

Appendix 1

SILLABY

Satuan Pendidikan : SMA

Kelas : XI

Kompetensi Inti / Core Competence :

KI 1 : Menghayati dan mengamalkan ajaran agama yang dianutnya

CC 1 : *Living and practice the teachings of their religion.*

KI 2 : Menghayati dan mengamalkan perilaku jujur, disiplin, tanggung jawab, peduli (gotong royong, kerjasama, toleran, damai), santun, responsif dan proaktif, dan menunjukkan sikap sebagai bagian dari solusi atas berbagai permasalahan dalam berinteraksi secara efektif dengan lingkungan sosial dan alam serta dalam menempatkan diri sebagai cerminan bangsa dalam pergaulan dunia.

CC 2 : *Living and practice honest behavior, discipline, responsibility, caring (team work, cooperation, tolerance, peace), polite, responsive and pro-active and displayed as part of the solution to various problems in interacting effectively with the social environment and nature and put themselves as a reflection of the nation in the association world.*

KI 3 : Memahami, menerapkan, dan menganalisis pengetahuan faktual, konseptual, prosedural, dan metakognitif berdasarkan rasa ingin tahunya tentang ilmu pengetahuan, teknologi, seni, budaya, dan humaniora dengan wawasan kemanusiaan, kebangsaan, kenegaraan, dan peradaban terkait penyebab fenomena dan kejadian, serta menerapkan pengetahuan prosedural pada bidang kajian yang spesifik sesuai dengan bakat dan minatnya untuk memecahkan masalah.

CC 3 : *Understanding, implementing, analyzing and evaluating factual knowledge, conceptual, procedural, and metacognitive by curiosity about science, technology, art, culture, and humanities with the insight of humanity, national, state, and civilization-related causes of phenomena and events and applying procedural knowledge in specific areas of study that suit their talents and interests to solve the problem.*

KI 4 : Mengolah, menalar, dan menyaji dalam ranah konkret dan ranah abstrak terkait dengan pengembangan dari yang dipelajarinya di sekolah secara mandiri, bertindak secara efektif dan kreatif, serta mampu menggunakan metoda sesuai kaidah keilmuan.

CC 4 : *Processing, reasoning, presenting, and creating in the realm of the concrete and the abstract realm associated with the development of learned at school independently and to act effectively and creatively, and are able to use the method according to the rules of science.*

Kompetensi Dasar	Materi Pokok	Pembelajaran	Penilaian	Alokasi Waktu	Sumber Belajar
1.1 Menyadari adanya keteraturan dari sifat hidrokarbon, termokimia, laju reaksi, kesetimbangan kimia, larutan dan koloid sebagai wujud kebesaran Tuhan YME dan pengetahuan tentang adanya keteraturan tersebut sebagai hasil pemikiran kreatif manusia yang kebenarannya bersifat tentatif. <i>Recognizing the regularity of hydrocarbons, thermochemicals, reaction rates, chemical equilibrium, solution and colloids as a manifestation of God's greatness and knowledge of the existence of such order as the result of creative human thought whose truth is tentative.</i> 2.1 Menunjukkan perilaku ilmiah (memiliki rasa ingin tahu, disiplin, jujur, objektif, terbuka, mampu membedakan fakta dan opini, ulet, teliti, bertanggung jawab, kritis, kreatif, inovatif, demokratis, komunikatif) dalam merancang dan melakukan percobaan serta berdiskusi yang diwujudkan dalam sikap sehari-hari. <i>Shows scientific behavior (curiosity, discipline, honest, objective, open, able to distinguish facts and opinions, resilient, meticulous, responsible, critical, creative, innovative, democratic, communicative) in designing and conducting experiments and</i>	- Sifat garam yang terhidrolisis - Tetapan hidrolisis (Kh) - pH garam yang terhidrolisis <i>Properties of a hydrolyzed salt</i> <i>hydrolysis constant (Kh)</i> <i>hydrolysed salt pH</i>	Mengamati (<i>Observing</i>) - Mencari informasi dari berbagai sumber tentang hidrolisis garam - Melakukan identifikasi pH garam dengan menggunakan kertas lakmus atau indikator universal atau pH meter Menanya (<i>Questioning</i>) - Mengajukan pertanyaan yang berkaitan dengan sifat garam yang berasal dari: - asam kuat dan basa kuat, - asam kuat dan basa lemah, - asam lemah dan basa kuat, - asam lemah dan basa lemah Mengumpulkan data (<i>Eksperimenting</i>) - Merancang percobaan dan mempresentasikan hasil rancangan identifikasi pH garam untuk menyamakan persepsi - Melakukan percobaan identifikasi garam. - Mengamati dan mencatat hasil titrasi Mengasosiasi (<i>Associating</i>) - Mengolah dan menganalisis data hasil pengamatan - Menyimpulkan sifat garam yang terhidrolisis - Menganalisis rumus kimia garam-garam dan memprediksi sifatnya - Menentukan grafik hubungan perubahan	Tugas - Merancang percobaan hidrolisis garam Observasi - Sikap ilmiah dalam melakukan percobaan dan presentasi, misalnya: cara menggunakan kertas lakmus, indikator universal atau pH meter; melihat skala volumed dan suhu, cara menggunakan pipet, cara menimbang, keaktifan, kerja sama, komunikatif, dan peduli lingkungan, dsb) Portofolio - Laporan percobaan	3 mgg x 4 jp	- Buku kimia kelas XI - Lembar kerja - Berbagai sumber lainnya

Kompetensi Dasar	Materi Pokok	Pembelajaran	Penilaian	Alokasi Waktu	Sumber Belajar
<i>discussions embodied in everyday attitude.</i> 2.2 Menunjukkan perilaku kerjasama, santun, toleran, cinta damai dan peduli lingkungan serta hemat dalam memanfaatkan sumber daya alam. <i>Demonstrate Behavior of cooperation, courteous, tolerant, peace-loving and caring environment and efficient in utilizing natural resources.</i> 2.3 Menunjukkan perilaku responsif dan pro-aktif serta bijaksana sebagai wujud kemampuan memecahkan masalah dan membuat keputusan. <i>Demonstrate responsive and proactive behavior as well as a wise manifestation of problem-solving skills and making decision.</i> 3.12 Menganalisis garam-garam yang mengalami hidrolisis. <i>Analyze the salts that have hydrolysis.</i> 4.11 Merancang, melakukan, dan menyimpulkan serta menyajikan hasil percobaan untuk menentukan jenis garam yang mengalami hidrolisis.		harga pH pada titrasi asam basa untuk menjelaskan sifat garam yang terhidrolisis - Menentukan tetapan hidrolisis (Kh) dan pH larutan garam yang terhidrolisis melalui perhitungan Mengkomunikasikan (Communicating) - Membuat laporan percobaan identifikasi garam dan mempresentasikannya dengan menggunakan tata bahasa yang benar	Tes tertulis uraian - Menganalisis grafik hubungan perubahan harga pH pada titrasi asam basa untuk menjelaskan sifat garam yang terhidrolisis - Menentukan tetapan hidrolisis (Kh) dan pH larutan garam yang terhidrolisis melalui perhitungan		

Appendix 2

LESSON PLAN

School	: Senior High School
Program	: Science
Subject Matter	: Chemistry
Topic	: Hydrolysis Of Salt
Grade/Semester	: XI / Even Semester
Time Allocation	: 8 x 45 Minutes

A. Core competences (CC) / Kompetensi Inti (KI) :

KI 1 : Menghayati dan mengamalkan ajaran agama yang dianutnya

CC 1 : *Living and practice the teachings of their religion*

KI 2 : Menghayati dan mengamalkan perilaku jujur, disiplin, tanggungjawab, peduli (gotong royong, kerjasama, toleran, damai), santun, responsif dan pro-aktif dan menunjukkan sikap sebagai bagian dari solusi atas berbagai permasalahan dalam berinteraksi secara efektif dengan lingkungan sosial dan alam serta dalam menempatkan diri sebagai cerminan bangsa dalam pergaulan dunia.

CC 2 : *Living and practicing honest behavior, discipline, responsibility, caring (mutual assistance, cooperation, tolerance, peace), polite, responsive and proactive, and demonstrate behaviors as part of the solution to various problems in interacting effectively with the social environment and the nature and position ourselves as a reflection of the nation in the association world.*

KI 3 : Memahami ,menerapkan, menganalisis pengetahuan faktual, konseptual, prosedural berdasarkan rasa ingintahunya tentang ilmu pengetahuan, teknologi, seni, budaya, dan humaniora dengan wawasan kemanusiaan, kebangsaan, kenegaraan, dan peradaban terkait penyebab fenomena dan kejadian, serta menerapkan

pengetahuan prosedural pada bidang kajian yang spesifik sesuai dengan bakat dan minatnya untuk memecahkan masalah.

CC 3 : *Understand, implement, and analyze factual knowledge, conceptual, procedural, and metacognitive based on his curiosity about science, technology, arts, culture, and humanities with an insight into humanity, national, state, and civilization-related causes of phenomena and events, and applying procedural knowledge in a specific field of study according to their talents and interests to solve problems.*

KI 4 : Mengolah, menalar, dan menyaji dalam ranah konkret dan ranah abstrak terkait dengan pengembangan dari yang dipelajarinya di sekolah secara mandiri, dan mampu menggunakan metoda sesuai kaidah keilmuan

CC 4 : *Processing, reasoning the realm of the concrete and abstract domains associated with the development of the learned at school independently, act effectively and creatively, and be able to use the method according to the rules of science.*

B. Basic Competences (SC) / Kompetensi Dasar (KD) :

1.1. Menyadari adanya keteraturan struktur partikel materi sebagai wujud kebesaran Tuhan YME dan pengetahuan tentang struktur partikel materi sebagai hasil pemikiran kreatif manusia yang kebenarannya bersifat tentatif.

Recognizing the regularity of the particle structure of matter as a manifestation of the glory of God Almighty and the knowledge of the structure of matter particles as a result of human creative thinking that truth is tentative

1.2 Menunjukkan perilaku ilmiah (memiliki rasa ingin tahu, disiplin, jujur, objektif, terbuka, mampu membedakan fakta dan opini, ulet, teliti, bertanggung jawab, kritis, kreatif, inovatif, demokratis, komunikatif)

dalam merancang dan melakukan percobaan serta berdiskusi yang diwujudkan dalam sikap sehari-hari.

Demonstrate scientific behavior (having curiosity, discipline, honest, objective, open, able to distinguish fact and opinion, tenacious, thorough, responsible, critical, creative, innovative, democratic, communicative) in designing and conducting experiments and discussions are realized in attitude everyday.

- 2.1. Menunjukkan perilaku kerjasama, santun, toleran, cinta damai dalam memanfaatkan sumber daya alam.

Shows the behavior of cooperation, courtesy, tolerance, love exploit natural resources.

- 2.2. Menunjukkan perilaku responsif, dan proaktif serta bijaksana sebagai wujud kemampuan memecahkan masalah dan membuat keputusan.

Shows the behavior of responsive, and proactive as well as wise as a manifestation of the ability to solve problems and make decisions.

Basic Competences from CC 3 / KD dari KI 3:

- 3.1 Mendeskripsikan sifat larutan garam dan peranan larutan garam dalam tubuh makhluk hidup.

Describe the nature of the role of salt solution and the salt solution in the living body.

- 3.2 Melakukan percobaan untuk mendeskripsikan sifat larutan garam serta peranan larutan garam dalam tubuh makhluk hidup dan menghitung pH-nya

Conducted an experiment to describe the nature of the salt solution and the role of the salt solution in the living body and calculate its pH

Basic Competences from CC 4 / KD dari KI 4:

- 4.1. Mengolah dan menganalisis perbedaan hidrolisis parsial dengan hidrolisis total berdasarkan percobaan.

Processing and analyzing the differences in the parcial hydrolysis with total hydrolysis based on experiment

- 4.2 Menghitung pH dan pOH larutan garam berdasarkan konsentrasi dan tetapan ionisasi asam atau basa pembentuknya

Calculate pH and pOH salt solution based on the concentration and ionization constant acid or base constituent

Indicator/ Indikator :

1. Pembelajaran perkembangan hidrolisis garam dapat melibatkan siswa secara aktif sebagai wujud kebesaran Tuhan Yang maha esa.

Learning development salt hydrolysis can involve students actively as a manifestation of the greatness of the Almighty God.

2. Bekerjasama dalam kegiatan kelompok dan memiliki perilaku ilmiah (Memiliki rasa ingin tahu, kreatif, teliti, terampil, berpikir kritis, dan ulet) dalam berdiskusi yang diwujudkan dalam sikap sehari-hari dapat ditunjukkan dengan baik.

Work in group activities and scientific behavior (Having curiosity, creative, thorough, skilled, critical thinking, and resilient) in the discussion which is manifested in everyday behaviors can be demonstrated well.

3. Berperilaku responsif, dan proaktif serta bijaksana sebagai wujud kemampuan memecahkan masalah dan membuat keputusan ditunjukkan dengan baik.

Behave responsive, and proactive as well as wise as a manifestation of the ability to solve problems and make decisions well demonstrated.

4. Membedakan hidrolisis parsial, hidrolisis total dan tetapan hidrolisis.

Distinguish parcial hydrolysis, total hydrolysis, and hydrolysis constant

5. Menjelaskan komponen dan cara kerja hidrolisis garam.

Describe the components and workings of the salt hydrolysis

6. Menghitung pH dan pOH larutan garam berdasarkan konsentrasi dan tetapan ionisasi asam atau basa pembentuknya.

Calculate pH and pOH of salt solution based on concentration and ionization constant acid or base of constituent.

C. Learning Objectives / Tujuan Pembelajaran :

After the learning conducted, student /setelah proses pembelajaran, siswa :

1. Menyadari keberadaan hidrolisis garam sebagai wujud kebesaran Tuhan Yang maha esa.

Recognizing exist of salt hydrolysis as a form of greatness of God the almighty one.

2. Dapat bekerjasama dalam kegiatan kelompok dan memiliki perilaku ilmiah (Memiliki rasa ingin tahu, kreatif, teliti, terampil, berpikir kritis, dan ulet) dalam berdiskusi yang diwujudkan dalam sikap sehari-hari dapat ditunjukkan dengan baik.

Able to work in group activities and scientific behavior (Having curiosity, creative, thorough, skilled, critical thinking, and resilient) in the discussion which is manifested in everyday behaviors can be demonstrated well.

3. Dapat berperilaku responsif, dan proaktif serta bijaksana sebagai wujud kemampuan memecahkan masalah dan membuat keputusan ditunjukkan dengan baik.

Can behave responsive, and proactive as well as wise as a manifestation of the ability to solve problems and make decisions well demonstrated.

4. Membedakan hidrolisis parsial, hidrolisis total berdasarkan percobaan.

Distinguish parcial hydrolysis, total hydrolysis by experiment

5. Menjelaskan komponen dan cara kerja hidrolisis garam.

Describe the components and workings of the salt hydrolysis

6. Menghitung pH dan pOH larutan garam berdasarkan konsentrasi dan tetapan ionisasi asam atau basa pembentuknya.

Calculate pH and pOH of salt solution based on concentration and ionization constant acid or base constituent.

D. Learning Material / Materi Pembelajaran :

a. Larutan Garam / Salt Solution

Garam merupakan senyawa ion, yang terdiri dari kation logam dan anion sisa asam. Kation garam dapat dianggap berasal dari suatu basa, sedangkan anionnya berasal dari suatu asam. Jadi, setiap garam mempunyai komponen basa (kation) dan komponen asam (anion).

Salts are ionic compounds, which consists of a metal cation and anion residual acid. Cation salt can be attributed to a base, while the anion derived from an acid. Thus, any salt has a basic component (cations) and acid components (anions).

b. Komponen Larutan Garam / Component of Salt solution

Larutan garam dibedakan atas / *Salt solution differentiated by:*

- Garam dari asam kuat dan basa kuat bersifat netral
Salts of strong acids and strong bases neutral
- Garam dari asam kuat dan basa lemah bersifat asam
Salt of strong acid and weak base are acidic
- Garam dari asam lemah dan basa kuat bersifat basa
Salt of weak acid and a strong base alkaline
- Garam dari asam lemah dan basa lemah bergantung pada harga tetapan ionisasi asam dan ionisasi basanya (K_a dan K_b)
Salt of weak acid and weak base ionization constants dependent on the acid and alkaline ionization (K_a and K_b).

E. Learning Strategy / Strategi Pembelajaran :

Model : Control Class (Using Module Based on Science Literation) and Control Class (Direct Instruction Method)

Methods : Discussion , Ask and Answer

F. Media and Learning Source / Media Pembelajaran dan Sumber Belajar :**1. Media**

- Presentation
- Module
- Worksheet

2. Learning Source

- Sudarmo, Unggul. 2014. *Kimia untuk SMA/MA Kelas XI*. Surakarta : Erlangga.
- Sutresna, Nana. 2011. *Kimia untuk SMA Kelas II*. Bandung : Grafindo Media Pratama.
- Kuswati, Ernavita, dkk. 2013. *Konsep dan Penerapan SMA/MA Kelas XI*. Jakarta : Bailmu.

G. Learning Activities / Langkah-langkah Pembelajaran

Aktivitas pembelajaran guru dan siswa di kelas kontrol /

Learning Activities of teacher and student in control class.

Pertemuan 1 / 1st meeting

Fase Pembelajaran <i>Learning Phase</i> <i>(control class)</i>	Sintak Metode Instruksi Langsung <i>Direct Instruction</i> <i>Methods Syntax</i>	Aktivitas Guru <i>Teacher's Activities</i>	Aktivitas Siswa <i>Student's Activity</i>	Alokasi Waktu <i>Time Allocation</i>
1. Kegiatan Pendahuluan <i>Initial Activities</i>	Penyampaian tujuan <i>(Delivering objective)</i>	a. Menciptakan suasana kelas yang religious dengan menunjuk salah satu siswa memimpin doa, memeriksa kehadiran siswa, memberikan motivasi, kebersihan dan kerapian ruangan kelas sebagai wujud kepedulian lingkungan. (religius dan peduli lingkungan) <i>Creating religious condition by asking one student to lead the pray, check attended list, give motivation, tidiness of classroom as an environment caring.</i>	a. Berdoa bersama, menjaga kebersihan, dan kerapian kelas. <i>Pray together, save the cleanliness and tidiness of classroom.</i>	3 minutes

2. Kegiatan Inti Core Activities	b. Guru mengawali kegiatan pembelajaran dengan melakukan tanya jawab sekilas sambil mengecek apakah siswa benar-benar sudah mempelajari terlebih dahulu materi yang akan diajarkan atau tidak. <i>The teacher beginning learning activities by asking student and also checking student they have learned or not the previously the materials that will be done.</i>	b. Menjawab pertanyaan Guru. <i>Answer the teacher question.</i>	3 minutes
	c. Guru memotivasi siswa mengenai manfaat mempelajari hidrolisis. (komunikatif dan kreatif). <i>The teacher motivating student about the benefit learning hydrolysis. (communicative and creative)</i>	c. Mendengarkan penjelasan guru. <i>Listening the teacher's explanation.</i>	5 minutes
	d. Membagikan pre-test kepada siswa dan menyuruh mengerjakannya. <i>give the pre-test to the student and tell them to do it.</i>	d. Mengerjakan soal pre-test yang telah diberikan oleh guru. <i>Doing the pre-test from teacher.</i> e. Mengumpulkan hasil jawaban pre-	40 minutes

	Evaluasi (Evaluation)	e. meminta murid untuk mengumpulkan kertas jawaban. <i>Teacher ask the student to collect the answer sheet.</i> f. Mengawali pembelajaran dengan menyampaikan indicator 1-2 dan tujuan pembelajaran yang ingin dicapai pada pertemuan hari ini. <i>Explaining the indicator 1-2 and the learning objectives that want to reach in this meeting.</i> g. Memberikan Modul kepada masing-masing siswa. <i>Give the module to all of student.</i> h. Menjelaskan kepada siswa pengertian hidrolisis dan cirri-ciri beberapa jenis garam yang dapat terhidrolisis dalam air. <i>Teacher is explaining about the meaning of hydrolysis and the properties of some salt that can be hydrolyzed in water.</i> i. menjelaskan tentang syarat-syarat terjadinya	test. <i>Collect the answered from pre-test.</i> f. Mendengarkan penjelasan guru. <i>Listening the teacher's explanation.</i> g. Membaca modul yang telah diberikan. <i>Read the book that after gived.</i> h. Mendengarkan penjelasan guru. <i>Listening the teacher's explanation.</i> i. Mendengarkan penjelasan guru. <i>Listening the teacher's</i>	30 minutes
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	reaksi hydrolisis <i>explaining the requirement the undergoing of hydrolysis reaction.</i> j. Menjelaskan tentang fungsi hidrolisis dalam kehidupan sehari-hari <i>Teacher explain about the function of hydrolysis in daily life.</i> k. Membagikan LKS tentang hydrolisis dan penggunaannya dalam kehidupan sehari-hari kepada siswa untuk dikerjakan . (tanggung jawab dan rasa ingin tau). <i>Give the first worksheet about salt hydrolysis for the student to do. (responsible and curiosity).</i> l. Meminta siswa untuk mengumpulkan LKS dan menyuruh siswa untuk mengerjakan di papan tulis untuk dibahas . (rasa ingin tau dan aspek penilaian). <i>asking collect the answer and ask the student to do those problems on white board</i>	<i>explanation.</i> j. Mendengarkan penjelasan guru. <i>Listening the teacher's explanation.</i> k. Menyelesaikan soal yang telah diberikan pada LKS. <i>Answered the question from LKS.</i> l. Mengumpulkan jawaban dari soal yang telah diberikan. <i>Collect the answered from question.</i>	9 minutes.
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3. Kegiatan Penutup Closing Activity	Penghargaan (Reward)	<i>regularly.(curiosity and achievement respect).</i> m. Meminta siswa membaca materi berikutnya mengenai cara menghitung pH dan menginformasikan pertemuan berikutnya pada mereka. <i>Asking student to read book for next subject matter and giving information in the next meeting.</i> n. menugaskan siswa mengerjakan soal soal yang berhubungan dengan hidrolisis dan perhitungan Ph larutan garam. (mandiri, kerja keras, rasa ingin tahu, gemar membaca, dan tanggung jawab). <i>asking student to do problems that related to hydrolysis and pH calculation of salt solution. (independent, work hard curiosity lots reading and responsible).</i> o. Guru menutup proses belajar mengajar di kelas. <i>Teacher is closing learning activity in cclass on this meeting.</i>	m. Melaksanakan perintah dari guru. <i>Doing the command from teacher.</i> n. Melaksanakan perintah dari guru. <i>Doing the command from teacher.</i>	
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Pertemuan 2 / 2nd meeting (2 x 45 minute)

Fase Pembelajaran <i>Learning Phase</i> <i>(Control class)</i>	Sintak Model Instruksi Langsung <i>Direct Instruction</i> <i>Models Syntax</i>	Aktivitas Guru <i>Teacher's Activities</i>	Aktivitas Siswa <i>Student's Activity</i>	Alokasi Waktu <i>Time Allocation</i>
4. Kegiatan Pendahuluan <i>Initial Activities</i>	Penyampaian tujuan <i>(Delivering objective)</i>	a. Menciptakan suasana kelas yang religious dengan menunjuk salah satu siswa memimpin doa, memeriksa kehadiran siswa, memberikan motivasi, kebersihan dan kerapian ruangan kelas sebagai wujud kepedulian lingkungan. <i>Creating religious condition by asking one student to lead the pray, check attended list, give motivation, tidiness of classroom as an environment caring.</i>	a. Berdoa bersama, menjaga kebersihan, dan kerapian kelas. <i>Pray together, save the cleanliness and tidiness of classroom.</i>	3 minutes
		b. Mengawali kegiatan pembelajaran dengan meminta siswa mengumpulkan tugas yang telah ditugaskan pada pertemuan sebelumnya.	b. Mengumpulkan tugas yang telah diberikan.	5 minutes

