CHAPTER I
INTRODUCTION

1. 1 Research Background

The Merdeka curriculum is considered more effective and focuses on the subject matter, character and skill development of students and creates a more active and fun learning atmosphere. In this curriculum, teachers are given the freedom to manage learning in the classroom and students are motivated to be active in discussions and dare to argue. Learning can also be done outside the classroom so that discussion activities are much more comfortable, not bored and schools adjust learning methods and subjects to the content of the curriculum, and this program aims to involve students in a student-centered approach (Napitupulu et al., 2023; Rahayu et al., 2022; Setiawan et al., 2023).

Chemistry learning taught at SMA Negeri 2 Percut Sei Tuan already uses the Merdeka curriculum. The subject matter of redox reactions is taught in class XII Odd Semester. To teach chemistry material, it is necessary to understand the characteristics of each chemistry teaching material (Fajri and Muna, 2023). To get maximum learning results, in every lesson the teacher must understand each characteristic of the students which usually students do not have the same characteristics or have each different characteristics such as: interest, motivation, student background, literacy and numeracy of each student (Easa & Blonder, 2022). The inequality of perception from students can lead to misconceptions of each student so that errors occur (Poluakan & Katuuk, 2022).

Redox material is classified as material that is difficult for students in SMA class XII to understand. This is because students are not fully able to understand the concepts of redox such as defining redox reactions, how to determine the oxidation number of a molecule/ion based on the oxidation number rule, substances that act as reductants or oxidizers in redox reactions so that misconceptions occur in the answers to redox reaction questions. In this material, students need to have a good level of understanding so that they do not make mistakes when calculating oxidation numbers which can cause inaccuracies in determining oxidation or reduction reactions (Khaerudin et al., 2023; Adjei et al.,

2022). Students' understanding of redox material can be improved by the way students must first understand the previous teaching materials: the concept of chemical substances, molecules, chemical reactions, balanced chemical reactions and oxidation numbers (Nazar et al., 2022).

Based on the results of interviews conducted at SMA N 2 Percut Sei Tuan, chemistry learning still uses lecture methods and question and answer discussions with the Problem Based Learning learning model. Then, the learning tools used are learning modules, Flow of Learning Objectives (ATP), Learning Outcomes (CP), package books and power point media for material exposure to students. In understanding the material, the level of student understanding is still low because students still have difficulty in understanding the concept of redox, how to determine the oxidation number of an element in compounds or ions and the redox reaction equation. Through the learning results, 50% of students still do not understand the name of the compound so that they have the wrong concept in determining the oxidation number and also wrong in understanding the redox reaction equation. For example, when students determine the oxidation number of Mn in the compound $MnSO_4$ they have the wrong concept in finding the oxidation number, namely by answering the rule of oxidation number O which is worth -2 multiplied by four so that O is worth -8, S is worth -2 because it is fixed and Mn is worth +6. While the correct concept is that the $MnSO_4$ compound ionizes into Mn^{2+} and SO_4^{2-}, then the oxidation number of Mn is +2.

This is because in the previous curriculum, namely the K13 curriculum, redox material was contained in grades X and XII so that the distance between the grade levels made them forget the concept of redox in grade X so that it needed to be repeated in grade XII. Therefore, grade XII students still tend to be wrong in answering or working on redox reaction equation questions. Meanwhile, in the Merdeka curriculum, redox learning is only carried out in class XII. In addition, the teacher has also never conducted an exam using a diagnostic test to find out students' misconceptions but only uses a regular test.

