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# The Analysis of HOTS (*Higher Order Thinking Skills*) Questions Based on Brookhart Category in the 2013 Curriculum High School Chemistry Textbook

***Lia Agustina[1*], Tonih Feronika[2], Luki Yunita[3]***
[1,2,3]Department of Chemistry Education, Universitas Islam Negeri Syarif Hidayatullah Jakarta
* E-mail Corresponding Author: lia.agustina15@mhs.uinjkt.ac.id

**Abstract**

Higher Order Thinking Skills is one of the skills necessary in 21st century. So, learning media are required to improve students' higher order thinking skills. Chemistry textbooks which are used as learning media should contain questions that improve students' thinking processes, especially higher order thinking skills (HOTS). However, there are no criteria for assessing the questions in the textbook, especially for higher order thinking questions. This study aims to determine the HOTS aspect using the Brookhart category on questions contained in the XII grade chemistry textbook. The research method used is descriptive method of document analysis. The results showed that the average percentage of HOTS questions in the three class XII chemistry textbooks was 25.95%, covering aspects of analyzing 8.85%, creating 3.51%, reasoning and logic 8.35%, problem solving 3.71%, and creative thinking 1.53%. Meanwhile, the aspects of evaluating and making decisions are not present in each analyzed chemistry textbook. Based on the research results, it can be seen that the chemistry textbook for class XII is still dominated by questions of low-level thinking skills.

Keywords: chemistry textbooks; higher order thinking skills; HOTS; question

**Abstrak**

Keterampilan berpikir tingkat tinggi merupakan satu diantara keterampilan yang dibutuhkan pada abad 21, untuk itu diperlukan media pembelajaran yang dapat meningkatkan kemampuan berpikir tingkat tinggi peserta didik. Buku teks kimia yang digunakan sebagai media pembelajaran sudah seharusnya berisi pertanyaan yang meningkatkan proses berpikir peserta didik, terutama keterampilan berpikir tingkat tinggi (HOTS). Namun, belum ada kriteria untuk menilai pertanyaan yang ada pada buku teks, khususnya untuk pertanyaan berpikir tingkat tinggi. Penelitian ini bertujuan untuk mengetahui aspek HOTS menggunakan kategori Brookhart pada pertanyaan yang terdapat dalam buku teks kimia kelas XII. Metode penelitian yang digunakan berupa metode deskriptif jenis analisis dokumen. Hasil penelitian menunjukkan rata-rata persentase pertanyaan HOTS ketiga buku teks kimia kelas XII sebesar 25,95%, meliputi aspek menganalisis 8,85%, mencipta 3,51%, penalaran dan logika 8,35%, pemecahan masalah 3,71%, dan berpikir kreatif 1,53%. Sementara aspek mengevaluasi dan mengambil keputusan tidak terdapat pada masing-masing buku teks kimia yang dianalisis. Berdasarkan hasil penelitian, dapat diketahui bahwa buku teks kimia kelas XII masih didominasi pertanyaan keterampilan berpikir tingkat rendah.

Kata kunci: buku teks kimia; keterampilan berpikir tingkat tinggi; HOTS; pertanyaan

## Introduction

Higher order thinking skills are one of the skills needed in the 21st century. Therefore, an education that can develop higher thinking skills for students is needed. In Indonesia, this is adopted by the 2013 Curriculum of "4K" (4C) which consists of (a) critical thinking and problem solving, (b) communication skills, (c) creativity and innovation, and (d) collaboration. These four 21st century skills can be relized if they are supported by learning oriented to the development of *HOTS* (Nofrion & Wijayanto, 2018). Brookhart (2010) classifies Higher Order Thinking Skills (HOTS) into seven aspects of skills: analyzing, evaluating, creating, reasoning and logic, decision making, problem solving, and creative thinking.

Based on the results of PISA 2018 (Program for International Students Assessment), students' scientific ability in Indonesia is ranked 71 out of 79 countries (Schleicher, 2019). This shows that Indonesia is still at a low level of thinking. Students are able to use the knowledge of content and basic or day-to-day procedures to recognize or identify the explanations of simple scientific phenomena. However, students are only able to identify causal or correlation relationships and interpret graphic and visual data which require cognitive skills at a lower level (Suprayitno, 2019). Meanwhile, the learning process in countries with high PISA scores prioritizes high-level reasoning processes which causes changes in the learning process, and mastery of practice questions which are dominated by memorization activities for preparation or exam implementation activities (Pratama & Retnawati, 2018). Therefore, in Indonesia, synergies of teaching, learning, and HOTS-oriented assessment are needed to develop students' higher-order thinking skills.