6. Kegiatan Penutup <i>Closing Activity</i>	Penghargaan (Reward)	<i>giving a chance to student to asking what they don't know. (curiosity).</i> g. Memerintahkan pada siswa agar mengerjakan soal-soal pada modul yang telah di berikan. <i>Give the command to student to answered the question in module.</i> h. Meminta siswa untuk mengumpul jawaban <i>Command the student to collect the answer.</i> i. Meminta siswa membaca materi yang telah dipelajari sebelumnya. <i>Asking students to read the previous matter</i> j. Menutup proses belajar mengajar di kelas. <i>Closing learning activity in class on this meeting.</i>	<i>understand.</i> g. Mengerjakan soal yang telah diberikan . <i>Answer the question that gived.</i> h. Mengumpulkan jawaban <i>Collect the answered.</i> i. Melaksanakan perintah dari guru. <i>Doing the command from teacher.</i> j. Melaksanakan perintah dari guru. <i>Doing the command from teacher.</i>	30 minutes 10 minutes 2 minutes

Pertemuan 3 / 3th meeting (3x 45 minutes)

Fase Pembelajaran Learning Phase (Control class)	Sintak Model Instruksi Langsung Direct Instruction Models Syntax	Aktivitas Guru Teacher's Activities	Aktivitas Siswa Student's Activity	Alokasi Waktu Time Allocation
7. Kegiatan Pendahuluan <i>Initial Activities</i>	Penyampaian tujuan <i>(Delivering objective)</i>	a. Menciptakan suasana kelas yang religious dengan menunjuk salah satu siswa memimpin doa, memeriksa kehadiran siswa, memberikan motivasi, kebersihan dan kerapian ruangan kelas sebagai wujud kepedulian lingkungan. <i>Creating religious condition by asking one student to lead the pray, check attended list, give motivation, tidiness of classroom as an environment caring.</i>	a. Berdoa bersama, menjaga kebersihan, dan kerapian kelas. <i>Pray together, save the cleanliness and tidiness of classroom.</i>	3 minutes
8. Kegiatan Inti <i>Core Activities</i>	Penjelasan <i>(Explanation)</i>	b. Mengawali pembelajaran dengan melanjutkan indicator selanjutnya dan mengulang indicator serta tujuan pembelajaran yang telah dipelajari	b. Mendengarkan penjelasan guru. <i>Listening the teacher explanation.</i>	3 minutes

9. Kegiatan Penutup Closing Activity	Evaluasi (Evaluation)	sebelumnya.. <i>Explaining learning by reviewing the previous indicator to students and explain next indicator and the purpose of learning materials.</i> c. Memberikan kesempatan kepada siswa untuk menanyakan hal-hal yang masih kurang dimengerti. (rasa ingin tau) <i>Giving a chance to student to ask what they don't know . (curiosity)</i>	c. Mengerjakan post test. <i>Doing the post test.</i>	20 Minute
	Penghargaan (Reward)	d. Memberikan posttest kepada siswa <i>Giving the pos-test</i> Menjelaskan secara singkat jawaban posttest. <i>Explaining briefly the answer of pos-tes</i> f. Menutup proses belajar mengajar di kelas. <i>Closing learning activity in class on this meeting.</i>	d. Mendengarkan penjelasan guru. <i>Listening explanation of teacher.</i>	60 minutes
				5 minutes

Aktivitas pembelajaran guru dan siswa di kelas eksperiment class /

Learning Activities of teacher and student in experiment class.

Pertemuan 1 / 1st meeting (2 x 45 minutes)

Fase Pembelajaran Learning Phase (experiment class)	Sintak Model Instruksi Langsung Direct Instruction Models Syntax	Aktivitas Guru Teacher's Activities	Aktivitas Siswa Student's Activity	Alokasi Waktu Time Allocation
10. Kegiatan Pendahuluan <i>Initial Activities</i>	Delivering Objective <i>(Menyampaikan tujuan)</i>	a. Menciptakan suasana kelas yang religious dengan menunjuk salah satu siswa memimpin doa, memeriksa kehadiran siswa, memberikan motivasi, kebersihan dan kerapian ruangan kelas sebagai wujud kepedulian lingkungan. <i>Creating religious condition by asking one student to lead the pray, check attended list, give motivation, tidiness of classroom as an environment caring.</i>	a. Berdoa bersama, menjaga kebersihan, dan kerapian kelas. <i>Pray together, save the cleanness and tidiness of classroom.</i>	3 minutes
		b. Guru mengawali kegiatan pembelajaran dengan melakukan tanya jawab sekilas	b. Menjawab pertanyaan Guru. <i>Answer the teacher question.</i>	5 minutes

11. Kegiatan Inti Core Activities	Present/deliver information <i>(Penyampaian Informasi)</i>	sambil mengecek apakah siswa benar-benar sudah mempelajari terlebih dahulu materi yang akan diajarkan atau tidak. <i>The teacher beginning learning activities by asking student and also checking student they have learned or not the previously the materials that will be done.</i> c. Guru memotivasi siswa mengenai manfaat mempelajari hidrolisis. (komunikatif dan kreatif). <i>The teacher motivating student about the benefit learning hydrolysis. (communicative and creative)</i> d. Membagikan pre-test kepada siswa dan menyuruh mengerjakannya. <i>give the pre-test to the student and tell them to do it.</i> e. meminta murid untuk mengumpulkan kertas jawaban. <i>Teacher ask the student to collect the</i>	c. Mendengarkan penjelasan guru. <i>Listening the teacher's explanation.</i> d. Mengerjakan soal pre-test yang telah diberikan oleh guru. <i>Doing the pre-test from teacher.</i> e. Mengumpulkan hasil jawaban pre-test. <i>Collect the answered from pre-test.</i>	40 minutes 30 minutes
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	Grouping (Pembentukan kelompok) Study Group (Belajar)	<i>answer sheet.</i> f. Membagi siswa menjadi beberapa kelompok kecil terdiri dari 5-6 siswa per kelompok. <i>Distributing students into some small groups consist of 5-6 students per group.</i> g. Mengawali pembelajaran dengan menyampaikan indicator 1-2 dan tujuan pembelajaran yang ingin dicapai pada pertemuan hari ini. <i>Teacher is explaining the indicator 1-2 and the learning objectives that want to reach in this meeting.</i> h. Memberikan modul tentang materi yang akan dipelajari. <i>Give the module about the materials.</i> i. Menjelaskan kepada siswa pengertian hidrolisis dan ciri-ciri beberapa jenis garam yang dapat terhidrolisis dalam air. <i>Explaining about the meaning of hydrolysis and the properties of some salt that can be hydrolyzed in water.</i>	f. Membentuk kelompok sesuai pembagian. <i>Establishing the appropriate division.</i> g. Mendengarkan penjelasan guru. <i>Students are listening explanation of teachers.</i> h. Membaca Modul <i>Read the module</i> i. Melakukan diskusi. <i>Doing the discussion.</i> Masing-masing kelompok berpikir	
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	Kelompok) Evaluation (Evaluasi)	j. Membimbing siswa untuk melakukan diskusi tentang basa pembentuk dan asam pembentuk dari masing-masing garam. <i>Guiding students to do discussion about basic and basic former of each salt</i> k. Meminta peserta didik menyampaikan hasil diskusi per kelompok di depan kelas. <i>Asking students to give the result per groups in class.</i> l. Memberikan tanggapan dan simpulan berdasarkan hasil diskusi kerja kelompok. <i>Giving the response and conclusion based on the group discussion.</i> (selama proses belajar, guru melakukan penilaian proses / <i>during learning process, the teacher does evaluation process</i>)	secara kreatif, bertanggung jawab, dan mandiri dalam setiap diskusi. <i>Each of group is thinking creatively, responsibility, and independently in every discussion.</i> k. Masing-masing kelompok menyampaikan hasil diskusi dan memberikan tanggapan secara mandiri dan tanggung jawab. <i>Each of group is accomplishing the discussion and giving argument independently and responsibility.</i>	10 minutes 2 minutes
	Reward (Penghargaan)	m. Memberikan catatan penting mengenai materi pokok yang harus dikuasainya & pemberian penghargaan, <i>Giving the important note about the main matter that must be mastered by students</i>	l. Mendengarkan penjelasan guru. <i>Listening explanation of teacher.</i> m. Menulis catatan yang diberikan guru. <i>Writing the note that given by</i>	

12. Kegiatan Penutup Closing Activity		n. Membimbing siswa membuat kesimpulan. <i>Guiding students to make conclusions & reward.</i> o. Meminta siswa membaca materi berikutnya mengenai cara menghitung pH solution. <i>Asking student to read book for next subject matter about pH solution.</i> h. Menutup proses belajar mengajar di kelas. <i>Closing learning activity in cclass on this meeting.</i>	<i>teacher.</i> n. Menyimpulkan hasil diskusi. <i>Resuming discuss result.</i> o. Mendengarkan penjelasan guru. <i>Listening explanation of teacher.</i>	
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Pertemuan 2 / 2nd meeting(2 x 45 minute)

Fase Pembelajaran <i>Learning Phase</i> <i>(Control class)</i>	Sintak Model Instruksi Langsung <i>Direct</i> <i>Instruction</i> <i>Models Syntax</i>	Aktivitas Guru <i>Teacher's Activities</i>	Aktivitas Siswa <i>Student's Activity</i>	Alokasi Waktu <i>Time Allocation</i>
13. Kegiatan Pendahuluan <i>Initial Activities</i>	Delivering Objective <i>(Menyampaikan tujuan)</i>	a. Menciptakan suasana kelas yang religious dengan menunjuk salah satu siswa memimpin doa, memeriksa kehadiran siswa, memberikan motivasi, kebersihan dan kerapian ruangan kelas sebagai wujud kepedulian lingkungan. <i>Creating religious condition by asking one student to lead the pray, check attended list, give motivation, tidiness of classroom as an environment caring.</i>	a. Berdoa bersama, menjaga kebersihan, dan kerapian kelas. <i>Pray together, save the cleanness and tidiness of classroom.</i>	3 minutes
14. Kegiatan Inti <i>Core Activities</i>	Present/deliver information <i>(Penyampaian</i>	b. Mengawali pembelajaran dengan menyampaikan indicator 3-4 dan tujuan pembelajaran yang ingin dicapai pada	b. Mendengarkan penjelasan guru. <i>Listening explanation of teachers.</i>	5 minute

	Informasi)	pertemuan hari ini. <i>Explaining the indicator 1-2 and the learning objectives that want to reach in this meeting.</i>		
	Grouping (Pembentukan kelompok)	c. Meminta siswa untuk duduk sesuai dengan kelompok yang telah dibagi pada pertemuan sebelumnya. <i>Asking students to sit based on the group that has been divide from the last meeting.</i>	c. Duduk berdasarkan kelompoknya. <i>Sitting based on their group</i>	
	Study Group (Belajar Kelompok)	d. Menjelaskan kepada siswa tentang rumus menghitung larutan garam dan cara menghitung pH larutan garam. <i>Explaining about the formula to calculate of salt solution and to calculate the pH of salt solution</i> e. Membimbing siswa untuk melakukan diskusi tentang cara penghitungan pH larutan garam <i>Guiding students to do discussion about to calculate the pH of solution</i>	d. Mendengarkan penjelasan guru. <i>Listening explanation of teachers</i> e. Siswa melakukan diskusi. <i>Students are doing the discussion.</i> Masing-masing kelompok berpikir secara kreatif, bertanggung jawab, dan mandiri dalam setiap	40 minutes

15. Kegiatan Penutup Closing Activity	Evaluation (<i>Evaluasi</i>)	f. Meminta peserta didik menyampaikan hasil diskusi per kelompok di depan kelas. <i>Asking students to give the result per groups in class.</i> g. Memberikan tanggapan dan simpulan berdasarkan hasil diskusi kerja kelompok. <i>Giving the response and conclusion based on the group discussion.</i> (selama proses belajar, guru melakukan penilaian proses / <i>during learning process, the teacher does evaluation process</i>) h. Memberikan catatan penting mengenai materi pokok yang harus dikuasainya, <i>Giving the important note about the main matter that must be mastered by students</i>	diskusi. <i>Each of group is thinking creatively, responsibility, and independently in every discussion.</i> f. Masing-masing kelompok menyampaikan hasil diskusi dan memberikan tanggapan secara mandiri dan tanggung jawab. <i>Each of group is accomplishing the discussion and giving argument independently and responsibility.</i> g. Mendengarkan penjelasan guru. <i>Listening explanation of teacher.</i> h. Mencatat materi yang telah diberikan guru. <i>Writing the matter that has been</i>	30 minutes 10 Minute 2 minutes
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	Reward (Penghargaan)	i. Memberikan reward bagi kelompok yang memiliki kerjasam yang baik dan aktif. <i>Providing reward for groups who have good cooperation and active</i> j. Meminta siswa membaca materi yang telah dipelajari sebelumnya. <i>Asking students to read the previous matter</i> k. Menutup proses belajar mengajar di kelas. <i>Closing learning activity in class on this meeting.</i>	<i>given by teacher.</i> i. Menerima penghargaan. <i>Receiving the reward.</i> j. Mendengarkan penjelasan guru. <i>Listening explanation of teacher.</i>	
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Pertemuan 3 / 3th meeting(2 x 45 minute)

Fase Pembelajaran <i>Learning Phase</i> <i>(Control class)</i>	Sintak Model Instruksi Langsung <i>Direct Instruction Models Syntax</i>	Aktivitas Guru <i>Teacher's Activities</i>	Aktivitas Siswa <i>Student's Activity</i>	Alokasi Waktu <i>Time Allocation</i>
16. Kegiatan Pendahuluan <i>Initial Activities</i>	Delivering Objective <i>(Menyampaikan tujuan)</i>	a. Menciptakan suasana kelas yang religious dengan menunjuk salah satu siswa memimpin doa, memeriksa kehadiran siswa, memberikan motivasi, kebersihan dan kerapian ruangan kelas sebagai wujud kepedulian lingkungan. <i>Creating religious condition by asking one student to lead the pray, check attended list, give motivation, tidiness of classroom as an environment caring.</i>	a. Berdoa bersama, menjaga kebersihan, dan kerapian kelas. <i>Pray together, save the cleanness and tidiness of classroom.</i>	3 minutes
17. Kegiatan Inti <i>Core Activities</i>	Present/deliver information <i>(Penyampaian</i>	b. Mengawali pembelajaran dengan mengulang indicator dan tujuan pembelajaran yang telah dipelajari	b. Mendengarkan penjelasan guru. <i>Listening explanation of teacher.</i>	15 minutes

18. Kegiatan Penutup Closing Activity	Informasi) Grouping (Pembentukan kelompok) Evaluation (Evaluasi)	sebelumnya.. <i>Explaining learning by reviewing the previous indicator to students</i> (selama proses belajar, guru melakukan penilaian proses / <i>during learning process, the teacher does evaluation process</i>) c. Memberikan posttest kepada siswa <i>Giving the pos-test</i>	c. Mengerjakan post test. <i>Doing the post test.</i>	60 minutes
	Reward (Penghargaan)	d. Menjelaskan secara singkat jawaban posttest & pemberian penghargaan. <i>Explaining briefly the answer of pos-test</i> e. Guru menutup proses belajar mengajar di kelas. <i>Teacher is closing learning activity in cclass on this meeting.</i>	d. Mendengarkan penjelasan guru. <i>Listening explanation of teacher.</i>	15 minute

H. Sistem Penilaian/Assesment System

1. Techniques of asesment : Group and Individual task
2. Instrument form : Multiple choice
3. Instrument : Attached

4. Appendix 3

5. TABLE OF SPECIFICATION BASED ON INDICATOR INSTRUMENT TEST

No	INDICATOR	QUESTION	COGNITIVE ASPEC	ANSWER	TOTAL QUESTION
1	Understanding the kind of salt which can be hydrolyzed in water.	1. Which of the following salt that will undergo total hydrolysis if dissolve in the water ? a. NaCN d. BaSO₄. b. NH₄CNe. KCl c. (NH₄)₂SO₄	C3	B	3
		4. The salt that will be in acidic solution if dissolved in water is... a. K₂SO₄ d. CH₃COONa b. NH₄Cl e. MgSO₄ c. Ba(NO₃)₂	C3	B	
		18. Among of the 1 molar solution below, which of solution that has the highest pH...			

		a. Na_2SO_4 b. CH_3COONa c. CH_3COOH	d. KCl e. NH_4NO_3	C2	B	
2	Determining the characteristics of some salt which can be hydrolyzed	3. The mixture of acid and base that will produce partial hydrolyzed salt in basic condition is the equivalent mixture of the solution... a. HCl with NaOH b. HCl with NH_4 c. CH_3COOH with NaOH d. CH_3COOH with NH_4 e. H_2SO_4 with NH_3		C3	C	4
		16. Among the following salt that will undergo the hydrolysis is... a. Sodium Sulphate b. Sodium Chloride c. Potassium chloride d. Potassium perchloride		C2	E	

		e. Ammonium Chloride. 20. The salt solution that has the $\text{pH} > 7$ is... a. $\text{CH}_3\text{COONH}_4$ d. KCN b. K_2SO_4 e. NH_4 c. NaCl 26. Look at the following salt : 1) Na_2CO_3 2) KNO_3 3) KNO_2 4) NaCl Which of the above solution that can make the red litmus become blue a. 1 and 2 b. 2 and 3 c. 3 and 4 d. 2 and 4 e. 1 and 3	C3 C4	D E	
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3	Understanding the properties of some salt which can be hydrolyzed from the ionization reaction equation.	7. Which of the following salts that will have the pH < 7 if dissolve in the water... a. NaCl b. Na₂CO₃ c. NaNO₃ d. NH₄Br e. CH₃COOK 6. From the following reaction , the pair of solution that will undergo hydrolysis is... a. 100 ml NaOH 0.1M + 100 ml H₂SO₄ 0.1M b. 50 ml HCN 0.1M + 50 ml KOH 0.05M c. 200 ml CH₃COOH 0.05M + 200ml Ca(OH)₂ 0.05M d. 10 ml HCl 0.1M + 20 ml NaOH 0.05M e. 50 ml KOH 0.2M + 50 ml HCN 0.1M 23. The salt that can hydrolyzed in water and produce the solution with the pH > 7 is...	C3 C3	D E	4
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		a. NaCl b. Na ₂ CO ₃ c. NaNO ₃ d. CH ₃ COONa e. NH ₄ Cl 21. Among the following salts, the salt that will not undergo hydrolysis if dissolved in the water is... a. KF b. NaCN c. NH ₄ Cl d. CH ₃ COONH ₄ e. BaSO ₄	C3 C3	D E	
4	Determining the characteristics of some salts which can be hydrolyzed from the ionization reaction equation.	15. The following salt that will undergo partial hydrolysis if dissolved in water. 1) Sodium Acetic 3) Ammonium chloride 2) Ammonium Acetic	C4	B	8

		4) Sodium Chloride So, the right answer is... a. 1,2,3 b. 1,3 c. 2,4 d. Only 4 e. All is right			
		13. A solution of ammonium bromine, NH_4Br 0.01M has the $\text{pH} = 5$ so, the hydrolysis constant of that solution is... a. 10^{-9} b. 10^{-8} c. 10^{-7} d. 10^{-6} e. 10^{-5}	C2	B	
		8. The salt that undergo total hydrolysis is: a. NaCl	C2	D	

		b. Na_2SO_4 c. NH_4Cl d. $\text{CH}_3\text{COONH}_4$ e. $(\text{NH}_4)_2\text{SO}_4$			
		22. Red litmus will change into blue if dip into solution... a. Na_3PO_4 b. MgCl_2 c. KNO_3 d. NH_4Br e. FeSO_4	C3	A	
		24. KCN solution in water will be base . The reaction that show the base properties happen is.... a. $\text{K}^+ + \text{OH}^- \longrightarrow \text{KOH}$ b. $\text{CN}^- + \text{H}^+ \longrightarrow \text{HCN}$ c. $\text{K}^+ + \text{H}_2\text{O} \longrightarrow \text{KOH} + \text{H}^+$	C2	E	

		d. $\text{CN}^- + \text{KOH} \longrightarrow \text{KCN} + \text{OH}^-$ e. $\text{CN}^- + \text{H}_2\text{O} \longrightarrow \text{HCN} + \text{OH}^-$			
		25. Which of the following salt that has the basic properties... a. Potasium Acetic b. Sodium Chloride c. Sodium Sulphate d. Ammonium Chloride e. Ammonium Acetic	C2	A	
		27. Which of the reaction below that show ZnSO_4 in acidic condition... a. $\text{SO}_4^{2-} + \text{H}^+ \longrightarrow \text{H}_2\text{SO}_4$ b. $\text{SO}_4^{2-} + 2\text{H}_2\text{O} \longrightarrow \text{H}_2\text{SO}_4 + 2\text{OH}^- + \text{H}^+$ c. $\text{Zn}^{2+} + 2\text{H}_2\text{O} \longrightarrow \text{Zn}(\text{OH})_2 + 2\text{H}^+$ d. $\text{Zn}^{2+} + \text{OH}^- \longrightarrow \text{Zn}(\text{OH})_2$ e. $\text{Zn}^{2+} + \text{HSO}_4^- \longrightarrow \text{ZnSO}_4$	C2	C	

	3. KCl 4. NH₄Cl The right answer is..... a. 1,2,3 b. 1,3 c. 2,4 d. Only 4 e. All is right. 14. In a solution , there is sodium acetic that will undergo the hydrolysis with the reaction , $\text{CH}_3\text{COO}^- + \text{H}_2\text{O} \longrightarrow \text{CH}_3\text{COOH} + \text{OH}^-$ If the hydrolysis constant $K_h = 10^{-9}$, so the solution has the pH..... a. 9 b. 7 c. 6 d. 5 e. 1	C3	A	
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		9. The salt solution that can make the blue litmus become red is.... a. KCl b. Na_2CO_3 c. $\text{Ca}_3(\text{PO}_4)_2$ d. $\text{Al}(\text{NO}_3)_3$ e. MgSO_4	C2	D	
6	Calculate the pH of hydrolyzed salt.	2. There is a salt solution of sodium acetic 0.01M if the K_a of CH_3COOH is 10^{-6}, the hydrolysis constant of sodium acetic is a. 10^{-8} b. 10^{-9} c. 10^{-12} d. 10^{-13} e. 10^{-14} 5. From the solution of NH_4Cl 0.1 M , known that $K_h = 10^{-9}$, so the pH of that solution is.... a. 5	C2 C2	A A	7

		b. 6 c. 7 d. 8 e. 9 10. From the solution of $(\text{NH}_4)_2\text{SO}_4$ 0.025M , known that $K_b = 10^{-5}$, so the pH of that solution is... a. 5 b. $6 - \log 5$ c. $6 + \log 5$ d. 7 e. $7 - \log 5$ 12. In a solution there is ammonium acetic 0.01M that undergo the total hydrolysis . If the K_b of $\text{NH}_3 = 10^{-7}$ and K_a of $\text{CH}_3\text{COOH} = 10^{-5}$, this solution has the pH..... a. 8 b. 7	C2	A	
			C2	C	

		c. 6 d. 5 e. 4 19. The pH of salt solution CH_3COONa 0.1M ($K_a = 10^{-5}$) is..... a. 7 b. 8 c. 9 d. 10 e. 11 29. In the 500 ml of solution, there is 4.1 gr CH_3COONa which is dissolved. If $K_a = 10^{-5}$, and Ar Na= 23, C=12, O=16, So the pH of solution is..... a. 6 b. 7 c. 8 d. 9 e. 10	C2 C4	C D	
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		17. 100 ml of NH_4Cl solution ($K_b \text{ NH}_4\text{Cl} = 10^{-5}$) has the $\text{pH} = 5$, the mass of NH_4Cl that dissolve is..... a. 0.535 gr d. 53.5 gr b. 5.35 gr e. 107 gr c. 10.7 gr	C4	A	
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Appendix 4**INSTRUMENT TEST BEFORE VALIDATION**

