

## CHAPTER I

### INTRODUCTION

#### 1.1. Background

In learning process, students are always directed to be able to understand the learning material as well as possible. In fact, during the learning process students do not always fully absorb the information, especially in Physics subjects which contain many scientific concepts. So that sometimes what students understand about a scientific concept is often different from the concept adopted by physicists in general (Suparno, 2013).

Physics has an important role in the development of science and technology. Given the important role of physics, physics should be well understood by students studying physics. Students' efforts to study physics often encounter obstacles due to the assumption that physics is an elusive lesson, and supported by unattractive teaching of physics. Researchers in the field of physics education in Indonesia cite various reasons regarding the lack of understanding of student physics. Many parties say that one of the causes of the lack of understanding of student physics is the existence of misconceptions (Maryani, 2013). Physics as a science there are concepts that must be studied. Two characteristics of physics concepts, namely abstract concepts and concrete concepts (Fathurohman, 2014). It is concrete because it can be felt and seen by one of the five senses, while abstract concepts of physics are sometimes difficult to describe, making it difficult for students to study the concept. This causes students think that physics is difficult and boring, and lessons that only cover complex set of formulas.

Before the learning process begins, each student already has the initial knowledge they gain from their daily life experience or from their self-study results. That initial knowledge was the student's initial concept (preconception). Sometimes the initial conception that students have and believe is incompatible

with scientific conception. Such circumstances are called misconceptions. Misconceptions can also be identified as concepts contrary to scientifically accepted and generally (Gurel et al., 2015).

In learning activities there are often various misconceptions that make the learning process is interrupted. Van den Berg (1991:10) states that the different conceptions or contrary to the conception of experts are referred to as misconceptions. In contrast to Van den Berg, it is concluded by (Pesman,2010), that misconception is cognitive structure that is firmly embedded but inconsistent with scientific concepts. However, the definition can be interpreted that not only is it inconsistent with scientific concepts, but a misconception is strongly supported by the individual them self.

Misconceptions can be caused by five things: students, teachers, textbooks, context, and teaching methods (Suparno, 2005) but the appearance of the most misconceptions is not during the teaching process but rather before the teaching process begins, namely in the initial concept that the student brings before he enters the learning process or so-called preconception. This preconception stems from the student's own thinking and the understanding of students who are still limited to the surrounding nature. In addition, misconceptions are also obtained from different experiences – different and inaccurate sources of information.

Misconceptions are found in all areas of science (Suparno, 2013). One of the common misconceptions is heat and temperature. (Suparno , 2013: 48) states that the misconceptions often experienced by students are same in this material. For example calor is not energy, boiling is the highest temperature reached by liquids, temperature is the nature of a material, objects that differ in temperature and contact with each other do not have to go to the same temperature. The results of the study (Alberta,2011) concluded that 85% of the 40 students of Grade VII Pontianak Good Shepherd Junior High School experienced misconceptions about calor.

Research (Eis,2012) concluded that the misconceptions experienced by grade VII students of SMPN 2 Pemangkat are some students consider that the

temperature in boiling water when the heat is given constantly increases in temperature for reasons such as; more temperature increase; because the its getting hotter; the temperature of boiling water will always increase if it is constantly heated; because the heat is mixed with boiling water.

A study conducted by Alfiani (2015) shows that there are still many students experiencing misconceptions, including: 1) temperature and heat are the same, 2) temperature can be transferred 3) when the object changes, the temperature of the object still rises 4) The iron ruler will save or absorb a better temperature than wooden ruler, 5) radiation emission power is influenced by the volume of the object. The existence of student misconceptions will hinder the process of receiving new knowledge or new material that is related to other knowledge through classroom learning so that it will hinder students in the learning process, therefore the identification of misconceptions is an important thing to do in the physics learning process.

Identification can be done before, during, and after the learning process and needs to be followed up with efforts to keep students out of their misconceptions. An error identifier will cause an error in how to resolve it, and the result will not be satisfactory (Tayubi,2005). This is important in order to be a source of information for educators and researchers in developing learning in the classroom to overcome and correct misconceptions.

