

YEAR 4

SEMESTER 2

Four-Year B.Ed. Course Manual

CHEMISTRY AROUND US





The Government of Ghana



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FOREWORD

These Initial Teacher Education course manuals were developed by a team consisting of members from Colleges of Education and four universities namely the University of Ghana, Kwame Nkrumah University of Science and Technology, University of Education, Winneba, and University for Development Studies. This team was originally constituted by the National Council for Tertiary Education (now the Ghana Tertiary Education Commission) in 2019 to support the delivery of the new B.Ed. curriculum with assistance from T-TEL and UK Aid. The revision, finalization and printing of these manuals took place in 2021 with support from T-TEL and Mastercard Foundation.

The course manuals have been produced for use as general guides for the delivery of the new four-year B.Ed. curriculum in Colleges of Education in collaboration with their affiliated universities. They are designed to support student teachers, tutors and lecturers in delivering a complete B.Ed. course for training student teachers which meet the requirements of the National Teachers' Standards, enabling them to teach effectively in basic schools.

The first section of the manuals is focused on the course information and vision for the B.Ed. curriculum. The second section presents the course details, goal for the subject or learning area, course description, key contextual factors as well as core and transferable skills and cross-cutting issues, including equity and inclusion. The third section is a list of course learning outcomes and their related learning indicators. The fourth section presents the course content which is broken down into units for each week, the topic and sub-strands and their related teaching and learning activities to achieve the learning outcomes and the teaching and learning strategies. This is followed by course assessment components in section five. Each manual contains a list of required reading and references as well as teaching and learning resources. The final section presents course related professional development for tutors and lecturers to be able to use each section of the manual.

Field instructions to guide Supported Teaching in School are integrated into the course manuals to provide the student teacher with guidance in developing teaching throughout the entire period of study to be able to meet the requirements of the National Teachers' Standards (NTS) and the National Teacher Education Curriculum Framework (NTECF). To ensure maximum benefit the course manuals should be used in addition to other resources such as the NTS, NTECF, National Teacher Education & Assessment Policy and the National Teacher Education Gender Equality and Social Inclusion (GESI) Strategy and Action Plan. This will help to ensure that student teachers learning is integrated within the wider teacher education policy framework.

Professor Mohammed Salifu Director General, Ghana Tertiary Education Commission

ACKNOWLEDGEMENTS

The course manuals were developed through the collaborative efforts of a team of individuals from Colleges of Education, University of Ghana, Kwame Nkrumah University of Science and Technology, University of Education, Winneba and University for Development Studies. They were produced in association with the Ghana Tertiary Education Commission of the Ministry of Education, Ghana.

A participatory team approach was used to produce these sets of resources for tutors/lecturers, mentors and student teachers. We are grateful to the specialists who contributed their knowledge and expertise.

Special thanks to Professor Jophus Anamuah-Mensah - T-TEL Key Advisor, Dr. Eric Daniel Ananga T-TEL Key Advisor for Curriculum reform and Beatrice Noble-Rogers who provided key editorial, review and content input and facilitated the process of drafting and finalising the course manual.

Patricia Appiah-Boateng and Gameli Samuel Hahomene, served as typesetting and formatting coordinators and designed and produced the illustrations, tables and other graphics which appear in the pages. They spent time and effort designing and redesigning the graphic layout and producing the camera-ready copies resulting in a set of materials that are easy to use, read and reference.

Thanks also goes to all T-Tel staff members who worked to support production of these course manuals, particularly Beryl Opong-Agyei and Gideon Okai. Their frankness and co-operative attitude complimented the team is approach used to produce these manual.

We are indebted to the Ministry of Education and the Ghana Tertiary Education Commission (GTEC) for the general support and specific helpful advice provided during production of the course manuals. Recognition and thanks must go to Chief Technical Advisor for T-TEL and Policy Advisor to the National Education Reform Secretariat, Akwasi Addae-Boahene, Prof. Mohammed Salifu, the Director General of GTEC and Mr. Jerry Sarfo the coordinator for the colleges of education, who in diverse ways supported during the course manual writing workshops.

In addition to all the staff who participated visibly in the development of these materials we would like to acknowledge all those people from the many colleges of education and universities in which we have worked and who have directly or indirectly, shared their views on the curriculum with us.

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INTRODUCTION TO COURSE MANUALS

Welcome to this B.Ed. Course manual.

Following the accreditation of the B.Ed. by the national accreditation Board with its recognition as a world class teacher education curriculum, the decision was taken to support effective implementation through the development of course manuals. The course manuals provide tutors and lecturers with the materials necessary to support teaching each of the B.Ed. courses. The manuals adhere directly to, and emphasise, the principles and standards set out in the NTS, NTECF and in the B.Ed. and will help ensure operationalising the Government's teacher education reform Policy.

The manuals serve the following purposes:

- they are the key educational agreements between the training institution and the student teachers. In this way student teachers know what the expectations are for them and for the training they will receive.
- they lay out the course outcomes, content, strategies, and assessment, thereby providing direction to and consistency in training and B.Ed. implementation among tutors across the country.
- they are explicit documents that provide other institutions with information on which to base transfer/ articulation decisions.

Specifically, they also:

- support coherent lesson planning and teaching which will enable student teachers to achieve the NTS and become good teachers who ensure all pupils' learning whilst offering tutors the flexibility for adaptation for local needs and contexts.
- Provide a lesson by lesson overview of the course, building on and developing the material in the course specifications.
- Inform tutors, student teachers and others working with student teachers about:
 1. What is to be taught and why.
 2. how it can be taught.
 3. how it should be assessed.
- Provide opportunities for student teachers to develop and apply knowledge during supported teaching in school, creating a strong bond between learning in school and in the training institution.
- Reflect the stage of student teacher development, set out in the model for progress across the four years of the B.Ed.
- Can be used as self-study tools by student teachers.
- Ensure that all information necessary to inform teacher training is in one place (serves as reference document).
- The manuals are the basis of the codes and university professional development sessions to ensure Principals, tutors, lecturers and heads of department are fully familiar with the details of: courses, outcomes, content, approaches, assessments and lessons.

Who are course manuals for:

- College of Education Tutors
- Teacher Education University Lecturers
- Student Teachers
- Mentors and Lead Mentors
- All Those with An Interested In Teacher Education.

USING THIS MANUAL

Writers of the manuals engaged widely with colleagues in each subject area at each stage of development. Besides, writers envisaged themselves in varied contexts as they wrote, to suggest methodologies and strategies for teaching the strands which would ensure student teachers are enabled to achieve the learning outcomes. In view of our commitment to creativity, problem solving, collaboration and to lifelong learning, we expect that individual tutors will “own” their manuals and become user-developers. Lessons in the manuals will be strands for weekly Pd meetings where tutors/lecturers will situate the lessons in the contexts of their colleges and their student teachers, to maximize the benefits.

It is also expected that tutors will model the best pedagogic practices for student teachers. Key among such practices is the communication of the importance of having a personal teaching philosophy. We expect that tutors and lecturers will explicitly communicate their personal teaching philosophies to their student teachers during the first meeting of every course. In preparation for this, we suggest you set out your personal teaching philosophy and how it will be demonstrated in your teaching using, or adapting, the sample sentence introductions below.

My teaching philosophy is

In view of this philosophy, I will facilitate this course by/through

A. Course Information					
Teaching Strategies and Assessments					
The vision for the New B.Ed. Curriculum					
The vision is to transform initial teacher education and train highly qualified, motivated new teachers who are effective, engaging and fully prepared to teach the JHS school curriculum. This would improve the learning outcomes and life chances of all learners they teach as set out in the National Teachers' Standards. In doing this it would instill in new teachers the Nation's core values of honesty, integrity, creativity and responsible citizenship and to achieve inclusive, equitable, high quality education for all learners					
i. Course Details					
Course Name	Chemistry Around Us				
Pre-requisite	Introduction to Basic Chemistry II				
Course Level	400	Course Code		Credit Value	3
1. Goal for the Subject or Learning Area					
The science programme is designed to transform the JHS teacher into one imbued with the right knowledge, technology, pedagogy, innovation, content and the core values and attitudes to promote inclusivity and inspire active learning at the JHS school level.					
2. Course Description					
The course for semester two of year Three uses the universal design for learning approach to extend the integrated science concepts for the JHS level and introduce specific teaching strategies and Assessment to the JHS curriculum so as to provide an enabling environment for student teachers to share their experiences for mopping up procedures. The following areas will guide the learning process: Reviewing the previous course on preparing to teach, Reviewing the basic school integrated science curriculum, implementing the basic school science curriculum, and reflective Practices. This is done through appropriate pedagogies such as Nature walk, talk for learning approaches, demonstrations, concept mapping, problem-based teaching /learning, and video presentations as well as authentic assessments mode such as concept mapping, using checklist to identify values and attitudes and, mind maps which provides for the teachers' attention on the need to ensure equity and the provision for SEN. This course continues to emphasize on the essential attitudes and values (NTS, 1a-c) of professional science teaching such as honesty, carefulness and accuracy. The student teacher, in this course, should be introduced to issues of transition in terms of use of the English language as medium of instruction and characteristics and learning styles of early adolescent, Supported Teaching in School (STS) (NTS, 2e), and managing transitions within early grade classes. (NTS, 2e, p.13), (NTS, 1a-c, p. 12), (NTS, 2c, P. 13).					
3. Key Contextual Factors					
Several interventions have been initiated by government to promote the teaching and learning of science in schools, as science is the gateway to industrial and technological growth. There are numerous challenges faced by secondary science education which includes the need for science equipment and also qualified science teachers who are trained to integrate ICT into the teaching and learning process.					
There is also a need for a conducive learning environment for a section of the early adolescent population who have the conception that STEM subjects are for boys rather than girls.					
The learning activities for this semester seeks to relate science to the learners' environment, make science culturally relevant and inclusive. It also seeks to promote professional scientific attitudes and skills development such as critical thinking, honesty, patience, sincerity, precision, and accuracy. Sensitive concepts may be explained within the appropriate local dialect and/or practices, in order to remove barriers that could prevent students of diverse abilities and strengths from participating in any science lesson, as well as managing transition from the upper primary through to the end of the JHS grade learning.					
4. Core and transferable skills and cross cutting issues, including equity and inclusion					
Critical and Independent Thinking, Equity and Inclusivity, Social Collaboration/Team work, Creativity, Innovation, Problem solving, Manipulation, Reflection, Developing scientific process skills and Inquiry.					
5. Course Learning Outcomes			6. Learning Indicators		
CLO1. explain the types of chemical bonding and how they define the characteristics of chemical substances. (NTS p.13;2b)			<ul style="list-style-type: none"> • Provide worksheets on types of chemical bonding and its definition on the characteristics of chemical substances. 		
CLO2. demonstrate understanding of the importance of pH in daily activities such as farming, food processing and water treatment. (NTS p.13;2b)			<ul style="list-style-type: none"> • Prepare Photograph/Report/video to show a visit to a farm, food processing company and water treatment plant • Provide exercises in student teachers' workbook on the use of pH in classifying solutions and discuss their importance in farming, food processing and water treatment 		