Subject : Chemistry
Topic : Salt Hydrolysis
Number of question : 30 items
Time Allocation : 60 minutes

Direction to the text:

1. Read each text well, then give (x) to each answer which you assume is right
 2. Doing problem which you assume easier beforehand
 3. Don't cooperate with your friend
-

1. Which of the following salt that will undergo total hydrolysis if dissolve in the water ?
 - a. NaCN
 - b. BaSO₄
 - c. (NH₄)₂SO₄
 - d. NH₄CN
 - e. KCl
2. There is a salt solution of sodium acetic 0.01M if the K_a of CH₃COOH is 10⁻⁶, the hydrolysis constant of sodium acetic is
 - a. 10⁻⁸
 - b. 10⁻⁹
 - c. 10⁻¹²
 - d. 10⁻¹³
 - e. 10⁻¹⁴
3. The mixture of acid and base that will produce partial hydrolyzed salt in basic condition is the equivalent mixture of the solution
 - a. HCl with NaOH
 - b. HCl with NH₄
 - c. CH₃COOH with NaOH
 - d. CH₃COOH with NH₄
 - e. H₂SO₄ with NH₃
4. The salt that will be in acidic solution if dissolved in water is.....
 - a. K₂SO₄
 - b. NH₄Cl
 - c. Ba(NO₃)₂
 - d. CH₃COONa
 - e. MgSO₄

5. From the solution of NH_4Cl 0.1 M , known that $K_h = 10^{-9}$, so the pH of that solution is....
- a. 5
b. 6
c. 7
d. 8
e. 9
6. From the following reaction , the pair of solution that will undergo hydrolysis..
- a. 100 ml NaOH 0.1M + 100 ml H_2SO_4 0.1M
b. 50 ml HCN 0.1M + 50 ml KOH 0.05M
c. 200 ml CH_3COOH 0.05M + 200 ml $\text{Ca}(\text{OH})_2$ 0.05M
d. 10 ml HCl 0.1M + 20 ml NaOH 0.05M
e. 50 ml KOH 0.2M + 50 ml HCN 0.1M
7. Which of the following salts that will have the $\text{pH} < 7$ if dissolve in the water
- a. NaCl
b. Na_2CO_3
c. NaNO_3
d. NH_4Br
e. CH_3COOK
8. The salt that undergo total hydrolysis is:
- a. NaCl
b. Na_2SO_4
c. NH_4Cl
d. $\text{CH}_3\text{COONH}_4$
e. $(\text{NH}_4)_2\text{SO}_4$
9. The salt solution that can make the blue litmus become red is....
- a. KCl
b. Na_2CO_3
c. $\text{Ca}_3(\text{PO}_4)_2$
d. $\text{Al}(\text{NO}_3)_3$
e. MgSO_4
10. From the solution of $(\text{NH}_4)_2\text{SO}_4$ 0.025M , known that $K_b = 10^{-5}$, so the pH of that solution is...
- a. 5
b. $6 - \log 5$
c. $6 + \log 5$
d. 7
e. $7 - \log 5$
11. There is a solution of $\text{CH}_3\text{COONH}_4$ 0.01M which has the $\text{pH} = 6$. If the K_b of $\text{NH}_3 = 10^{-5}$ so the acetic acid constant is.....
- a. 10^{-9}
d. 10^{-4}

- b. 10^{-8} e. 10^{-3}
 c. 10^{-5}
12. In a solution there is ammonium acetate 0.01M that undergoes the total hydrolysis. If the K_b of $\text{NH}_3 = 10^{-7}$ and K_a of $\text{CH}_3\text{COOH} = 10^{-5}$, this solution has the pH...
- a. 8 d. 5
 b. 7 e. 4
 c. 6
13. A solution of ammonium bromide, NH_4Br 0.01M has the pH = 5 so, the hydrolysis constant of that solution is
- a. 10^{-9} d. 10^{-6}
 b. 10^{-8} e. 10^{-5}
 c. 10^{-7}
14. In a solution, there is sodium acetate that will undergo the hydrolysis with the reaction, $\text{CH}_3\text{COO}^- + \text{H}_2\text{O} \longrightarrow \text{CH}_3\text{COOH} + \text{OH}^-$. If the hydrolysis constant $K_h = 10^{-9}$, so the solution has the pH.....
- a. 9 d. 5
 b. 7 e. 1
 c. 6
15. The following salt that will undergo partial hydrolysis if dissolved in water.
- 1) Sodium Acetate 3) Ammonium chloride
 2) Ammonium Acetate 4) Sodium Chloride
- So, the right answer is.....
- a. 1,2,3 d. Only 4
 b. 1,3 e. All is right
 c. 2,4
16. Among the following salt that will undergo the hydrolysis is....
- a. Sodium Sulphate d. Potassium perchlorate
 b. Sodium Chloride e. Ammonium Chloride.
 c. Potassium chloride

24. KCN solution in water will be base . The reaction that show the base properties happen is....



25. Which of the following salt that has the basic properties

a. Potassium Acetic

d. Ammonium Chloride

b. Sodium Chloride

e. Ammonium Acetic.

c. Sodium Sulphate

26. Look at the following salt :

$$1) \text{Na}_2\text{CO}_3$$

2) KNO_3

3) KNO_2

4) NaCl

Which of the above solution that can make the red litmus become blue

a. 1 and 2

d. 2 and 4

b. 2 and 3

e. 1 and 3

c. 3 and 4

27. Which of the reaction below that show ZnSO_4 in acidic condition



28. The salt solution which is in the acidic condition is.....

a. Cuprum (II) Sulfide

d. Potassium Carbonate

b. Magnesium Nitrate

e. Magnesium Chloride.

c. Sodium Acetic

29. In the 500 ml of solution, there is 4.1 gr CH_3COONa which is dissolved. If $K_a = 10^{-5}$, and $\text{Ar Na} = 23$, $\text{C} = 12$, $\text{O} = 16$, So the pH of solution is.....

a. 6

d. 9

b. 7

e. 10

C. 8

30. Among the following salt that will undergo hydrolysis if dissolve in water is :



The right answer is...

a. 1,2,3

d. Only 4

b. 1,3

e. All is right.

c. 2,4



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Appendix 5

INSTRUMENT TEST AFTER VALIDATION

Subject : Chemistry
 Topic : Salt Hydrolysis
 Number of question : 20 items
 Time Allocation : 60 minutes

Direction to the text:

4. Read each text well, then give (x) to each answer which you assume is right
5. Doing problem which you assume easier beforehand
6. Don't cooperate with your friend

1. Which of the following salt that will undergo total hydrolysis if dissolve in the water ?
 a. NaCN
 b. NH_4CN
 c. $(\text{NH}_4)_2\text{SO}_4$
 d. BaSO_4
 e. KCl
2. There is a salt solution of sodium acetic 0.01M if the K_a of CH_3COOH is 10^{-6} , the hydrolysis constant of sodium acetic is
 a. 10^{-8}
 b. 10^{-9}
 c. 10^{-12}
 d. 10^{-13}
 e. 10^{-14}
3. The mixture of acid and base that will produce partial hydrolyzed salt in basic condition is the equivalent mixture of the solution
 a. HCl with NaOH
 b. HCl with NH_4
 c. CH_3COOH with NaOH
 d. CH_3COOH with NH_4
 e. H_2SO_4 with NH_3
4. The salt that will be in acidic solution if dissolved in water is.....
 a. K_2SO_4
 b. NH_4Cl
 c. $\text{Ba}(\text{NO}_3)_2$
 d. CH_3COONa
 e. MgSO_4

5. From the solution of NH_4Cl 0.1 M , known that $K_h = 10^{-9}$, so the pH of that solution is....
- a. 5
b. 6
c. 7
d. 8
e. 9
6. From the following reaction , the pair of solution that will undergo hydrolysis..
- a. 100 ml NaOH 0.1M + 100 ml H_2SO_4 0.1M
b. 50 ml HCN 0.1M + 50 ml KOH 0.05M
c. 200 ml CH_3COOH 0.05M + 200 ml $\text{Ca}(\text{OH})_2$ 0.05M
d. 10 ml HCl 0.1M + 20 ml NaOH 0.05M
e. 50 ml KOH 0.2M + 50 ml HCN 0.1M
7. The salt that undergo total hydrolysis is:
- a. NaCl
b. Na_2SO_4
c. NH_4Cl
d. $\text{CH}_3\text{COONH}_4$
e. $(\text{NH}_4)_2\text{SO}_4$
8. From the solution of $(\text{NH}_4)_2\text{SO}_4$ 0.025M , known that $K_b = 10^{-5}$, so the pH of that solution is...
- a. 5
b. $6 - \log 5$
c. $6 + \log 5$
d. 7
e. $7 - \log 5$
9. There is a solution of $\text{CH}_3\text{COONH}_4$ 0.01M which has the $\text{pH} = 6$. If the K_b of $\text{NH}_3 = 10^{-5}$ so the acetic acid constant is.....
- a. 10^{-9}
b. 10^{-8}
c. 10^{-5}
d. 10^{-4}
e. 10^{-3}
10. In a solution there is ammonium acetic 0.01M that undergo the total hydrolysis. If the K_b of $\text{NH}_3 = 10^{-7}$ and K_a of $\text{CH}_3\text{COOH} = 10^{-5}$, this solution has the pH...
- a. 8
b. 7
c. 6
d. 5
e. 4

11. A solution of ammonium bromine, NH_4Br 0.01M has the $\text{pH} = 5$ so, the hydrolysis constant of that solution is
- 10^{-9}
 - 10^{-8}
 - 10^{-7}
 - 10^{-6}
 - 10^{-5}
12. In a solution, there is sodium acetate that will undergo the hydrolysis with the reaction, $\text{CH}_3\text{COO}^- + \text{H}_2\text{O} \longrightarrow \text{CH}_3\text{COOH} + \text{OH}^-$. If the hydrolysis constant $K_h = 10^{-9}$, so the solution has the pH
- 9
 - 7
 - 6
 - 5
 - 1
13. Among the following salt that will undergo the hydrolysis is....
- Sodium Sulphate
 - Sodium Chloride
 - Potassium chloride
 - Potassium perchlorate
 - Ammonium Chloride.
14. The pH of salt solution CH_3COONa 0.1M ($K_a = 10^{-5}$) is.....
- 7
 - 8
 - 9
 - 10
 - 11
15. The salt solution that has the $\text{pH} > 7$ is.....
- $\text{CH}_3\text{COONH}_4$
 - K_2SO_4
 - NaCl
 - KCN
 - NH_4Cl
16. The salt that can hydrolyzed in water and produce the solution with the $\text{pH} > 7$
- NaCl
 - Na_2CO_3
 - NaNO_3
 - CH_3COONa
 - NH_4Cl
17. KCN solution in water will be base. The reaction that show the base properties happen is....
- $\text{K}^+ + \text{OH}^- \longrightarrow \text{KOH}$
 - $\text{CN}^- + \text{H}^+ \longrightarrow \text{HCN}$
 - $\text{CN}^- + \text{KOH} \longrightarrow \text{KCN} + \text{OH}^-$
 - $\text{CN}^- + \text{H}_2\text{O} \longrightarrow \text{HCN} + \text{OH}^-$



18. Which of the reaction below that show $ZnSO_4$ in acidic condition



19. In the 500 ml of solution , there is 4.1 gr CH_3COONa which is dissolved. If $K_a = 10^{-5}$, and $Ar\ Na = 23$, $C = 12$, $O = 16$, So the pH of solution is.....

a. 6

d. 9

b. 7

e. 10

c. 8

20. Among the following salt that will undergo hydrolysis if dissolve in water is :

1. Na_2SO_4

3. KCl

2. CH_3COONa

4. NH_4Cl

The right answer is.....

a. 1,2,3

d. Only 4

b. 1,3

e. All is right.

c. 2,4

Appendix 6

LEMBAR EVALUASI BAHAN AJAR BERBASIS LITERASI SAINS UNTUK KELAS XI

Judul Skripsi : The Development of Teaching Material Based on Science Literation on Salt Hydrolysis for Grade XI Senior High School

Materi Pelajaran : Kimia

Materi Pokok : Hidrolisis Garam

Bapak/Ibu yang terhormat,

Saya memohon bantuan Bapak/Ibu untuk mengisi angket ini. Angket ini diajukan untuk mengetahui pendapat Bapak/Ibu tentang kelayakan atau kevalidan bahan ajar kimia berbasis literasi sains. Aspek penilaian bahan ajar ini terdiri atas aspek kelayakan isi, penyajian bahan ajar dan penilaian bahasa oleh BSNP serta dari aspek bahan ajar berbasis literasi sains. Penilaian, saran, dan koreksi dari Bapak/Ibu akan sangat bermanfaat untuk memperbaiki dan meningkatkan kualitas bahan ajar ini. Atas perhatian dan kesediaan Bapak/Ibu untuk mengisi angket ini, saya ucapkan terima kasih.

A. Petunjuk Pengisian

1. Isilah tanda *check* (✓) pada kolom yang Bapak/Ibu anggap sesuai dengan aspek penilaian yang ada.
2. Kriteria Penilaian

Terlampir dalam rubrik penilaian.

B. Aspek Penilaian

1. Aspek Kelayakan Isi

Indikator Penilaian	Butir Penilaian	Alternatif Pilihan			
		4	3	2	1
a. Cakupan materi	1) Kelengkapan materi				
	2) Keluasan materi				

	3)Kedalaman materi				
b.Akurasi materi	1)Akurasi fakta				
	2)Akurasi konsep/prinsip/hukum/teori				
	3)Akurasi prosedur				
c.Kemutakhiran dan kontekstual	1)Kesesuaian dengan perkembangan ilmu				
	2)Keterkinian/ketermasaan fitur				
	3)Real life				
d.Ketaatan pada hukum dan perundang-undangan	1)Bagian pendahuluan				
	2)Bagian isi				
	3)Bagian penutup				
e.Keterampilan	1)Cakupan keterampilan				
	2)Akurasi kegiatan				
	3)Karakteristik kegiatan				
	4)Aplikasi kewirausahaan				

2. Aspek Teknik Penyajian

Indikator Penilaian	Butir Penilaian	Alternatif Pilihan			
		4	3	2	1
a.Teknik Penyajian	1)Konsistensi sistematika sajian dalam bab				
	2)Kelogisan penyajian				
	3)Keruntutan penyajian				
	4)Koherensi				
b.Pendukung Penyajian Materi	1)Kesesuaian dan ketepatan ilustrasi dengan materi				
	2) <i>Advance organizer</i> (pembangkit motivasi belajar) pada awal bab				

	3)Soal latihan pada setiap akhir bab				
	4)Rujukan/sumber acuan termasa untuk teks, tabel, gambar, dan lampiran				
	5)Ketepatan penomoran dan penamaan tabel/gambar dan lampiran				
c.Penyajian Pembelajaran	1)Keterlibatan aktif peserta didik				
	2)Berpusat pada peserta didik				
	3)Komunikasi interaktif				
	4)Pendekatan ilmiah				
	5)Variasi dalam penyajian				
d.Kelengkapan Penyajian	1)Bagian pendahuluan				
	2)Bagian isi				
	3)Bagian penutup				

3. Aspek Penilaian Bahasa

Indikator Penilaian	Butir Penilaian	Alternatif Pilihan			
		4	3	2	1
a. Sesuai dengan Perkembangan Peserta Didik	1) Kesesuaian dengan tingkat perkembangan berpikir peserta didik				
	2) Kesesuaian dengan tingkat perkembangan sosial/emosional peserta didik				
b. Komunikatif	1) Keterpahaman peserta didik terhadap pesan				
c. Dialogis dan Interaktif	1) Kemampuan memotivasi peserta didik				
	3) Dorongan berpikir kritis pada peserta didik				

d. Lugas	1) Ketepatan struktur kalimat				
	2) Kebakuan istilah				
e. Koherensi dan Keruntutan Alur Pikir	1) Ketertautan antara bab/sub bab/alinea				
	2) Keutuhan makna dalam bab/sub bab/alinea				
f. Kesesuaian dengan Kaidah Bahasa Indonesia yang benar	1) Ketepatan tata bahasa				
	2) Ketepatan Ejaan				
g. Penggunaan Istilah dan Simbol / Lambang	1) Konsistensi penggunaan istilah				
	2) Konsistensi penggunaan simbol/lambang				

4. Aspek Kegrafisan

Indikator Penilaian	Butir Penilaian	Alternatif Pilihan			
		4	3	2	1
Ukuran					
a. Ukuran buku	1) Kesesuaian ukuran buku dengan standar ISO: A4 (210 x 297 mm) atau B5 (176 x 250 mm)				
Desain Sampul Buku					
b. Tipografi Sampul buku	1) Huruf yang digunakan menarik dan mudah dibaca				
c. Ilustrasi buku	1) Mencerminkan isi buku				

Desain Isi Buku					
d. Tata letak isi buku	1) Tata letak konsisten				
	2) Unsur tata letak harmonis				
	3) Penempatan dan penampilan unsur tata letak (judul, sub bab, ilustrasi, ruang putih)				
	4) Penempatan hiasan / ilustrasi sebagai latar belakang tidak mengganggu judul, teks, angka halaman.				
	5) Penempatan judul, subjudul, ilustrasi, dan keterangan gambar tidak mengganggu pemahaman				
e. Tipografi isi buku	1) Tipografi sederhana				
	2) Tipografi mudah dibaca				
	3) Tipografi memudahkan pemahaman				
f. Ilustrasi isi buku	1) Ilustrasi memperjelas dan mempermudah pemahaman				
	2) Ilustrasi isi menimbulkan daya tarik				

5. Aspek Literasi Sains

Indikator Penilaian	Butir Penilaian	Alternatif Pilihan			
		4	3	2	1
a. Sains sebagai batang tubuh pengetahuan (<i>a body of knowledge</i>)	Menyajikan fakta-fakta				
	Menyajikan konsep-konsep				
	Menyajikan hipotesis-hipotesis				
	Mengajukan pertanyaan kepada siswa untuk mengingat pengetahuan atau informasi				
b. Sains sebagai cara untuk menyelidiki (<i>way of investigating</i>)	Mengharuskan siswa untuk menjawab pertanyaan melalui penggunaan materi				
	Mengharuskan siswa untuk menjawab pertanyaan melalui penggunaan tabel-tabel				
	Mengharuskan siswa untuk membuat kalkulasi				
	Mengharuskan siswa untuk menerangkan jawaban				
	Melibatkan siswa dalam eksperimen atau aktivitas berfikir				
c. Sains sebagai cara berfikir (<i>way of thinking</i>)	Menyajikan metode ilmiah dan pemecahan masalah				
	Menekankan sifat empiris dan objektivitas ilmu sains				
	Mengilustrasikan penggunaan asumsi-asumsi				
	Menunjukkan bagaimana ilmu sains berjalan dengan pertimbangan deduktif				
	Mendiskusikan fakta dan bukti				

d. Interaksi antara sains, teknologi dan masyarakat (Interaction of science, technology, and society)	Menggambarkan kegunaan ilmu sains dan teknologi bagi masyarakat				
	Menyebutkan contoh pemanfaatan di kehidupan masyarakat				

C. Komentar dan Saran

.....

.....

.....

.....

D. Simpulan

Bahan Ajar Kimia Berbasis Literasi Sains pada Materi Hidrolisis Garam untuk Kelas XI ini dinyatakan *) :

1. Layak digunakan di lapangan tanpa ada revisi
2. Layak digunakan di lapangan dengan revisi
3. Tidak layak digunakan di lapangan

*) Lingkari salah satu

Medan, 2018
Ahli Materi,

Validator

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Appendix 7

Data Analysis of Teaching Material by Validator

No	Respondent	Presentation Feasibility Based on Science Literation																Total	average	%
		A				B					C					D				
		A1	A2	A3	A4	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	D1	D2			
1	R1	4	4	3	4	4	4	3	3	4	4	3	3	3	4	3	4	57	3,5625	89,06
2	R2	4	4	3	4	4	4	3	4	3	4	3	4	3	4	3	4	58	3,625	90,62
Total		8	8	6	8	8	8	6	7	7	8	6	7	6	8	6	8	115	3,59375	
average		3,75				3,5					3,5					3,5				

No	Respondent	Content Feasibility																Total	Average	%
		A			B			C			D			E						
		A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3	E1	E2	E3	E4			
1	R1	4	3	3	4	4	4	3	3	4	4	4	4	3	3	3	3	56	3,5	87,5
2	R2	4	3	3	4	4	4	3	3	4	4	4	4	4	3	3	3	57	3,5625	89,06
Total		8	6	6	8	8	8	6	6	8	8	8	8	7	6	6	6	113	3,53125	
average		3,33333333			4			3,33333333			4			3,125						

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No	Respondent	Presentation Feasibility																	Total	Average	%
		A				B					C					D					
		A1	A2	A3	A4	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	D1	D2	D3			
1	R1	3	4	4	3	4	4	4	3	4	4	4	3	3	4	4	4	4	63	3,705882	92,64
2	R2	3	4	4	3	4	4	4	3	4	4	4	4	3	4	4	4	4	64	3,764706	94,11
Total		6	8	8	6	8	8	8	6	8	8	8	7	6	8	8	8	8	127	3,735294	
average		3,5				3,8					3,7					4					

No	Respondent	Penilaian Bahasa														Total	Average	%
		A		B	C		D		E		F		G					
		A1	A2	B1	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2				
1	R1	3	3	4	4	3	3	3	4	4	3	3	4	4	45	3,461538462	86,53	
2	R2	3	3	4	4	3	4	3	4	4	3	3	4	4	46	3,538461538	88,46	
Total		6	6	8	8	6	7	6	8	8	6	6	8	8	91	3,5		
average		3		4	3,5		3,25		4		3		4					

No	Respondent	Graffity Feasibility														Total	Average		%
		A	B	C	D						E			F					
		A1	B1	C1	D1	D2	D3	D4	D5	E1	E2	E3	F1	F2					
1	R1	4	4	4	4	4	4	4	4	4	4	4	4	3	51	3,923076923	98,07		
2	R2	4	3	4	4	4	4	4	4	4	4	4	4	3	50	3,846153846	96,15		
Total		8	7	8	8	8	8	8	8	8	8	8	8	6	101	3,884615385			
average		4	3,5	4	4						4			3,5					

Appendix 8

Validation Table

No	Student	Question Number																														Total	Y2
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
1	A	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	0	0	1	1	23	529
2	B	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24	576
3	C	1	0	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	1	0	0	1	1	1	1	22	484
4	D	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	0	1	0	1	1	23	529
5	E	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	0	0	1	0	0	0	21	441
6	F	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	1	1	0	0	1	0	1	1	21	441
7	G	1	1	0	1	1	1	0	0	1	1	0	1	1	1	1	0	1	1	1	0	1	0	1	1	1	0	1	0	1	1	21	441
8	H	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	0	0	1	0	0	0	0	1	1	21	441
9	I	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	0	0	0	0	20	400
10	J	0	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	0	1	0	0	0	1	0	1	0	16	256
11	K	0	1	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1	1	0	0	1	0	0	0	1	0	1	0	18	324
12	L	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	0	1	0	1	0	1	0	0	0	1	0	1	0	1	1	19	361
13	M	1	1	1	1	1	0	1	1	1	0	0	1	0	1	1	1	1	0	1	1	0	0	0	1	0	0	0	0	0	1	17	289
14	N	1	1	0	1	1	0	1	0	1	1	0	1	1	0	1	1	1	0	0	0	0	1	0	1	1	0	0	1	0	1	17	289
15	O	0	1	1	1	1	1	0	1	0	0	0	1	0	1	1	1	0	0	1	0	1	0	0	0	0	0	1	1	1	1	17	289
16	P	0	1	1	1	0	0	1	0	1	1	1	1	1	0	1	0	1	0	0	1	1	0	1	1	0	0	0	0	1	1	16	256
17	Q	1	1	1	1	0	0	1	0	1	0	0	0	1	0	1	1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	16	256