One form of conceptual error that occurs is in determining the oxidation number of the H atom in the H_2O compound is +2, while it is the value of 2 H atoms not 1 H atom. Students use this method when doing the pre-test based on

the explanation of the material from the teacher. The same thing also happens when students determine the oxidation number value of O, namely giving answers +2 and -2, while the compound in the problem is not a peroxide. Relatively weak concept understanding is found in the subconcepts of redox reactions based on electron transfer; increase or decrease in oxidation number; redox reactions; oxidizing and reducing substances; and application of redox reactions. Among these subconcepts, the application of redox reactions has the lowest percentage of student understanding at 14.29% and 26.98% for the redox subconcept material based on electron transfer. While based on theory, redox reactions involve the transfer of electrons from one reactant to another. When oxidation occurs, reduction also occurs, and substances that lose electrons will be oxidized and substances that gain electrons will be reduced (Yuniarti et al., 2020; Rahmiati et al., 2022; Mayeem et al., 2023).

The most common errors found explain that knowing the representation of oxidation-reduction reactions, the dependence between oxidation and reduction reactions, the process of electron transfer, the meaning of oxidation numbers, identifying reagents as oxidants or reductants, and the balancing of redox reactions. In addition, the language used in textbooks often does not adequately explain the concepts involved in redox reactions (Goes et al., 2020).

The level of misconceptions that occur in students of class X MIPA SMA Negeri 9 Bengkulu City in the 2018/2019 academic year on the concept material of redox reactions is 35.7%. The highest misconception in determining the oxidation number of negative ion elements and the oxidation number between two atoms bound in a compound based on the rule of oxidation number is 46% and the lowest misconception in conceptual understanding of oxidation and reduction redox reactions is 23%. Conceptual errors experienced by students in understanding the material are called misconceptions (Yuniarti et al., 2020).

Despite formal learning, misconceptions tend to persist. A misconception refers to a concept that is not in accordance with scientific concepts or the accepted understanding of experts in that field (Medina, 2022). Thus, students who experience misconceptions will believe that the knowledge they have is correct. To correct these misconceptions, cognitive conflict can help students gain new

understanding in accordance with facts or theories. In addition, cognitive conflict can reduce the level of misconceptions held by students (Putri et al., 2023).

The occurrence of misconceptions can occur if students do not understand the basic material that needs to be mastered before learning redox. The material that is the basic reference for learning redox is the symbol of chemical elements which aims to recognize chemical elements, compound names that function to determine a substance including mixtures, compounds or elements, or chemical formulas to determine the constituent elements of a compound and the rules for determining the correct oxidation number, it will be difficult to determine the oxidation number of polyatomic compounds or ions that have more than two elements (Delisma et al., 2020).

Learning can be successful when students are able to understand concepts correctly. In fact, students still experience misconceptions. This issue must be studied more deeply than just conventional academic achievement tests (Annisa, 2019). Therefore, it is important to determine misconceptions in subjects where students have learning difficulties and identify the factors that cause these misconceptions to appear (Ayyıldız et al., 2022). There are several ways that can analyze student misconceptions such as: concept maps, diagnostic tests, interviews, class discussions and questions and answers (Annisa, 2019).

Until now, to find out which students have misconceptions, the first step in identifying them is to use diagnostic tests. Diagnostic tests are believed to help teachers detect misconceptions. There are several diagnostic tests, including: diagnostic essay tests, multiple choice tests, interviews and graded multiple choice tests. Each diagnostic test has its own advantages and disadvantages (Yuberti et al., 2020). One type of diagnostic test is the three-level multiple choice test. This test consists of three parts, each containing questions about the concept of the material, the reason for answering the first question, and the student's level of confidence in the previous two parts of the question. This method is very effective for measuring students' level of understanding (Mellyzar, 2021).

In this research, diagnostic tests were carried out using the web which is certainly much more effective than a manual system for conducting tests. The advantage of utilizing the web when conducting tests is that the results of working

on questions can be checked automatically (Lestariningtias et al., 2020). Technologies such as digital learning tools and social learning platforms make it easier for teachers to form and manage groups. With the help of these technologies, teachers can connect with their students to give advice, ask questions to improve their knowledge, and share their knowledge with their students (Zaripova et al., 2021). The relevance of using web services in education lies in the fact that information technology serves not only as a tool used to solve specific pedagogical problems, but also adds variety to the educational process, promotes the formation of self-learning skills, and stimulates the development of the educational process itself (Sultanova et al., 2021).

