthermore, understanding students' misconceptions can inform the design of targeted interventions and instructional scaffolds to support students in overcoming their misconceptions. By explicitly addressing these misconceptions in

the classroom, teachers can enhance students' conceptual understanding, promote scientific literacy, and contribute to meaningful learning experiences. Overall, the analyses of students' misconceptions serve as a valuable resource for teachers to adapt their teaching practices and implement innovative approaches that specifically target and correct these misconceptions. By doing so, teachers can foster a more accurate and comprehensive understanding of the acid and base topic among students, promoting deeper engagement and successful learning outcomes.

1.2 Research Problem

Based on the above background context, the proposed research problem is "How is the diagnosing of middle-school students' misconception using a four-tier diagnostic test on acids and bases topic?". Integrated the research problem, two research questions were developed for this problem:

1. What is the students' conception profile on acids and bases topic?
2. What are the most common students' misconception about acids and bases topic?

1.3 Operational Definition

1. Students' Conception

Students' prior knowledge or preconceptions while beginning new learning have a significant impact on their success when studying specific topics (Habiddin, 2019). In order to learn science, comprehending the concept holds significance for students. When students possess erroneous comprehension of subjects, it results from their misconstruing these very concepts.

2. Students' Misconception

Misconception occurs when a student has an incorrect understanding of an idea. If students choose wrong answers in the first and third tiers, but they choose sure option it can be diagnosed as misconception. Various factor can arise the misconception of the students such as their social experience.

3. Four-tier Diagnostic Test

A diagnostic test featuring four tiers, encompassing the principal query, confidence level regarding the query, rationale, and confidence level for the rationale, serves as a tool for evaluating students' grasp of concepts. Both the initial

and third tiers comprise four choices each. Construct 13 sets of questions, with 3 subtopics in acid and base: Characteristics of Acid and Base, Identification of Acid and Base, and Determination Acid and Base Scale. Responses to each question were organized into sequences and subsequently classified as misconception, scientific knowledge, false positive, false negative, and lack of knowledge. Frequency and percentage data were subjected to statistical analysis in order to chart the way students conceptualize acid and base principles. Moreover, group outcomes were evaluated to identify potential notable distinctions between them.

4. Acids and Bases Topic

The subject of acids and bases constitutes a segment within the 2013 National Curriculum's chemistry curriculum. This subject is presented to seventh-grade students during the initial semester. This study will delve into three specific subtopics encompassed within this area of study: Characteristics of Acid and Base, Identification of Acid and Base, and Determination Acid and Base Scale.

1.4 Limitation of Problem

To focus this research, the researcher limits it to several things. First, this study focused on the topic of acid and base in grade 7 junior high school based on the 2013 curriculum. Second, the researcher selects a four-tier multiple choice diagnostic test from among the different diagnostic tests that are readily available In this research, we haven't been able to identify the source of students' misconceptions solely through the use of this instrument.

1.5 Research Objective

Elaborating on the research problem, this research aims to investigate the following questions:

1. To analyze students' conceptions level on the topic of acid and base use four tier diagnostic tests.
2. To analyze the most common student’s misconception on acid base topic.

1.6 Research Benefit

1. For teachers

This research offers significant benefits for teachers. By identifying and

understanding the misconceptions held by students, especially in the context of the acid and base topic, teachers can gain valuable insights into their students' thinking and knowledge gaps. This research equips teachers with valuable insights into students' misconceptions, enabling them to evaluate students effectively, design targeted assessments, provide personalized feedback, and plan instruction that directly addresses and rectifies these misconceptions. This, in turn, promotes more meaningful and effective learning experiences for students in the context of the acid and base topic.

2. For students

This research can be useful for students by providing theoretical concepts on the topic of acid and base. The theoretical ideas on the subject of acid and base that are presented in this research might be helpful for students. Students studying the topic may use this as reading material. Also, students may learn where common misunderstandings about acid and base occur so that they can avoid them earlier.

3. For other researchers

This study might be helpful for other researchers who will do additional research since a variety of data and theories are available. It doesn't matter whether it's for researchers who will look into misconceptions about acid and base topic or other subjects. Because further research is absolutely needed in this area.

1.7 Organizational Structure of Research Paper

Chapter I: Introduction

This chapter contains of research problem, research question, limitation problem, research objective, and research benefit.

Chapter II: Literature Review

This chapter contains a literature review of the variables that are considered important. Those variables are students' understanding of science, students' misconception in science, four-tier diagnostic tests, and acid and base topics.

Chapter III: Research Methodology

This chapter contains of research method, research design, population and

sample, definition operational, research instrument, data analysis, research procedure.

Chapter IV: Result and Discussion

This chapter contains the result of the data analysis. It also contains a discussion that is constructed based on the result. The result and discussion in this chapter are meant to answer the research questions.

Chapter V: Conclusion, Implication, and Recommendation

This chapter contains the conclusion draw from the result and discussion. It also contains implications and recommendations for future research.