18	R	0	1	1	1	1	0	1	0	1	0	0	1	0	0	1	0	1	0	0	1	1	0	1	0	0	1	0	0	0	13	169			
19	S	0	1	0	0	1	0	1	0	1	1	0	1	0	0	1	1	1	0	1	0	1	0	0	0	0	0	0	0	1	1	0	13	169	
20	T	1	1	0	1	1	0	1	0	1	1	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	12	144	
21	U	0	1	0	1	1	1	0	1	0	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	0	12	144	
22	V	0	0	0	0	0	1	0	0	1	0	1	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	10	100	
23	W	1	0	0	1	1	0	1	0	0	1	0	1	1	0	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	12	144
24	X	0	0	0	0	0	0	1	1	0	1	0	0	0	0	1	0	1	0	1	1	1	0	1	1	0	1	1	0	0	0	0	10	100	
25	Y	0	0	0	1	0	1	1	0	1	1	0	0	0	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	1	0	1	0	13	169
26	Z	1	0	0	1	0	1	1	0	0	0	0	0	0	1	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	1	0	10	100	
27	AA	1	0	1	0	0	0	1	1	0	1	1	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	10	100	
28	BB	1	0	1	1	0	0	1	0	1	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	100	
29	CC	1	0	0	0	0	0	1	0	1	1	1	0	0	0	1	1	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0	11	121	
30	DD	0	0	0	0	1	1	1	0	1	0	0	0	0	1	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	10	100	
31	EE	0	1	1	0	0	0	1	0	1	0	1	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	10	100	
32	FF	0	1	0	0	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	10	100	
33	GG	0	0	1	0	0	0	1	0	1	0	0	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	8	64	
34	HH	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0	8	64	
Σ X		19	20	18	24	19	15	30	12	29	21	16	19	18	19	29	18	32	6	19	13	29	3	12	19	4	1	17	4	15	14	514	8590		
Σ X ²		361	400	324	576	361	225	900	144	841	441	256	361	324	361	841	324	1024	36	361	169	841	9	144	361	16	1	289	16	225	196				
Σ XY		330	339	311	414	328	264	451	213	445	363	273	333	323	323	454	312	485	85	324	244	441	35	215	321	71	12	293	68	261	259				
r hitung		0,516	0,446	0,467	0,673	0,492	0,449	-0,05	0,396	0,111	0,561	0,373	0,552	0,611	0,432	0,264	0,479	0,031	-0,09	0,444	0,585	0,044	-0,22	0,421	0,407	0,196	-0,11	0,431	0,14	0,413	0,576				

r tabel	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339			
Status	V	V	V	V	V	V	TV	V	TV	V	V	V	V	V	TV	V	TV	TV	V	V	TV	TV	V	V	TV	TV	V	TV	V	V		
p	0,559	0,588	0,529	0,706	0,559	0,441	0,882	0,353	0,853	0,618	0,471	0,559	0,529	0,559	0,853	0,529	0,941	0,176	0,559	0,382	0,853	0,088	0,353	0,559	0,118	0,029	0,5	0,118	0,441	0,412		
q	0,441	0,412	0,471	0,294	0,441	0,559	0,118	0,647	0,147	0,382	0,529	0,441	0,471	0,441	0,147	0,471	0,059	0,824	0,441	0,618	0,147	0,912	0,647	0,441	0,882	0,971	0,5	0,882	0,559	0,588		
pq	0,247	0,242	0,249	0,208	0,247	0,247	0,104	0,228	0,125	0,236	0,249	0,247	0,249	0,247	0,125	0,249	0,055	0,145	0,247	0,236	0,125	0,08	0,228	0,247	0,104	0,029	0,25	0,104	0,247	0,242		
Σ pq	5,837																															
r	0,831																															

Appendix 9

CALCULATE VALIDITY OF INSTRUMENT

According calculated by using SPSS 22 for Windows with Correlate formula, The result of $r_{\text{calculate}}$ for every instrument test , such as :

VALIDATION TABLE

item_1	Pearson Correlation Sig. (2-tailed) N	,516** ,002 34	item_16	Pearson Correlation Sig. (2-tailed) N	,479** ,004 34
item_2	Pearson Correlation Sig. (2-tailed) N	,446** ,008 34	item_17	Pearson Correlation Sig. (2-tailed) N	,031 ,860 34
item_3	Pearson Correlation Sig. (2-tailed) N	,467** ,005 34	item_18	Pearson Correlation Sig. (2-tailed) N	-,090 ,614 34
item_4	Pearson Correlation Sig. (2-tailed) N	,673** ,000 34	item_19	Pearson Correlation Sig. (2-tailed) N	,444** ,009 34
item_5	Pearson Correlation Sig. (2-tailed) N	,492** ,003 34	item_20	Pearson Correlation Sig. (2-tailed) N	,585** ,000 34
tem_6	Pearson Correlation Sig. (2-tailed) N	,449** ,008 34	item_21	Pearson Correlation Sig. (2-tailed) N	,044 ,806 34
item_7	Pearson Correlation Sig. (2-tailed) N	-,047 ,792 34	item_22	Pearson Correlation Sig. (2-tailed) N	-,219 ,214 34
item_8	Pearson Correlation Sig. (2-tailed) N	,396* ,020 34	item_23	Pearson Correlation Sig. (2-tailed) N	,421* ,013 34

item_9	Pearson Correlation Sig. (2-tailed) N	,111 ,530 34	item_24	Pearson Correlation Sig. (2-tailed) N	,407* ,017 34
item_10	Pearson Correlation Sig. (2-tailed) N	,561** ,001 34	item_25	Pearson Correlation Sig. (2-tailed) N	,196 ,267 34
item_11	Pearson Correlation Sig. (2-tailed) N	,373* ,030 34	item_26	Pearson Correlation Sig. (2-tailed) N	-,111 ,534 34
item_12	Pearson Correlation Sig. (2-tailed) N	,552** ,001 34	item_27	Pearson Correlation Sig. (2-tailed) N	,431* ,011 34
item_13	Pearson Correlation Sig. (2-tailed) N	,611** ,000 34	item_28	Pearson Correlation Sig. (2-tailed) N	,140 ,430 34
item_14	Pearson Correlation Sig. (2-tailed) N	,432* ,011 34	item_29	Pearson Correlation Sig. (2-tailed) N	,413* ,015 34
item_15	Pearson Correlation Sig. (2-tailed) N	,264 ,132 34	item_30	Pearson Correlation Sig. (2-tailed) N	,576** ,000 34

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

According Product Moment test , the calculate of data is :

From the appendix, can get :

Question number 1 ,

$$R_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{(N\sum X^2 - (\sum X)^2)(N\sum Y^2 - (\sum Y)^2)}}$$

From table , can get the data :

$$\begin{array}{lll} \sum X = 19 & \sum (x)^2 = 361 & N = 34 \\ \sum xy = 330 & \sum y = 514 & \sum y^2 = 8590 \end{array}$$

With using Product Moment Formula :

$$\begin{aligned} R_{xy} &= \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{(N\sum X^2 - (\sum X)^2)(N\sum Y^2 - (\sum Y)^2)}} \\ R_{xy} &= \frac{(34 \times 330) - (19 \times 514)}{\sqrt{((34)(19) - (19)^2)((34)(8590) - (514)^2)}} \\ R_{xy} &= 0.515 \end{aligned}$$

With consultation $r_{\text{calculate}} = 0,515$ and r_{table} product moment with α 5% for $n = 34$. The result for r_{table} 0,339 , so $r_{\text{calculate}} > r_{\text{table}}$. Where $0,515 > 0,339$. So the conclusion for question number 1 can called valid. And then for every question can calculated the validation with same procedure.

Correlation $r_{\text{calculate}} > r_{\text{tabel}}$ and validation of test

No	$r_{\text{calculate}}$	r_{tabel}	Status	No	$r_{\text{calculate}}$	r_{tabel}	Status
1.	0.516	0.339	Valid	16.	0.479	0.339	Valid
2.	0.446	0.339	Valid	17.	-0.031	0.339	Unvalid
3.	0.467	0.339	Valid	18.	-0.090	0.339	Unvalid
4.	0.673	0.339	Valid	19.	0.444	0.339	Valid

5.	0.492	0.339	Valid	20.	0.585	0.339	Valid
6.	0.449	0.339	Valid	21.	0.044	0.339	Unvalid
7.	-0.047	0.339	Unvalid	22.	-0.219	0.339	Unvalid
8.	0.396	0.339	Valid	23.	0.421	0.339	Valid
9.	0.111	0.339	Unvalid	24.	0.407	0.339	Valid
10.	0.561	0.339	Valid	25.	0.196	0.339	Unvalid
11.	0.373	0.339	Valid	26.	-0.111	0.339	Unvalid
12.	0.552	0.339	Valid	27.	0.431	0.339	Valid
13.	0.611	0.339	Valid	28.	0.140	0.339	Unvalid
14.	0.432	0.339	Valid	29.	0.413	0.339	Valid
15.	0.264	0.339	Unvalid	30.	0,576	0.339	Valid

After compared $r_{\text{calculate}}$ with r_{table} of significant level 0,05 and $N=34$, We get from 30 question in instrument test, only 20 question that enter in valid categorize. So, only 20 question that can used as instrument test.

Appendix 10

RELIABILITY OF INSTRUMENT TEST

Calculated of reliability using SPSS 22for Windows with analyzescalse reability analyze formula, so the calculate of data occurred amount of Cronbach's Alpha is :

		N	%	Reliability Statistics	
Cases	Valid	34	100,0	Cronbach's Alpha	N of Items
	Excluded ^a	0	,0		
	Total	34	100,0	,837	20

The result of Cronbach's Alpha is 0.837. Occurred this data, the conclusion is instrument can called reliability or accepted.To calculate reliability instrument, used KR-21 formula such as:

$$R_{11} = \left(\frac{k}{k-1} \right) \frac{S^2 - \sum P_q}{S^2}$$

After doing multiplication p and q with every item , so the calculate :

$$\sum y = 347 \qquad \sum y^2 = 4343$$

$$\sum pq = 4.839 \qquad N = 34$$

To calculate total of variant can using the formula :

$$S^2 = \frac{\sum y^2 - \frac{(\sum y)^2}{N}}{N} \qquad \text{So,} \qquad R_{11} = \left(\frac{n}{n-1} \right) \frac{S^2 - \sum P_q}{S^2}$$

$$S^2 = \frac{4343 - \frac{(347)^2}{34}}{34} \qquad R_{11} = \left(\frac{34}{34-1} \right) \frac{23.57 - 4.839}{23.57}$$

$$S^2 = \frac{4343 - 3541,4}{34} \qquad R_{11} = 1.03 \times 0.813$$

$$S^2 = 23.57 \qquad R_{11} = 0.837$$

Result r_{11} with r_{table} moment product α 5% we get r_{table} 0.339, so the result of $r_{\text{calculate}} > r_{\text{table}}$ where, $0.837 > 0.339$. So, the conclusion all of the question is reliability.

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
item_1	9,65	22,053	,419	,829
item_2	9,62	22,425	,341	,833
item_3	9,68	22,286	,365	,832
item_4	9,50	21,288	,653	,819
item_5	9,65	21,932	,446	,828
item_6	9,76	22,428	,337	,833
item_7	9,85	22,311	,380	,831
item_8	9,59	21,825	,482	,826
item_9	9,74	22,504	,318	,834
item_10	9,65	21,872	,459	,827
item_11	9,68	21,377	,567	,822
item_12	9,65	22,296	,366	,831
item_13	9,68	22,165	,392	,830
item_14	9,65	22,296	,366	,831
item_15	9,82	21,422	,575	,822
item_16	9,85	22,372	,367	,831
item_17	9,65	22,660	,287	,835
item_18	9,71	22,396	,341	,833
item_19	9,76	22,428	,337	,833
item_20	9,79	21,865	,465	,827

Appendix 11

Table of Difficulty Level

No	Student	Question Number																													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	A	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	0	0	1	1
2	B	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1
3	C	1	0	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	0	1	1	1	0	0	1	0	0	1	1	1	1
4	D	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	0	1	0	1	1
5	E	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	0	0	1	0	0	0
6	F	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	1	0	1	1	0	0	1	0	1	1
7	G	1	1	0	1	1	1	0	0	1	1	0	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	0	1	0	1
8	H	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	0	0	1	0	0	0	0	1	1
9	I	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	0	0	0	0
10	J	0	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	0	1	0	0	0	0	1	0	0
11	K	0	1	0	1	1	0	1	1	1	1	0	1	1	1	1	1	1	0	1	1	0	0	1	0	0	0	0	1	0	0
12	L	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	0	1	0	1	0	1	0	0	0	0	1	0	1	0	1
13	M	1	1	1	1	1	0	1	1	1	0	0	1	0	1	1	1	1	0	1	1	0	0	0	1	0	0	0	0	0	0
14	N	1	1	0	1	1	0	1	0	1	1	0	1	1	0	1	1	1	0	0	0	0	1	0	1	1	0	0	1	0	0
15	O	0	1	1	1	1	1	1	0	1	0	0	1	0	1	1	1	0	0	1	0	1	0	0	0	0	0	0	1	1	1
16	P	0	1	1	1	0	0	1	0	1	1	1	1	1	0	1	0	1	0	0	1	1	0	1	1	0	0	0	0	0	0
17	Q	1	1	1	1	0	0	1	0	1	0	0	0	1	0	1	1	1	0	1	0	1	0	1	1	0	0	0	1	1	0
18	R	0	1	1	1	1	0	1	0	1	0	0	1	0	0	1	0	1	0	0	1	1	0	1	0	0	0	0	1	0	0
19	S	0	1	0	0	1	0	1	0	1	1	0	1	0	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	1	1
20	T	1	1	0	1	1	0	1	0	1	1	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0

21	U	0	1	0	1	1	1	1	0	1	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0
22	V	0	0	0	0	0	1	0	0	1	0	1	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0	1	0	0	0
23	W	1	0	0	1	1	0	1	0	0	1	0	1	1	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0
24	X	0	0	0	0	0	0	0	1	1	0	1	0	0	0	1	0	1	0	1	1	1	0	1	1	0	0	0	0	0	0
25	Y	0	0	0	1	0	1	1	0	1	1	0	0	0	1	1	1	1	1	0	0	1	0	0	0	0	0	1	0	1	0
26	Z	1	0	0	1	0	1	1	0	0	0	0	0	0	1	0	0	1	1	1	0	1	0	0	0	0	0	0	0	1	0
27	AA	1	0	1	0	0	0	1	1	0	1	1	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0
28	BB	1	0	1	1	0	0	1	0	1	1	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
29	CC	1	0	0	0	0	0	1	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	0	1	0	0	0	0	0	0
30	DD	0	0	0	0	1	1	1	0	1	0	0	0	0	1	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	1
31	EE	0	1	1	0	0	0	1	0	1	0	1	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0
32	FF	0	1	0	0	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0
33	GG	0	0	1	0	0	0	1	0	1	0	0	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1
34	HH	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0
SX		19	20	18	24	19	15	30	12	29	21	16	19	18	19	29	18	32	6	19	13	29	3	12	19	4	1	17	4	15	14
P = B / J		0,559	0,588	0,529	0,706	0,56	0,441	0,882	0,353	0,853	0,618	0,47	0,559	0,529	0,56	0,853	0,529	0,94	0,176	0,56	0,382	0,85294	0,08824	0,35294	0,55882	0,11765	0,02941	0,5	0,11765	0,44118	0,41176
Status		M	M	M	M	M	M	E	M	E	M	M	M	M	M	E	M	E	D	M	M	E	D	M	M	D	D	M	D	M	M

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Appendix 12

CALCULATION OF DIFFICULTY LEVEL

To calculate Index difficulty of Instrument the formula that used is :

$$P = \frac{B}{J_s}$$

Where :

P : index of difficulty

B : the number of students who answered that question correctly

J_s : the total number of students taking the test

So, for question number 1 , B = 19 ; J_s = 34

$$P = \frac{B}{J_s} = \frac{19}{34} = 0,558$$

Index Difficulty of Instrument for question number1 can categorize Middle, with using same procedure, can get index difficulty instrument for every question such as:

No	Index difficulty of instrument (P)	Status	No	Index difficulty of instrument (P)	Status
1.	0.559	Middle	16.	0.53	Middle
2.	0.558	Middle	17.	0.941	Easy
3.	0.53	Middle	18.	0.18	Difficult
4.	0.7	Middle	19.	0.56	Middle
5.	0.56	Middle	20.	0.38	Middle
6.	0.441	Middle	21.	0.853	Easy
7.	0.882	Easy	22.	0.088	Difficult
8.	0.35	Middle	23.	0.35	Middle

9.	0.853	Easy	24.	0.559	Middle
10.	0.618	Middle	25.	0.12	Difficult
11.	0.471	Middle	26.	0.029	Difficult
12.	0.56	Middle	27.	0.5	Middle
13.	0.529	Middle	28.	0.118	Difficult
14.	0.56	Middle	29.	0.44	Middle
15.	0.85	Easy	30.	0.412	Middle

According the result of calculated , from 30 question that after tested we get 20 question that Middle categorize , 5 Easy , and 5 difficult categorize.

Appendix 13

Table of Different Index

Student	Item Number																														Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
14	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
17	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	24
BA	13	14	13	17	13	10	15	9	15	14	11	13	14	13	16	13	16	2	13	11	14	0	10	13	3	0	12	3	10	12	
JA	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	
Student	Item Number																														Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
18	0	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	0	1	0	0	0	1	0	1	0	16
19	0	1	1	1	1	0	1	0	1	0	0	1	0	0	1	0	1	0	0	1	1	0	1	0	0	0	1	0	0	0	13
20	0	1	0	0	1	0	1	0	1	1	0	1	0	0	1	1	1	0	1	0	1	0	0	0	0	0	0	1	1	0	13

21	0	0	0	1	0	1	1	0	1	1	0	0	0	1	1	1	1	1	0	0	1	0	0	0	0	0	1	0	1	0	13
22	1	1	0	1	1	0	1	0	1	1	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0	12
23	0	1	0	1	1	1	1	0	1	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	12
24	1	0	0	0	0	0	1	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	0	1	0	0	0	0	0	0	11
25	0	0	0	0	0	1	0	0	1	0	1	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0	1	0	0	0	10
26	0	0	0	0	0	0	0	1	1	0	1	0	0	0	1	0	1	0	1	1	1	0	1	1	0	0	0	0	0	0	10
27	1	0	0	1	0	1	1	0	0	0	0	0	0	1	0	0	1	1	1	0	1	0	0	0	0	0	0	0	1	0	10
28	1	0	1	0	0	0	1	1	0	1	1	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	10
29	1	0	1	1	0	0	1	0	1	1	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	10
30	0	0	0	0	1	1	1	0	1	0	0	0	0	1	0	1	1	1	0	0	1	0	0	0	0	0	0	0	1	0	10
31	0	1	1	0	0	0	1	0	1	0	1	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	10
32	0	1	0	0	0	0	1	1	1	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	10
33	0	0	1	0	0	0	1	0	1	0	0	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	8
34	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0	8
BB	5	7	5	7	6	5	15	4	14	7	6	5	4	7	12	6	16	4	6	3	15	2	3	6	1	1	6	1	5	2	
JB	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	
PA = BA / JA	0,765	0,824	0,765	1	0,765	0,588	0,88	0,529	0,88	0,82	0,65	0,76	0,82	0,76	0,94	0,76	0,94	0,12	0,76	0,65	0,82	0	0,59	0,76	0,18	0	0,71	0,18	0,59	0,71	
PB = BB / JB	0,294	0,412	0,294	0,412	0,353	0,294	0,88	0,235	0,82	0,41	0,35	0,29	0,24	0,41	0,71	0,35	0,94	0,24	0,35	0,18	0,88	0,12	0,18	0,35	0,06	0,06	0,35	0,06	0,29	0,12	
D = PA - PB	0,471	0,412	0,471	0,588	0,412	0,294	0	0,294	0,06	0,41	0,29	0,47	0,59	0,35	0,24	0,41	0	0,12	0,41	0,47	0,06	0,12	0,41	0,41	0,12	0,06	0,35	0,12	0,29	0,59	
Status	G	G	G	G	G	AD	B	AD	B	G	AD	G	G	AD	AD	G	B	B	G	G	B	B	G	G	B	B	AD	B	AD	G	

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Appendix 14

DIFFERENT INDEX OF INSTRUMENT

For determine Different Index of Instrument the formula that used is :

$$D = \frac{B_A}{J_A} - \frac{B_B}{J_B} = P_A - P_B$$

Where:

D : distinguishing power

J : Total participants

J_A : the number of upper participants

J_B : the number of under participants

B_A: the number of upper participants who answered the question correctly

B_B: the number of under participants who answered the question correctly.

So, for question number 1 , B_A =13 ; B_B= 5 ; J_A=17 ; J_B=17

$$D = \frac{B_A}{J_A} - \frac{B_B}{J_B} = \frac{13}{17} - \frac{5}{17} = 0.471$$

Index Distinguish for question number 1 can categorize as Adequate question. With same procedure for other question , get the index distinguish below:

Tabel 11 .1Calculated Index Distinguish of Instrument

No	Index distinguish of instrument (D)	Status	No	Index distinguish of instrument (D)	Status
1.	0.471	Good	16.	0.41	Good
2.	0.412	Good	17.	0	Bad
3.	0.471	Good	18.	-0.12	Bad
4.	0.588	Good	19.	0.41	Good
5.	0.412	Good	20.	0.47	Good

6.	0.294	Adequate	21.	-0.06	Bad
7.	0	Bad	22.	-0.12	Bad
8.	0.294	Adequate	23.	0.41	Good
9.	0.06	Bad	24.	0.41	Good
10.	0.41	Good	25.	0.12	Bad
11.	0.29	Adequate	26.	-0.06	Bad
12.	0.47	Good	27.	0.35	Adequate
13.	0.59	Good	28.	0.12	Bad
14.	0.35	Adequate	29.	0.29	Adequate
15.	0.24	Adequate	30.	0.59	Good

According the calculated of Distinguish Index of Instrument, from 30 question have 14 Good categorize, 7 Adequate categorize, and than 9 Bad categorize for Distinguish Index.