CLO3. demonstrate adequate knowledge on the importance of electrolytes and non-electrolytes and discuss buffers and their applications (NTS p.14, 3i), (NTS p. 13, 2b)	<ul style="list-style-type: none"> • Present group report on the chemical and biological importance of electrolytes from non-electrolytes • Design chart showing applications of buffer in chemical systems and in everyday life
CLO4. Recognize the uses and economic importance of water and describe our climate (tropical wet and dry) and its effect on food production as well as explain the chemical importance of nitrogen and phosphorus cycles in food production. (NTS 1a, 1b & 1e, p12; 2b, p13; 3a & 3i, Pg.14)	<ul style="list-style-type: none"> • Collect samples of multimedia/PowerPoint presentation on the use and the economic importance of water • Provide a short write-up on the climate and its effect on food production
CLO5. Further studies on secondary school chemistry curriculum and co- planning, co-teaching and co-assessment	<ul style="list-style-type: none"> • Prepare Lesson notes that caters for special needs, equity, inclusivity and is conceptual-based • Present report on peer- review of co- planning, co-teaching and co-assessment by student teachers

7. Course Content

Unit (Week)	Topic	Subtopic (if any)	Teaching and learning activity to achieve the learning outcomes
Week 1	Recap of the course Introduction to Basic Chemistry II and Introduction to Chemistry Around Us Manual	<ul style="list-style-type: none"> • Recap of Introduction to Basic Chemistry II lessons and challenges thereof. • Introducing Year 4 semester 2 CM. 	<ul style="list-style-type: none"> • Demonstrations and discussions of Introduction to Basic Chemistry II CM • Reflections, presentations and designing Maps on challenges and unique nature of Y4 semester 2 CM
Week 2	Chemical bonding in substances	<ul style="list-style-type: none"> • Physical properties of compounds • Chemical properties of compounds 	<ul style="list-style-type: none"> • Discussion on the how the bonds in a substance define its physical properties such as solubility in water • Video presentation on the formation of covalent and ionic bonds
Week 3	Hydrogen ion concentration (pH) in systems	<ul style="list-style-type: none"> • Importance of pH in the food industry/preservation. 	<ul style="list-style-type: none"> • Show thoughts discussion and videos presentations of PH in substances and foods • Simulation and multimedia presentations on importance of PH in food preservations.
Week 4	Hydrogen ion concentration (pH) in systems	<ul style="list-style-type: none"> • Concept of buffer • Buffers and their applications 	<ul style="list-style-type: none"> • Videos presentations and discussions of Buffers and the application of buffers • Reflection on practicing professional attitudes and skills. • Demonstrate some buffer applications
Week 5	Electrolytes and non-electrolytes	<ul style="list-style-type: none"> • Conceptual meaning of electrolytes and non-electrolytes • Importance of electrolytes and non-electrolytes 	<ul style="list-style-type: none"> • Pyramid discussions are used to explain the concepts of electrolytes and non-electrolytes. • Simulations and brainstorming activities on the importance of electrolytes
Week 6	Course Review with STS seminar	<ul style="list-style-type: none"> • Reviewing and reflecting on all lessons • STS Seminar on post Internship 	<ul style="list-style-type: none"> • Face-to-face: Discussion, talk for learning approaches with student teacher presentations on lessons learnt from week 1 to week 5 • Independent Study: problem-based learning on National Teacher's Standards and reflection on what has been observed and done during STS.

Week 7	Water	<ul style="list-style-type: none"> • Aqua chemistry • Purification Water • Uses of water and economic Importance 	<ul style="list-style-type: none"> • PowerPoint Presentation and Discussion of Water, its Structure and its purification • Seminar/field trip to water treatment plant
Week 8	Climate	<ul style="list-style-type: none"> • Types of climate (Wet tropical, Tropical monsoon, Tropical wet and dry) 	<ul style="list-style-type: none"> • Discussions and Group presentations on climate and climate types • Reflections on Climate Changes
Week 9	Food Production	<ul style="list-style-type: none"> • Relationship between chemicals and food production (Nitrogen, potassium and phosphorus) 	<ul style="list-style-type: none"> • OER/video presentations on climate change and its effects on food production • Field trip interactions to the farms/markets to find the effect of climate on food production • Discussion on the importance of nitrogen, potassium and phosphorus in food production.
Week 10	Further studies on the Secondary School Chemistry Curriculum	<ul style="list-style-type: none"> • Prepare 30-minute lessons that demonstrate content and pedagogical issues enshrined in the curriculum • Identify students who struggle to overcome barriers • In collaboration with co-teacher and mentor, write individualized plans of action, including differentiated instruction/assessment 	<ul style="list-style-type: none"> • Talk for learning approaches on how to prepare a typical lesson plan that caters for special needs, equity, inclusivity and is conceptual-based • Video/ multimedia simulation on a typical chemistry lesson that is inclusive. • Group presentation and reflections of well-prepared lesson plans and differentiated instruction/ assessment tools.
Week 11	Co- planning, co-teaching and co-assessment	<ul style="list-style-type: none"> • Plan for and teach sequences of lessons with regard issues of equity and inclusivity. evaluate and reflect on teaching and on pupils' learning to support students 	<ul style="list-style-type: none"> • Small group discussions on co-planning, co-teaching and co-assessment • Diagnostic assessment tools by student teachers mixed ability/gender based group. • Seminar presentations on co-planning, co-teaching and co-assessment in mixed ability/gender based group. • Role play/student practice of teaching strategies to teaching and assessment
Week 12	Course Review II with STS seminar	<ul style="list-style-type: none"> • Reviewing and reflecting on lessons 7-11 and Post STS Seminar 	<ul style="list-style-type: none"> • Face-to-face: Discussion, talk for learning approaches with student teacher presentations on lessons learnt from week 7 – week 11 • Independent Study: problem-based learning on National Teacher's Standards and reflection on Post STS

Teaching and Learning Strategies:

Group Discussions, Role Play activities, Multimedia presentations, Independent Study, face-to-face, video presentations, simulations and Computer assisted instructions, field trips and seminar presentations, talk for learning approaches, showthought, practical demonstrations, problem solving tutorials, interactive demonstrations.

Course Assessment Components:

Component 1: Subject Portfolio Assessment (30% overall score)

- Selected Item of Student work (3 items – 10%) = 30%
- Midterm assessment – 20%
- Reflective Journal – 40%

Organization of the Subject Portfolio- 10% (How its presented/organized)

Component 1: Summary of Assessment Method: ~~End of Semester Examination on key concepts as shown in the lessons.~~

Core skills to be acquired: Cognitive, literacy, numeracy, writing and reading

Weighting: 40%

CLO1 to CLO6

NTS

1

Professional Development

The Teacher(s):

- a) Critically and collectively reflects to improve teaching and learning.
- b) Improves personal and professional development through lifelong learning and Continuous Professional Development.

Community of Practice

The Teacher:

- d) Is guided by legal and ethical teacher codes of conduct in his or her development as a professional teacher.

2

Knowledge of educational frameworks and curriculum

The Teacher:

- a) Demonstrates familiarity with the education system and key policies guiding it.
- b) Has comprehensive knowledge of the official school curriculum, including learning outcomes.
- c) Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in.

Managing the learning environment

The Teacher:

- a) Plans and delivers varied and challenging lessons, showing a clear grasp of the intended outcomes of their teaching.

3

Managing the learning environment

The Teacher:

- a) Plans and delivers varied and challenging lessons, showing a clear grasp of the intended outcomes of their teaching.

Assessment

The Teacher:

- k) Integrates a variety of assessment modes into teaching to support learning.

Component 2: Subject Project (30% overall Semester score)

- **Introduction; a clear statement of aim and purpose of the project -10%**
- **Methodology; What the student teacher has done and why to achieve the purpose of the project – 20%**
- **Substantive/Main section of the work – 40%**

Conclusion – 30%

Component 2: Assessment for Learning Presentations/Portfolio

Summary of Assessment Method: Peer Review / Tutor assessment of portfolio of materials and resources amassed during the course:

In the final session of the course student teachers present the teaching and learning portfolios they have developed during the course for peer review and then tutor assessment. The final portfolio should include: all the items added throughout the course: presentations, TLMs, example plans for lessons and an up-dated personal teaching philosophy for teaching early grade science, a list of key lessons learned during the course and three targets for developing their skills, knowledge and understanding of teaching and learning further–

Weighting: 30%

CLO 1, CLO 4, CLO5 and CLO6

NTS:

1b) Improves personal and professional development through lifelong learning and Continuous Professional Development.

1d) Is guided by legal and ethical teacher codes of conduct in his or her development as a professional teacher.

1g) Sees his or her role as a potential agent of change in the school, community and country

<p>2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes</p> <p>2c) Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in.</p> <p>3e) Employs a variety of instructional strategies that encourages student participation and critical thinking.</p> <p>3i) Explains concepts clearly using examples familiar to students.</p> <p>3j) Produces and uses a variety of teaching and learning resources including ICT, to enhance learning</p>
<p>Component 3: End of Semester Examination – (40% overall Semester Assessment) Component 3: Assessment as Learning Review of Reports/Portfolio Summary of Assessment Method: Peer Review documents/ Evidence of report from school (STS) visits for portfolio/Reflective notes and as prescribed by University of Affiliation Core skills to be acquired: Pedagogical, observational and cooperative skills Weighting: 30% Write a 1500 word report on what strategies need to be used in science teaching to ensure all learners are included and that the teaching is appropriate to the typical characteristics of the upper primary learner. Include reference: to examples of teaching you have observed and taken part in in school; topics covered during the course and The Basic School Science Curriculum CLO1, CLO4, CLO5 and CLO6 NTS: 1a) Critically and collectively reflects to improve teaching and learning 2c) Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in. 3m) Identifies and remediates learners’ difficulties or misconceptions, referring learners whose needs lie outside the competency of the teacher.</p>
<p>Required Reading and Reference List</p> <p>Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J. W., Fometu, E., &Wiredu, M.B. (2008). <i>Ghana association of science teachers integrated science for senior high schools</i>. Accra: Unimax MacMillan.</p> <p>Abbey, T. K., &Essiah, J.W. (1995). <i>Ghana association of science teachers physics for senior high schools</i>. Accra: Unimax Macmillan.</p> <p>Ameyibor, K., &Wiredu, M. B. (2006). <i>Ghana association of science teachers’ chemistry for senior high schools</i>. Accra: Unimax MacMillan.</p> <p>Asabere-Ameyaw, A., &Oppong, E. K. (2013). <i>Integrated science for the basic school teacher I</i>. Winneba: IEDE.</p> <p>Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V.&Obeng-Ofori, D. (2011). <i>SWL integrated science for senior high schools: Students book</i>. Accra, Ghana; Sam-Woode Ltd.</p>
<p>Teaching and Learning resources</p> <p>Smartphones, Tablets, Productivity tools (software that allow teachers to work better), Subject based instructional tools/applications, Instructional laboratories, Smart boards, projectors, Smart screens, Open ERs – YouTube, Coursera, Khan Academy, TESSA and UNESCO OERs, iBox, and standard laboratories</p>
<p>Course related professional development for tutors/ lecturers</p> <ul style="list-style-type: none"> • Development of Concept Maps/ Concept cartoons Charts/ technical/action research report writing/ • Training in Use of CMs/ Appreciating the place of the Cross-cutting issues in the CLOs and Teaching -Learning Activities/ Assessment component requirement for active learning/ model teaching to reflect the desired PCK students-teachers are required to learn.