Misconception detection in students taken to determine the appropriate steps in overcoming learning problems, therefore an appropriate evaluation tools are needed to identify the misconceptions so as not to continue continuously. There are several ways to address student misconceptions in physics. Broadly the steps used to overcome student misconceptions are:

1. Finding or uncovering student misconceptions.
2. Look for the cause of student misconceptions.
3. Seek appropriate treatment to overcome student misconceptions.

So far, teachers indicated the students' misconceptions only by interviews because the misconception detection evaluation instrument has not been developed. The test instruments used by teachers in both multiple choice and essay are unable to distinguish between students who knew concepts, experienced misconceptions, and students who did not know the concept. Misconceptions are difficult to eliminate, but if they can be identified early, prevention and misconceptions correction can be done (Salirawati, 2011).

One of the effective ways to identify student misconceptions is diagnostic misconception tests in written form. Misconception diagnostic tests are intended to determine the learning difficulties experienced by students. Various types of assessments as diagnostic tests are used in science education to identify student misconceptions including open-ended questions, concept maps, multiple choice. Several studies have successfully developed diagnostic misconceptions whose results can be known quickly and accurately, including two-tier and three-tier multiple choice diagnostic test.

Two-tier and three-tier diagnostic tests address detection issues compared to regular multiple-choice tests. However, in its development two-tier still has a weakness that cannot distinguish lack of knowledge and misconceptions. This weakness was then corrected by the presence of three-tier test. Three-tier comes with added confidence levels after the first two levels. The student's answer to each item is considered a misconception when the student answers the first and second tiers incorrectly for a high reason, therefore the three-tier is useful for identifying misconceptions free of error and lack of knowledge.

The relevant research that has used the Three Tier Test diagnostic instrument is Arslan et al (2012), who concluded that a valid and reliable Three tier diagnostic test instrument not only identifies the teacher's misconceptions in teaching but also the misconceptions of students in learning. Silung et al (2016) in his research concluded that the Three tier test developed is a reliable and valid measuring tool for investigating conceptual understanding and misconceptions of students.

The interview results with physics teachers at SMA N 7 Medan, Mrs. Andrita Nababan, S.Pd, M.Si on October 27, 2020 also showed that there were still misconceptions found in students when the learning process took place, such as when students were asked by the teacher then students answered the questions. This concept, the concept given by students is different from the actual concept, this is due to the student's preconceptions and still lack of reading and understanding of the physics subject matter. Therefore, the use of diagnostic tests in schools is very necessary so that teachers can find out concepts that are already understood by students, not understood and students who are in misconception. Diagnostic tests are tests that are used to identify student weaknesses so that appropriate treatment is possible.

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). After conducting this test, the student's conceptual weaknesses are identified and the educator can take corrective action as a follow-up action. Corrective action taken by educators is expected to direct students to strengthen concepts that have not been mastered and learning objectives can be achieved optimally, in conducting the test author realize that the data collecting process on this study is taking time. The application of Google Forms can be used as a solution when doing a three-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 described above, and considering the importance of diagnostic tests that can assist teachers in conducting diagnostic tests and determining the characteristics of student misconceptions that lead to improved understanding of student concepts in heat and temperature, the author interested in conducting research with the title "The Identification of Students

Misconceptions Using Three Tier Multiple Choice Diagnostic (Mcd) Tests Assisted by Google Form On Heat and temperature Material "

### **1.2. Problem Identification**

Based on the background of the problems described above, the relevant problems to the research can be identified, including:

1. Students experience misconceptions about heat and temperature material.
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.

### **1.3. Research Scope**

Based on the background of the problems above, the scope of this research is: "Developing of three-tier diagnostic tests to identify student misconceptions on heat and temperature topic assisted by Google Forms".

### **1.4. Problem Formulation**

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

1. What are the characteristics of the Three 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 Scope**

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 I SMA Negeri 7 Medan.
2. Using a three-tier diagnostic test instrument.

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 study are to:

1. Describe the characteristics of the Three 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 material.

### **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 in 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. Three-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).