



UNIVERSITAS NEGERI YOGYAKARTA

Preparation of Test Instruments: Critical Thinking Test





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1. Basic Analysis of Instrument Development

- Objective: determine the level of critical thinking skills of high school students on the reaction rate material
- Data type: quantitative
- Instruments used test
- The form of the instrument essay questions
- Instrument developed by myself
- Synthesis of theory on critical thinking skills
- Reaction rate material analysis for SMA

2. Instrument Arrangement

- ❖ Compose a grid of critical thinking skills test material reaction rate
- ❖ Develop item descriptions
- ❖ Creating scoring guidelines

3. Instrument Testing/Analysis

Theoretical and empirical validation



Critical Thinking Skill Theory Synthesis

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1. Analyzing the theory of critical thinking skills from 5 related text books and 2 reputable international journals, in separate tables

Sources 1:

Critical thinking experts	Definition	Aspect	Aspect definition	Indicator	Notes

2. Compile a comparison matrix of critical thinking skills theory analysis from all sources

Critical thinking experts	Sources (Write Similar Sources)	Aspect (Give sign for similar aspect)	Indicator (Give sign for similar indicator)
Etc			



Critical thinking experts	Sources (Write Similar Sources)	Aspect (Give sign for similar aspect)	Indicator (Give sign for similar indicator)
Ennis (1993)	Ennis, R.H. (1993) Critical thinking assessment, Theory Into Practice, 32:3, 179-186	1. Judge the credibility of sources. 2. Identify conclusions, reasons, and assumptions. 3. Judge the quality of an argument, including the acceptability of its reasons, assumptions, and evidence. 4. Develop and defend a position on an issue. 5. Ask appropriate clarifying questions. 6. Plan experiments and judge experimental designs. 7. Define terms in a way appropriate for the context. 8. Be open-minded. 9. Try to be well informed. 10. Draw conclusions when warranted, but with caution	
Peter Facione (1990)	1. Heard J., Scoular, C., Duckworth, D., Ramalingam, D., & Teo, I. (2020). Critical thinking: Skill development framework. Australian Council for Educational Research 2. Peter A. Facione. 2020. Critical Thinking: What It Is and Why It Counts	1. Interpretation 2. Analysis 3. Evaluation 4. Inference 5. Explanation 6. Self-regulation	Notes: In determining the same aspect/indicator, it is always based on the initial definition or explanation from the originator of the idea, because it could be that the words used are the same but have different meanings/interpretations. In choosing aspects, adjust to the intended use of the instrument
Danczak et al. (2018) yang dikembangkan dari The WGCTA (Facione)	Danczak, Stephen M.; Thompson, Christopher D.; Overton, Tina L. (2019). Development and validation of an instrument to measure undergraduate chemistry students' critical thinking skills. Chemistry Education Research and Practice, (), 10.1039.C8RP00130H–. doi:10.1039/c8rp00130h	1. Making assumptions, 2. Analysing arguments, 3. Developing hypotheses, 4. Testing hypotheses, 5. Drawing conclusions.	
Changwong et al (2018) yang dikembangkan dari Watson-Glaser CTA test	Changwong, K., Sukkamart, A., & Sisan, B. (2018). Critical thinking skill development: Analysis of a new learning management model for Thai high schools. Journal of International Studies, 11(2), 37-48. doi:10.14254/2071-8330.2018/11-2/3	1. Inferences, 2. Recognition of assumptions, 3. Deductions, 4. Interpretation, 5. Evaluation of arguments	



1. Inferences,
2. Recognition of assumptions,
3. Deductions,
4. Interpretation,
5. Evaluation of arguments

1. Interpretation information
2. Ask Appropriate Clarifying questions
3. Making assumptions
4. Explanation
5. Analysing Arguments
6. Drawing conclusions



3. Synthesis of operational definitions of critical thinking skills for reaction rate materials

Critical thinking operational definition	Critical thinking aspect	Operational definition of critical thinking aspect	Critical thinking indicators
Deep and generic thinking skills to overcome a problem related to the reaction rate material which includes skills in.... (6 aspects)	1. Interpretation information	Expressing understanding of the information presented	a. Identify relevant information b. Identify linkage of available information c. Explain scientific information
	2. Ask Appropriate Clarifying questions	Asking questions to clarify information	a. Asking conceptual questions b. Asking causality questions c. Asking extended questions
	3. Making assumptions	Making claims, hypotheses and rationales against a fact or problem	a. Expressing opinions based on assumptions b. Formulate a hypothesis on a problem c. Agree on a fact with logical reasons
	4. Explanation	Etc	Etc
	5. Analysing Arguments		
	6. Drawing conclusions		