Based on *Permendikbud* (Regulation of Ministry of Education & Culture) Number 22 of 2016 concerning Standards of Learning Process in Elementary & Secondary, consisted of planning, implementation, and assessment, a learning plan consists of formulating a learning implementation plan (*RPP*), selecting media and learning resources, preparing learning assessment tools and learning scenarios that will be used at the learning implementation stage. Textbooks are one of the learning media that can be used at the learning implementation stage. According to Damanik & Zainil (2019), textbooks are tools in the teaching and learning process. This is reinforced by the results of a survey in 12 South Tangerang City Senior High Schools, where all schools use textbooks as learning media. Seven different types of books were obtained from one school to another. In supporting the learning of the 2013 curriculum implementing 21st century skills, it is necessary to harmonize the textbooks used in the learning process (Rizqiana, Siddiq & Rahmawati, 2019).

Before being used in learning activities, textbooks must go through a feasibility test conducted by the National Education Standards Agency (BSNP) and stipulated through a ministerial regulation (Rahmawati, 2015). There are four components of the assessment by BSNP, namely: content, presentation, language, and graphics. One of the assessments on the presentation component is assessing the existence of practice questions that can measure students' understanding of the material presented in the textbook. However, in the presentation component assessment items, it is not explained how the criteria should be for the questions in the textbook, especially questions for higher-order thinking skills.

A good textbook is a textbook that meets the needs of learners in all domains, such as remembering, understanding, applying, analyzing, evaluating, and creating. Questions that train higher order thinking skills (analyze, evaluate, and create) should be included in the textbook (Abdelrahman, 2014). Types of questions contained in science textbooks, such as chemistry, must be able to facilitate and improve students' thinking processes and encourage students to work independently (Upahi & Jimoh, 2016).

Based on the interview results conducted with grade XII chemistry teachers

in South Tangerang City State Senior High School, it was found that the material on Colligative Properties of Solutions, as well as Redox and Electrochemistry, were considered to require high-level thinking skills. In line with the research conducted by Haryani, Prasetya, & Saptarini (2014) which stated that the material of Colligative Properties of Solutions as well as Redox and Electrochemistry were considered difficult by teachers and prospective chemistry teachers because the material was abstract, and there were applications of concepts into calculations. Based on the background that has been explained, the researcher is interested in analyzing the HOTS type questions contained in grade XII chemistry textbooks, especially on the material of Colligative Properties of Solutions as well as Redox and Electrochemistry.

## Research Method

The research design used was a descriptive method of document analysis. In document analysis, research was carried out on the information which were documented in the recording, either in images, sounds, writings, or others. Document analysis research is also known as content analysis research. In document analysis, researchers described the content of the communication material objectively and systematically, with a quantitative approach.

The population of this study were all chemistry textbooks for grade XII used by all State Senior High Schools in South Tangerang City based on the results of interviews. Purposive sampling technique was used to determine the sample of books to be analyzed. Three chemistry textbooks for grade XII were chosen because they were most widely used in state senior high schools of South Tangerang City. Each chemistry textbook was coded A, B, and C respectively.

Interviews and document studies were used as data collection techniques. Structured interviews were conducted with chemistry teachers in class XII at SMA Negeri Tangerang Selatan regarding the use of textbooks and materials that require higher-order thinking skills. The next stage was document study. The documents analyzed were in the form of questions existing in the textbooks that have been set as samples. The questions analyzed were existed in Colligative Properties of Solutions and Redox and Electrochemistry chapters. The questions in the chapter were analyzed based on the aspect of higher order thinking skills based on Brookhart.

Data analysis techniques in this study were divided into two, namely quantitative data and qualitative data. Data analysis technique used to obtain quantitative data was triangulation technique. Quantitative data obtained in this study were in the form of simple calculations presented in percentage form. Meanwhile, the qualitative data were a description of the results that have been obtained based on quantitative calculations.