LESSON 1

Year of B.Ed.	4	Semester	2	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12
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Title of Lesson	Recap of the course Introduction to Basic Chemistry II and Introduction to Chemistry Around Us Manual						Lesson Duration	3 Hours
Lesson description	The lesson is intended to review and embed principles and concepts acquired in the course basic chemistry II and how these can be used to develop concepts in the chemistry around us. Further, the lesson is designed to embed concepts in chemistry that are often used on a daily basis in the environment.							
Previous student teacher knowledge, prior learning (assumed)	Student teachers have been introduced to the course on Basic Chemistry II.							
Possible barriers to learning in the lesson	Possible misconceptions that student teachers may bring to the classroom: <ul style="list-style-type: none"> Dogma of the composition of compounds in the home and environment. 							
Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face ✓	Practical Activity	Work-Based Learning	Seminars ✓	Independent Study ✓	e-learning opportunities ✓	Practicum	
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	Face-to face: Discussions, demonstrations and observations, rhyming and singing Seminars: Presentations and discussions Independent Study: Reflections e-learning Opportunities: Simulations, video presentations							
Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description. <ul style="list-style-type: none"> Write in full aspects of the NTS addressed 	<ul style="list-style-type: none"> Develop appropriate knowledge in some chemical compounds in the environment. Discard the preconceived notion some compounds in the environment. (NTS) 2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in. 2e: Understands how early adolescent learner learns in diverse contexts and applies this in his or her teaching. 3d: Manages behaviour and learning with small and large classes)							
<ul style="list-style-type: none"> Learning Outcome for the lesson, picked and developed from the course specification Learning indicators for each learning outcome 	Learning Outcomes			Learning Indicators		Identify which cross-cutting issues, core and transferable skills, inclusivity. Equity and addressing diversity. How will these be addressed or developed		
	<ul style="list-style-type: none"> Demonstrate the ability to transfer knowledge and skills from one lesson onto developing new concepts (NTS 2e & 2f, p.13 			<ul style="list-style-type: none"> Present a checklist on new expectations based on the links between Basic chemistry II and chemistry around us. 		Through discussions and sharing of ideas in class student teachers develop the skills of communication, collaboration and		

			mutual respect while appreciating individual difference and abilities. They also acquire skills in handling devices, develop critical thinking, honesty, accuracy and responsibility through active participation in group work/discussion.	
Topic/Title	Sub Topic	Time or Stage	Teaching and learning to achieve learning outcomes: depending on delivery mode selected. Teacher led, collaborative group work or independent study	
			Teacher Activity	Student Activity
Recap of the course Introduction to Basic Chemistry II and Introduction to Chemistry Around Us Manual	Recap of lessons from Basic Chemistry II	60 minutes	Face-to-face: Tutor reviews lessons on Basic Chemistry II with student teachers and leads student teachers to discuss their expectations of Year 4 Semester 2 Course on Chemistry Around Us	Face-to-face: Students teachers discuss lessons on Basic Chemistry II and come out with key concepts from the previous semester lessons.
	Introducing New CM (Chemistry Around Us)	60 minutes	Face-to-face: Teacher initiates a discussion to introduce the new course Manual (CM) to student teachers in whole group.	Face-to-face: Student teachers discuss with tutor on their expectations for the new CM (while skimming through new CM) and the links or similarities with the previous lesson on Basic School Chemistry.
	Reflections on Expectations for the CM	60 minutes	Face-to-face/Group activity: Tutor groups student teachers into mixed ability to discuss and reflect on the new CM	Face-to-face: Student teachers in mixed ability group discuss among themselves and later share their reflections with tutor on the expectations of the new CM.
Which cross cutting issues will be addressed or developed and how	Equity and SEN: through appropriate gender and equity sensitive group work to protect vulnerable student teachers, establish an interactive and inclusive classroom atmosphere.			
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	<ul style="list-style-type: none"> • Assessment as learning: student teachers provide list of key concepts in previous lesson. • Assessment for learning: student teachers in groups provides a reflective report on expectations for new CM. 			
Teaching Learning Resources	Course manual for basic chemistry II and Course Manual for Year 4 semester 2			
Required Text (core)	Abbey, T. K., Alhassan, B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). <i>Ghana association of science teachers integrated science for senior high schools</i> . Accra: Unimax MacMillan; Handbook for PD Coordinators Themes 1 – 10.			
Additional Reading List	Abbey, T. K., & Essiah, J.W. (1995). <i>Ghana association of science teachers physics for senior high schools</i> . Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). <i>Ghana association of science teachers: chemistry for senior high schools</i> . Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). <i>Integrated science for the basic school teacher I</i> . Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V. & Obeng-Ofori, D. (2011). <i>SWL integrated science for senior high schools: Students book</i> . Accra, Ghana; Sam-Woode Ltd.			
CPD Requirement	CoE Tutors need training on arranging and composing rhymes and songs as well as game construction			

Course Assessment	¹ Component 1: Subject Portfolio Assessment (30% overall score) <ul style="list-style-type: none"> • Selected Item of Student work (3 items – 10%) = 30% • Midterm assessment – 20% • Reflective Journal – 40% • Organization of the Subject Portfolio- 10% (How its presented/organized) ² Component 2: Subject Project (30% overall Semester score)
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¹ See rubrics on subject Portfolio Assessment in Annex 6 of NTEAP

² See rubrics on Subject Project Assessment in Annex 6 of NTEAP

LESSON 2

Year of B.Ed.	4	Semester	2	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12							
Title of Lesson	Chemical bonding in substances						Lesson Duration	3 Hours				
Lesson description	The lesson is designed to make student teachers reflect substances in the home and environment and how they are formed (bonding) as well explain their characteristics using the knowledge of how they are formed. The topical issues discussed in this lesson are physical and chemical properties of Compounds and how these can be made practical in class for the JHS learner.											
Previous student teacher knowledge, prior learning (assumed)	Recap of basic chemistry II and introduction of Chemistry around us.											
Possible barriers to learning in the lesson	Student-teachers may: <ul style="list-style-type: none"> Have memorized concepts of technical repeated scientific explanation of compounds and mixtures from the SHS. 											
Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face √	Practical Activity	Work-Based Learning	Seminars √	Independent Study √	e-learning opportunities √	Practicum					
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	Face-to face: Discussions, demonstrations and observations Seminars: Group presentations of reflective reports and discussions Independent study: Reflective report writing e-learning Opportunities: Simulations, video presentations											
Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description. <ul style="list-style-type: none"> Write in full aspects of the NTS addressed 	<ul style="list-style-type: none"> Appreciate that teaching is basically facilitation and learning is an active process. Demonstrate the skill and knowledge in identifying and developing appropriate teaching strategies NTS 1a) Critically and collectively reflects to improve teaching and learning. 1c) Demonstrates effective growing leadership qualities in the classroom and wider school. Community of Practice 2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in. 2e: Understands how children develop and learn in diverse contexts and applies this in his or her teaching. 3a) Plans and delivers varied and challenging lessons, showing a clear grasp of the intended outcomes of their teaching. 3b) Carries out small-scale action research to improve practice. 3d: Manages behaviour and learning with small and large classes											
Learning Outcome for the lesson, picked and developed	Learning Outcomes				Learning Indicators			Identify which cross-cutting issues, core and transferable skills, inclusivity. Equity and addressing diversity. How will these be addressed or developed				

<p>from the course specification</p> <ul style="list-style-type: none"> • Learning indicators for each learning outcome 	<ul style="list-style-type: none"> • Demonstrate knowledge of the physical and Chemical properties of compound(NTS 2c, p.13) • Demonstrate the skill to explain these properties to JHS learners 	<ul style="list-style-type: none"> • Produce charts and drawings showing Physical and chemical properties of compounds • Present Video/multimedia to explain the concepts to the JHS learner 	<p>Through group discussions and sharing of ideas in class student teachers develop the skills of communication, collaboration and mutual respect while appreciating individual difference and abilities. They also acquire skills in handling devices, develop critical thinking, honesty, accuracy and responsibility through active participation in group work/discussion.</p>	
Topic/Title	Sub Topic	Time or Stage	Teaching and learning to achieve learning outcomes: depending on delivery mode selected. Teacher led, collaborative group work or independent study	
			Teacher Activity	Student Activity
Chemical bonding in substances	Physical Properties of Compounds	30 minutes	<p>Face-to-face/e-learning: Tutor uses video and other internet to initiate lesson and allows student teachers to form groups of 3 members in mixed ability to discuss the lessons on chemical substances and their physical appearance using lessons learnt from lesson 1</p>	<p>Face-to-face/e-learning: Student teachers form groups of 3 members in mixed ability to view videos or other internet resources and discuss the lessons on chemical substances and their physical appearance using lessons learnt from lesson 1</p>
	Chemical Properties	60 minutes	<p>Face-to-face/e-Learning: Tutor uses video and internet resources to guide student teachers in their groups to discuss chemical substance and their chemical composition.</p>	<p>Face-to-face/e-learning: Student teachers view videos from internet resources on the chemical composition of chemical substances and discuss with tutor.</p>
	Reflections on Chemical Bonding	60 minutes	<p>Seminar: Tutor guides student-teachers to reflect on the Physical and Chemical Properties and how bonding results in these properties using videos and other internet resources.</p>	<p>Face-to-face: Student teachers reflect on the Physical and Chemical Properties and how bonding results in these properties using videos and other internet resources. Student teachers cross share their reflections</p>
Which cross cutting issues will be addressed or developed and how	Equity and SEN: through appropriate gender and equity sensitive group work to protect vulnerable student teachers, establish an interactive and inclusive classroom atmosphere.			

	<ul style="list-style-type: none"> • Introduction; a clear statement of aim and purpose of the project -10% • Methodology; What the student teacher has done and why to achieve the purpose of the project – 20% • Substantive/Main section of the work – 40% • Conclusion – 30% <p>Component 3: End of Semester Examination – (40% overall Semester Assessment)</p>
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Lesson assessments – evaluation of learning: of, for and as learning within the lesson	<ul style="list-style-type: none"> • Assessment as learning: student teachers’ cross share their reflections.
Teaching Learning Resources	Cardboards, poster papers, https://www.youtube.com/watch?v=KjoQHggzda8 , https://www.youtube.com/watch?v=VSc491HLzDo , https://opentextbc.ca/chemistry/chapter/physical-and-chemical-properties/
Required Text (core)	Abbey, T. K., Alhassan, B., Ameyibor, K., Essiah, J. W., Fometu, E., &Wiredu, M.B. (2008). <i>Ghana association of science teachers integrated science for senior high schools</i> . Accra: Unimax MacMillan; Handbook for PD Coordinators Themes 1 – 10.
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). <i>Ghana association of science teachers physics for senior high schools</i> . Accra: Unimax Macmillan. Ameyibor, K., &Wiredu, M. B. (2006). <i>Ghana association of science teachers: chemistry for senior high schools</i> . Accra: Unimax MacMillan. Asabere-Ameyaw, A., &Oppong, E. K. (2013). <i>Integrated science for the basic school teacher I</i> . Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., &Obeng-Ofori, D. (2011). <i>SWL integrated science for senior high schools: Students book</i> . Accra, Ghana; Sam-Woode Ltd.
CPD Requirement	Training student teachers on how to teach thermal energy

