

# CHAPTER I

## INTRODUCTION

### 1.1. Background

The 2013 revised curriculum is the current curriculum in the Indonesian Education System. This curriculum has four aspects, namely aspect of knowledge, aspect of skills, aspect of attitude, and aspect of behavior. The 2013 revised curriculum is a character and competency-based curriculum that requires students to be active in the learning process. With the responsibility of students to be active in the learning process, students are expected to be able to learn and seek their knowledge. This is called student-centered learning.

Based on the results of interviews that have been conducted with one of the physics teachers at SMA N. 7 Medan, the implementation of the 2013 revised curriculum learning is still not optimal because with students as the center of learning, sometimes the knowledge obtained does not come from reliable sources and there are errors in understanding the knowledge. At this time, the teacher acts as a facilitator. The teacher acts as a facilitator, it means the teacher provides services to facilitate students in learning activities, namely getting learning resources and understanding concepts. This is intended to prevent misconceptions about the learning topics being studied.

The misconception is a situation when someone misinterprets a concept (Faizah, 2016). According to Nurlaili (2012), conception is an understanding or interpretation of a scientific concept that has been in mind. This often happens in the learning process. Misconceptions are generally built on sense or built intuitively from students' daily experiences and are only pragmatic explanations of reality. Students' misconceptions may also be obtained through the learning process at the previous education level.

Misconceptions in physics (Suparno, 2013) include: (1) Preconception occurs when students have not attended formal learning, students already have

initial concepts based on their experiences and phenomena of everyday life. (2) Associative thinking has occurred when the term misinterpreted scientific concepts or the relationship between the concept and other concepts. (3) the humanistic thinking, students think that the nature of objects or behavior of things is analogous to human nature. (4) Incomplete reasoning is caused by incomplete information so that students draw wrong conclusions apart from that it occurs because of wrong logic in concluding or in generalizing. (5) False intuition, usually stemming from constant observation, results in a spontaneous feeling when faced with a problem. (6) The stage of students' cognitive development has influenced misconceptions because students have not been able to abstract the problems that must be solved. (7) The ability of students, students who are less talented in physics, or less able to learn physics so that it is difficult to grasp the correct concepts in the learning process. (8) Student interest in the form of low aptitude or level of intelligence that exists in students as a basis for understanding scientific concepts.

Misconceptions exist in all fields of science (Suparno, 2013). Physics is a discipline that is prone to student misconceptions. Because physics is a science that explains natural phenomena that can be understood by the human mind through concepts, theories, and events that occur in the environment. The concept is the basis of thinking for understanding physics. Understanding the concept is very meaningful and important, as a way to organize or organize knowledge and is the basis for building thinking towards a higher level of thinking. If students fail to understand the concept, then students will fail to build their thinking to a higher level.

Misconceptions in physics can occur in various concepts such as electricity, mechanics, optics, heat, the properties of matter, earth, space, and modern physics (Suparno, 2013). Other physics concepts that often have misconceptions are heat and temperature. Most students still understand heat and temperature only in events or phenomena that often occur without understanding the basic concepts. Thus, students fail to apply this phenomenon to solve heat and

temperature problems. Some of the misconceptions that are often found in the concepts of heat and temperature are that heat and temperature are the same, heat is not energy, objects that are different temperatures and in contact with each other do not have to go to the same temperature, boiling is the highest temperature reached by a liquid. Also, on other research that did at SMA Negeri 8 Bulukumba found 63.56% misconceptions in the concept of temperature, 47.03% of form change, and 29.52% of misconceptions experienced by students in heat and temperature topic which was in the medium category (Nursyamsi *et al.*, 2018).

The misconception is one of the things that teachers must be considered. Because a learning process that does not consider to misconceptions can cause various learning errors and a low student achievement index (Hartanto, 2017). A teacher must be able to distinguish between students who understand concepts, do not understand, and those who experience misconceptions (Fariyani *et al.*, 2015). Through teachers 'understanding of their students' knowledge, is a necessary key step that may significantly assist them in their efforts to design an effective learning environment. Therefore we need a tool to identify student misconceptions so that teachers can find solutions to overcome these problems. Diagnostic tests can be used as a tool to identify student misconceptions. Based on the information obtained, the diagnostic test has never been formally conducted by the teacher at SMA N.7 Medan. So, there are still student misconceptions in physics lessons, one of which is in the material of heat and temperature. So far, the teacher only asks spontaneous questions during the continuous learning process, to find out students' understanding of a physics topics.

Diagnostic tests are tests that are used to identify student weaknesses so that appropriate treatment is possible. The benefits of diagnostic tests can be used by teachers to determine the level of students' mastery of concepts, lack of knowledge, misconceptions, and learning difficulties. There are various kinds of diagnostic tests that have been developed by experts to diagnose the concepts students have, such as interviews, concept maps, open-ended questions, multiple-choice tests, two-tier diagnostic tests, three-tier diagnostic tests, and four-tier

diagnostic tests (Gurel *et al.*, 2017). The selection of the right diagnostic test is very important in determining the treatment to be carried out by the teacher. If the diagnostic test results are correct, the treatment will be effective, but preferably, if the diagnostic test results are wrong, the treatment will be ineffective (Gurel *et al.*, 2015).