## Research Result & Discussion

### Distribution of Questions in each Chemistry Textbook

Each book has a different distribution of questions, as described in table 1. The questions in each chemistry textbook are essays and multiple choice. In each book, two chapters were selected to be analyzed, namely the Chapter on Colligative Properties of Solutions and Redox and Electrochemistry. The questions analyzed in each chapter included questions in the exercise, evaluation, practicum, and task sections.

**Table 1**
*Distribution of Questions in each Chemistry Textbook*

| Book Code | Number of questions in each section | | | | Total |
|---|---|---|---|---|---|
| | L | P | E | T | |
| A | 198 | 28 | 88 | 2 | 316 |
| B | 125 | 9 | 148 | 4 | 286 |
| C | 49 | 21 | 62 | 34 | 166 |
| Total | | | | | 768 |

Information:
L : Exercise E : Evaluation
P : Practicum T : Task

**Distribution of each HOTS Aspect according to Brookhart in the three chemistry textbooks**

The questions in the three chemistry textbooks for grade XII were based on Brookhart's HOTS criteria, which consist of seven aspects and are divided into several criteria.

**Table 2**
*Percentage Distribution of HOTS Aspects on Questions in Three Chemistry Textbooks Using Brookhart Categories*

| HOTS Aspect | HOTS Criteria | Chemistry Textbook | | | Total of Each Criteria | Average |
|---|---|---|---|---|---|---|
| | | A | B | C | | |
| Analyzing | Focusing on the question or identifying the main idea | 5,70 | 2,45 | 4,22 | 12,37 | 8,85 |
| | Analyzing argument | 4,11 | 4,54 | 3,61 | 12,26 | |
| | Comparing and Contrasting | 0 | 0,70 | 1,21 | 1,91 | |
| Evaluating | Evaluating materials and methods based on the intended purpose. | 0 | 0 | 0 | 0 | 0 |
| Creating | Combining different things in a new way | 1,60 | 0,70 | 1,21 | 3,51 | 3,51 |
| Reasoning & Logic | Making or evaluating deductive conclusions | 2,85 | 3,15 | 0,60 | 6,60 | 8,35 |
| | Making or evaluating inductive conclusions | 5,70 | 1,40 | 3,01 | 10,11 | |
| Decision Making | Evaluating the credibility of a source | 0 | 0 | 0 | 0 | 0 |
| | Identifying implied assumptions | 0 | 0 | 0 | 0 | |
| | Identifying rhetorical and persuasive strategies | 0 | 0 | 0 | 0 | |
| Problem Solving | Identifying and defining problems | 1,60 | 2,10 | 4,82 | 8,52 | 3,71 |
| | Identify inaccuracies to solve the problem | 0 | 0 | 0 | 0 | |
| | Describing and evaluating several solution strategies | 0 | 0 | 0 | 0 | |
| | Creating a model of the problem | 2,53 | 0,35 | 1,81 | 4,69 | |
| | Identifying obstacles in solving problems | 0 | 0 | 0 | 0 | |
| | Explaining with data | 5,40 | 6,30 | 4,82 | 16,52 | |
| | Utilizing analogy | 0 | 0 | 0 | 0 | |
| | Solving problems in reverse | 0 | 0 | 0 | 0 | |
| Creative Thinking | Creative Thinking | 0,32 | 0 | 1,21 | 1,53 | 1,53 |
| Total HOTS Questions | | | | | | 25,95 |

From the findings in Table 2, it can be seen that the distribution of HOTS questions in the three textbooks is 25.95%. Each aspect of HOTS obtained a different average, namely: analyzing 8.85%; created 3.51%; reasoning and logic 8.35%; problem solving 3.71%; and 1.53% creative thinking. Meanwhile, evaluating and making decisions aspects are not found in each textbook. These results are in line with the research conducted by Upahi & Jimoh (2016) on three chemistry textbooks, which stated that the analysis aspect had an average with the most dominant percentage of 19.5%, while the evaluation aspect of 2.17% and creation aspect of 2.34%.

According to Upahi and Jimoh (2016), analyzing aspect has a large percentage compared to other aspects of higher-order thinking skills, because analyzing is an intermediate stage of the cognitive process level. In addition, the question of analyzing aspects of the textbook is considered appropriate as an introductory question for students for each discipline at the tertiary level. There is a difference in percentage figures in the analytical aspect obtained (8.85%) with the results of previous studies by Upahi & Jimoh (19.5%) and Dávila & Talanquer (30.8%). This is due to differences in the number and part of the questions in the textbook analyzed. In Upahi & Jimoh's research (2016), the questions analyzed were taken from the end of each chapter in each textbook, the results obtained that the most analyzing aspects were at the end of each chapter.