Appendix 15

Data for Student in Experimental Class with Using Module Based on Science Literation

No	Sample	Pretest		Post Test		Different	Gain
		X1	X1 ²	X2	X2 ²		
1	Andreas	45	2025	85	7225	40	0.72
2	Andrian	40	1600	75	5625	35	0.58
3	Auliana	40	1600	80	6400	40	0.66
4	Baihaqi	40	1600	85	7225	45	0.75
5	Daniel	30	900	60	3600	30	0.42
6	Delpiero	45	2025	75	5625	30	0.54
7	Dian	45	2025	60	3600	15	0.27
8	Diva	30	900	90	8100	60	0.85
9	Ervina	25	625	80	6400	55	0.73
10	Eza	35	1225	85	7225	50	0.76
11	Fadlan	45	2025	75	5625	30	0.54
12	Faradilla	40	1600	90	8100	50	0.83
13	Febriellah	40	1600	85	7225	45	0.75
14	Firzha	30	900	80	6400	50	0.71
15	Golda	35	1225	90	8100	55	0.85
16	Indriani	35	1225	75	5625	40	0.61
17	Jovis	20	400	90	8100	70	0.87
18	Khairina	40	1600	95	9025	55	0.91
19	Kristiadi	40	1600	85	7225	45	0.75
20	Meyuliza	40	1600	85	7225	45	0.75

21	Miko	45	2025	85	7225	40	0.72
22	M. Daud	50	2500	60	3600	10	0.2
23	M. Fauzi	40	1600	90	8100	50	0.83
24	M. Rizky	40	1600	85	7225	45	0.75
25	M. Rizky P	30	900	80	6400	50	0.71
26	Mutia	35	1225	90	8100	55	0.85
27	Putri	30	900	65	4225	35	0.5
28	Richard	35	1225	95	9025	60	0.92
29	Ridho	35	1225	85	7225	50	0.76
30	Samuel	35	1225	90	8100	55	0.85
31	Syaibatul	20	400	85	7225	65	0.81
32	Tasya	35	1225	80	6400	45	0.69
33	Vrans	35	1225	85	7225	50	0.76
34	Yohana	30	900	75	5625	45	0.64
35	Yully	30	900	70	4900	40	0.57
36	Zulfina	30	900	95	9025	65	0.92
ΣX		1295	48275	2940	243300		
Average		35,9722222		81,6666667			
Maximum		50		95			
Minimum		20		60			
Deviation Standart (S)		6,95079075		9,56182887			
Varians (S²)		48,3134920		91,4285714			

Appendix 16

**Data for Student in Control Class withUsing
Module in the School**

No	Sample	Pre-test		Post test		difference	Gain
		X1	X1 ²	X2	X2 ²		
1	Adri	40	1600	65	4225	25	0.42
2	Arif	40	1600	80	6400	40	0.67
3	Ayu	30	900	55	3025	25	0.36
4	Bagas	40	1600	65	4225	25	0.42
5	Cindy	40	1600	70	4900	30	0.50
6	Eko	20	400	50	2500	30	0.38
7	Fadhillah	30	900	70	4900	40	0.57
8	Fadlan	40	1600	75	5625	35	0.58
9	Fernando	35	1225	60	3600	25	0.38
10	Fiza	30	900	70	4900	40	0.57
11	Ilmi	35	1225	70	4900	35	0.54
12	Juwita	45	2025	70	4900	25	0.45
13	Kristinus	50	2500	65	4225	15	0.30
14	M. Alfian	40	1600	65	4225	25	0.42
15	M. Fillah	40	1600	75	5625	35	0.58
16	M. Hafiz	50	2500	70	4900	20	0.40
17	Nabila A	35	1225	70	4900	35	0.54
18	Nabilah S	45	2025	70	4900	25	0.45
19	Nisrina	50	2500	65	4225	15	0.30
20	Nurfaizi	35	1225	60	3600	25	0.38

21	Nuzulul	35	1225	65	4225	30	0.46
22	Peter	40	1600	70	4900	30	0.50
23	Putri	40	1600	65	4225	25	0.42
24	Rafi	35	1225	65	4225	30	0.46
25	Rianda	35	1225	70	4900	35	0.54
26	Richie	45	2025	65	4225	20	0.36
27	Ridho	45	2025	70	4900	25	0.45
28	Rizal	40	1600	70	4900	30	0.50
29	Shafa	45	2025	75	5625	30	0.55
30	Shindy	35	1225	65	4225	30	0.46
31	Suwaibatul	35	1225	75	5625	40	0.62
32	Tigor	35	1225	85	7225	50	0.77
33	Vivi	45	2025	75	5625	30	0.55
34	Wind C	35	1225	75	5625	40	0.62
35	Yoan	40	1600	85	7225	45	0.75
36	Zahdira	30	900	95	9025	65	0.92
ΣX		1385	54725	2510	177400		
Average							
		38,47222		69,72222			
Maximum		50		95			
Minimum		20		50			
Deviation Standart (S)		6,416435		8,275993			
Varians (S²)		41,17063		68,49206			

Appendix 17

RESULT DATA OF STUDENT IN EXPERIMENTAL AND CONTROL CLASS

A. Experimental Class

After doing *pre-test* and *posttest* in experimental class by using module based on science Literation, the result is :

The formula that used are:

$$\text{Score of Student} = \frac{\text{Result Score}}{\text{Maximum Score}} \times 100$$

Calculate the data for question number 1

$$\begin{aligned} \text{➤ Pretest Score} &= \frac{9}{20} \times 100 \\ &= 45 \end{aligned}$$

$$\begin{aligned} \text{➤ Posttestscore} &= \frac{17}{20} \times 100 \\ &= 85 \end{aligned}$$

By same process , calculate the data for question number 2 until 20.

Pretest and Posttest in Experimental Class

No	Sample	Pretest		Post Test	
		X1	X1 ²	X2	X2 ²
1	Andreas	45	2025	85	7225
2	Andrian	40	1600	75	5625
3	Auliana	40	1600	80	6400
4	Baihaqi	40	1600	85	7225
5	Daniel	30	900	60	3600
6	Delpiero	45	2025	75	5625
7	Dian	45	2025	60	3600

8	Diva	30	900	90	8100
9	Ervina	25	625	80	6400
10	Eza	35	1225	85	7225
11	Fadlan	45	2025	75	5625
12	Faradilla	40	1600	90	8100
13	Febriellah	40	1600	85	7225
14	Firzha	30	900	80	6400
15	Golda	35	1225	90	8100
16	Indriani	35	1225	75	5625
17	Jovis	20	400	90	8100
18	Khairina	40	1600	95	9025
19	Kristiadi	40	1600	85	7225
20	Meyuliza	40	1600	85	7225
21	Miko	45	2025	85	7225
22	M. Daud	50	2500	60	3600
23	M. Fauzi	40	1600	90	8100
24	M. Rizky	40	1600	85	7225
25	M. Rizky P	30	900	80	6400
26	Mutia	35	1225	90	8100
27	Putri	30	900	65	4225
28	Richard	35	1225	95	9025
29	Ridho	35	1225	85	7225
30	Samuel	35	1225	90	8100
31	Syaibatul	20	400	85	7225

32	Tasya	35	1225	80	6400
33	Vrans	35	1225	85	7225
34	Yohana	30	900	75	5625
35	Yully	30	900	70	4900
36	Zulfina	30	900	95	9025
ΣX		1295	48275	2940	243300
Average		35,97222222		81,66666667	
Maximum		50		95	
Minimum		20		60	
Deviation Standart (S)		6,950790751		9,561828875	
Varians (S²)		48,31349206		91,42857143	

CALCULATE THE AVERAGE AND STANDARD DEVIATION

1. Average and standard deviation for average of pre-test is:

$$\sum X = 1295 \qquad \sum X^2 = 48275 \qquad n = 36$$

So, the average is :

$$\bar{X} = \frac{1295}{36} = 35.97$$

Standard deviation:

$$\begin{aligned}
 SD &= \sqrt{\frac{n\sum X^2 - (\sum X)^2}{n(n-1)}} \\
 &= \sqrt{\frac{36(48275) - (1295)^2}{36(36-1)}} \\
 &= \sqrt{\frac{1737900 - 1677025}{1260}} = 6.95
 \end{aligned}$$

Variant (S²)

$$S^2 = (6.95)^2$$

$$S^2 = 48.31$$

2. Average of standard deviation in post tes

From post test data ,

$$\sum X = 2940 \quad \sum X^2 = 243300 \quad n = 36$$

So, the average :

$$\bar{X} = \frac{2940}{36} = 81,66$$

Deviation Standard :

$$\begin{aligned} SD &= \sqrt{\frac{n\sum X^2 - (\sum X)^2}{n(n-1)}} \\ &= \sqrt{\frac{36(243300) - (2940)^2}{36(36-1)}} \\ &= \sqrt{\frac{8758800 - 8643600}{1260}} = 9.56 \end{aligned}$$

Variants (S^2)

$$S^2 = (9.56)^2$$

$$S^2 = 91.39$$

B. Control Class

After doing *pretest* and *posttest* in control class , there are class using module in the school, so the data is :

The formula that used are:

$$\text{Score of Student} = \frac{\text{Result Score}}{\text{Maximum Score}} \times 100$$

Calculate the data for question number 1

$$\begin{aligned} \text{➤ Pretest Score} &= \frac{8}{20} \times 100 \\ &= 40 \end{aligned}$$

$$\text{➤ Posttest score} = \frac{13}{20} \times 100$$

$$= 75$$

By same process , calculate the data for question number 2 until 20.

Table *Pretest and Posttest* in Control class

No	Sample	Pre-test		Post test		difference	Gain
		X1	X1 ²	X2	X2 ²		
1	Adri	40	1600	65	4225	25	0.42
2	Arif	40	1600	80	6400	40	0.67
3	Ayu	30	900	55	3025	25	0.36
4	Bagas	40	1600	65	4225	25	0.42
5	Cindy	40	1600	70	4900	30	0.50
6	Eko	20	400	50	2500	30	0.38
7	Fadhillah	30	900	70	4900	40	0.57
8	Fadlan	40	1600	75	5625	35	0.58
9	Fernando	35	1225	60	3600	25	0.38
10	Fiza	30	900	70	4900	40	0.57
11	Ilmi	35	1225	70	4900	35	0.54
12	Juwita	45	2025	70	4900	25	0.45
13	Kristinus	50	2500	65	4225	15	0.30
14	M. Alfian	40	1600	65	4225	25	0.42
15	M. Fillah	40	1600	75	5625	35	0.58
16	M. Hafiz	50	2500	70	4900	20	0.40
17	Nabila A	35	1225	70	4900	35	0.54
18	Nabilah S	45	2025	70	4900	25	0.45
19	Nisrina	50	2500	65	4225	15	0.30
20	Nurfaizi	35	1225	60	3600	25	0.38
21	Nuzulul	35	1225	65	4225	30	0.46
22	Peter	40	1600	70	4900	30	0.50
23	Putri	40	1600	65	4225	25	0.42
24	Rafi	35	1225	65	4225	30	0.46
25	Rianda	35	1225	70	4900	35	0.54
26	Richie	45	2025	65	4225	20	0.36
27	Ridho	45	2025	70	4900	25	0.45
28	Rizal	40	1600	70	4900	30	0.50

29	Shafa	45	2025	75	5625	30	0.55
30	Shindy	35	1225	65	4225	30	0.46
31	Suwaibatu 1	35	1225	75	5625	40	0.62
32	Tigor	35	1225	85	7225	50	0.77
33	Vivi	45	2025	75	5625	30	0.55
34	Wind C	35	1225	75	5625	40	0.62
35	Yoan	40	1600	85	7225	45	0.75
36	Zahdira	30	900	95	9025	65	0.92
ΣX		1385	54725	2510	177400		
Average		38,47222		69,72222			
Maximum		50		95			
Minimum		20		50			
Deviation Standart (S)		6,416435		8,275993			
Varians (S²)		41,17063		68,49206			

Calculate Average and Standard Deviation

1. Average and standard deviation for pre-test

From pre-test data , the result is:

$$\Sigma X = 1385 \quad \Sigma X^2 = 54725$$

$$n = 36$$

So, the average:

$$\bar{X} = \frac{1385}{36} = 38.47$$

Deviation Standard:

$$\begin{aligned}
 SD &= \sqrt{\frac{n \Sigma X^2 - (\Sigma X)^2}{n(n-1)}} \\
 &= \sqrt{\frac{36(54725) - (1385)^2}{36(36-1)}} \\
 &= \sqrt{\frac{1970100 - 1918225}{1260}} \\
 &= 6.41
 \end{aligned}$$

Varians (S^2)

$$S^2 = (6.41)^2$$

$$S^2 = 41.17$$

2. Average of Standard deviation in post test

From the data , the result is :

$$\sum X = 2510$$

$$\sum X^2 = 177400$$

$$n = 36$$

So, the average :

$$\bar{X} = \frac{2730}{36} = 75.83$$

Standard deviation :

$$\begin{aligned} SD &= \sqrt{\frac{n\sum X^2 - (\sum X)^2}{n(n-1)}} \\ &= \sqrt{\frac{36(177400) - (2510)^2}{36(36-1)}} \\ &= \sqrt{\frac{6386400 - 6300100}{1260}} \\ &= 8.27 \end{aligned}$$

Varian (S^2)

$$S^2 = (8.27)^2$$

$$S^2 = 68.49$$

Appendix 18

NORMALITY TEST FOR EXPERIMENTAL CLASS (USING MODULE BASED ON SCIENCE LITERATION) AND CONTROL CLASS (USING MODULE IN THE SCHOOL)

According calculated by using SPSS 22 for Windows , The result is :

a. Normality for pretest data .

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Experiment Class	36	20.00	50,00	35.97	6.951
Control Class	36	20,00	50,00	38.47	6.416

One-Sample Kolmogorov-Smirnov Test

		Experimental Class	Control Class
N		36	36
Normal Parameters ^{a, b}	Mean	35,97	38,47
	Std. Deviation	6.95079	6,41643
Most Extreme Differences	Absolute	,172	,132
	Positive	,172	,132
	Negative	-,124	-,121
Kolmogorov-Smirnov Z		1,034	,790
Asymp. Sig. (1-tailed)		.235	.298

a. Test distribution is Normal.

b. Calculated from data.

According calculated of data by using SPSS, in control class the sign.= 0.298 and in experimental class the sign = 0.235. where, sign > α (0.298 > 0.05 and 0.235 > 0.05) so , the conclusion is : Data from experimental class (using

module based on science literation) and Control class (Direct Instruction Method) is Normal distributed categorized.

b. Normalityfor posttest data .

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Experiment Class	36	55	95	81,53	9,915
Control Class	36	50	95	69,72	8,276

One-Sample Kolmogorov-Smirnov Test

		ExperimentClass	ControlClass
N		36	36
Normal Parameters ^{a,,b}	Mean	81.53	69.72
	Std. Deviation	9.915	8.276
Most Extreme Differences	Absolute	.220	.209
	Positive	.220	.209
	Negative	-.113	-.173
Kolmogorov-Smirnov Z		1.311	1.064
Asymp. Sig. (1-tailed)		.220	.172

a. Test distribution is Normal.

b. Calculated from data.

According calculated of data by using SPSS, in control class the sign.= 0.172 and in experimental class the sign = 0.220. where, sign > α (0.172 > 0.05 and 0.220 > 0.05) so , the conclusion is : Data from experimental class (using module based on science literation) and Control class (Direct Instruction Method) is Normal distributed categorized .

The calculated of normality test data obtained by using the chi square test

A. EXPERIMENTAL CLASS

1. Normality of Pretest in Experimental Class

For pretest data in experimental class, result of normality test obtained by using the chi square test as follows:

A. Number of intervals class for chi squared test, the number of classes defined interval = 6. This is consistent with 6 areas of raw Normal curve.

B. Long of Interval class (PK):

$$\begin{aligned}\text{Interval Class (PK)} &= \frac{\text{Bigest Score} - \text{Small Score}}{6} \\ &= \frac{50 - 20}{6} \\ &= 5\end{aligned}$$

C. Compile the data into a Normality table to determine the Chi Square, so it is presented in the following table.

Table for Normality Test

Interval	Fo	Fh	fo-fh	(fo-fh) ²	$\frac{(fo - fh)^2}{fh}$
20 – 25	3	2,34% x 36= 0.84	2.16	4.6656	5.55
26 – 30	8	13,53% x 36 = 4.87	3.13	9.7969	2.01
31 – 35	9	34,13% x 36 = 12.28	-3.28	10.758	0.87
36 – 40	10	34,14% x 36= 12.29	-2.29	5.2441	0.42
41 – 45	5	13,53% x 36 = 4.87	0.13	0.0169	0.003
46 – 50	1	2,34% x 36 = 0.84	0.16	0.0256	0.03
Quantity	36	36	0		X ² = 8.88

From the table for testing normality data, obtained Chi Square count (X²) = 8.88, being the price at the table Chi quadrate $\alpha = 0.05$, db = 5 is 11.07. Because Chi squared count (X²) < price of Chi Square table, it was concluded that the data pre-test for the experimental class were **normally distributed**.

2. Normality of Posttest in Experimental Class

For Posttest data in experimental class, result of normality test obtained by using the chi square test as follows:

- A. Number of intervals class for chi squared test, the number of classes defined interval = 6. This is consistent with 6 areas of raw Normal curve.

- B. Long of Interval Class (PK):

$$\begin{aligned}\text{Interval Class (PK)} &= \frac{\text{Bigest score} - \text{Smallest score}}{6} \\ &= \frac{95 - 60}{6} \\ &= 5.8 \\ &= 6\end{aligned}$$

- C. Compile the data into a Normality table to determine the Chi Square, so it is presented in the following table.

Table for Normality test

Interval	Fo	fh	fo-fh	(fo-fh) ²	$\frac{(fo - fh)^2}{fh}$
58 – 64	2	2,34% x 36 = 0.84	1.16	1.3456	1.60
65 – 71	2	13,53% x 36 = 4.87	-2.87	8.2369	1.69
72 – 78	6	34,13% x 36 = 12.28	-6.28	39.438	3.21
79 – 85	17	34,14% x 36 = 12.29	4.71	22.184	1.80
86 – 92	8	13,53% x 36 = 4.87	2.13	4.5369	0.93
93 – 99	2	2,34% x 36 = 0.84	1.16	1.3456	1.60
Quantity	36	36	0		$X^2 = 10.38$

From the table for testing normality data, obtained Chi Square count (X^2) = 10.38, being the price at the table Chi quadrate $\alpha = 0.05$, db = 5 is 11.07. Because Chi squared count (X^2) < price of Chi Square table, it was concluded that the data posttest for the experimental class were **Normally distributed**.

B. CONTROL CLASS

1. Normality of Pretest in Control Class

For pretest data in control class, result of normality test obtained by using the chi square test as follows:

A. Number of intervals class for chi squared test, the number of classes defined interval = 6. This is consistent with 6 areas of raw Normal curve.

B. Long of Interval class (PK):

$$\begin{aligned}\text{Interval Class (PK)} &= \frac{\text{Bigest Score} - \text{Small Score}}{6} \\ &= \frac{50 - 20}{6} \\ &= 5\end{aligned}$$

C. Compile the data into a Normality table to determine the Chi Square, so it is presented in the following table.

Table for Normality Test

Interval	Fo	fh	fo-fh	(fo-fh) ²	$\frac{(fo - fh)^2}{fh}$
20 – 25	1	2,34% x 36 = 0.84	0.16	0.0256	0.03
26 – 30	4	13,53% x 36 = 4.87	-0.87	0.7569	0.15
31 – 35	11	34,13% x 36 = 12.28	-1.28	1.6384	0.13
36 – 40	11	34,14% x 36 = 12.29	-1.29	1.6641	0.13
41 – 45	6	13,53% x 36 = 4.87	1.13	1.2769	0.26
46 – 50	3	2,34% x 36 = 0.84	2.16	4.6656	5.55
Quantity	36	36	0		X ² = 6.25

From the table for testing normality data, obtained Chi Square count (X²) = 6.25, being the price at the table Chi quadrate $\alpha = 0.05$, db = 5 is 11.07. Because Chi squared count (X²) < price of Chi Square table, it was concluded that the data pre-test for the control class were **normally distributed**.

2. Normality of Posttest in Control Class

For Posttest data in control class, result of normality test obtained by using the chi square test as follows:

A. Number of intervals class for chi squared test, the number of classes defined interval = 6. This is consistent with 6 areas of raw Normal curve

B. Long of Interval Class (PK):

$$\begin{aligned}\text{Interval Class (PK)} &= \frac{\text{Bigest score} - \text{Smallest Score}}{6} \\ &= \frac{95 - 50}{6} \\ &= 7.5 \\ &= 8\end{aligned}$$

C. Compile the data into a Normality table to determine the Chi Square, so it is presented in the following table.

Table of Normality test

Interval	Fo	Fh	fo-fh	(fo-fh) ²	$\frac{(fo - fh)^2}{fh}$
42– 50	1	2,34% x 36= 0.84	0.16	0.0256	0.03
52–60	3	13,53% x 36 = 4.87	-1.87	3.4969	0.71
62 –70	21	34,13% x 36 = 12.28	8.72	76.038	6.19
72– 80	7	34,14% x 36= 12.29	-5.29	27.984	2.27
82– 90	2	13,53% x 36 = 4.87	-2.87	8.2369	1.69
92 –100	1	2,34% x 36 = 0.84	0.16	0.0256	0.03
Quantity	36	36	0		X ² =9.23

From the table for testing normality data, obtained Chi Square count (X²) = 9.23, being the price at the table Chi quadrate $\alpha = 0.05$, db = 5 is 11.07. Because Chi squared count (X²) < price of Chi Square table, it was concluded that the data pre-test for the control class were **normally distributed**.

Appendix 19

HOMOGENEITY TEST

To test whether the two groups of sample come from the same population, we tested the similarity of two variance with the formula :

$$F = \frac{S_1^2}{S_2^2}$$

Where : S_1^2 = the largest variant of data
 S_2^2 = the smallest variant of data

The creation of test is $F_{\text{calculated}} < F_{\text{table}}$ at significant level $\alpha = 0,05$ so data called homogeny.

- **Determine F_{table}**

Price of F_{table} with significant level $\alpha = 0.05$ is adjusted to the distribution list of F, for $n_1 = 36$, dk numerator = $36-1 = 35$ and for $n_2 = 36$ dk denominator = $36-1 = 35$. For $F_{(0,05)(35,35)}$ is not obtained in the distribution list of F, so the price of F_{table} is calculated by using interpolation :

$$F_{(0,05)(35,34)} = 1.80$$

$$F_{(0,05)(35,36)} = 1.78$$

$$F_{\text{table}} = 1.80 + \left(\frac{36-34}{36-34}\right)(1.78 - 1.80)$$

$$= 1.80 - 0,02$$

$$= 1.78$$

- **EXPERIMENTAL CLASS & CONTROL CLASS**

1. Homogeneity test for Pretest data

Based on the results test of two groups is known that the variance (S^2) pretest for the experimental class was 48.65 and the variance (S^2) pretest for control class is 40.21.

From appendix of tabulation test, the result of data such as:

Pretest data in experimental class

$$SD = 6.95 \quad S^2 = 48.31 \quad n = 36$$

✓ Pretest data in control class

$$SD = 6.41 \quad S^2 = 41.17 \quad n = 36$$

So :

$$F = \frac{\text{Biggest var iants}}{\text{Smallest var iants}}$$

$$F = \frac{48.31}{41.17}$$

$$F_{\text{calculate}} = 1.17$$

From the calculation obtained the $F_{\text{calculated}} < F_{\text{table}} (1.17 < 1.78)$ so *pretest* data of control class and experiment class is **“homogeneous”**.

2. Homogeneity test for Posttest data

Based on the results test of two groups is known that the variance (S^2) pretest for the experimental class was 48.65 and the variance (S^2) pretest for control class is 40.21 So:

From appendix of tabulation test, the result of data such as:

Posttest data in experimental class

$$SD = 9.56 \quad S^2 = 91.42 \quad n = 36$$

✓ Posttest data in control class

$$SD = 8.27 \quad S^2 = 68.49 \quad n = 36$$

So :

$$F = \frac{\text{Biggest var iants}}{\text{Smallest var iants}}$$

$$F = \frac{91.42}{68.49}$$

$$F_{\text{calculate}} = 1.33$$

From the calculation obtained the $F_{\text{calculated}} < F_{\text{table}} (1.33 < 1.78)$ so *pretest* data of control class and experiment class is **“homogeneous”**.