LESSON 3

Year of B.Ed.	4	Semester	2	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12		
Title of Lesson	Hydrogen ion Concentration (pH) in Systems			Lesson Duration	3 Hours		
Lesson description	The lesson is designed to further improve student teachers conceptual understanding of chemicals (Acids and Alkalis or bases) and to guide student teachers to be able to present this in practical ways for the JHS learner.						
Previous student teacher knowledge, prior learning (assumed)	Student teachers have gone through a course in Acids and bases and lesson 2						
Possible barriers to learning in the lesson	Student teachers may: <ul style="list-style-type: none"> Misconceptions about the sources of acids in the environment 						
Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face ✓	Practical Activity	Work-Based Learning	Seminars ✓	Independent Study	e-learning opportunities ✓	Practicum
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	Face-to face: Discussions, demonstrations Seminar: presentations from reflections e-learning Opportunities: Simulations, video presentations						
Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description. <ul style="list-style-type: none"> Write in full aspects of the NTS addressed 	<ul style="list-style-type: none"> Demonstrate the knowledge and understanding in pH in systems NTS 1a) Critically and collectively reflects to improve teaching and learning. 1c: Demonstrates effective growing leadership qualities in the classroom and wider school. Community of Practice 2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in. 2e: Understands how children develop and learn in diverse contexts and applies this in his or her teaching. 3a: Plans and delivers varied and challenging lessons, showing a clear grasp of the intended outcomes of their teaching. 3b: Carries out small-scale action research to improve practice. 3d: Manages behaviour and learning with small and large classes						
<ul style="list-style-type: none"> Learning Outcome for the lesson, picked and developed from the course specification Learning indicators for each learning outcome 	Learning Outcomes	Learning Indicators		Identify which cross-cutting issues, core and transferable skills, inclusivity. Equity and addressing diversity. How will these be addressed or developed			

	<ul style="list-style-type: none"> • Demonstrate knowledge and skills in identifying pH in systems (NTS 2c, p.13) • Demonstrate the ability to explain the concepts of pH to JHS learners. 	<ul style="list-style-type: none"> • Present concept maps on pH in systems in the home • Demonstrate how to explain the concepts to their peers 	Through group discussions and sharing of ideas in class student teachers develop the skills of communication, collaboration and mutual respect while appreciating individual difference and abilities. They also acquire skills in handling devices, develop critical thinking, honesty, accuracy and responsibility through active participation in group work/discussion.	
Topic/Title	Sub Topic	Time or Stage	Teaching and learning to achieve learning outcomes: depending on delivery mode selected. Teacher led, collaborative group work or independent study	
			Teacher Activity	Student Activity
Hydrogen ion Concentration (pH) in Systems	Introduction to the concepts of pH (Hydrogen ion concentration in systems	40 minutes	Face-to-face/e-learning: Tutor using videos/internet resources discusses with student teachers to recap lesson on acids and alkalis/bases and introduce the concepts of pH.	Face-to-face: Student teachers discuss with Tutor to recap lesson on acids and alkalis/bases and introduce the concepts of pH
	Importance of pH in the food Industry	60 minutes	Independent Study: Tutor Presents a checklist on some pH systems in the immediate school environment to student teachers and directs them, in mixed ability groups to walk round the school/college premises to identify and fill out the checklist for discussion later in the classroom	Independent Study: Student teachers collect checklist on some pH systems in the immediate school environment and form themselves into mixed ability groups to walk round the school/college premises to identify and fill out the checklist for discussion later in the classroom
		80 mins	Face-to-Face/Seminar: Tutor guides student teachers in their groups to discuss their findings from the nature walk and cross share.	Face-to-Face/Seminar: Student teachers, in their groups return to the class, under the guidance of the Tutor discuss their findings and cross share.
Which cross cutting issues will be addressed or developed and how	Equity and SEN: through setting ground rules to protect vulnerable student-teachers and establishing an interactive and inclusive classroom atmosphere and encourage collaboration and mutual respect. Innovation and creativity through experimentations and practical activities.			
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	<ul style="list-style-type: none"> • Assessment as learning: student teachers Cross share their checklist content. 			
Teaching Learning Resources	Simulations and multimedia, posters, projectors, https://sciencing.com/can-affected-change-ph-levels-6165622.html , https://www.youtube.com/watch?v=id1yK29TTcc , https://www.youtube.com/watch?v=d8f85k3LwwA , https://www.youtube.com/watch?v=9X5DTFYgtsQ , https://www.youtube.com/watch?v=v9-9MfJMtyg			

Required Text (core)	Abbey, T. K., Alhassan, B., Ameyibor, K., Essiah, J. W., Fometu, E., &Wiredu, M.B. (2008). <i>Ghana association of science teachers integrated science for senior high schools</i> . Accra: Unimax MacMillan; Handbook for PD Coordinators Themes 1 – 10.
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). <i>Ghana association of science teachers physics for senior high schools</i> . Accra: Unimax Macmillan. Ameyibor, K., &Wiredu, M. B. (2006). <i>Ghana association of science teachers: chemistry for senior high schools</i> . Accra: Unimax MacMillan. Asabere-Ameyaw, A., &Oppong, E. K. (2013). <i>Integrated science for the basic school teacher I</i> . Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V.&Obeng-Ofori, D. (2011). <i>SWL integrated science for senior high schools: Students book</i> . Accra, Ghana; Sam-Woode Ltd.
CPD Requirement	Training student teachers on how to teach thermal energy
Course Assessment	³ Component 1: Subject Portfolio Assessment (30% overall score) <ul style="list-style-type: none"> • Selected Item of Student work (3 items – 10%) = 30% • Midterm assessment – 20% • Reflective Journal – 40% • Organization of the Subject Portfolio- 10% (How its presented/organized) ⁴ Component 2: Subject Project (30% overall Semester score) <ul style="list-style-type: none"> • Introduction; a clear statement of aim and purpose of the project -10% • Methodology; What the student teacher has done and why to achieve the purpose of the project – 20% • Substantive/Main section of the work – 40% • Conclusion – 30% Component 3: End of Semester Examination – (40% overall Semester Assessment)

³ See rubrics on subject Portfolio Assessment in Annex 6 of NTEAP

⁴ See rubrics on Subject Project Assessment in Annex 6 of NTEAP

LESSON 4

Year of B.Ed.	4	Semester	2	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12
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Title of Lesson	Hydrogen ion Concentration (pH) in Systems				Lesson Duration	3 Hours	
Lesson description	The lesson is designed to further improve student teachers conceptual understanding of chemicals (Acids and Alkalis or bases) and to guide student teachers to be able to present this in practical ways for the JHS learner- a continuation from lesson 3						
Previous student teacher knowledge, prior learning (assumed)	From Lesson 3						
Possible barriers to learning in the lesson	Student teachers may: <ul style="list-style-type: none"> Misconceptions about the sources of acids and bases in the environment. 				Student teachers may: Misconceptions about the sources of acids and bases in the environment		
Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face ✓	Practical Activity	Work-Based Learning	Seminars ✓	Independent Study ✓	e-learning opportunities ✓	Practicum
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	Face-to face: Discussions, demonstrations and observations Seminars: Group presentations of reports and discussions Independent Study: Reflection and cross sharing e-learning Opportunities: Simulations, video presentations						
Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description. <ul style="list-style-type: none"> Write in full aspects of the NTS addressed 	<ul style="list-style-type: none"> Demonstrate the knowledge and understanding in Buffers in systems NTS 1a) Critically and collectively reflects to improve teaching and learning. 1c: Demonstrates effective growing leadership qualities in the classroom and wider school. Community of Practice 2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in. 2e: Understands how children develop and learn in diverse contexts and applies this in his or her teaching. 3a: Plans and delivers varied and challenging lessons, showing a clear grasp of the intended outcomes of their teaching. 3b: Carries out small-scale action research to improve practice. 3d: Manages behaviour and learning with small and large classes						

<ul style="list-style-type: none"> • Learning Outcome for the lesson, picked and developed from the course specification • Learning indicators for each learning outcome 	Learning Outcomes	Learning Indicators	Identify which cross-cutting issues, core and transferable skills, inclusivity. Equity and addressing diversity. How will these be addressed or developed	
	<ul style="list-style-type: none"> • Demonstrate knowledge and skills in identifying buffers in systems (NTS 2c, p.13) • Demonstrate the ability to explain the concepts of pH to JHS learners 	<ul style="list-style-type: none"> • Prepare a checklist of buffers • Demonstrate an understanding of buffers by explaining to peers 	Through group discussions and sharing of ideas in class student teachers develop the skills of communication, collaboration and mutual respect while appreciating individual difference and abilities. They also acquire skills in handling devices, develop critical thinking, honesty, accuracy and responsibility through active participation in group work/discussion.	
Topic/Title	Sub Topic	Time or Stage	Teaching and learning to achieve learning outcomes: depending on delivery mode selected. Teacher led, collaborative group work or independent study	
			Teacher Activity	Student Activity
Further review of the integrated science curriculum	Recap of lesson 3 of pH in systems and introducing buffers	60 minutes	Face-to-face: Tutor allows student teachers in whole group to revise the key concepts from lesson 3. Using the outcome of the responses, introduce the concept of buffers – acid - base balance.	Face-to-face: student teachers in whole group revise the key concepts from lesson 3. Student teachers respond to the discussions on the concept of buffers
	Buffers and their Applications	60 minutes	Face-to-face/e-Learning: Using simulations and multimedia presentations, Tutor guide student teachers to observe and discuss buffers in biological system – food, blood etc Independent Study: Tutor Allows student teachers to form inclusive, multi-grade, and developmentally appropriate groups to reflect and develop an appropriate checklist that they will cross share on the applications of buffers	Face-to-face: student teachers to observe and discuss buffers in biological systems Independent Study: student teachers form inclusive, multi-grade, and developmentally appropriate groups to reflect and develop an appropriate checklist that they will cross share on the applications of buffers
	Reflecting on buffer systems and Application	60 minutes	Face-to-face/Seminar: Tutor allows student teachers to form groups of mixed abilities of 3 members to plan and demonstrate the explanation of buffers to JHS learners	Face-to-face/Seminar: Student teachers to form groups of mixed abilities of 3 members to plan and demonstrate the explanation of buffers to JHS learners

Which cross cutting issues will be addressed or developed and how	Equity and SEN: through appropriate gender and equity sensitive group work to protect vulnerable student teachers, establish an interactive and inclusive classroom atmosphere.
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	<ul style="list-style-type: none"> Assessment as learning: student teachers Make checklist of buffers in systems
Teaching Learning Resources	Simulations and multimedia, posters, projectors, https://sciencing.com/can-affected-change-ph-levels-6165622.html , https://www.youtube.com/watch?v=id1yK29TTcc , https://www.youtube.com/watch?v=d8f85k3LwwA , https://www.youtube.com/watch?v=9X5DTFYgtsQ , https://www.youtube.com/watch?v=v9-9MfJMtyg
Required Text (core)	Abbey, T. K., Alhassan, B., Ameyibor, K., Essiah, J. W., Fometu, E., &Wiredu, M.B. (2008). <i>Ghana association of science teachers integrated science for senior high schools</i> . Accra: Unimax MacMillan; Handbook for PD Coordinators Themes 1 – 10.
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). <i>Ghana association of science teachers physics for senior high schools</i> . Accra: Unimax Macmillan. Ameyibor, K., &Wiredu, M. B. (2006). <i>Ghana association of science teachers: chemistry for senior high schools</i> . Accra: Unimax MacMillan. Asabere-Ameyaw, A., &Oppong, E. K. (2013). <i>Integrated science for the basic school teacher I</i> . Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V.&Obeng-Ofori, D. (2011). <i>SWL integrated science for senior high schools: Students book</i> . Accra, Ghana; Sam-Woode Ltd.
CPD Requirement	Training student teachers on how to teach Optics
Course Assessment	<p>⁵Component 1: Subject Portfolio Assessment (30% overall score)</p> <ul style="list-style-type: none"> Selected Item of Student work (3 items – 10%) = 30% Midterm assessment – 20% Reflective Journal – 40% Organization of the Subject Portfolio- 10% (How its presented/organized) <p>⁶Component 2: Subject Project (30% overall Semester score)</p> <ul style="list-style-type: none"> Introduction; a clear statement of aim and purpose of the project -10% Methodology; What the student teacher has done and why to achieve the purpose of the project – 20% Substantive/Main section of the work – 40% Conclusion – 30% <p>Component 3: End of Semester Examination – (40% overall Semester Assessment)</p>