Meanwhile, the analytical aspect obtained in this study has a dominant percentage of 8.85%. This is because the basic competencies of the 2013 curriculum on the material of Colligative Properties of Solutions as well as Redox and Electrochemistry require analytical skills. This is in line with the research of Abdullah, Albeta & Ardiansyah (2018) which states that the colligative property of solution material is one of the materials that requires higher-order thinking skills, because students are asked to analyze, sort, and relate the relationships between concepts on the topic. Research conducted by Damayanti, Masykuri & Yamtimah (2019) stated that Redox and Electrochemistry materials also require higher-order thinking skills because in this material there are several topics (eg electrolysis) that require students to have the skills to analyze the reactions that occur at the anode and cathode and the result of the reaction.

Criteria for evaluating aspect consists of the ability to identify and assess. While the decision-making aspect consists of criteria to evaluate and identify. So, it can be concluded that the evaluation aspect is one of the criteria for making decisions (Brookhart, 2010). The same thing was expressed by Anderson & Krathwohl (2014) who stated the evaluation aspect as the ability to make decisions based on criteria and standards. The results of the analysis of questions in the three chemistry textbooks showed that there was no question on evaluating and making decisions aspects. This is because there are no basic competencies that require students to evaluate or make decisions based on criteria and standards. This is in line with research conducted by Zorluoglu, Kizilaslan & Yapucuoglu (2020) based on the results of the analysis of the chemistry curriculum in textbooks in Turkey, where the percentage of evaluating aspects is 0%.

**The description of the HOTS Aspects on the questions of grade XII chemistry textbooks**

1. Analyzing

The ability to analyze is when students are able to break down information and explain its parts. The analyzing aspect consists of three criteria, namely focusing on questions or identifying the main idea, analyzing arguments, and comparing and contrasting.

a. Focusing on questions or identifying the main idea

The criteria for focusing on questions obtained the largest percentage, i.e. 12.37%, because this criterion is a basic skill in the ability to analyze in various fields of science.

**Figure 1**
*Questions on Criteria Focus on Questions*

| |
|---|
| Does the tube containing rusty nails contain oxygen and water? |

(Purba, 2016: 76)

The question above is an exampl of a question on the criteria of focusing on questions. The question requires students to conduct an experiment and then answer the question based on the results obtained. These questions go through several thought processes, by connecting experimental data to conclude and answer questions.

The students' ability to focus on questions can be assessed by asking questions in the form of problems, policies, or experiments and its results, then asking about the main problem in the questions given or asking of what criteria students use to evaluate the quality and truth of an argument or conclusion. In learning chemistry, focusing on questions can train students to be more interested in and be able to interpret the learning carried out. Focusing on questions can improve students' higher order thinking skills.

b. Analyzing argument

The analyzing argument is the ability to identify underlying assumptions, represent the logic or structure of an argument, find irrelevancies if any, and assess similarities or differences in two or more arguments. Questions on the criteria for analyzing the argument resulted in a percentage of 12.26%.

**Figure 2**
*Questions on the Criteria of Analyzing Arguments*

| |
|---|
| Why do iron cans that are coated with tin corrode are slower than those that are not coated with tin? Also explain why slightly chipped car paint can cause the car to corrode on the inside. |

(Sudarmo, 2013: 80)

The question above is an example of question on the criteria of analyzing arguments. The question asks students to explain the reasons that support the argument. Students must connect and identify existing events or phenomena with knowledge relevant to the phenomenon. The ability to analyze students' arguments can be assessed by providing an argument, idea, or statement and then asking things that support or contradict the idea, argument, or statement. The ability to argue is a part of making decisions, defending them, and influencing others (Ch & Gusniarti, 2014).

c. Comparing and Contrasting

To compare is to determine the relationship between two ideas, two objects, and the like. Distinguishing is the process of sorting out the relevant material from the irrelevant, or the important from the unimportant. The criteria for comparing and differentiating obtained a percentage of 1.91% in the three chemistry textbooks.