4. Material Analysis of Reaction Rates based on High School Chemistry Basic Competencies

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Formulation of Basic Competence (KD) related to reaction rate (class XI)		Competency Achievement Indicators (GPA)	Concepts and Sub-concepts
3.6 Explain the factors that affect the rate of a reaction using collision theory	4.6 Presenting information search results on ways to organize and store materials to prevent uncontrollable physical and chemical changes	3.6.1 Describe the collision theory to explain chemical reactions 3.6.2 Analyzing the factors that affect the reaction rate dst	Concepts and Subconcepts of 3.6.2 Factors affecting the reaction rate 1. Concentration 2. Temperature 3. Surface area 4. Catalyst 5. Activation energy etc
3.7 Determine the order of the reaction and the rate constant for the reaction based on experimental data	4.7 Designing, conducting, and concluding and presenting experimental results of factors that affect reaction rates and reaction orders	dst	



Preparation of critical thinking skills test instrument

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1. Preparation of the Critical Thinking Test Grid for the reaction rate material

IPK (code)	Concepts and Sub-concepts	Critical thinking aspect	Critical Thinking Indicator	Question Indicator	No of Question	Amount
3.6.2	Temperature	Interpretation information	Identify relevant information			
			Identify linkage of available information	Given a narrative about fruit storage, students can identify the relationship between material storage techniques and the rate of fruit spoilage	2,3	2
			Explain scientific information			

Notes:
Remember, it is not necessary to list Bloom's cognitive level,



2. Develop Critical Thinking Test Items for the reaction rate material

Question Indicators: Given a narrative about fruit storage, students can identify the relationship between material storage techniques and the rate of fruit spoilage

Item number : 3

Question Points:

There must be a narrative (can be contextual/factual, or fictitious)

“Vegetables and fruits are a source of nutrients needed by the body. By consuming vegetables and fruit not only can reduce the risk of heart attack, but the antioxidant content in it can fight free radicals that trigger the formation of cancer cells. This type of food is very good eaten fresh. But sometimes many people who keep it for a long time. Mistakes in choosing vegetables and fruits that are not fresh and improper storage methods, often cause vegetables and fruit to be damaged so that they become unsafe for consumption. 2. Fruit can be left in the open, stored in the refrigerator”

Question:

Why should we pay attention to fruit storage techniques based on the narrative conveyed?

How is temperature related to fruit decay rate? explanation

3. Develop Guidelines for Critical Thinking Test Scoring of the reaction rate material

Question:

Why should we pay attention to fruit storage techniques based on the narrative conveyed?

Answer:

Due to improper storage techniques (open places and refrigerators), which have consequences on the aspect of storage temperature, will cause the fruit to spoil quickly.

Scoring guidelines:

0,25

0,25

0,25

0,25

Total score: 1

Table 1 Core critical thinking skills

Skill	Experts' consensus description	Subskills
Interpretation	Comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgements, conventions, beliefs, rules, procedures or criteria.	• Categorisation • Decode significance • Clarify meaning
Analysis	Identify the intended and actual inferential relationships among statements, questions, concepts, descriptions or other forms of representation intended to express beliefs, judgements, experiences, reasons, information, or opinions.	• Examine ideas • Identify arguments • Identify reasons and claims
Evaluation	Assess the credibility of statements or other representations that are accounts or descriptions of a person's perception, experience, situation, judgement, belief, or opinion; and to assess the logical strength of the actual or intended inferential relationships among statements, descriptions, questions or other forms of representation.	• Query evidence • Conjecture alternatives • Draw logically valid or justified conclusions
Inference	Identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses; to consider relevant information and to reduce the consequences flowing from data, statements, principles, evidence, judgements, beliefs, opinions, concepts, descriptions, questions, or other forms of representation.	• Assess credibility of claims • Assess quality of arguments using inductive and deductive reasoning
Explanation	To state the results of one's reasoning; to justify that reasoning in terms of the evidential, conceptual, methodological, criteriological and contextual considerations upon which one's results were based; and to present one's reasoning in the form of cogent arguments.	• State results • Justify procedures • Present arguments
Self-regulation	Self-consciously to monitor one's cognitive activities, the elements used in those activities, and the results educed, particularly by applying skills in analysis and evaluation to one's own inferential judgements with a view toward questioning, confirming, validating, or correcting either one's reasoning or one's results.	• Self-monitor • Self-correct

Adapted from Facione (1990)

Is it okay if aspects and indicators are taken/adopted from only one source?



It's okay for S1 level adoption or adaptation of aspects, for example from Facione

Thank You
Any Question?