⁵ See rubrics on subject Portfolio Assessment in Annex 6 of NTEAP

⁶ See rubrics on Subject Project Assessment in Annex 6 of NTEAP

LESSON 5

Year of B.Ed.	4	Semester	2	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12
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Title of Lesson	Electrolytes and non-electrolytes				Lesson Duration	3 Hours	
Lesson description	The lesson is designed to further improve student teachers knowledge and understanding on electrolytes and non-electrolytes and to guide them to be able to teach same concepts for the JHS learner.						
Previous student teacher knowledge, prior learning (assumed)	Student teachers learnt about pH in systems from lesson 3						
Possible barriers to learning in the lesson	Student teachers may have alternative explanations for electrolytes						
Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face ✓	Practical Activity	Work-Based Learning	Seminars ✓	Independent Study ✓	e-learning opportunities ✓	Practicum
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	Face-to face: Discussions, demonstrations and observations Seminars: Group presentations and discussions Independent Study: Reflection e-learning Opportunities: Simulations, video presentations						
Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description. <ul style="list-style-type: none"> Write in full aspects of the NTS addressed 	<ul style="list-style-type: none"> Identify learners with learning difficulty and collaborating with other experts to help learners overcome learning anxieties NTS 1a) Critically and collectively reflects to improve teaching and learning. 1c: Demonstrates effective growing leadership qualities in the classroom and wider school. Community of Practice 2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in. 2e: Understands how children develop and learn in diverse contexts and applies this in his or her teaching. 3a: Plans and delivers varied and challenging lessons, showing a clear grasp of the intended outcomes of their teaching. 3b: Carries out small-scale action research to improve practice. 3d: Manages behaviour and learning with small and large classes						
<ul style="list-style-type: none"> Learning Outcome for the lesson, picked and developed from the course specification Learning indicators for each learning outcome 	Learning Outcomes	Learning Indicators		Identify which cross-cutting issues, core and transferable skills, inclusivity. Equity and addressing diversity. How will these be addressed or developed			
	<ul style="list-style-type: none"> Explain the use for electrolytes and non electrolytes (NTS 2c, p. 13, 3i, 3i, p.14) 	<ul style="list-style-type: none"> Prepare model experimental set-up to show the demonstration use of electrolytes and non electrolytes 		Through group discussions and sharing of ideas in class student teachers develop the skills of communication, collaboration and mutual respect while appreciating individual difference and abilities. They also acquire skills in handling devices, develop critical thinking, honesty, accuracy and responsibility through active participation in group work/discussion.			

Topic/Title	Sub Topic	Time or Stage	Teaching and learning to achieve learning outcomes: depending on delivery mode selected. Teacher led, collaborative group work or independent study	
			Teacher Activity	Student Activity
Electrolytes and Non electrolytes	Recap of previous lesson 3 and Introduction to the conceptual meaning of Electrolytes and Non electrolytes	60 minutes	Face-to-face/e-learning: Tutor allows student teachers in whole group to revise the key concepts from lesson 3. Using the outcome of the responses, introduce the concept of Electrolytes and non electrolytes. https://www.youtube.com/watch?v=2U2DBWWo6nc	Face-to-face/e-learning: student teachers in whole group to revise the key concepts from lesson 3. Discuss the concept of Electrolytes and non electrolytes.
	Importance of Electrolytes and Non electrolytes	70 minutes	Face-to-face/e-Learning: Forming groups with 3 members with different abilities and strengths Tutor guides student teachers to: <ul style="list-style-type: none"> • Brainstorm the importance of electrolytes and non electrolytes • Creating a checklist of the uses of electrolytes and non electrolytes for cross sharing 	Face-to-face/e-Learning: Forming groups with 3 members with different abilities and strengths student teachers: <ul style="list-style-type: none"> • Brainstorm the importance of electrolytes and non electrolytes • Creating a checklist of the uses of electrolytes and non electrolytes for cross sharing and peer review
	Reflecting on teaching Electrolyte and non electrolytes to JHS learners	50 minutes	Seminar/E-learning opportunities: Tutor allows student teachers maintain their groups of mixed abilities of 3 members to do peer teaching/ micro teaching to demonstrate explanations of the concepts to JHS learner	Seminar/E-learning opportunities: student teachers maintain their groups of mixed abilities of 3 members to do peer teaching/ micro teaching to demonstrate explanations of the concepts to JHS learner
Which cross cutting issues will be addressed or developed and how	Equity and SEN: through appropriate gender and equity sensitive group work to protect vulnerable student teachers, establish an interactive and inclusive classroom atmosphere.			
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	<ul style="list-style-type: none"> • Assessment as learning: student teachers create checklist for peer review 			
Teaching Learning Resources	Simulations and multimedia, posters, projectors, some fruit juice. https://www.youtube.com/watch?v=2U2DBWWo6nc , https://www.youtube.com/watch?v=hxNoZ9ZYt7k			
Required Text (core)	Abbey, T. K., Alhassan, B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). <i>Ghana association of science teachers integrated science for senior high schools</i> . Accra: Unimax MacMillan; Handbook for PD Coordinators Themes 1 – 10.			
Additional Reading List	Abbey, T. K., & Essiah, J.W. (1995). <i>Ghana association of science teachers physics for senior high schools</i> . Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). <i>Ghana association of science teachers: chemistry for senior high schools</i> . Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). <i>Integrated science for the basic school teacher I</i> . Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., & Obeng-Ofori, D. (2011). <i>SWL integrated science for senior high schools: Students book</i> . Accra, Ghana; Sam-Woode Ltd.			

CPD Requirement	CoE Tutors need training in collaboration
Course Assessment	<p>⁷Component 1: Subject Portfolio Assessment (30% overall score)</p> <ul style="list-style-type: none"> • Selected Item of Student work (3 items – 10%) = 30% • Midterm assessment – 20% • Reflective Journal – 40% • Organization of the Subject Portfolio- 10% (How its presented/organized) <p>⁸Component 2: Subject Project (30% overall Semester score)</p> <ul style="list-style-type: none"> • Introduction; a clear statement of aim and purpose of the project -10% • Methodology; What the student teacher has done and why to achieve the purpose of the project – 20% • Substantive/Main section of the work – 40% • Conclusion – 30% <p>Component 3: End of Semester Examination – (40% overall Semester Assessment)</p>

⁷ See rubrics on subject Portfolio Assessment in Annex 6 of NTEAP

⁸ See rubrics on Subject Project Assessment in Annex 6 of NTEAP

LESSON 6

Year of B.Ed.	4	Semester	2	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12
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Title of Lesson	Course Review I with STS seminar						Lesson Duration	3 hours
Lesson description	This lesson is a review and audit of the lessons for the first half of the semester as well as review and discussion of lessons learned, reflection on observations made during the supported teaching in schools (STS).							
Previous student teacher knowledge, prior learning (assumed)	Lessons learnt from lesson 1 through lesson 5 in all learning approaches and observations/experiences during STS.							
Possible barriers to learning in the lesson	Lack of understanding and possible misconception to some concepts not adequately dealt with. Lessons not appropriately understood by student teachers.							
Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face √	Practical Activity	Work-Based Learning	Seminars √	Independent Study √	e-learning opportunities √	Practicum	
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	Face-to-Face: Discussion, group work in same ability group works. Seminar: Presentations and peer review. Independent Study: Tutor and student teacher reflections (individually and collectively) e-learning Opportunities: OERs and Video presentations							
<ul style="list-style-type: none"> Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description. Write in full aspects of the NTS addressed 	<ul style="list-style-type: none"> Ascertain the level of understanding of concepts. Test various skills and cross – cutting issues Provide remedial tuition/tutorials where necessary for experiences during STS Correct misconceptions and misinformation Build the necessary support going forward on SEN and gender issues <p>NTS</p> <p>1a) Critically and collectively reflects to improve teaching and learning.</p> <p>1c) Demonstrates effective growing leadership qualities in the classroom and wider school.</p> <p>Community of Practice</p> <p>2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in.</p> <p>2e: Understands how children develop and learn in diverse contexts and applies this in his or her teaching.</p> <p>3a) Plans and delivers varied and challenging lessons, showing a clear grasp of the intended outcomes of their teaching.</p> <p>3b) Carries out small-scale action research to improve practice.</p> <p>3d: Manages behaviour and learning with small and large classes)</p>							
<ul style="list-style-type: none"> Learning Outcome for the lesson, picked and developed from the course specification Learning indicators for each learning outcome 	Learning Outcomes	Learning Indicators				Identify which cross – cutting Issues, core and transferable skills, inclusivity. Equity and addressing diversity. How will these be addressed or developed		
	<ul style="list-style-type: none"> Identify weaknesses and strengths in learning the early grade science lesson for the period under review 	<ul style="list-style-type: none"> Make a list of weaknesses and strengths on poster papers for sharing 				Collaborations, Communication and Research: Through group work and presentation		

	<ul style="list-style-type: none"> Be able to reflect on lessons learnt so far STS and state new insights and/or grey areas needing remedies 	<ul style="list-style-type: none"> Provide a reflection report on STS and demonstrations and illustrations on a given media of lessons learnt so far 	Equity and Reflection is developed from reflective activities
	<ul style="list-style-type: none"> Correct misconception/mis information for earlier (lesson 1 – 5) lessons 	<ul style="list-style-type: none"> Present concept maps and/or models linking misconceptions/misinformation to new insights 	Creativity and critical thinking are developed in developing models and concept maps
Content of lesson picked and developed from the course specification	Sub Topic	Time or Stage	Teaching and learning to achieve learning outcomes: depending on delivery mode selected. Teacher led, collaborative group work or independent study
Topic Title			Teacher Activity Facilitate and provide the necessary tools for student activities.
Course Review 1 with STS seminar	Reviewing the understanding of lessons 1-5 and discussion of observations during STS	60 minutes 90 minutes	<p>Face-to-face: Teacher led brainstorming session with student teachers to unearth the weaknesses and strengths of student teachers in the lessons 1 – 5. Initiate discussion using groupings (Same ability and then mixed groups) to identify student teachers’ strengths and weakness in the lessons learnt so far.</p> <p>STS Seminar: Teacher allows two or three resource persons to make presentations on STS based on the NTS. Tutor then guides student teachers through problem-based learning on National Teacher’s Standards and reflection on observations made during STS.</p>
	Remedies to course topics	30 minutes	<p>Face-to-face: Teacher groups student teachers according to remedy need and provide specific task assistance in the areas on concept needing remedy.</p> <p>Face-to-face: Students work in the special groups (Same remedy need group) on tasks to remedy their learning need. They then present concept maps and/or models linking misconceptions/misinformation to new insights.</p>
Which cross cutting issues will be addressed or developed and how	Equity and SEN: through mixed and same group work to protect vulnerable student teachers and establishing an interactive and inclusive classroom atmosphere. Through modelling and group work, collaboration is established.		
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	<ul style="list-style-type: none"> Student teachers’ presentations during group work and model work presentation helps to assess them of learning Assessment for and as learning: Student teachers working in groups on remedial tutoring helps to assess them for and as learning 		
Teaching Learning Resources	Cardboards, Course manual, Flip charts, Poster paper		
Required Text (core)	Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J. W., Fometu, E., &Wiredu, M.B. (2008). <i>Ghana</i>		