The question above is an example of question on the criteria of comparing and contrasting. The question asks students to compare between two phenomena or events, after which students are asked to distinguish based on these phenomena or events. When there is a process of comparing and contrasting, there will be a shift on attention and focus between relevant and irrelevant material (Rochman & Hartoyo, 2018). According to Setyarini & Ling (2019), to develop higher order thinking skills, exercises are needed that encourage students to compare and differentiate.

**Figure 3**
*Questions on the Criteria of Comparing and Contrasting*

| |
|---|
| If pure water and sugar solution are heated respectively, the water as the solvent will evaporate. Guess which liquid evaporates more, pure water or sugar solution? |

(Sutresna, Sholehudin & Herlina, 2016: 6)

2. Creating

The aspect of creating involves the process of arranging elements into a coherent or functional whole. From the three chemistry textbooks analyzed, the creative aspect percentage is 3.51%.

**Figure 4**
*Questions on Creating Aspect*

| |
|---|
| Find in electronic media (internet) or books in the library about how to electrolyze metals (electroplating). Make an experimental design to coat iron metal (nails) with copper metal in groups. Show the teacher the results of the experimental design that your group has made. If it's approved, do the experiment. Make a report on the results of the experiments carried out. |

(Sudarmo, 2013: 68)

The question above is an example of a question on the aspect of creating. The question asks students to make a new experimental design by applying the information that has been sought previously, after which students are asked to make a report of the experiment carried out. This question goes through the process of formulating, that is looking for information about metal plating on objects. Then, it is followed by the planning process which is making work steps and completion plans in carrying out the metal plating process on objects. The last is the production process, namely making reports from the experimental design of the plating process on objects.

According to Ramadhana, et.al., (2018) a question that raises a plan or suggestion for a case or problem, in which students are given a task to draw suggestions based on the given problem including questions or tasks that develop creative abilities.

3. Reasoning & Logic

Reasoning and logic abilities are skills to assess whether a fact or claim is true and relevant to an argument or problem that occurs, and assesses whether two things or events are consistent or not. Questions on the aspects of reasoning and logic obtained a percentage of 8.35%. Aspects of reasoning and logic are divided into two, namely making or evaluating both deductive & inductive conclusions.

a. Making or evaluating deductive conclusions

The ability of deductive reasoning is reasoning to draw specific conclusions from general matters or cases. Questions on the criteria for making or evaluating deductive conclusions have a percentage of 6.60%.

**Figure 4**
*Questions on Criteria for Making or Evaluating Deductive Conclusions*

The following data is used to answer questions number 32 and 33.
$Cu^{2+} + 2e^- \rightarrow Cu$ $E^o = +0{,}34$ volt
$Sn^{2+} + 2e^- \rightarrow Sn$ $E^o = -0{,}14$ volt
$Ni^{2+} + 2e^- \rightarrow Ni$ $E^o = -0{,}25$ volt
$Cd^{2+} + 2e^- \rightarrow Cd$ $E^o = -0{,}40$ volt

Which of the following statements is true regarding this data?
(1) Among the metals above, $Cu^{2+}$ is the strongest oxidizing agent
(2) The pair of electrodes that produces the largest cell potential is the Cu with Cd
(3) Ni is soluble in $Cu^{2+}$ solution but insoluble in $Cd^{2+}$ solution
(4) Among the above metals, Sn is the strongest reducing agent

(Sudarmo, 2013: 78)

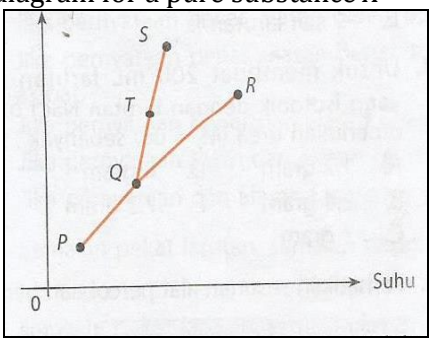
The question above is an example of question on the criteria for making or evaluating deductive conclusions. The question asks students to choose an appropriate statement from a series of choices in the form of a true or false statement based on the data provided. To assess the ability of students to make or evaluate deductive conclusions, the questions or tasks given are in the form of statements that are considered true/false or one or more logical conclusions that are considered true/false, then questions are given which conclusion is in accordance with the statement.

b. Making or evaluating deductive conclusions

Inductive reasoning is an action to draw conclusions or make a new general statement based on several specific statements that are known to be true. Questions on the criteria for making or evaluating inductive conclusions obtained a percentage of 10.11%.