Quizizz is a web application that supports learning, document creation, exercises, quizzes with attractive images. Creating assignments or quizzes with images means that teachers can add images to the questions. The addition of images to the questions makes it easier for students to understand the material and answer. In this quiz application, students can also see the rankings they have achieved to motivate them to achieve the desired learning outcomes (Annisa & Erwin, 2021). Quizizz has several advantages, first, the use is quite easy, the quiz that is compiled can be directly added to the Quizizz media application and can be arranged with images, backgrounds, and choice options. Then, Quizzes can be shared with codes to students. Third, the Quizizz media application provides statistical data on student quiz results that can be downloaded in the form of an Excel spreadsheet. Fourth, the use of the Quizizz media application is quite flexible because there is a time setting in the quiz (Rizki et al., 2022).

Diagnostic tests as formative tests can improve students' learning ability. The use of diagnostic tests as formative tests can be considered when forming heterogeneous groups for chemistry learning. The results showed an increase in learning outcomes of the lowest by 26.85% and the highest by 38.9%, as well as a significant increase of 32.583% (Putri & Rinaningsih, 2020).

The web-based diagnostic test is expected to analyze students' misconceptions on redox material so as to find out students' learning difficulties and the causes of misconceptions. The web-based diagnostic test is expected to analyze students' misconceptions on redox material so as to find out students'

learning difficulties and the causes of misconceptions (Hidayah & Muchtar, 2022). In addition, the web-based diagnostic test is also expected to increase students' enthusiasm for learning during learning so that students are more familiar with their potential abilities in participating in learning or working on redox material questions and recognizing material that has been mastered or not as learning evaluation material as well as a reference for teachers to deepen material and strengthen material that has not been mastered. Based on the background description, the researcher is interested in conducting research with the title **"Analysis of Student Misconceptions Using Web-Based Diagnostic Tests on Redox Material"**

1. 2 The Problem Of Identification

Identify the following problems :

1. Students have difficulty understanding the concept of redox, determining oxidation numbers, and equalizing redox reactions.
2. Material redox often causes misconceptions because students' lack of understanding
3. Web-based test instrument that can analyze student misconceptions
4. Factors causing students' misconceptions on redox materials

1. 3 Scope of Research

Based on the background of the problem and problem identification, the scope of this research is:

1. Students' misconceptions on redox materials
2. Factors causing students' misconceptions on redox materials

1. 4 Problem Limitation

The problem limitations in this research are:

1. Students' misconceptions are limited to the redox material
2. This research was conducted in class XII of SMA Negeri 2 Percut Sei Tuan.
3. The results of the web-based three-tier diagnostic test measure the level of student misconceptions.
4. The factors that cause student misconceptions are carried out by giving a questionnaire and the results obtained are based on student perceptions.

1. 5 Problem Formulation

Based on the background and problem boundaries above, the problem formulation in this research is:

1. How is the category of students' conceptions on the redox material using a web-based diagnostic test?
2. How many the percentage of students who experience misconceptions in each concept on the redox material?
3. What are the factors that cause students' misconceptions on the redox material?

1. 6 Research Objectives

In accordance with the research problem formulated, the objectives of this study are:

1. Identifying the categories of students' conceptions on the redox material
2. Knowing the percentage of students who experience misconceptions in each redox concept
3. Identifying the factors that cause students' misconceptions on the redox material

1. 7 Research Benefits

The benefits expected and to be achieved in this research are as follows :

1. For students

Contributing ideas about the misconceptions experienced by students so that they can provide an overview to improve their understanding of the concept.

2. For teachers

Teachers can find out the extent of students' understanding of the redox concept so that it makes it easier for teachers to determine the appropriate treatment with the weakness of understanding the material.

3. For Schools

This research is expected to provide consideration for schools to improve the teaching system in the teaching and learning process.

4. For researchers

Gaining knowledge and insight into classroom learning using web-based diagnostic tests on redox material.