	<i>association of science teachers integrated science for senior high schools</i> . Accra: Unimax MacMillan.
Additional Reading List	<p>Abbey, T. K., &Essiah, J.W. (1995). <i>Ghana association of science teachers physics for senior high schools</i>. Accra: Unimax Macmillan.</p> <p>Ameyibor, K., &Wiredu, M. B. (2006). <i>Ghana association of science teachers chemistry for senior high schools</i>. Accra: Unimax MacMillan.</p> <p>Asabere-Ameyaw, A., &Oppong, E. K. (2013). <i>Integrated science for the basic school teacher I</i>. Winneba: IEDE.</p> <p>Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., &Obeng-Ofori, D. (2011). <i>SWL integrated science for senior high schools: Students book</i>. Accra, Ghana; Sam-Woode Ltd.</p>
CPD Requirement	Training on preparation of checklist and Reflection guides. Workshop on developing simple teaching learning materials (improvisation)
Course Assessment	<p>⁹Component 1: Subject Portfolio Assessment (30% overall score)</p> <ul style="list-style-type: none"> • Selected Item of Student work (3 items – 10%) = 30% • Midterm assessment – 20% • Reflective Journal – 40% • Organization of the Subject Portfolio- 10% (How its presented/organized) <p>¹⁰Component 2: Subject Project (30% overall Semester score)</p> <ul style="list-style-type: none"> • Introduction; a clear statement of aim and purpose of the project -10% • Methodology; What the student teacher has done and why to achieve the purpose of the project – 20% • Substantive/Main section of the work – 40% • Conclusion – 30% <p>Component 3: End of Semester Examination – (40% overall Semester Assessment)</p>

⁹ See rubrics on subject Portfolio Assessment in Annex 6 of NTEAP

¹⁰ See rubrics on Subject Project Assessment in Annex 6 of NTEAP

LESSON 7

Year of B.Ed.	4	Semester	2	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12
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Title of Lesson	Water				Lesson Duration	3 Hours
Lesson description	The lesson is designed to further enhance the student teachers' knowledge and understanding of the aqua chemistry, water purification and water uses and to enable them to better appreciate how these concepts can be taught to the JHS learner.					
Previous student teacher knowledge, prior learning (assumed)	Student teachers in the previous lesson (lesson 5).					
Possible barriers to learning in the lesson	Student teachers may alternative explanations for water treatment and uses.					
Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face √	Practical Activity	Work-Based Learning	Seminars √	Independent Study √	e-learning opportunities √
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	Face-to face: Discussions, demonstrations and observations Seminar: Group presentations of reports and discussions Independent Study: student teachers Reflections e-learning Opportunities: Simulations, video presentations					
Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description. <ul style="list-style-type: none"> Write in full aspects of the NTS addressed 	<ul style="list-style-type: none"> Deepening the student teachers conceptual understanding of Aqua chemistry Helping the Student teacher to be able to develop the right conceptions for aqua chemistry and be able to teach NTS 1a) Critically and collectively reflects to improve teaching and learning. 1c: Demonstrates effective growing leadership qualities in the classroom and wider school. Community of Practice 2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in. 2e: Understands how children develop and learn in diverse contexts and applies this in his or her teaching. 3a: Plans and delivers varied and challenging lessons, showing a clear grasp of theintended outcomes of their teaching. 3b: Carries out small-scale action research to improve practice. 3d: Manages behaviour and learning with small and large classes					
<ul style="list-style-type: none"> Learning Outcome for the lesson, picked and developed from the course specification Learning indicators for each learning outcome 	Learning Outcomes	Learning Indicators		Identify which cross- cutting issues, core and transferable skills, inclusivity. Equity and addressing diversity. How will these be addressed or developed		
	<ul style="list-style-type: none"> Demonstrate knowledge and understanding of the applications water. (NTS 2c, p. 13, 3i, 3i, p.14) 	<ul style="list-style-type: none"> Present tables illustration/concept cartoons of uses of water. 		Through group discussions and sharing of ideas in class student teachers develop the skills of communication, collaboration and mutual respect while appreciating individual difference and abilities. They also acquire skills in handling devices, develop critical thinking, honesty, accuracy and responsibility through active participation in group work/discussion.		

Topic/Title	Sub Topic	Time or Stage	Teaching and learning to achieve learning outcomes: depending on delivery mode selected. Teacher led, collaborative group work or independent study	
			Teacher Activity	Student Activity
Water	Recap of lesson 5 and Aqua Chemistrys.	40 minutes 40 mins	<p>Face-to-face Tutor initiates a discussion with student teachers in whole group, on the key concepts of lesson 5 (Electrolytes and no electrolytes)</p> <p>Face-to-Face/e-learning:using videos and internet resources to engage student Teachers to introduce the concept aqua chemistry.</p>	<p>Face-to-face: Student teachers discuss the key concepts of lesson 5 and outline their strengths and weaknesses and expectations.</p> <p>Face-to-Face: Student teachers view videos and internet resources and discuss the concept aqua chemistry</p>
	Purification of water, uses and economic importance of water	40 minutes	<p>Face-to-face/e-Learning/Independent Study: Forming groups with 3 members of different abilities and strengths with the use of simulator/videos/multimedia and Tutor guides student teachers to discuss:</p> <ul style="list-style-type: none"> • How to purify water for domestic and industrial use • Economic importance of water 	<p>Face-to-face/e-Learning/Independent Study: Forming groups with 3 members of different abilities and strengths with the use of simulator/videos/multimedia student teachers discuss:</p> <ul style="list-style-type: none"> • How to purify water for domestic and industrial use • Economic importance of water
	Reflecting on how to teach Water to JHS learners	60 minutes	Face-to-face/Seminar: Tutor Maintaining groups with 3 members of different abilities and strengths and encouraging student teachers to micro teach using the concept of water	Face-to-face/E-learning opportunities: Student teachers maintain their groups of mixed abilities of 3 members to plan and do peer teaching/ micro teaching lesson on water to JHS learners
Which cross cutting issues will be addressed or developed and how	Equity and SEN: through appropriate gender and equity sensitive group work to protect vulnerable student teachers, establish an interactive and inclusive classroom atmosphere.			
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	<ul style="list-style-type: none"> • Assessment as learning: student teachers present Short lessons water from the JHS curriculum 			
Teaching Learning Resources	Simulations, videos and multimedia, posters, projectors. https://www.youtube.com/watch?v=pjClihDmfeA , https://www.youtube.com/watch?v=ckYb53ZWwDk			
Required Text (core)	Abbey, T. K., Alhassan, B., Ameyibor, K., Essiah, J. W., Fometu, E., &Wiredu, M.B. (2008). <i>Ghana association of science teachers integrated science for senior high schools</i> . Accra: Unimax MacMillan; Handbook for PD Coordinators Themes 1 – 10.			
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). <i>Ghana association of science teachers physics for senior high schools</i> . Accra: Unimax Macmillan. Ameyibor, K., &Wiredu, M. B. (2006). <i>Ghana association of science teachers: chemistry for senior high schools</i> . Accra: Unimax MacMillan.			

	Asabere-Ameyaw, A., &Oppong, E. K. (2013). <i>Integrated science for the basic school teacher I</i> . Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., &Obeng-Ofori, D. (2011). <i>SWL integrated science for senior high schools: Students book</i> . Accra, Ghana; Sam-Woode Ltd.
CPD Requirement	CoE Tutors need training on arranging on how to teach atomic and nuclear physics
Course Assessment	¹¹ Component 1: Subject Portfolio Assessment (30% overall score) <ul style="list-style-type: none"> • Selected Item of Student work (3 items – 10%) = 30% • Midterm assessment – 20% • Reflective Journal – 40% • Organization of the Subject Portfolio- 10% (How its presented/organized) ¹² Component 2: Subject Project (30% overall Semester score) <ul style="list-style-type: none"> • Introduction; a clear statement of aim and purpose of the project -10% • Methodology; What the student teacher has done and why to achieve the purpose of the project – 20% • Substantive/Main section of the work – 40% • Conclusion – 30% Component 3: End of Semester Examination – (40% overall Semester Assessment)

¹¹ See rubrics on subject Portfolio Assessment in Annex 6 of NTEAP

¹² See rubrics on Subject Project Assessment in Annex 6 of NTEAP

LESSON 8

Year of B.Ed.	4	Semester	2	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12
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Title of Lesson	Types of Climate and their effect on food				Lesson Duration	3 Hours
Lesson description	Climate, which is an aggregation of daily weather changes influences agriculture and vegetation within our various communities and the world over. The way climate has affected crop production will be discussed with respect to the various climate types.					
Previous student teacher knowledge, prior learning (assumed)	Students have experienced the occurrence of day and night and seasonal changes such as the rainy (wet) and dry seasons.					
Possible barriers to learning in the lesson	Misconceptions may exist about how students perceive the occurrence of the various weather changes and how they affect food production					
Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face	Practical Activity		Seminar	Independent study	e-learning opportunities
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	Mixed group activities, discussions and reporting, demonstration & observation.					
<ul style="list-style-type: none"> What you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description. Write in full aspects of the NTS addressed 	<p>This lesson is intended to help students would demonstrate understanding of the climatic principles that affect food production. It is also intended to further help students embed pedagogic content knowledge on teaching and to acquire the requisite practical skills for teaching the effects of the climate on food production.</p> <p>NTS</p> <p>1a) Critically and collectively reflects to improve teaching and learning. 1c) Demonstrates effective growing leadership qualities in the classroom and wider school. Community of Practice</p> <p>2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in. 2e: Understands how children develop and learn in diverse contexts and applies this in his or her teaching.</p> <p>3a) Plans and delivers varied and challenging lessons, showing a clear grasp of the intended outcomes of their teaching. 3b) Carries out small-scale action research to improve practice. 3d: Manages behaviour and learning with small and large classes)</p>					
<ul style="list-style-type: none"> Learning Outcome for the lesson, picked and developed from the course specification Learning indicators for each learning outcome 	Learning Outcomes		Learning Indicators		Identify the which cross cutting issues- core and transferable skills, inclusivity, equity and diversity. How will these be developed?	
	Demonstrate an appreciation of misconceptions associated with the effect of types of climate on food production		Produce charts, diagrams, and models that depict different types of world climates		Equity and Inclusivity: Communication, critical thinking, collaboration, creativity, appreciation and problem solving.	