Appendix 20

HYPOTHESIS TEST

The data that used in testing this hypothesis is gain data of the both group samples. Hypothesis test used in this research is Right Side T-Test. So:

$\bar{g}_1$ average of normalized gain experiment class	= 0.76
$\bar{g}_2$ average of normalized gain control class	= 0.54
S_1^2 variance of experiment class	= 0.032
S_2^2 variance of control class	= 0.020
n_1 total sample in experimnet class	= 36
n_2 total sample in control class	= 36

$$T_{\text{calculate}} = \frac{\bar{g}_1 - \bar{g}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

$$t = \frac{0.76 - 0.54}{\sqrt{\frac{0.032}{36} + \frac{0.020}{36}}}$$

$$t = \frac{0.22}{0.036}$$

$$t = 6.1$$

From the distribution list score t for $\alpha = 0.05$ with $dk = (n_1 + n_2 - 2) = (36+36-2) = 70$ was not found, then the price table t can be calculated as follows:

dk	dk numerator
30	1.70
Different 10	Different 0.02
40	1.68

$$Max = \frac{36 - 30}{10} \times 0.02 = 0.01$$

$$F_{\text{tabel}} = 1.70 - 0.01 = 1.686$$

Ha testing criteria is acceptable if the price of $t_{\text{calculate}} > t_{\text{table}}$ which means also reject Ho. From the data obtained $t_{\text{calculate}} (6.1) > t_{\text{table}} (1.686)$.

Appendix 21

Percentage of Improved Learning Outcomes(%Gain)

Improved learning outcomes of students taught with cooperative learning by using Module Based on Science Literation with Direct Instruction Method viewed using gain:

$$\% \text{ gain} = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

a. Experimental Class

$$\% \text{ gain} = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

Calculate the data number 1

$$\begin{aligned} \text{Normalized gain} &= \left| \frac{85 - 45}{100 - 45} \right| \\ &= 0.72 \end{aligned}$$

In the sample number 1, located at $g > 0.7$ so the sample enter in high categorized of gain . In the same way, do to the data no. 2 to 35

Average of pretest score = 35.97

Average of post test score = 81.66

Maximum Score = 95

$$\text{So: } g = \frac{81.66 - 35.97}{100 - 35.97}$$

$$g = 0.71$$

$$\text{or } g = \frac{\sum G_i}{N}$$

$$g = \frac{25.56}{36}$$

$$g = 0.71$$

So, Increasing the Learning Outcomes of student in experimental Class is 0.71or 71 % (High Gain).

Gain Table for Experimental Class

No	Sample Name	Pretest value	Posttest Value	Posttest - Pretest	100 - Prettest	Gain Normalized	Category
1	Andreas	45	85	40	55.00	0.72	High
2	Andrian	40	75	35	60.00	0.58	Medium
3	Auliana	40	80	40	60.00	0.66	Medium
4	Baihaqi	40	85	45	60.00	0.75	High
5	Daniel	30	60	30	70.00	0.42	Medium
6	Delpiero	45	75	30	55.00	0.54	Medium
7	Dian	45	60	15	55.00	0.27	Low
8	Diva	30	90	60	70.00	0.85	High
9	Ervina	25	80	55	75.00	0.73	High
10	Eza	35	85	50	65.00	0.76	High
11	Fadlan	45	75	30	55.00	0.54	Medium
12	Faradilla	40	90	50	60.00	0.83	High
13	Febriellah	40	85	45	60.00	0.75	High
14	Firzha	30	80	50	70.00	0.71	High
15	Golda	35	90	55	65.00	0.85	High
16	Indriani	35	75	40	65.00	0.61	Medium
17	Jovis	20	90	70	80.00	0.87	High
18	Khairina	40	95	55	60.00	0.91	High
19	Kristiadi	40	85	45	60.00	0.75	High
20	Meyuliza	40	85	45	60.00	0.75	High
21	Miko	45	85	40	55.00	0.72	High
22	M. Daud	50	60	10	50.00	0.2	Low
23	M. Fauzi	40	90	50	60.00	0.83	High
24	M. Rizky	40	85	45	60.00	0.75	High
25	M. Rizky P	30	80	50	70.00	0.71	High
26	Mutia	35	90	55	65.00	0.85	High

27	Putri	30	65	35	70.00	0.5	Medium
28	Richard	35	95	60	65.00	0.92	High
29	Ridho	35	85	50	65.00	0.76	High
30	Samuel	35	90	55	65.00	0.85	High
31	Syaibatul	20	85	65	80.00	0.81	High
32	Tasya	35	80	45	65.00	0.69	Medium
33	Vrans	35	85	50	65.00	0.76	High
34	Yohana	30	75	45	70.00	0.64	Medium
35	Yully	30	70	40	70.00	0.57	Medium
36	Zulfina	30	95	65	70.00	0.92	High
Average		35.97	81.66	45.69	64.01	0.70	
Σ Gain						25.56	
Gain = average posttest - average pretest / 100 - pretest						0.71	High
Gain = sum Gain / student quantity						0.71	High

Standart Deviasi Gain in Experiment Class

$$\Sigma X = 25.56$$

$$\Sigma X^2 = 18.96$$

$$n = 36$$

$$\bar{X} = \frac{25.56}{36} = 0.71$$

$$\begin{aligned}
 SD &= \sqrt{\frac{n\Sigma X^2 - (\Sigma X)^2}{n(n-1)}} \\
 &= \sqrt{\frac{36(18.96) - (25.56)^2}{36(36-1)}} \\
 &= \sqrt{\frac{682.56 - 653.31}{1260}} \\
 &= 0.152
 \end{aligned}$$

Variants (s^2)

$$S^2 = (0.152)^2$$

$$S^2 = 0.023$$

b. Control Class

$$\% \text{ gain} = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

Calculate the data number 1

$$\begin{aligned} \text{Normalized gain} &= \left| \frac{65 - 40}{100 - 40} \right| \\ &= 0,42 \end{aligned}$$

In the sample number 1, located at $0.3 \leq g \leq 0.7$ g so the sample enter in medium categorized of gain . In the same way, do to the data no. 2 to 35 ..

Average score for pretest = 38.47

Average score for posttest = 69.72

Maximum Score = 100

$$\text{So: } g = \frac{69.72 - 38.47}{100 - 38.47}$$

$$g = 0.50$$

or

$$g = \frac{\sum G_i}{N}$$

$$g = \frac{18.13}{36}$$

$$g = 0.50$$

So, Increasing the Learning Outcomes of student in Control Class is 0,50

atau 50 % (Middle gain)

No	Sample Name	Pretest value	Posttest Value	Posttest - Pretest	100 - Pretest	Gain Normalized	Category
1	Adri	40	65	25.00	60.00	0.42	Medium
2	Arif	40	80	40.00	60.00	0.67	Medium
3	Ayu	30	55	25.00	70.00	0.36	Medium
4	Bagas	40	65	25.00	60.00	0.42	Medium
5	Cindy	40	70	30.00	60.00	0.50	Medium

6	Eko	20	50	30.00	80.00	0.38	Medium
7	Fadhillah	30	70	40.00	70.00	0.57	Medium
8	Fadlan	40	75	35.00	60.00	0.58	Medium
9	Fernando	35	60	25.00	65.00	0.38	Medium
10	Fiza	30	70	40.00	70.00	0.57	Medium
11	Ilmi	35	70	35.00	65.00	0.54	Medium
12	Juwita	45	70	25.00	55.00	0.45	Medium
13	Kristinus	50	65	15.00	50.00	0.30	Medium
14	M. Alfian	40	65	25.00	60.00	0.42	Medium
15	M. Fillah	40	75	35.00	60.00	0.58	Medium
16	M. Hafiz	50	70	20.00	50.00	0.40	Medium
17	Nabila A	35	70	35.00	65.00	0.54	Medium
18	Nabilah S	45	70	25.00	55.00	0.45	Medium
19	Nisrina	50	65	15.00	50.00	0.30	Medium
20	Nurfaizi	35	60	25.00	65.00	0.38	Medium
21	Nuzulul	35	65	30.00	65.00	0.46	Medium
22	Peter	40	70	30.00	60.00	0.50	Medium
23	Putri	40	65	25.00	60.00	0.42	Medium
24	Rafi	35	65	30.00	65.00	0.46	Medium
25	Rianda	35	70	35.00	65.00	0.54	Medium
26	Richie	45	65	20.00	55.00	0.36	Medium
27	Ridho	45	70	25.00	55.00	0.45	Medium
28	Rizal	40	70	30.00	60.00	0.50	Medium
29	Shafa	45	75	30.00	55.00	0.55	Medium
30	Shindy	35	65	30.00	65.00	0.46	Medium
31	Suwaibatul	35	75	40.00	65.00	0.62	Medium
32	Tigor	35	85	50.00	65.00	0.77	High
33	Vivi	45	75	30.00	55.00	0.55	Medium
34	Wind C	35	75	40.00	65.00	0.62	Medium
35	Yoan	40	85	45.00	60.00	0.75	High

36	Zahdira	30	95	65.00	70.00	0.92	High
Average		38.47	69.72	31.25	61.31	0.50	
Σ Gain						18.13	
gain = average posttest - average pretest / 100 - pretest						0.50	Medium
gain = sum gain / student quantity						0.50	Medium

Standard Deviation Gain in Control Class

$$\Sigma X = 18.13$$

$$\Sigma X^2 = 9.75$$

$$n = 36$$

$$\bar{X} = \frac{18.13}{36} = 0.50$$

$$\begin{aligned}
 SD &= \sqrt{\frac{n\Sigma X^2 - (\Sigma X)^2}{n(n-1)}} \\
 &= \sqrt{\frac{36(9.75) - (18.13)^2}{36(36-1)}} \\
 &= \sqrt{\frac{351 - 328.69}{1260}} \\
 &= 0.133
 \end{aligned}$$

Variants (s^2)

$$S^2 = (0.133)^2$$

$$S^2 = 0.017$$

So, the difference of improving student learning outcomes in experiments class with control control class is $71\% - 50\% = 21\%$.

*Appendix 22***DOCUMENTATION**

Picture 1 . Student doing pre-test in experimental class





Picture 2. Student doing group discussion in experimental class



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Picture 3 . Student doing pre-test in control class





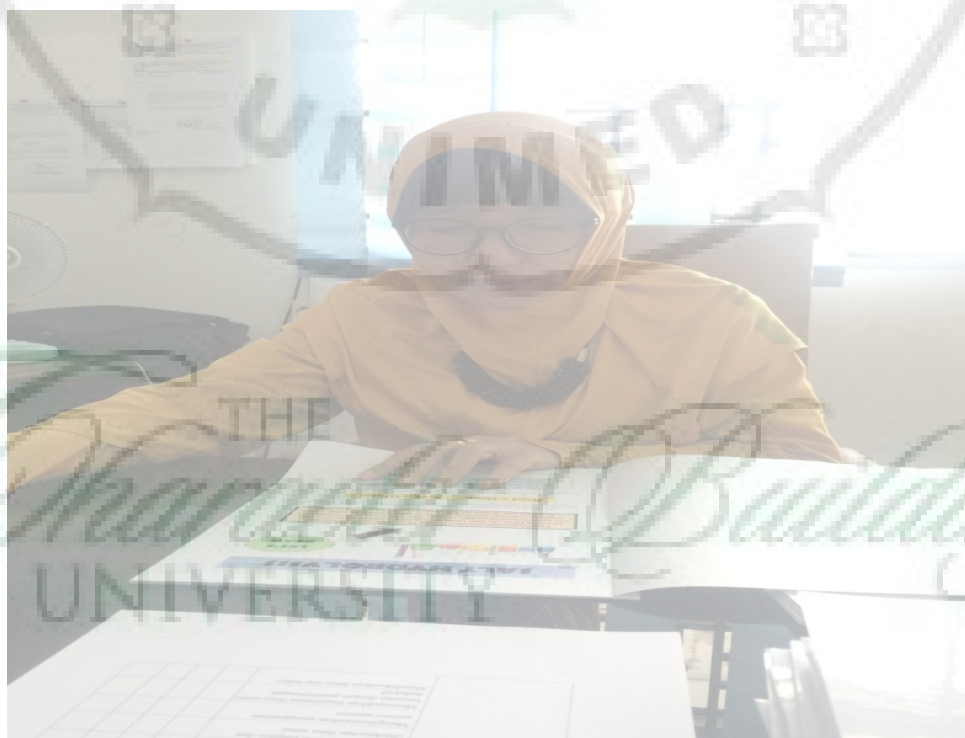
Picture 4. Teacher give the explanation in the experiment class.



Picture 5. Teacher give the explanation in the control class.



Picture 6. Validation of Module by Lecture



Appendix 23

TABLE OF r-PRODUCT MOMENT SCORE

N	Taraf Signif		N	Taraf Signif		N	Taraf Signif	
	5%	1%		5%	1%		5%	1%
3	0.997	0.999	27	0.381	0.487	55	0.266	0.345
4	0.950	0.990	28	0.374	0.478	60	0.254	0.330
5	0.878	0.959	29	0.367	0.470	65	0.244	0.317
6	0.811	0.917	30	0.361	0.463	70	0.235	0.306
7	0.754	0.874	31	0.355	0.456	75	0.227	0.296
8	0.707	0.834	32	0.349	0.449	80	0.220	0.286
9	0.666	0.798	33	0.344	0.442	85	0.213	0.278
10	0.632	0.765	34	0.339	0.436	90	0.207	0.270
11	0.602	0.735	35	0.334	0.430	95	0.202	0.263
12	0.576	0.708	36	0.329	0.424	100	0.195	0.256
13	0.553	0.684	37	0.325	0.418	125	0.176	0.230
14	0.532	0.661	38	0.320	0.413	150	0.159	0.210
15	0.514	0.641	39	0.316	0.408	175	0.148	0.194
16	0.497	0.623	40	0.326	0.403	200	0.138	0.181
17	0.482	0.606	41	0.308	0.398	300	0.113	0.1840
18	0.468	0.590	42	0.304	0.393	400	0.098	0.128
19	0.456	0.575	43	0.301	0.389	500	0.083	0.115
20	0.444	0.561	44	0.297	0.384	600	0.080	0.105
21	0.433	0.549	45	0.294	0.380	700	0.074	0.097
22	0.423	0.537	46	0.291	0.376	800	0.070	0.091
23	0.413	0.526	47	0.288	0.372	900	0.055	0.085
24	0.404	0.515	48	0.284	0.368	1000	0.062	0.081
25	0.396	0.505	49	0.281	0.364			
26	0.388	0.496	50	0.279	0.361			

Sumber : Silitonga (2011)

Appendix 24

Table of CHI KUADRAT

dk	Taraf Significance					
	50%	30%	20%	10%	5%	1%
1	0.455	1.074	1.642	2.706	3.481	6.635
2	0.139	2.408	3.219	3.605	5.591	9.210
3	2.366	3.665	4.642	6.251	7.815	11.341
4	3.357	4.878	5.989	7.779	9.488	13.277
5	4.351	6.064	7.289	9.236	11.070	15.086
6	5.348	7.231	8.558	10.645	12.592	16.812
7	6.346	8.383	9.803	12.017	14.017	18.475
8	7.344	9.524	11.030	13.362	15.507	20.090
9	8.343	10.656	12.242	14.648	16.919	21.666
10	9.342	11.781	13.442	15.987	18.307	23.209
11	10.341	12.899	14.631	17.275	19.675	24.725
12	11.340	14.011	15.812	18.549	21.026	26.217
13	12.340	15.19	16.985	19.812	22.368	27.688
14	13.332	16.222	18.151	21.064	23.685	29.141
15	14.339	17.322	19.311	22.307	24.996	30.578
16	15.338	18.418	20.465	23.542	26.296	32.000
17	16.337	19.511	21.615	24.785	27.587	33.409
18	17.338	20.601	22.760	26.028	28.869	34.805
19	18.338	21.689	23.900	27.271	30.144	36.191
20	19.3337	22.775	25.038	28.514	31.410	37.566
21	20.337	23.858	26.171	29.615	32.671	38.932
22	21.337	24.939	27.301	30.813	33.924	40.289
23	22.337	26.018	28.429	32.007	35.172	41.638
24	23.337	27.096	29.553	33.194	35.415	42.980
25	24.337	28.172	30.675	34.382	37.652	44.314
26	25.336	29.246	31.795	35.563	38.885	45.642
27	26.336	30.319	32.912	36.741	40.113	46.963
28	27.336	31.391	34.027	37.916	41.337	48.278
29	28.336	32.461	35.139	39.087	42.557	49.588
30	29.336	33.530	36.250	40.256	43.775	50.892

Sumber : Sugiyono (2006)

Appendix 25

Table of Distribution F Value
(Upper row for $\alpha = 0,05$ and lower row for $\alpha = 0,01$)

$V_2 = dk$ Penyebut	$V_1 = dk$ pembilang																							
	1	2	3	4	5	6	7	8	9	10	11	12	14	16	20	24	30	40	50	75	100	200	500	∞
1	181	200	216	225	230	234	237	239	241	242	243	244	246	245	248	249	250	251	252	253	253	254	254	254
	4.052	4999	5403	5625	5764	5859	5928	5981	6022	6022	6082	6106	6142	6169	6208	6234	6258	6286	6302	6323	6334	6352	6361	6366
2	18.51	19.00	19.16	19.25	19.30	19.33	19.36	19.37	19.38	19.39	19.40	19.41	19.42	19.43	19.44	19.45	19.46	19.47	19.47	19.48	19.49	19.49	19.50	19.50
	98.49	99.01	99.17	99.25	99.30	99.33	99.34	99.36	99.38	99.40	99.41	99.42	99.43	99.44	99.45	99.46	99.47	99.48	99.48	99.49	99.49	99.49	99.50	99.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.94	8.94	8.94	8.94	8.94	8.94	8.94	8.94	8.94	8.94	8.94	8.94	8.94	8.94	8.94	8.94	8.94	8.94
	34.12	30.81	29.46	28.71	28.21	28.91	27.67	27.49	27.34	27.23	27.13	27.05	26.92	26.83	26.69	26.60	26.50	26.41	26.30	26.27	26.23	26.18	26.14	26.12
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.93	5.91	5.87	5.84	5.80	5.77	5.74	5.71	5.70	5.68	5.66	5.65	5.64	5.63
	21.20	18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.66	14.54	14.45	14.37	14.24	14.15	14.02	13.93	13.83	13.74	13.69	13.61	13.57	13.52	13.48	13.46
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.78	4.74	4.70	4.68	4.64	4.60	4.56	4.53	4.50	4.46	4.44	4.42	4.40	4.38	4.37	4.36
	16.26	13.27	12.06	11.39	10.97	10.67	10.45	10.27	10.15	10.05	9.96	9.89	9.77	9.68	9.55	9.47	9.38	9.29	9.24	9.17	9.13	9.07	9.04	9.02
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.03	4.00	3.96	3.92	3.87	3.84	3.81	3.77	3.75	3.72	3.71	3.69	3.68	3.67
	13.74	10.92	9.78	9.15	8.75	8.47	8.26	8.10	7.98	7.87	7.79	7.72	7.60	7.52	7.39	7.31	7.23	7.14	7.09	7.02	6.99	6.94	6.90	6.88
7	5.59	4.74	4.35	4.12	3.97	3.97	3.97	3.97	3.97	3.97	3.97	3.97	3.97	3.97	3.97	3.97	3.97	3.97	3.97	3.97	3.97	3.97	3.97	3.97
	12.25	9.55	8.45	7.85	7.46	7.39	7.00	6.81	6.71	6.62	6.54	6.47	6.35	6.27	6.15	6.07	5.98	5.90	5.85	5.78	5.75	5.70	5.67	5.63
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.34	3.31	3.28	3.23	3.20	3.15	3.12	3.08	3.05	3.03	3.00	3.00	2.98	2.94	2.93
	11.26	8.65	7.59	7.01	6.63	6.37	6.19	6.03	5.91	5.82	5.71	5.67	5.56	5.46	5.36	5.28	5.20	5.14	5.06	5.06	5.00	4.96	4.88	4.86
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.13	3.10	3.07	3.02	2.98	2.93	2.90	2.86	2.82	2.80	2.77	2.76	2.73	2.72	2.71
	10.56	8.02	6.99	6.42	6.02	5.80	5.62	5.47	5.35	5.26	5.18	5.14	5.00	4.92	4.80	4.73	4.64	4.56	4.51	4.45	4.44	4.36	4.33	4.31
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.97	2.94	2.91	2.86	2.82	2.77	2.74	2.70	2.67	2.64	2.61	2.59	2.56	2.55	2.54
	10.04	5.56	6.55	5.99	5.64	5.39	5.21	5.06	4.95	4.85	4.78	4.71	4.60	4.52	4.41	4.33	4.25	4.17	4.12	4.05	4.01	3.96	3.93	3.91
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.86	2.82	2.79	2.74	2.70	2.65	2.61	2.57	2.53	2.50	2.47	2.45	2.42	2.41	2.40
	9.65	7.20	6.22	5.67	5.32	5.07	4.88	4.74	4.63	4.54	4.46	4.40	4.29	4.21	4.10	4.02	3.94	3.86	3.74	3.80	3.70	3.66	3.94	3.60
12	4.75	3.88	3.49	3.26	3.11	3.00	2.92	2.85	2.80	2.76	2.72	2.69	2.64	2.60	2.54	2.50	2.46	2.42	2.40	2.36	2.35	2.32	2.31	2.30
	9.33	6.93	5.95	5.41	5.06	4.82	4.65	4.50	4.39	4.30	4.22	4.16	4.05	3.98	3.86	3.78	3.70	3.61	3.56	3.49	3.49	3.41	3.38	3.36
13	4.67	3.80	3.41	3.18	3.02	2.92	2.84	2.77	2.72	2.67	2.63	2.60	2.55	2.51	2.46	2.42	2.38	2.34	2.32	2.28	2.26	2.24	2.24	2.21
	9.07	6.70	5.74	5.20	4.86	4.62	4.44	4.30	4.19	4.10	4.02	3.96	3.85	3.78	3.67	3.59	3.51	3.42	3.37	3.30	3.27	3.21	3.18	3.16
14	4.60	3.74	3.34	3.11	2.96	2.85	2.77	2.70	2.65	2.60	2.56	2.53	2.48	2.44	2.39	2.35	2.31	2.27	2.24	2.21	2.19	2.16	2.14	2.13
	8.86	6.51	5.56	5.03	4.69	4.46	4.28	4.14	4.03	3.94	3.86	3.80	3.70	3.62	3.51	3.43	3.34	3.26	3.21	3.14	3.11	3.06	3.02	3.00
15	4.54	3.68	3.29	3.06	2.90	2.79	2.70	2.64	2.59	2.55	2.51	2.48	2.43	2.39	2.33	2.29	2.25	2.21	2.18	2.15	2.12	2.10	2.08	2.07
	8.68	6.36	5.42	4.89	4.56	4.32	4.14	4.00	3.89	3.73	3.67	3.56	3.48	3.39	3.36	3.29	3.20	3.12	3.07	3.00	2.97	2.92	2.89	2.87
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.45	2.42	2.37	2.33	2.28	2.24	2.20	2.16	2.13	2.09	2.07	2.04	2.02	2.01
	8.53	6.23	5.29	4.77	4.44	4.20	4.03	3.89	3.78	3.69	3.61	3.55	3.45	3.37	3.25	3.18	3.10	3.01	2.96	2.89	2.86	2.80	2.77	2.75
17	4.45	3.59	3.20	2.96	2.81	2.70	2.62	2.55	2.50	2.45	2.41	2.38	2.33	2.29	2.23	2.19	2.15	2.11	2.08	2.04	2.02	1.99	1.97	1.96
	8.40	6.11	5.18	4.67	4.34	4.10	3.93	3.79	3.68	3.59	3.52	3.45	3.35	3.27	3.16	3.08	3.00	2.92	2.86	2.79	2.76	2.70	2.67	2.65
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.37	2.34	2.29	2.25	2.19	2.15	2.11	2.07	2.04	2.00	1.98	1.95	1.93	1.92
	8.28	6.01	5.09	4.58	4.25	4.01	3.85	3.71	3.60	3.51	3.44	3.37	3.27	3.19	3.07	3.00	2.91	2.83	2.78	2.71	2.68	2.62	2.59	2.57
19	4.38	3.52	3.13	2.90	2.74	2.63	2.55	2.48	2.43	2.38	2.34	2.31	2.26	2.21	2.15	2.11	2.07	2.02	2.00	1.96	1.94	1.91	1.90	1.88
	8.18	5.93	5.01	4.50	4.17	3.94	3.77	3.63	3.52	3.43	3.36	3.30	3.19	3.12	3.00	2.92	2.84	2.76	2.70	2.63	2.60	2.54	2.51	2.49
20	4.35	3.49	3.10	2.87	2.71	2.60	2.52	2.45	2.40	2.35	2.31	2.28	2.23	2.18	2.12	2.08	2.04	1.99	1.96	1.92	1.90	1.87	1.85	1.84
	8.10	5.85	4.94	4.43	4.10	3.87	3.71	3.56	3.45	3.37	3.30	3.23	3.13	3.05	2.94	2.86	2.77	2.69	2.63	2.56	2.53	2.47	2.44	2.42