**Figure 5**
*Questions on Criteria for Making or Evaluating Inductive Conclusions*

The following figure is a P-T diagram for a pure substance *X*




Which of the following statements is true?
a. Q is the critical point of substance X
b. The melting point of substance X increases with an increase in external pressure
c. At point R, the three phases are in equilibrium
d. The boiling point of substance X decreases when the external pressure is increased
e. At point T, solid X is in equilibrium with vapor X

(Purba, 2016: 37)

The question above is an example of questions on the criteria for making or evaluating inductive conclusions. The question asks students to choose the correct conclusion or statement related to the data provided, which is in the form of an image. For this reason, students must understand the meaning of the image given and relate it to the statement. The students' ability to make or evaluate inductive conclusions can be assessed by asking questions or assignments in the form of scenarios and some information. Then, ask students to draw appropriate conclusions from the information and explain why these conclusions are considered true.

4. Problem Solving

Problem solving ability occurs when a person is able to identify exactly what problems are encountered, what causes the problem cannot be solved, and what solutions can solve the problem. The percentage of problem solving aspect in the three chemistry textbooks was 3.71%. There are three criteria for problem solving abilities contained in chemistry textbooks, namely identifying and determining problems, making a model of the problem, and explaining with data.

a. Identifying and defining problems

The ability to identify and determine problems is the first stage in problem solving ability. Questions on the criteria to identify and determine the problem obtained a percentage of 8.52%.

**Figure 6**

*Questions on Criteria Identifying and Defining Problems*

| |
|---|
| Observe some metal objects around you. Old metal objects will look dull. The electroplating process can be used as a way to make metal objects look beautiful and attractive…<br>Describe the substances needed, the processing steps, and the reactions that occur during the plating process. Find the information needed to know the metal plating process from various reading sources. After that, discuss the information obtained in groups. |

(Sutresna, Sholehudin & Herlina, 2016: 37)

The question above is an example of question on the criteria for identifying and determining problems. The question asks students to identify problems by searching from various reading sources based on an event or events in everyday life. Those questions are examples of open and non-routine questions, because there may be more than one answer for students are asked to seek information from various reading sources. According to Afifah & Retnawati (2018) to instill HOTS values, one strategy that can be done is to compile problems that are not routine or open.

b. Making a model of the problem

Making a model of the problem is one of the stages in problem solving ability, namely planning a problem solving. Questions on the criteria for making a model of the problem obtained a percentage of 4.69%.

**Figure 7**

*Questions on Criteria Create a Model of the Problem*

| |
|---|
| Draw a diagram of an electrolytic cell for plating iron with silver. Write the electrode reactions and the cell reactions. |

(Sutresna, Sholehudin & Herlina, 2016: 89)

The question above asks students to make a diagram or picture of a problem or phenomenon. The students' ability to make a model of the problem can be assessed by asking questions that require students to state the problem in the form of diagrams or pictures that show the situation of the problem. Making an image or model is a

strategy in solving problems. This strategy can be used to help clarify the relationship between the data provided and the problems at hand (Ayuningrum, 2017).

c. Explaining with data

Questions on the criteria of explaining with data resulted in a percentage of 16.52%. The question above asks students to solve the problem by choosing the correct statement based on information in the form of a data table. The students' ability to explain with data can be assessed by asking questions or assignments in the form of interpretive data (graphics or data tables) or other information, then asking students to solve problems and explain procedures based on the data.

**Figure 8**

*Questions on Criteria of Explaining with Data*

The following is the freezing point data (Tb) of various electrolyte and nonelectrolyte solutions.

| **Solution** | **Concentration (m)** | **Freezing Point (°C)** |
|---|---|---|
| Sugar | 0,1 | −0,186 |
| Urea | 0,2 | −0,372 |
| NaCl | 0,1 | −0,372 |
| $MgSO_4$ | 0,2 | −0,744 |
| $K_2SO_4$ | 0,1 | −0,558 |

The correct statement based on the data is ….

a. The freezing point of an electrolyte solution is higher than that of a nonelectrolyte solution
b. at the same concentration, the freezing point of an electrolyte solution is lower than that of a nonelectrolyte solution
c. The greater the concentration of a substance, the higher the freezing point of the solution
d. The greater the concentration of a substance, the higher the freezing point of the solution
e. Electrolyte solutions of the same concentration have the same freezing point

(Sutresna, Sholehudin & Herlina, 2016: 26)

The question above asks students to solve the problem by choosing the correct statement based on information in the form of a data table. The students' ability to explain with data can be assessed by asking questions or assignments in the form of interpretive data (graphics or data tables) or other information, then asking students to solve problems and explain procedures based on the data..