Topic/Title	Subtopic	Time or stage	Teaching and learning to achieve learning outcomes: depending on delivery mode selected. Teacher led, collaborative group work or independent study	
			Teacher Activity	Student Activity
Types of Climate and their effect on food	Types of world climates	90 minutes	Open-ended questions for the identification of misconceptions associated with weather changes and climates Lecture, discussion, presentation, demonstration, Observations on internet, role play	Work in mixed groups to produce models and charts of different climates
	Effect of climates on food production	45 minutes	Teacher-led simulations	Simulations and multimedia presentations (ibox) Role play on climatic changes on food production (crops, fish, meat)
	Practical activity of crop production	45 minutes	Practical activity of effect of climatic conditions on pepper/okro/tomato seedlings	Perform simple activities to set up experiment with seedlings under different artificial weather conditions
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	Short youtube videos, posters, reports			
Teaching/learning Resources	Charts, globe, models, poster colours and cards, patch of land or pot for seedlings, poster papers, internet			
Required Text (core)	Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). <i>Ghana association of science teachers integrated science for senior high schools</i> . Accra: Unimax MacMillan.			
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). <i>Ghana association of science teachers physics for senior high schools</i> . Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). <i>Ghana association of science teachers' chemistry for senior high schools</i> . Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). <i>Integrated science for the basic school teacher I</i> . Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., & Obeng-Ofori, D. (2011). <i>SWL integrated science for senior high schools: Students book</i> . Accra, Ghana; Sam-Woode Ltd. Zumdahl, S. S., &Zumdahl, S. A. (2009). <i>Chemistry</i> . Belmont, CA: Cengage Learning.			
CPD needs	Provision of ibox			
Course Assessment	¹³ Component 1: Subject Portfolio Assessment (30% overall score) <ul style="list-style-type: none"> ● Selected Item of Student work (3 items – 10%) = 30% ● Midterm assessment – 20% ● Reflective Journal – 40% ● Organization of the Subject Portfolio- 10% (How its presented/organized) ¹⁴ Component 2: Subject Project (30% overall Semester score)			

¹³ See rubrics on subject Portfolio Assessment in Annex 6 of NTEAP

¹⁴ See rubrics on Subject Project Assessment in Annex 6 of NTEAP

	<ul style="list-style-type: none">• Introduction; a clear statement of aim and purpose of the project -10%• Methodology; What the student teacher has done and why to achieve the purpose of the project – 20%• Substantive/Main section of the work – 40%• Conclusion – 30% <p>Component 3: End of Semester Examination – (40% overall Semester Assessment)</p>
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LESSON 9

Year of B.Ed.	4	Semester	2	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12
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Title of Lesson	Climatic effects on nutrition in foods				Lesson Duration	3 Hours
Lesson description	This lesson looks at the relationship between climate, availability of nutrients and food production					
Previous student teacher knowledge, prior learning (assumed)	Learners know that adequate rain during the rainy season boosts food production and vice versa. They have also studied the water, carbon, hydrogen, phosphorus and nitrogen cycles.					
Possible barriers to learning in the lesson	Learners sometimes think that poor climatic conditions and subsequent famines are punishments from gods or evil deeds by community members					
Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face	Practical Activity	Work-Based Learning		Independent study	e-learning opportunities
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	Mixed group discussions and reporting, observation, situational analysis (field trips).					
<ul style="list-style-type: none"> Overarching outcome, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description. Write in full aspects of the NTS addressed 	<p>Students embark on field trip to various farms for whole class discussions on their observations. This lesson is intended to further help student teachers embed pedagogic content knowledge on teaching and to acquire the requisite practical skills for teaching how climate change can affect the value of food produce.</p> <p>NTS 1a) Critically and collectively reflects to improve teaching and learning. 1c) Demonstrates effective growing leadership qualities in the classroom and wider school. Community of Practice 2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in. 2e: Understands how children develop and learn in diverse contexts and applies this in their teaching. 3a) Plans and delivers varied and challenging lessons, showing a clear grasp of the intended outcomes of their teaching. 3b) Carries out small-scale action research to improve practice. 3d: Manages behaviour and learning with small and large classes</p>					
<ul style="list-style-type: none"> Learning Outcome for the lesson, picked and developed from the course specification Learning indicators for each learning outcome 	Learning Outcomes	Learning Indicators	Identify which cross cutting issues- core and transferable skills, inclusivity, equity and diversity and how these be addressed			
	Demonstrate understanding of the effect of climatic change on nature of the soil for plant crops and nutritive value of produced crops for farm animals and farmed fish	Report in diverse forms	Equity and Inclusivity: Social collaboration, innovation, communication, critical thinking, creativity, problem solving			

Topic/Title	Subtopic	Time or stage	Teaching and learning to achieve learning outcomes: depending on delivery mode selected. Teacher led, collaborative group work or independent study	
			Teacher Activity	Student Activity
Climatic effects on nutrition in foods	Climate and some natural cycles	60 minutes	Teacher-led discussion on how changes in cycles and climates bear on each other	Talk for on breaks in climatic patterns and cycles
	Effect of climatic change on production of nutrients	80 minutes	Put students in mixed groups to discuss and share their experiences on how change in climate affects nutrient production in different spheres (hydro, geo, etc)	Pyramid discussion to elucidate importance of preserving nature and the environment for sustainability
	Relationship between climate and food production	40 minutes	Teacher-led discussions on how breaks in cycles affect climate and subsequently food and sustainability of resources	Short group presentations on field trips and how nitrogen, potassium and phosphorus affect food production
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	Reports, posters, charts			
Teaching/learning Resources	Tools for drawing, poster paper, poster colour			
Required Text (core)	Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). <i>Ghana association of science teachers integrated science for senior high schools</i> . Accra: Unimax MacMillan.			
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). <i>Ghana association of science teachers physics for senior high schools</i> . Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). <i>Ghana association of science teachers’ chemistry for senior high schools</i> . Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). <i>Integrated science for the basic school teacher I</i> . Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., & Obeng-Ofori, D. (2011). <i>SWL integrated science for senior high schools: Students book</i> . Accra, Ghana; Sam-Woode Ltd. Zumdahl, S. S., &Zumdahl, S. A. (2009). <i>Chemistry</i> . Belmont, CA: Cengage Learning.			
CPD needs	Talk for learning approaches, pyramid discussion			
Course Assessment	¹⁵ Component 1: Subject Portfolio Assessment (30% overall score) <ul style="list-style-type: none"> ● Selected Item of Student work (3 items – 10%) = 30% ● Midterm assessment – 20% ● Reflective Journal – 40% ● Organization of the Subject Portfolio- 10% (How its presented/organized) ¹⁶ Component 2: Subject Project (30% overall Semester score) <ul style="list-style-type: none"> ● Introduction; a clear statement of aim and purpose of the project -10% 			

¹⁵ See rubrics on subject Portfolio Assessment in Annex 6 of NTEAP

¹⁶ See rubrics on Subject Project Assessment in Annex 6 of NTEAP

	<ul style="list-style-type: none">• Methodology; What the student teacher has done and why to achieve the purpose of the project – 20%• Substantive/Main section of the work – 40%• Conclusion – 30% <p>Component 3: End of Semester Examination – (40% overall Semester Assessment)</p>
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LESSON 10

Year of B.Ed.	4	Semester	2	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12
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Title of Lesson	Further Studies on the Secondary School Chemistry Curriculum				Lesson Duration	3 Hours
Lesson description	This lesson exposes students to salient or core concepts, misconceptions surrounding them and sequencing concepts for conceptual teaching and learning as well as pedagogies for best teaching practices.					
Previous student teacher knowledge, prior learning (assumed)	Students have studied other curriculum and teaching strategies for various levels and disciplines					
Possible barriers to learning in the lesson	Misconceptions about some concepts and teaching practices					
Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face	Practical Activity		Seminar	Independent study	elearning
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	Mixed group activities, discussions and reporting, demonstration, observation & role play					
<ul style="list-style-type: none"> What you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description. Write in full aspects of the NTS addressed 	<ul style="list-style-type: none"> To deepen student teacher understanding of the curriculum, lesson preparation and teaching. Test various pedagogical skills and cross – cutting issues Build the necessary knowledge on SEN and Gender issue To develop the knowledge to teach given topics NTS: 1a- Critically and collaboratively reflect to improve teaching and learning. 1f-Develops a positive teacher identity and acts as a good role model for students 2b-Has comprehensive knowledge of the official school curriculum, including learning outcomes 3e: Employs a variety of instructional strategies that encourages student participation and critical thinking. 3g: Employs instructional strategies appropriate for mixed ability, multilingual and multi-age classes					
<ul style="list-style-type: none"> Learning Outcome for the lesson, picked and developed from the course specification Learning indicators for each learning outcome 	Learning Outcomes		Learning Indicators		Identify the which cross cutting issues- core and transferable skills, inclusivity, equity and diversity and how these be addressed	
	Demonstrate an appreciation of misconceptions associated with some chemical concepts and provide remediation for them through best pedagogical practices		List some concepts that are misconstrued and how to remediate them		Equity and Inclusivity: Communication, critical thinking, collaboration, creativity and problem solving.	
Topic/Title	Subtopic	Time or stage		Teaching and learning to achieve learning outcomes: depending on delivery mode selected. Teacher led, collaborative group work or independent study		
	Trend of curriculum and main components	90 minutes		Teacher Activity		Student Activity
Further Studies on the Secondary School Chemistry Curriculum				Put students in groups to analyse the entire curriculum, looking out for patterns and barriers that must be overcome		Work in mixed groups to assess sequencing in syllabus Talk for learning approaches on how to

				prepare lessons that cater for special needs, equity and is conceptual-based
	Formation of night and day	90 minutes	Open-ended questions for the identification of misconceptions Discussion, presentation, demonstration, Observations, role play	Simulations and multimedia presentations (ibox) Prepare 30-minute e-lessons that demonstrate content and pedagogical issues enshrined in curriculum Role play on identification and correction of misconceptions
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	Communication skills, analytical and deductive skills, demonstration of acquired communicative skills, reflective skills			
Teaching/learning Resources	Curriculum			
Required Text (core)	Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). <i>Ghana association of science teachers integrated science for senior high schools</i> . Accra: Unimax MacMillan.			
Additional Reading List	Abbey, T. K., & Essiah, J.W. (1995). <i>Ghana association of science teachers physics for senior high schools</i> . Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). <i>Ghana association of science teachers' chemistry for senior high schools</i> . Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). <i>Integrated science for the basic school teacher I</i> . Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., & Obeng-Ofori, D. (2011). <i>SWL integrated science for senior high schools: Students book</i> . Accra, Ghana; Sam-Woode Ltd. Zumdahl, S. S., & Zumdahl, S. A. (2009). <i>Chemistry</i> . Belmont, CA: Cengage Learning.			
CPD needs	Provision of ibox			
Course Assessment	¹⁷ Component 1: Subject Portfolio Assessment (30% overall score) <ul style="list-style-type: none"> • Selected Item of Student work (3 items – 10%) = 30% • Midterm assessment – 20% • Reflective Journal – 40% • Organization of the Subject Portfolio- 10% (How its presented/organized) ¹⁸ Component 2: Subject Project (30% overall Semester score) <ul style="list-style-type: none"> • Introduction; a clear statement of aim and purpose of the project -10% • Methodology; What the student teacher has done and why to achieve the purpose of the project – 20% • Substantive/Main section of the work – 40% • Conclusion – 30% Component 3: End of Semester Examination – (40% overall Semester Assessment)			