The four-tier diagnostic test is an extension of the three-tier diagnostic test with the addition of a level of confidence in choosing reasons. The four-tier diagnostic test has an advantage over the two-tier and three-tier diagnostic tests because the four-tier diagnostic test can diagnose misconceptions accurately and is free from errors and lack of knowledge (Gurel *et al.*, 2015). Two-tier diagnostic tests are less efficient at identifying widespread misconceptions, and the test results are insufficient to reflect misconceptions about a lack of knowledge. This is because the two-tier diagnostic test overestimates students' level of misconceptions and cannot detect students' misunderstanding of concepts. The three-tier diagnostic test is the activity of constructing a multiple-choice test. The first tier includes regular multiple-choice tests, the second tier covers the reasons for the selected answers from the first tier, and the third tier is the level of confidence of the answers selected. However, the three-tier has a weakness, namely underestimating the level of students' lack of understanding because the level of confidence in the three-tier, this makes the student's level of confidence in choosing answers at the first, second or both levels is not known (Gurel *et al.*, 2015).

The four-tier diagnostic test, which has four stages in its processing, has a weakness, namely that it requires a longer time in the test and administration (data input and processing). The data obtained from the four-tier diagnostic test is quite a lot so it is prone to errors when inputting data and it takes a lot of time. The use of Google Forms can be used as a solution when doing a four-tier diagnostic test, Google Forms will automatically save student answers and can be downloaded in the form of an Excel document (Purwati & Alifi, 2018). Based on the background description that the researcher has mentioned, the researcher is interested in

researching about **"The Development of Four-tier Diagnostic Test to Identificate Students' Misconception Assisted by Google Form on Heat and Temperature Topic"**.

### **1.2. Problem Identification**

Based on the background, the relevant problems identification are:

1. Students experience misconceptions about heat and temperature topic.
2. Students' errors in connecting preconceptions with concepts.
3. Diagnostic tests have never been carried out in schools to determine the profile of student misconceptions.
4. Students are interestless in learning physics.
5. The students' understanding of the heat and temperature concepts in SMA Negeri 7 Medan in class XI MIAis still not good enough.

### **1.3. Research Limit**

Based on the background, the limit of this research are:

1. Develop the Four-tier Diagnostic Test instrument.
2. Identify students misconceptions on Heat and Temperature material.
3. The research method design is ADDIE.

### **1.4. Problem Formulation**

Based on the problem identification above, the problem formulations are:

1. What are the characteristics of the Four-tier Diagnostic Test instrument for heat and temperature topic will be developed?
2. What is the profile of student misconceptions at SMA N. 7 Medan on heat and temperature topic.

### **1.5. Problem Limit**

Given the extent of the problem, it is necessary to limit this research as follows:

1. The research subjects were students of class XI semester II SMA Negeri 7 Medan.
2. The instrument is developed is four-tier diagnostic test.
3. The heat and temperature topic that will be identified misconceptions refers to the 2013 revised curriculum.

### **1.6. Research Objectives**

Based on the problem formulation of the research, the objectives of the research are to:

1. Describe the characteristics of the Four-tier Diagnostic Test instrument of the heat and temperature topic will be developed.
2. Knowing the profile of student misconceptions at SMA N. 7 Medan on heat and temperature topic.

### **1.7. Research Benefits**

The expected benefits of this research are:

#### **1.7.1. For School**

Giving good contribution to the quality of school as students learning outcomes and teacher's professionalism.

#### **1.7.2. For Teacher**

The results of this research are expected to provide information about students' misconceptions about the heat and temperature topic so that the teacher can determine what sub-concepts need further explanation in the learning process.



### 1.7.3. For Student

The results of this research are expected to detect students' misconceptions in physics, especially on the heat and temperature topic.

### 1.7.4. For Other Researchers

These research results are expected can be used as a reference to reveal specific misconceptions and can be used as a reference for applying learning models that are able to reduce misconceptions experienced by students on heat and temperature topic.

### 1.7.5. For Scientific Development

These research results are expected can provide information that can develop science education specifically about misconceptions on heat and temperature topic.

## 1.8. Operational Definition

Based on the explanation above, the operational definitions of this research are:

1. The misconception is a conception of someone who is not by the scientific conception possessed by experts (Maison *et al.*, 2019).
2. The research instrument is a tool or facility used by researchers in collecting data (Nurlaila *et al.*, 2016)
3. Diagnostic tests are tests designed to identify strengths and weaknesses in students' knowledge (Jang & Maryam, 2013).
4. Four-tier is a test that can accurately measure the misconceptions held by respondents so that the conclusions drawn are free from errors and lack of knowledge (Gurel *et al.*, 2015).
5. Google Forms is a form template system that can be used to obtain user information. This application works in Google Drive storage, this template is very easy to understand and use (Rahardja *et al.*, 2018).