5. Creative Thinking

Creative thinking is putting things together in new ways, observing things that others might have missed, building something new, using unusual or unconventional images that still work to make interesting points, and the like. Questions on the aspect of creative thinking resulted in a percentage of 1.53%.

Those questions or instructions ask students to make an experimental design using something new (derived from nearby tools and materials), based on the results of seeking for information they get. To stimulate the creativity of students, the tasks or questions given must make students create according to their own rights.

In dealing with problems or events training creative thinking skills, students use imagination, intelligence, insight, and ideas once facing such situations. In addition, students are asked to suggest original and new designs, generate different hypotheses,

and solve problems by finding something new (Birgili, 2015).

**Figure 9**
*Questions on Aspects of Creative Thinking*

**Voltaic Cells from Surrounding Materials**

Often, we hear on the news, the discovery of electricity that comes from fruit. For example, *kedondong* and oranges.

1. Make groups of 3-4 people
2. Discuss with your group why the fruit can be used to generate electricity. Then, look for other fruit that you think can be used.
3. Make an experimental design to make a series of voltaic cells from these materials.
4. Submit it to your teacher, then when approved, make the Voltaic cell.
5. Present the voltaic cell that you have made in front of the class

(Purba, 2016: 97)

Those questions or instructions ask students to make an experimental design using something new (derived from nearby tools and materials), based on the results of seeking for information they get. To stimulate the creativity of students, the tasks or questions given must make students create according to their own rights.

In dealing with problems or events training creative thinking skills, students use imagination, intelligence, insight, and ideas once facing such situations. In addition, students are asked to suggest original and new designs, generate different hypotheses, and solve problems by finding something new (Birgili, 2015).

## Conclusion

Based on the results of the study, it can be seen that the three chemistry textbooks used by grade XII of State Senior High Schools in South Tangerang City are still dominated by questions of low-level thinking skills. This is because the percentage of high-level thinking skills questions contained in grade XII chemistry textbooks is only 25.95%, and there are several HOTS aspects that do not exist in the textbooks such as aspects of evaluating and making decisions.

## Bibliography

Abdelrahman, M. S. B. (2014). An Analysis of the Tenth Grade English Language Textbooks Questions in Jordan Based on the Revised Edition of Bloom's Taxonomy An Analysis of the Tenth Grade English Language Textbooks Questions in Jordan Based on the Revised Edition of Bloom's Taxonomy. *Journal of Education and Practice*, *5*(18), 139–151.

Abdullah, A., Albeta, S. W., & Ardiansyah, A. (2018). Profile Of Chemical Teacher Candidates' Higher Order Thinking Skills (HOTS) on Ionic Equilibrium In Solution Topic. *Unnes Science Education Journal*, *7*(3), 300–305.

Afifah, I. R. N., & Retnawati, H. (2019). Is it Difficult to Teach Higher Order Thinking Skills ? *Journal of Physics: Conference Series*, 1–7.

Anderson, L. W., & Krathwohl, D. R. (2001). *A Taxonomy For Learning, Teaching, and Assessing: A Revision Of Bloom's Taxonomy Of Educational Objectives*. London: Pearson Education.

Ayuningrum, D. (2017). Strategi Pemecahan Masalah Matematika Siswa SMP ditinjau dari Tingkat Berpikir Geometri Van Hiele. *KREANO Jurnal Matematika Kreatif-Inovatif*, *8*(1), 27–34.

Birgili, B. (2015). Creative and Critical

Thinking Skills in Problem-based Learning Environments. *Journal of Gifted Education and CreativityCreativity*, *2*(2), 71–80.

Brookhart, S. M. (2010). in Your Classroom. In *How to Assess Higher-Order Thinking Skills in Your Classroom*. USA: ASCD.