$V_2 = dk$ Penyebut	$V_1 = dk$ pembilang																							
	1	2	3	4	5	6	7	8	9	10	11	12	14	16	20	24	30	40	50	75	100	200	500	∞
21	4,32	3,47	3,07	2,84	2,68	2,57	2,49	2,42	2,37	2,32	2,28	2,25	2,20	2,15	2,09	2,05	2,00	1,96	1,93	1,89	1,87	1,84	1,82	1,81
	8,02	5,78	4,87	4,37	4,04	3,81	3,65	3,51	3,40	3,31	3,24	3,17	3,07	2,99	2,88	2,80	2,72	2,63	2,58	2,51	2,47	2,42	2,38	2,36
22	4,30	3,44	3,05	2,82	2,66	2,55	2,47	2,40	2,35	2,30	2,26	2,23	2,18	2,13	2,07	2,03	1,98	1,93	1,91	1,87	1,84	1,81	1,80	1,78
	7,94	5,72	4,82	4,31	3,99	3,76	3,59	3,45	3,35	3,26	3,18	3,12	3,02	2,94	2,83	2,75	2,67	2,58	2,53	2,46	2,42	2,37	2,33	2,31
23	4,28	3,42	3,03	2,80	2,64	2,53	2,45	2,38	2,32	2,28	2,24	2,20	2,14	2,10	2,04	2,00	1,96	1,96	1,96	1,96	1,96	1,96	1,96	1,96
	7,88	5,66	4,76	4,26	3,94	3,71	3,54	3,41	3,30	3,21	3,14	3,07	2,97	2,89	2,78	2,70	2,62	2,53	2,48	2,41	2,37	2,32	2,28	2,26
24	4,26	3,40	3,01	2,78	2,62	2,51	2,43	2,36	2,30	2,26	2,22	2,18	2,13	2,09	2,02	1,98	1,94	1,89	1,86	1,82	1,80	1,76	1,74	1,73
	7,82	5,61	4,72	4,22	3,90	3,67	3,50	3,36	3,25	3,17	3,09	3,03	2,93	2,85	2,74	2,65	2,58	2,49	2,44	2,36	2,33	2,27	2,23	2,21
25	4,24	3,38	2,99	2,76	2,60	2,49	2,41	2,34	2,28	2,24	2,20	2,16	2,11	2,06	2,00	1,96	1,92	1,87	1,84	1,80	1,77	1,74	1,72	1,71
	7,77	5,57	4,68	4,18	3,86	3,63	3,46	3,32	3,21	3,13	3,05	2,99	2,89	2,81	2,70	2,62	2,54	2,45	2,40	2,32	2,29	2,23	2,19	2,17
26	4,22	3,37	2,89	2,74	2,59	2,47	2,39	2,32	2,27	2,22	2,18	2,15	2,10	2,05	1,99	1,95	1,90	1,85	1,82	1,78	1,76	1,72	1,70	1,69
	7,72	5,53	4,64	4,14	3,82	3,59	3,42	3,29	3,17	3,09	3,02	2,96	2,86	2,77	2,66	2,58	2,50	2,41	2,36	2,28	2,25	2,19	2,15	2,19
27	4,21	3,35	2,96	2,73	2,57	2,46	2,37	2,30	2,25	2,20	2,16	2,13	2,08	2,03	1,97	1,97	1,97	1,97	1,97	1,97	1,97	1,97	1,97	1,97
	7,68	5,49	4,60	4,11	3,79	3,56	3,39	3,26	3,14	3,06	2,98	2,93	2,83	2,74	2,63	2,63	2,63	2,63	2,63	2,63	2,63	2,63	2,63	2,63
28	4,20	3,34	2,95	2,71	2,56	2,44	2,36	2,29	2,24	2,19	2,15	2,21	2,06	2,02	1,96	1,91	1,87	1,81	1,78	1,75	1,72	1,69	1,67	1,65
	7,64	5,45	4,57	4,07	3,76	3,53	3,36	3,23	3,11	3,03	2,95	2,90	2,80	2,71	2,60	2,52	2,44	2,35	2,30	2,22	2,18	2,13	2,09	2,06
29	4,18	3,33	2,93	2,70	2,54	2,43	2,35	2,28	2,22	2,18	2,14	2,10	2,05	2,00	1,94	1,90	1,85	1,80	1,77	1,73	1,71	1,68	1,65	1,64
	7,60	5,52	4,54	4,04	3,73	3,50	3,33	3,20	3,08	3,00	2,92	2,87	2,77	2,68	2,57	2,49	2,41	2,32	2,27	2,19	2,15	2,10	2,06	2,03
30	4,17	3,32	2,92	2,69	2,53	2,42	2,34	2,27	2,21	2,16	2,12	2,09	2,04	1,99	1,93	1,89	1,84	1,79	1,76	1,72	1,69	1,66	1,64	1,62
	7,56	5,39	4,51	4,02	3,70	3,47	3,30	3,17	3,06	2,98	2,90	2,84	2,74	2,66	2,55	2,47	2,38	2,29	2,24	2,16	2,13	2,07	2,03	2,01
32	4,15	3,30	2,90	2,67	2,51	2,40	2,32	2,25	2,19	2,14	2,10	2,07	2,02	1,97	1,91	1,86	1,82	1,76	1,74	1,69	1,67	1,64	1,61	1,59
	7,50	5,34	4,46	3,97	3,66	3,42	3,25	3,12	3,01	2,94	2,86	2,80	2,70	2,62	2,51	2,42	2,34	2,25	2,20	2,12	2,08	2,02	1,98	1,96
34	4,13	3,28	2,88	2,65	2,49	2,38	2,30	2,23	2,17	2,12	2,08	2,05	2,00	1,95	1,89	1,84	1,80	1,74	1,71	1,67	1,64	1,61	1,59	1,57
	7,44	5,29	4,42	3,93	3,61	3,38	3,21	3,08	2,97	2,89	2,82	2,76	2,66	2,58	2,47	2,38	2,30	2,21	2,15	2,08	2,04	2,98	2,94	2,91
36	4,11	3,26	2,80	2,63	2,48	2,36	2,28	2,21	2,15	2,10	2,06	2,03	1,89	1,89	1,89	1,89	1,89	1,78	1,72	1,69	1,65	1,62	1,59	1,56
	7,39	5,25	4,38	3,89	3,58	3,35	3,18	3,04	2,94	2,86	2,78	2,72	2,62	2,62	2,62	2,62	2,62	2,26	2,17	2,12	2,04	2,00	1,94	1,87
38	4,10	3,25	2,85	2,62	2,46	2,35	2,26	2,19	2,14	2,09	2,05	2,02	1,96	1,92	1,85	1,80	1,76	1,71	1,67	1,63	1,60	1,57	1,54	1,53
	7,35	5,21	4,34	3,86	3,54	3,32	3,15	3,02	2,91	2,82	2,75	2,69	2,59	2,51	2,40	2,32	2,22	2,14	2,08	2,00	1,97	1,90	1,86	1,84
40	4,08	3,23	2,84	2,61	2,45	2,34	2,25	2,18	2,12	2,07	2,04	2,00	1,95	1,90	1,84	1,79	1,74	1,69	1,65	1,61	1,659	1,55	1,53	1,51
	7,31	5,18	4,31	3,83	3,51	3,29	3,12	2,99	2,88	2,80	2,73	2,66	2,56	2,49	2,37	2,29	2,20	2,11	2,05	1,97	1,94	1,88	1,84	1,81
42	4,07	3,22	2,83	2,59	2,44	2,32	2,24	2,17	2,11	2,06	2,02	1,99	1,94	1,89	1,82	1,78	1,73	1,68	1,64	1,60	1,57	1,54	1,51	1,49
	7,27	5,15	4,29	3,80	3,49	3,26	3,10	2,96	2,86	2,77	2,70	2,64	2,54	2,46	2,35	2,26	2,17	2,08	2,02	1,94	1,91	1,85	1,80	1,78
44	4,06	3,21	2,82	2,58	2,43	2,31	2,23	2,16	2,10	2,05	2,01	1,98	1,92	1,88	1,81	1,76	1,66	1,63	1,58	1,56	1,52	1,50	1,48	1,48
	7,24	5,12	4,26	3,78	3,46	3,24	3,07	2,94	2,84	2,75	2,68	2,62	2,52	2,44	2,32	2,24	2,06	2,00	1,92	1,88	1,82	1,78	1,75	1,75
46	4,05	3,20	2,81	2,57	2,42	2,30	2,22	2,14	2,09	2,04	2,00	1,97	1,91	1,87	1,80	1,75	1,71	1,65	1,62	1,57	1,54	1,51	1,48	1,46
	7,21	5,10	4,24	3,76	3,44	3,22	3,05	2,92	2,82	2,73	2,66	2,60	2,50	2,42	2,39	2,22	2,13	2,04	1,98	1,90	1,86	1,80	1,76	1,72
48	4,04	3,19	2,80	2,56	2,41	2,30	2,21	2,14	2,08	2,03	1,99	1,96	1,90	1,86	1,79	1,74	1,70	1,64	1,61	1,56	1,53	1,50	1,47	1,45
	7,19	5,08	4,22	3,74	3,42	3,20	3,04	2,90	2,80	2,71	2,64	2,58	2,48	2,40	2,28	2,20	2,11	2,02	1,96	1,88	1,84	1,78	1,73	1,70
50	4,03	3,18	2,79	2,56	2,40	2,29	2,29	2,13	2,07	2,02	1,98	1,95	1,90	1,85	1,78	1,74	1,69	1,63	1,69	1,55	1,52	1,48	1,46	1,44
	7,17	5,06	4,20	3,72	3,11	3,18	3,02	2,88	2,78	2,70	2,62	2,56	2,16	2,39	2,26	2,18	2,40	2,00	1,94	1,86	1,82	1,76	1,71	1,68s
55	4,02	3,17	2,78	2,51	2,38	2,27	2,18	2,11	2,05	2,00	1,97	1,93	1,88	1,83	1,76	1,72	1,67	1,64	1,58	1,52	1,50	1,46	1,43	1,41
	7,12	5,01	4,16	3,68	3,37	3,15	2,98	2,85	2,75	2,66	2,59	2,53	2,43	2,35	2,23	2,45	2,00	1,96	1,90	1,82	1,78	1,71	1,66	1,64

$V_2 = dk$ Penyebut	$V_1 = dk$ pembilang																							
	1	2	3	4	5	6	7	8	9	10	11	12	14	16	20	24	30	40	50	75	100	200	500	∞
60	4,00	4,00	3,45	2,76	2,52	2,37	2,25	2,17	2,10	2,01	1,99	1,95	1,92	1,86	1,81	1,75	1,70	1,65	1,59	1,56	1,50	1,48	1,44	1,41
	7,08	7,08	4,98	4,13	3,65	3,31	3,12	2,95	3,82	3,72	2,03	2,56	2,50	2,40	2,32	2,20	2,12	2,02	1,93	1,87	1,79	1,71	1,68	1,63
65	3,99	3,11	2,73	2,54	2,36	2,24	2,45	2,08	2,02	1,98	1,91	1,90	1,85	1,80	1,73	1,68	1,63	1,57	1,5	1,49	1,46	1,42	1,39	1,37
	7,01	4,95	4,10	3,62	3,31	3,09	2,93	2,79	2,70	2,61	2,51	2,17	2,37	2,30	2,18	2,09	2,00	1,90	1,81	1,76	1,71	1,61	1,60	1,56
70	3,98	3,13	2,71	2,50	2,35	2,32	2,11	2,07	2,01	1,97	1,93	1,89	1,84	1,79	1,72	1,67	1,62	1,56	1,53	1,17	1,45	1,40	1,37	1,35
	7,01	4,92	4,08	3,60	3,29	3,07	2,91	2,77	2,67	2,59	2,51	2,15	2,35	2,28	2,15	2,07	1,98	1,88	1,82	1,74	1,69	1,63	1,56	1,53
80	3,96	3,11	2,72	2,48	2,33	2,21	2,42	2,05	1,99	1,95	1,91	1,88	1,82	1,77	1,70	1,65	1,60	1,60	1,60	1,60	1,60	1,60	1,60	1,60
	6,96	4,86	4,04	3,58	3,25	3,01	2,87	2,71	2,61	2,55	2,48	2,44	2,32	2,24	2,11	2,04	1,94	1,94	1,94	1,94	1,94	1,94	1,94	1,94
100	3,91	3,09	2,70	2,46	2,30	2,49	2,40	2,03	1,97	1,92	1,88	1,85	1,79	1,75	1,68	1,63	1,57	1,	1,63	1,63	1,63	1,63	1,63	1,63
	6,90	4,82	3,98	3,51	3,20	2,99	2,82	3,69	2,59	2,51	2,43	2,36	2,26	2,49	2,06	1,98	1,89	1,98	1,98	1,98	1,98	1,98	1,98	1,98S
125	3,92	3,07	2,68	2,44	2,29	2,17	2,08	2,01	1,95	1,90	1,86	1,83	1,77	1,72	1,65	1,60	1,55	1,49	1,45	1,39	1,36	1,31	1,27	1,25
	6,81	4,78	3,91	3,47	3,17	2,95	2,79	2,65	2,56	2,47	2,40	2,33	2,23	2,45	2,03	1,91	1,85	1,75	1,68	1,59	1,54	1,46	1,40	1,37s
150	3,91	3,06	2,67	2,43	2,27	2,16	2,07	2,00	1,91	1,89	1,85	1,82	1,76	1,54	1,61	1,59	1,54	1,47	1,44	1,37	1,34	1,29	1,25	1,22
	6,81	4,75	3,91	3,14	3,13	2,92	2,76	2,62	2,53	2,41	2,37	2,30	2,20	2,42	2,00	1,91	1,82	1,72	1,66	1,56	1,51	1,43	1,37	1,33
200	3,89	3,01	2,65	2,11	2,26	2,14	2,05	1,98	1,92	1,87	1,83	1,80	1,71	1,69	1,62	1,57	1,52	1,45	1,42	1,35	1,32	1,26	1,22	1,19
	6,76	4,74	3,85	3,44	3,41	2,90	2,73	2,60	2,50	2,44	2,33	2,28	2,17	2,09	1,97	1,88	1,79	1,69	1,62	1,53	1,48	1,39	1,33	1,28
400	3,86	3,02	2,62	2,39	2,23	2,42	2,03	1,96	1,90	1,83	1,81	1,78	1,72	1,67	1,60	1,54	1,49	1,42	1,38	1,32	1,28	1,22	1,16	1,13
	6,70	4,66	3,83	3,36	3,06	2,85	2,69	2,55	2,46	2,37	2,29	2,23	2,12	2,04	1,92	1,84	1,74	1,64	1,57	1,47	1,42	1,32	1,24	1,19
1000	3,85	3,00	2,64	2,38	2,22	2,10	2,02	1,95	1,89	1,81	1,80	1,76	1,70	1,65	1,58	1,53	1,47	1,44	1,36	1,30	1,26	1,19	1,13	1,08
	6,68	4,62	3,80	3,34	3,04	2,82	2,66	2,53	2,13	2,34	2,26	2,20	2,09	2,04	1,89	1,81	1,71	1,61	1,54	1,44	1,38	1,28	1,19	1,11
∞	3,81	2,99	2,60	2,37	2,21	2,09	2,01	1,94	1,88	1,83	1,79	1,75	1,69	1,64	1,57	1,52	1,46	1,40	1,35	1,28	1,24	1,47	1,11	1,00
	6,61	4,60	3,78	3,32	3,02	2,80	2,61	2,51	2,11	2,32	2,24	2,48	2,07	1,99	1,87	1,79	1,69	1,59	1,52	1,41	1,36	1,25	1,15	1,00

Appendix 26

Table of Distribution t Score

	α untuk uji t dua pihak					
	0.50	0.20	0.10	0.05	0.02	0.01
	α untuk uji t satu pihak					
Db	0.25	0.10	0.05	0.025	0.01	0.005
1	1.000	3.078	6.314	12.706	31.821	63.657
2	0.816	1.866	2.920	4.303	6.965	9.925
3	0.765	1.638	2.353	3.182	4.541	5.841
4	0.741	1.533	2.132	2.776	3.747	4.604
5	0.727	1.486	2.015	2.571	3.365	4.032
6	0.718	1.440	1.943	2.447	3.143	3.707
7	0.711	1.415	1.895	2.365	2.998	3.499
8	0.706	1.397	1.860	2.306	2.896	3.355
9	0.703	1.383	1.833	2.262	2.821	3.250
10	0.700	1.372	1.812	2.228	2.764	3.165
11	0.697	1.363	1.796	2.201	2.718	3.106
12	0.695	1.356	1.782	2.178	2.681	3.055
13	0.692	1.350	1.771	2.160	2.650	3.012
14	0.691	1.345	1.761	2.145	2.624	2.977
15	0.690	1.341	1.753	2.132	2.623	2.947
16	0.689	1.337	1.749	2.120	2.583	2.921
17	0.688	1.333	1.740	2.110	2.567	2.898
18	0.688	1.330	1.743	2.01	2.552	2.878
19	0.687	1.328	1.729	2.093	2.539	2.861
20	0.687	1.325	1.725	2.086	2.528	2.845
21	0.686	1.323	1.721	2.080	2.518	2.831
22	0.686	1.321	1.717	2.074	2.508	2.819
23	0.685	1.319	1.714	2.069	2.500	2.807
24	0.685	1.318	1.711	2.064	2.492	2.797
25	0.684	1.316	1.708	2.060	2.485	2.787
26	0.684	1.315	1.706	2.056	2.479	2.779
27	0.684	1.314	1.703	2.052	2.473	2.771
28	0.683	1.313	1.701	2.048	2.467	2.763
29	0.683	1.311	1.699	2.045	2.462	2.756
30	0.683	1.310	1.697	2.042	2.457	2.750
40	0.681	1.303	1.684	2.021	2.423	2.704
60	0.679	1.296	1.671	2.000	2.390	2.660
120	0.677	1.289	1.658	1.980	2.358	2.617
∞	0.674	1.282	1.645	1.960	2.326	2.576

Sumber : Silitonga (2006)

**BASED ON
SCIENCE
LITERATION**

**GRADE XI
SENIOR HIGH SCHOOL**

SALT HYDROLYSIS



**A
R
T
I
C
L
E**

Devi Rianti Sari

State University of Medan



SALT HYDROLYSIS



**LET'S
READ**

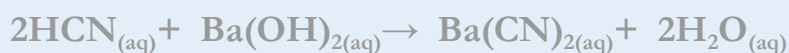
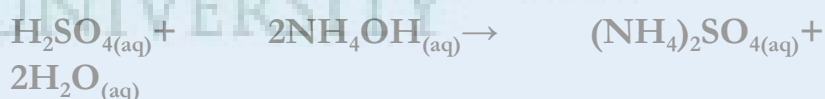
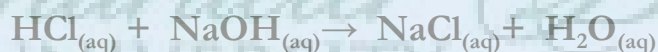


Like vegetables without salt. Have you ever heard the phrase? How do you taste vegetables without salt? It turns out to be uncomfortable, yaaaa. The salt used at household is sodium chloride (NaCl), which is also known as table salt. Kitchen salt is one of salt that is found in everyday life.

We already know that salt is a compound formed from the reaction between acid and base. Salt is a compound resulting from a neutralization reaction between acid solution and base solution. Generally :



Here are some examples of salt forming reactions (also known as salting reactions or neutralization reactions) :



There are various kinds of salt compounds that are often used in everyday life. One of them is Sodium Chloride. This salt can be used as food seasoning, so the food we eat will taste more delicious.

Not only the the kitchen salt found in life. The One Almighty God has bestowed his grace, with the availability of salts that are beneficial to human life. Some types of salt are often found in daily life as follows:

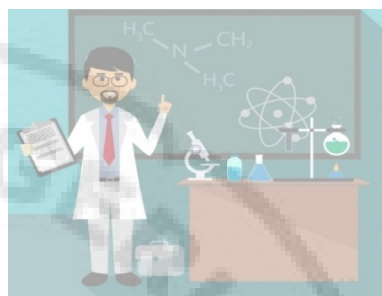
1. Sodium Bicarbonate (NaHCO_3) or known as baking soda, used as a developer on baking and antacid drugs (gastric pains or stomach acid)
2. Sodium Nitrite (NaNO_2) is used as a preservative of processed foods such as sausage, corned beef and burgers.
3. Sodium Benzoate ($\text{C}_6\text{H}_5\text{COONa}$) is used as a preservative of foods and beverages such as fruit juice, soy sauce, margarine, butter, jam and fruit syrup. Sodium benzoate is also used in the manufacture of soft drinks.
4. Potassium Nitrate (KNO_3), sodium nitrate (NaNO_3), ammonium sulfate ($(\text{NH}_4)_2\text{SO}_4$), ammonium nitrate (NH_4NO_3), and ammonium phosphate ($(\text{NH}_4)_3\text{PO}_4$) are used for agricultural fertilizers.
5. Copper (II) sulfate (CuSO_4) and iron (II) sulfate (FeSO_4) are used as plant pesticides.

Table Data of Experiment Using Litmus Paper

No	Solution	Forming Base	Forming Acid	Discoloration		Solution Properties	pH
				Red Litmus	Blue Litmus		
1.	NaCl	Strong	Strong	Red	Blue	Neutral	7
2.	NH_4Cl	Weak	Strong	Red	Red	Acid	< 7
3.	CH_3COONa	Strong	Weak	Blue	Blue	Base	> 7
4.	Na_2CO_3	Strong	Weak	Blue	Blue	Base	> 7
5.	$\text{Al}_2(\text{SO}_4)_3$	Weak	Strong	Red	Red	Acid	< 7
6.	$\text{CH}_3\text{COONH}_4$	Weak	Weak	Red	Blue	Neutral	7
7.	NH_4CN	Weak	Weak	Blue	Blue	Base	> 7

Note : If the salt is formed from acid and base weak, then the properties of salt are determined by the value of k_a and k_b , for NH_4CN the value of $K_a < K_b$ is neutral.