¹⁷ See rubrics on subject Portfolio Assessment in Annex 6 of NTEAP

¹⁸ See rubrics on Subject Project Assessment in Annex 6 of NTEAP

LESSON 11

Year of B.Ed.	4	Semester	2	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12
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Title of Lesson	Co-planning, co-teaching and co-assessment			Lesson Duration	3 Hours
Lesson description	Interpreting, planning, executing and assessing lessons taught in reflective mode				
Previous student teacher knowledge, prior learning (assumed)	Students have observed lessons in schools, co-taught with class teachers, co-assessed and reflected over these personal and dual activities. Thirty-minute lessons have been prepared from week 10.				
Possible barriers to learning in the lesson					
Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face	Practical Activity	Work-Based Learning	Independent study	e-learning opportunities Practicum
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	Mixed group discussions and reporting, observation, role play, situational analysis				
<ul style="list-style-type: none"> Purpose of the lesson. What you want to achieve Write in full aspects of the NTS addressed 	<p>Students would identify parts of the curriculum, cast/enact them in role-play to depict different teaching and learning styles, reflect on them in pairs/groups (taking into consideration issues of inclusivity, gender and ability) and assess outcomes as learning ‘of, as, and for’.</p> <ul style="list-style-type: none"> To deepen student teacher understanding of lesson preparation and teaching. Test various pedagogical skills and cross – cutting issues Build the necessary knowledge on SEN and Gender issue To develop the knowledge to teach the topic <p>NTS: 1a- Critically and collaboratively reflect to improve teaching and learning. 1f-Develops a positive teacher identity and acts as a good role model for students 2b-Has comprehensive knowledge of the official school curriculum, including learning outcomes 3e: Employs a variety of instructional strategies that encourages student participation and critical thinking. 3g: Employs instructional strategies appropriate for mixed ability, multilingual and multi-age classes</p>				
<ul style="list-style-type: none"> Learning Outcome for the lesson, picked and developed from the course specification Learning indicators for each learning outcome 	Learning Outcomes		Learning Indicators		Identify the which cross cutting issues-core and transferable skills, inclusivity, equity and diversity and how these will be addressed
	Demonstrate understanding of curriculum, required pedagogies and assessment procedures. Understand how learning occurs in diverse contexts and apply this in their execution of co-planned and co-taught lesson		In pairs co-plan, co-teach, co-assess and co-reflect prepared 30-minute lesson from week 10		Equity and Inclusivity: Social collaboration, innovation, communication, critical thinking, creativity, problem solving and deduction

Topic/Title Co-planning, co-teaching and co-assessment	Subtopic	Time or stage	Teaching and learning to achieve learning outcomes: depending on delivery mode selected. Teacher led, collaborative group work or independent study	
			Teacher Activity	Student Activity
	Analysis of the curriculum	60 minutes	Teacher-led discussion on salient components of the curriculum to consider as translated into 30-minute lesson	Talk for learning approaches on structure of the curriculum
	Co-plan co-teach, and co-assess	90 minutes	Put students in pairs to enact the 30-minute lessons from week 10 (Each teaches a 30-minute lesson)	Small group discussion of outcome of practicum
	Co-reflect	30 minutes	Teacher-led whole-class reflective sessions	Discussions on outcome of paired activities
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	Reports, samples of lesson notes, samples of assessed exercises from lesson			
Teaching/learning Resources	Curriculum, lesson notes, internet (if required), ibox			
Required Text (core)	Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). <i>Ghana association of science teachers integrated science for senior high schools</i> . Accra: Unimax MacMillan.			
Additional Reading List	<p>Abbey, T. K., & Essiah, J.W. (1995). <i>Ghana association of science teachers physics for senior high schools</i>. Accra: Unimax Macmillan.</p> <p>Ameyibor, K., & Wiredu, M. B. (2006). <i>Ghana association of science teachers' chemistry for senior high schools</i>. Accra: Unimax MacMillan.</p> <p>Asabere-Ameyaw, A., & Oppong, E. K. (2013). <i>Integrated science for the basic school teacher I</i>. Winneba: IEDE.</p> <p>Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., & Obeng-Ofori, D. (2011). <i>SWL integrated science for senior high schools: Students book</i>. Accra, Ghana; Sam-Woode Ltd.</p> <p>Zumdahl, S. S., & Zumdahl, S. A. (2009). <i>Chemistry</i>. Belmont, CA: Cengage Learning.</p>			
CPD needs	Talk for learning approaches, pyramid discussion			
Course Assessment	<p>¹⁹Component 1: Subject Portfolio Assessment (30% overall score)</p> <ul style="list-style-type: none"> • Selected Item of Student work (3 items – 10%) = 30% • Midterm assessment – 20% • Reflective Journal – 40% • Organization of the Subject Portfolio- 10% (How its presented/organized) <p>²⁰Component 2: Subject Project (30% overall Semester score)</p> <ul style="list-style-type: none"> • Introduction; a clear statement of aim and purpose of the project -10% • Methodology; What the student teacher has done and why to achieve the purpose of the project – 20% • Substantive/Main section of the work – 40% • Conclusion – 30% <p>Component 3: End of Semester Examination – (40% overall Semester Assessment)</p>			

¹⁹ See rubrics on subject Portfolio Assessment in Annex 6 of NTEAP

²⁰ See rubrics on Subject Project Assessment in Annex 6 of NTEAP

LESSON 12

Year of B.Ed.	4	Semester	2	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12
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Title of Lesson	Course Review II with STS seminar				Lesson Duration	3 hours	
Lesson description	This lesson is a review and audit of the lessons for the second half of the semester as well as review and discussion of lessons learned, reflection and peer review of teaching and learning portfolios.						
Previous student teacher knowledge, prior learning (assumed)	Lessons learnt from lesson 7 through lesson 11 in all learning approaches and experiences.						
Possible barriers to learning in the lesson	Misconception to some concepts not adequately dealt with. Pedagogical issues not appropriately understood by student teachers.						
Lesson Delivery – chosen to support students in achieving the outcomes	Face-to-face √	Practical Activity √	Work-Based Learning	Seminars √	Independent Study √	e-learning opportunities √	Practicum
Lesson Delivery – main mode of delivery chosen to support student teachers in achieving the learning outcomes.	Face-to-Face: Discussion, group work in same ability group works. Practical Activity: Modelling, Concept Mapping and Cartooning, Co-teaching and Co-planning. Independent Study: Tutor and student teacher reflections (individually and collectively) Seminars: Presentation of reflections and micro teaching e-learning Opportunities: OERs and Video presentations						
<ul style="list-style-type: none"> Purpose for the lesson, what you want the students to achieve, serves as basis for the learning outcomes. An expanded version of the description. Write in full aspects of the NTS addressed 	<ul style="list-style-type: none"> Ascertain the level of pedagogical skills acquisition. Assess various skills and cross – cutting issues Provide remedial tuition/tutorials on where necessary for experiences during lessons and planning and micro teaching Correct misinformation Build the necessary support going forward on SEN and Gender issue <p>NTS</p> <p>1a: Critically and collectively reflects to improve teaching and learning</p> <p>2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in.</p> <p>3b: Carries out small-scale action research to improve practice.</p> <p>3e: Employs a variety of instructional strategies that encourages student participation and critical thinking.</p> <p>3g: Employs instructional strategies appropriate for mixed ability, multilingual and multi-age classes)</p>						
<ul style="list-style-type: none"> Learning Outcome for the lesson, picked and developed from the course specification Learning indicators for each learning outcome 	Learning Outcomes		Learning Indicators		Identify cross – cutting Issues, core and transferable skills, inclusivity. Equity and addressing diversity and how these will be developed		
	<ul style="list-style-type: none"> Identify weakness and strengths in acquisition of skills for teaching the chemistry topics for the semester. 		<ul style="list-style-type: none"> Make a list of weaknesses and strengths on poster papers for sharing 		Collaborations, Communication and Research: Through group work and presentation		
	<ul style="list-style-type: none"> Be able to reflect on lessons and state new insights or grey areas needing remedies Basis for co-planning and co-teaching 		<ul style="list-style-type: none"> Provide a reflection report on STS and demonstrations and illustrations on a given media of lessons learnt so far Present teaching and learning e-portfolios developed throughout semester. 		Equity and Reflection is developed from reflective activities		

	<ul style="list-style-type: none"> Correct misconception/misinformation for earlier (lesson 7 – 11) lessons 	<ul style="list-style-type: none"> Present concept maps and/or models linking misconceptions/misinformation to new insights 	Creativity and critical thinking is developed in developing models, concept maps and methodologies for teaching	
Content of lesson picked and developed from the course specification	Sub Topic	Time or Stage	Teaching and learning to achieve learning outcomes: depending on delivery mode selected. Teacher led, collaborative group work or independent study	
Topic Title			Teacher Activity	Student Activity
Course Review II			Facilitate and provides the necessary tool for students' activities.	
	Reviewing the essence of co-planning and co-teaching.	60 minutes 70 minutes 20 minutes	<p>Face-to-face: Tutor led brainstorming session with student teachers to unearth weaknesses and strengths of student teachers in STS. InitiateTalk for learning approach using groups (Same ability and mixed groups).</p> <p>STS Seminar: Tutor Uses mixed ability, and mixed sex groupings to encourage student teachers to cross share and peer review their teaching</p> <p>Seminar: Student teachers peer review teaching and learning portfolios.</p>	<p>Face-to-face: Student teachers discuss their experiences in the STS provide a checklist to identify and record all weaknesses and strengths.</p> <p>STS Seminar: Student teachers Working in mixed groups and mixed sex groups co plan and cross share and later peer review their teaching skills.</p> <p>Seminar: Student teachers peer review their e-portfolios as they cross share their portfolios</p>
	Remedies to course topics	30 minutes	Face-to-face: Teacher groups student teachers according to remedy need and provide specific task assistance in the areas needed.	Face-to-face: Students work in the special groups (Same remedy need group) on tasks to remedy their learning needs.
Which cross cutting issues will be addressed or developed and how	Equity and SEN: through mixed and same group work to protect vulnerable student teachers and establishing an interactive and inclusive classroom atmosphere. Through modelling and group work, collaboration is established.			
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	<ul style="list-style-type: none"> Keep students peer Review ratings of their co-teaching plans for their portfolio for marks to be added to Assessment component 1. 			
Teaching Learning Resources	Cardboards, Course manual, Poster paper, Flip chart stands.			

Required Text (core)	Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J. W., Fometu, E., &Wiredu, M.B. (2008). <i>Ghana association of science teachers integrated science for senior high schools</i> . Accra: Unimax MacMillan.
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). <i>Ghana association of science teachers physics for senior high schools</i> . Accra: Unimax Macmillan. Ameyibor, K., &Wiredu, M. B. (2006). <i>Ghana association of science teachers chemistry for senior high schools</i> . Accra: Unimax MacMillan. Asabere-Ameyaw, A., &Oppong, E. K. (2013). <i>Integrated science for the basic school teacher I</i> . Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., &Obeng-Ofori, D. (2011). <i>SWL integrated science for senior high schools: Students book</i> . Accra, Ghana; Sam-Woode Ltd.
CPD Requirement	Workshop on preparation of checklist and Reflection guides.
Course Assessment	²¹ Component 1: Subject Portfolio Assessment (30% overall score) <ul style="list-style-type: none"> • Selected Item of Student work (3 items – 10%) = 30% • Midterm assessment – 20% • Reflective Journal – 40% • Organization of the Subject Portfolio- 10% (How its presented/organized) ²² Component 2: Subject Project (30% overall Semester score) <ul style="list-style-type: none"> • Introduction; a clear statement of aim and purpose of the project -10% • Methodology; What the student teacher has done and why to achieve the purpose of the project – 20% • Substantive/Main section of the work – 40% • Conclusion – 30% Component 3: End of Semester Examination – (40% overall Semester Assessment)

²¹ See rubrics on subject Portfolio Assessment in Annex 6 of NTEAP

²² See rubrics on Subject Project Assessment in Annex 6 of NTEAP