Ch, I. F., & Gusniarti, W. F. (2014). Profil Keterampilan Argumentasi Siswa Pada Konsep Koloid Yang Dikembangkan Melalui Pembelajaran Inkuiri Argumentatif. *EDUSAINS*, *6*(01), 31–40.

Damanik, S. N. H., & Zainil, Y. (2019). The Analysis Of Reading Comprehension Questions In English Textbook By Using Higher Order Thinking Skill At Grade X Of SMAN 2 Padang. *Journal of English Language Teaching*, *8*(1), 249–258.

Damayanti, I., Masykuri, M., & Yamtinah, S. (2019). Pengembangan Instrumen Penilaian Testlet Untuk Mengukur Kemampuan Berpikir Tingkat Tinggi Pada Materi Elektrokimia. *INKUIRI: Jurnal Pendidikan IPA*, *8*(1), 59–71.

Haryani, S., Prasetya, A. T., & Saptarini. (2014). Identifikasi Materi Kimia SMA Sulit Menurut Pandangan Guru dan Calon Guru Kimia. *Seminar Nasional Kimia Dan Pendidikan Kimia VI*, 43–52.

Nofrion, N., & Wijayanto, B. (2018). Learning Activities in Higher Order Thinking Skill (Hots) Oriented Learning Context. *Geosfera Indonesia*, *3*(2), 122–130.

Pratama, G. S., & Retnawati, H. (2018). Urgency of Higher Order Thinking Skills (HOTS) Content Analysis in Mathematics Textbook. *Journal of Physics: Conference Series*, *1097*(1), 1–8.

Purba, M. (2016). *Kimia untuk SMA/MA Kelas XII Kelompok Peminatan Matematika dan Ilmu-Ilmu Alam*. Jakarta: Erlangga.

Rahmawati, G. (2015). Buku Teks Pelajaran Sebagai Sumber Belajar Siswa Di Perpustakaan Sekolah Di Sman 3 Bandung. *Edulib*, *5*(1), 102–113.

Ramadhana, N. A., Rozimela, Y., & Fitrawati. (2018). High Order Thinking Skills-Based Questions In The Test Items Developed By Senior High School English Teachers Of Padang. *Journal of English Language Teaching*, *7*(4), 720–731.

Rizqiana, F. A., Siddiq, M. & Rahmawati, A. (2019). Analisis Textbooks for High School Student Studying the Sciences Chemistry Materi Pokok Hidrokarbon dalam Perspektif Kurikulum 2013. *Journal of Educational Chemistry (JEC)*, 1(1): 22-27.

Rochman, S., & Hartoyo, Z. (2018). Analisis High Order Thinking Skills (HOTS) Taksonomi Menganalisis Permasalahan Fisika. *SPEJ (Science and Physics Education Journal)*, *1*(2), 78–88.

Schleicher, A. (2019). *PISA 2018: Insights and Interpretations*. Paris: *OECD Publishing*.

Setyarini, S., & Ling, M. A. (2019). Promoting Higher Order Thinking Skills in Storytelling for Teaching English to Young Adolescents in 21st Century. *International Seminar on Language, Education, and Culture, KnE Social Sciences*, *2019*, 155–164.

Sudarmo, U. 2013. *Kimia untuk SMA/MA Kelas XII Kelompok Peminatan Matematika dan Ilmu Alam*. Jakarta: Erlangga

Suprayitno, T. (2019). *Pendidikan di Indonesia: belajar dari hasil PISA 2018*. Jakarta: Badan Penelitian dan Pengembangan Kemendikbud.

Sutresna, N., Sholehudin, D. & Herlina, T. (2016). *Buku Siswa Aktif dan Kreatif Belajar Kimia 3 untuk SMA/MA Kelas XII Peminatan Matematika dan Ilmu-Ilmu Alam*. Bandung: Grafindo.

Upahi, J. E., & Jimoh, M. (2016). Classsification of End-of-Chapter Questions in Senior School Chemistry Textbooks used in Nigeria. *European Journal of Science and Mathematics Education*, *4*(1), 90–102.

Zorluoglu, S. L., Kizilaslan, A., & Yapucuoglu, M. D. (2020). The analysis of 9th grade chemistry curriculum and textbook according to revised Bloom's taxonomy. *Cypriot Journal of Educational Sciences*, *15*(1), 9–20.