**LET'S
INVESTIGATE**



1. Make a group consist of 5-6 students.
2. Complete the table below based on table in the page 2 with your group

ACID AND BASE PROPERTIES BASED ON LITMUS PAPER

Characteristic of Salt	Name of Salt	The Component				pH
		acid		base		
		weak	strong	weak	Strong	
Neutral						
Acid						
Base						

Discussion Forum

Based on the table of acid and base properties based on litmus paper, try to discuss with your group members some of the following questions!

- 1) How many groups of salt solutions are based on their properties? Mention!
- 2) How can salt be neutral?
- 3) Write down the reaction that produces neutral salt.
- 4) How can salts be acidic?
- 5) Write down the reaction that produces acidic salt
- 6) How can salt be base?
- 7) Write down a reaction that produces a base salt.

Analyze the effect of acid-base salt on salt characteristics based on the complete table that has been done:

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The Conclusion :

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SPEAK UP

In this activity, present the analysis result from the discussion forum. Through this activity, you will train your confidence and ability to communicate. Share your group's opinions in front of the class in turn, so other groups can provide feedback and opinions. Each group will be given 10 minutes to present the report, while the other group can ask and argue.



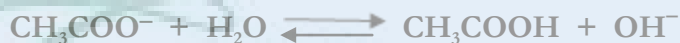
REPORTAGE

After making observations and knowing the various properties of salt, you will discuss how it can occur. In this chapter, you will study a theory that explains the different properties of salt solutions, using the concept of salt hydrolysis.

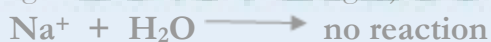
Salt is a compound formed from the reaction between acid and base. The word Hydrolysis comes from Yunani, where hydro means water and lysis means decomposition. Salt hydrolysis is described as a reaction of anion or cationsalt's, or both with water. Thus, salt hydrolysis is the decomposition of salt by water which will produce acid and base back. Salt hydrolysis usually affects the pH of a solution.

If you dissolve a salt into water, then there will be two possibilities that occur, namely:

1. Ions derived from weak acids (eg CH_3COO^- , CN^- , and S^{2-}) or ions derived from weak bases (eg NH_4^+ , Fe^{2+} , and Al^{3+}) will react with water. The reaction of an ion with water is called hydrolysis. Ongoing hydrolysis is caused by the tendency of these ions to form the acid or base of the origin. Example :



2. Ions derived from strong acids (eg Cl^- , NO_3^- , and SO_4^{2-}) or ions derived from strong bases (eg Na^+ , K^+ , and Ca^{2+}) do not react with water or hydrolysis does not occur. This is because the ions have no tendency to form the acid or base of the origin. (Remember again about acid-base strength!)



Hydrolysis can only occur in salt solution formed from weak acid ions, weak base ions, or both. Thus, a neutral salt (from strong acids and strong bases) does not occur hydrolysis. To better understand about hydrolysis, consider the following theories:

Acid and Base Strong

Look again at one of the salts derived from acids and bases strong in the table data of experiment using litmus paper, for example NaCl (Sodium Chloride). From the results of the experiment it is found that NaCl salt is neutral and $\text{pH} = 7$. It shows that $[\text{H}^+] = [\text{OH}^-]$. If the salt of NaCl is dissolved in water, the equation of the reaction can be written as follows:



Salt (Sodium Chloride)



Based on the reaction, the NaCl compound undergoes perfect ionization, both cation and anion, only hydrated by water, not reacting with water. Thus, the salt is not hydrolyzed in water. As a result, the concentration of H^+ ions does not change with the OH^- ion concentration, so the salt solution is neutral and has a $\text{pH} = 7$.

"Salt that are formed from strong acids and strong bases not experienced hydrolysis"

Now consider the other salt compounds from the practicum data formed from strong acids and strong bases. What is the nature of the salt compound? If there are groups whose data are not neutral, try to investigate and reanalyze why it can happen.

Example :

The salt below which does not have hydrolysis is

- a. CH_3COONa
- b. K_2SO_4
- c. NH_4Cl
- d. HCOOK
- e. NH_4NO_3

Completion :

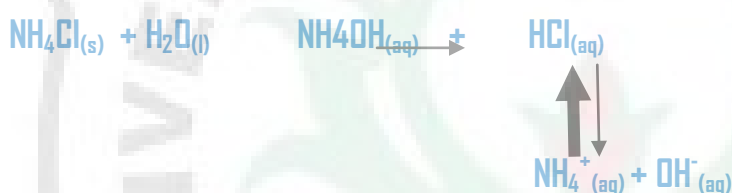
Answer : b

The salt does not undergo hydrolysis is a salt derived from a strong acid and a strong base, namely K_2SO_4 (derived from KOH is a strong base and H_2SO_4 a strong acid).

Strong Acid and Weak Base



Consider again one of the salts formed from strong acids and weak bases in the observation table, example NH_4Cl (Ammonium Chloride). What is the pH of the 0.5 M NH_4Cl solution you get? $\text{pH} = \dots$ properties = How can a 0.5 M NH_4Cl solution be acidic? When the salt is dissolved in water, imagine the following equilibrium :



NH_4OH compounds are more likely to form molecules, whereas HCl compounds will be more likely to form ions. Thus in the solution $[\text{H}^+] > [\text{OH}^-]$, this occurs because OH^- from H_2O forms the NH_4OH molecule while H^+ does not form molecules. Furthermore, NH_4^+ (cations derived from weak base species) is hydrolyzed by water. The reaction is as follows :



Hydrolysis of a cation derived from a weak base produces H^+ ions, while the Cl^- anion (derived from a strong acid species) is not hydrolyzed by water. As a result, the concentration of H^+ ions becomes higher than the OH^- ion concentration. Thus, the salt solution experiences **partial hydrolysis (only cations)**. The salt solution is **acidic** and has a **pH < 7**.

"Salt that are formed from strong acid and weak base weak will experience partial hydrolysis (cation)"

Determine the pH of Salt Solution

From the equation above can be determined equilibrium constant that is:

$$K = \frac{[\text{NH}_4\text{OH}][\text{H}^+]}{[\text{NH}_4^+][\text{H}_2\text{O}]}$$

$$K [\text{H}_2\text{O}] = \frac{[\text{NH}_4\text{OH}][\text{H}^+]}{[\text{NH}_4^+]}$$

Where $[\text{H}_2\text{O}]$ the price is always fixed then the above equation can be written as the price of hydrolysis constant (K_h).

$$K_h = \frac{[\text{NH}_4\text{OH}][\text{H}^+]}{[\text{NH}_4^+]}$$

The relationship between K_h (equilibrium constant of hydrolysis), K_b (the equilibrium ionization equilibrium constant) and K_w (equilibrium water constant) for the above hdirolysis reaction can be searched by multiplying the right side by $\frac{[\text{OH}^-]}{[\text{OH}^-]}$

$$\begin{aligned} K_h &= \frac{[\text{NH}_4\text{OH}][\text{H}^+]}{[\text{NH}_4^+]} \cdot \frac{[\text{OH}^-]}{[\text{OH}^-]} \\ &= \frac{[\text{NH}_4\text{OH}]}{[\text{NH}_4^+][\text{OH}^-]} \cdot [\text{H}^+][\text{OH}^-] \\ &= \frac{1}{K_b} \cdot K_w \end{aligned}$$

So for the salt derived from strong acid and weak base can be formulated the price of hydrolysis of K_h constant as follows:

$$K_h = \frac{K_w}{K_b}$$

From the equation above we can determine the concentration of H^+ is:

$$[H^+] = \sqrt{\frac{K_w}{K_b}} \cdot [g]$$

Information :

K_w = the equilibrium constant of water

K_b = the base ion equilibrium constant

$[g]$ = salt molarity

$$pH = -\log [H^+]$$

Now look again at the results of the observation table, try to calculate how many pH of salt formed from strong acid and weak base using the above calculation. Are the results consistent with your observations? If not, discuss with your group why it happened!

Example :

If the concentration of NH_4Cl 0,5 M and the K_b NH_4OH is $1,8 \cdot 10^{-5}$. So the pH of solution is

...

a. 3,8

b. 4,8

c. 7,8

d. 8,8

e. 9,8

Jawab: C

The ammonium chloride solution is formed from a weak base mixture (NH_4OH) with a strong acid (HCl)

Completion :

Thus, the salt solution experience partial and acidic hydrolysis : $NH_4Cl_{(aq)} \rightarrow NH_4^+_{(aq)} + Cl^-_{(aq)}$

Hydrolyzed ions are NH_4^+ ions. The concentration of NH_4^+ ions is 0.5 M. Thus, the pH of the salt solution can be obtained by the following equation:

$$[H^+] = \sqrt{\frac{K_w}{K_b}} \cdot [g]$$

$$[H^+] = 1,6 \cdot 10^{-5} \text{ M}$$

Thus, the pH of said salt solution is 4.8

Weak Acid and Strong Base

Take a look at the observation tables you've worked on, look at one example of a salt formed from a weak acid and a strong base, such as CH_3COONa (Sodium Acetate). What is the pH and the CH_3COONa 0.2M solution you find? How can the solution be base? If CH_3COONa is dissolved in water, imagine the following equilibrium:



CH_3COOH compounds are more likely to form molecules, whereas the NaOH compounds will be more likely to form ions. Thus in the solution $[\text{H}^+] < [\text{OH}^-]$, this occurs because H^+ of H_2O forms CH_3COOH while OH^- does not form molecules. Furthermore CH_3COO^- (anions derived from weak acid species) is hydrolyzed by water. The reaction is as follows :



Hydrolysis of anions derived from weak acids produces OH^- ions, while Na^+ cations (derived from strong base species) are not hydrolyzed by water. As a result, the concentration of H^+ ions becomes less than the OH^- ion concentration. Thus, the salt solution undergoes partial hydrolysis (only anions only). The salt solution is alkaline and has a $\text{pH} > 7$.

“Salt that are formed from weak acids and strong base will experience partial hydrolysis (anion)”

Determine the pH of Salt Solution

From the equation above can be determined equilibrium constant that is:

$$K = \frac{[\text{CH}_3\text{COOH}][\text{OH}^-]}{[\text{CH}_3\text{COO}^-][\text{H}_2\text{O}]}$$

$$K [\text{H}_2\text{O}] = \frac{[\text{CH}_3\text{COOH}][\text{OH}^-]}{[\text{CH}_3\text{COO}^-]}$$

Where $[H_2O]$ the price is always fixed then the above equation can be written as the price of hydrolysis constant (K_h).

$$K_h = \frac{[CH_3COOH][OH^-]}{[CH_3COO^-]}$$

The relationship between K_h (equilibrium constant of hydrolysis), K_b (the equilibrium ionization equilibrium constant) and K_w (equilibrium water constant) for the above hdirolysis reaction can be searched by multiplying the right side by $\frac{[H^+]}{[H^+]}$

$$\begin{aligned} K_h &= \frac{[CH_3COOH][OH^-][H^+]}{[CH_3COO^-][H^+]} \\ &= \frac{[CH_3COOH]}{[CH_3COO^-][H^+]} [H^+][OH^-] \\ &= \frac{1}{K_a} \cdot K_w \end{aligned}$$

So for the salt derived from strong acid and weak base can be formulated the price of hydrolysis of K_h constant as follows :

$$K_h = \frac{K_w}{K_a}$$

From the equation above we can determine the concentration of OH^- is :

$$[OH^-] = \sqrt{\frac{K_w}{K_a}} \cdot [g]$$

Information :

K_w = the equilibrium constant of water

K_a = the acid ion equilibrium constant

$[g]$ = salt molarity

$$pOH = -\log [OH^-]$$

$$pH = 14 - pOH$$

Now look again at the results of the observation table, try to calculate how the pH of the salt compound formed from weak acid and strong base using the above calculations. Are the results consistent with the results of your practicum? If not, discuss with your group why it happened!

Example :

If the concentration of CH_3COONa 0,2 M and the K_a is CH_3COOH 2.10^{-5} So, the pH of solution is

Answer :

The sodium acetate solution is formed from a strong base mixture (NaOH) with a weak acid (CH_3COOH).

Completion :

Thus, the salt solution experience partial and alkaline hydrolysis.

$\text{CH}_3\text{COONa}_{(\text{aq})} \rightarrow \text{Na}^+_{(\text{aq})} + \text{CH}_3\text{COO}^-_{(\text{aq})}$ The hydrolyzed ion is the Na^+ ion. The concentration of Na^+ ions is 0.2 M. Thus, the pH of the salt solution can be obtained by the following equation:

$$[\text{OH}^-] = \sqrt{\frac{K_w}{K_a} \cdot [\text{g}]}$$

$$[\text{OH}^-] = 10^{-5} \text{ M}$$

Thus, the pH of said salt solution is 9.

Acid and Base Weak

In contrast to the three types of salts previously described, salts derived from weak acids and weak bases when dissolved in water will experience total hydrolysis. Consider the practice results in the observation table for salts derived from weak acids and weak bases, example $\text{CH}_3\text{COONH}_4$. Note the pH of the 0.1 M $\text{CH}_3\text{COONH}_4$ solution.

What is the properties of the solution? Both cations of both weak bases and anions of weak acids can be hydrolysed. The reaction is as follows :



As it turns out, the hydrolysis of both ions produces H^+ ions and OH^- ions. Thus, the salt solution undergoes total hydrolysis. The nature of the resulting solution depends on the ratio of strength of weak acid (K_a) to weak base strength (K_b).

There are three possible comparisons K_a to K_b values:

- $K_a > K_b$:** acid properties are more dominant; salt solution is **acidic**; **pH of salt solution is less than 7.**
- $K_a = K_b$:** both acid and base properties dominate; salt solution is neutral; **pH of salt solution equal to 7.**
- $K_a < K_b$:** the nature of bases is more dominant; salt solution is **basic**; **pH of salt solution more than 7.**

"Salt that are formed from weak acid and weak base will experience total hydrolysis"

Determine the pH of Salt Solution

Now consider again the K_a and K_b constant obtained in the above equation. If both equations are related to the water equilibrium constant (K_w), then the hydrolysis constant for salts derived from weak base and weak acid the formed is defined:

$$K_h = \frac{[\text{CH}_3\text{COOH}][\text{OH}^-]}{[\text{CH}_3\text{COO}^-]} \times \frac{[\text{NH}_4\text{OH}][\text{H}^+]}{[\text{NH}_4^+]} \times \frac{[\text{OH}^-]}{[\text{H}^+]}$$

$$K_h = \frac{K_w}{K_a \cdot K_b}$$

From the above equation we can know that the price $[\text{H}^+]$ is not dependent on salt concentration but only bergantung on price K_a or K_b .

Jika $K_a > K_b$

$$[\text{H}^+] = \sqrt{\frac{K_w \cdot K_a}{K_b}}$$

Jika $K_a < K_b$

$$[\text{OH}^-] = \sqrt{\frac{K_w \cdot K_b}{K_a}}$$

Example :

Calculate the pH of NH_4CN 2,00 M!

($K_a \text{ HCN} = 4,9 \cdot 10^{-10}$ and $K_b \text{ NH}_4\text{OH} = 1,8 \cdot 10^{-5}$).

Answer : The ammonium cyanide solution is formed from a weak base mixture (NH_4OH) with a weak acid (HCN). Thus, total hydrolysis total.



Hydrolyzed ion are ion NH_4^{+} dan ion CN^{-} .

Thus, the pH of the saline solution can be obtained by the following equation:

$$[\text{H}^{+}] = \sqrt{\frac{K_w \cdot K_a}{K_b}}$$

$$[\text{H}^{+}] = 5,22 \cdot 10^{-10} \text{ M}$$

Thus, the pH of said salt solution is 9.28.

EXERCISE

- Write the hydrolysis reaction of the following salt!
a. KCN b. CuSO_4 c. Na_3PO_4
- Into 250 ml water was dissolved 5.35 gram NH_4Cl . If the K_b of NH_4OH (aq) is 1.8×10^{-5} , calculate the pH of the solution. (Mr. $\text{NH}_4\text{Cl} = 53.5$)
- If 100 mL of 0.2 M CH_3COOH solution mixed with 100 ml of 0.2 M NaOH solution with the $K_a \text{ CH}_3\text{COOH} = 2 \times 10^{-5}$. Determine the pH of the solution!
- How many grams of NH_4Br should be dissolved in 500 mL of solution to obtain solution with $\text{pH} = 5 - \log 2$? ($K_b \text{ NH}_4\text{OH}_{(\text{aq})} = 1.8 \times 10^{-5}$) Ar N = 14; H = 1; Br = 80.
- If the $K_a \text{ HOCN} = 3.3 \times 10^{-4}$ and $K_b \text{ NH}_3 = 1.75 \times 10^{-5}$. Calculate the pH of 0.4 M NH_4OCN solution!



KEMENTERIAN RISET, TEKNOLOGI, DAN PENDIDIKAN TINGGI
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Laman : www.fmipa.unimed.ac.id

Nomor : 1046 /UN33.4.1/LT/2018
Lampiran : 1 (satu) berkas Proposal Penelitian
Perihal : Izin Melaksanakan Penelitian
Kepada Yth. : Sdr. Kepala SMA Negeri 1 Taring Tinggi
di
Tempat

Medan, 08 Februari 2018

Dengan hormat, kami memohon bantuan Saudara agar dapat memberikan izin melaksanakan penelitian di instansi yang Saudara pimpin kepada mahasiswa kami tersebut di bawah ini :

Nama : Devi Rianti Sari
NIM : 4143332007
Jurusan : Kimia
Program Studi : S-1 Pendidikan Kimia Bilingual
Dosen Pembimbing : Prof. Dr. Ramlan Silaban, M.S.
Judul Penelitian : The Development of Teaching Material Based on Salt Hydrolysis for Grade XI Senior High School.

Perlu diketahui bahwa kegiatan ini dilaksanakan untuk memperoleh data yang akan digunakan dalam penyusunan skripsi mahasiswa tersebut guna memenuhi salah satu syarat memperoleh gelar Sarjana Pendidikan (S.Pd) di FMIPA Unimed.

Demikian kami sampaikan, atas perhatian dan kerja sama yang baik diucapkan terima kasih.

a.n. Dekan
Wakil Dekan Bidang Akademik

Prof. Dr. Herbert Sipahutar, M.S., M.Sc
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dan Ilmu Pengetahuan
di-

Medan

Nomor: 421.3/020 /SMA.01/2018

Lamp. : -

Hal : Izin Melaksanakan Penelitian

Dengan hormat.

Sehubungan dengan surat Saudara Nomor : 1096/UN33.4.1/LT/2018, tanggal 08 Februari 2018, mengenai hal pada pokok surat di atas, melalui surat ini kami sampaikan kepada Saudara bahwa kami memberikan izin kepada :

Nama : Devi Rianti Sari
NIM : 4143332007
Jurusan : Kimia
Program Studi : S1 Pendidikan Kimia Bilingual

untuk melakukan Penelitian di SMA Negeri 1 Kota Tebing Tinggi, dengan judul penelitian :

**The Development of Teaching Material Based on Salt Hydrolysis
for Grade XI Senior High School**

Demikian surat ini kami sampaikan untuk dapat dipergunakan dalam urusan selanjutnya, terima kasih.



580703 198703 1 003



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SURAT KETERANGAN
Nomor : 421.3/082 /SMA.01/2018

Yang bertanda tangan di bawah ini :

Nama : **Drs. Sariono**
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Jabatan : Kepala Sekolah
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Dengan ini menerangkan bahwa :

Nama : **Devi Rianti Sari**
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Program Studi : S-1 Pendidikan Kimia Bilingual

Sesuai dengan surat Nomor : 1096/UN33.4.1/LT/2018, tanggal 08 Pebruari 2018, benar telah melakukan Penelitian pada tanggal 14 Februari sampai dengan 16 Maret 2018 di SMA Negeri 1 Kota Tebing Tinggi, dengan judul Penelitian :

**The Development of Teaching Material Based on Salt Hydrolysis
for Grade XI Senior High School**

Demikian Surat Keterangan ini diperbuat untuk dipergunakan dalam urusan selanjutnya. Terima kasih.

Tebing Tinggi, 16 Maret 2018



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SURAT PERNYATAAN

Saya yang bertanda tangan di bawah ini :

Nama : Dr. Ir. Nurfajriani, M.Si
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Jabatan : Dosen Kimia
Jurusan : Kimia

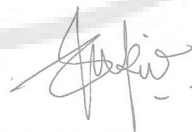
Telah menjadi validator instrument test untuk penelitian yang berjudul "**The Development of Teaching Material Based on Science Literation on Salt Hydrolysis for Grade XI Senior High School**" dari mahasiswa :

Nama : Devi Rianti Sari
NIM : 4143332007
Jurusan : Chemistry
Program studi : Chemistry Education Study Program
Fakultas : MIPA

Demikianlah surat pernyataan ini saya perbuat dengan sebenar – benarnya, sekian dan terimakasih.

Medan, 7 February 2018

Validator,



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SURAT PERNYATAAN

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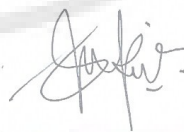
Telah menjadi validator modul untuk penelitian yang berjudul **"The Development of Teaching Material Based on Science Literation on Salt Hydrolysis for Grade XI Senior High School"** dari mahasiswa :

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Demikianlah surat pernyataan ini saya perbuat dengan sebenar – benarnya, sekian dan terimakasih.

Medan, 7 February 2018

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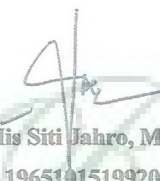
Nama : Dr. Iis Siti Jahro, M.Si
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Jabatan : Dosen Kimia
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Telah menjadi validator modul untuk penelitian yang berjudul "The Development of Teaching Material Based on Science Literation on Salt Hydrolysis for Grade XI Senior High School" dari mahasiswa :

Nama : Devi Rianti Sari
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Program studi : Chemistry Education Study Program
Fakultas : MIPA

Demikianlah surat pernyataan ini saya perbuat dengan sebenar – benarnya, sekian dan terimakasih.

Medan, February 5th 2018
Validator,


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NIP: 196510151992032003



KEMENTERIAN RISET, TEKNOLOGI, DAN PENDIDIKAN TINGGI
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FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
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KELAS BILINGUAL / KELAS BERSTANDAR INTERNASIONAL

Jln Willem Iskandar, Psr V Medan 20221. Telp. (061)6613319-6614002

Kepada Yth. Prof. Dr. Ramlan Silaban, M.S
Dosen Kelas Bilingual Berstandar Internasional
FMIPA UNIMED
di
Medan

Nomor: 092/BIL/LK/VIII/2017

Dengan hormat, kami meminta kesediaan Saudara untuk menjadi dosen Pembimbing dalam penyusunan Skripsi atas nama mahasiswa:

Nama : Devi Rianti Sari
NIM : 4143332007
Program Studi : Chemistry Education

Sebagai salah satu persyaratan untuk memperoleh gelar sesuai dengan Program Studinya. Demikian kami sampaikan, atas kerjasama yang baik kami ucapkan terima kasih.



Wakil Dekan Bidang Akademik,

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Medan, 22 Agustus 2017
Koordinator Kelas Bilingual

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SURAT PERSETUJUAN

Mahasiswa yang namanya tersebut di bawah ini:

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Dapat saya setuju untuk dibimbing dalam penyusunan Skripsinya dalam rangka memenuhi salah satu persyaratan untuk memperoleh gelar sesuai dengan program studinya.

Medan, 22 Agustus 2017
Dosen Pembimbing Skripsi

Prof. Dr. Ramlan Silaban, M.S
NIP. 19960618 198703 1 002

Dibuat rangkap 4 (empat):

1. Kuning untuk Fakultas
2. Merah untuk Bilingual
3. Hijau untuk Dosen Pembimbing
4. Putih untuk Yang Bersangkutan