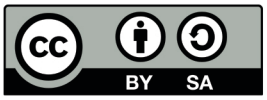
YEAR 2

SEMESTER 1

Four-Year B.Ed. Course Manual

PARTICULATE NATURE OF CHEMISTRY

The Government of Ghana



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, NTCEF, 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.

CORE WRITING TEAM

Names of writers	Subject		Names of writers	Subject
Dr. Isaac Eshun			Cletus Ngaaso	Social Studies
Dr. Anthony Baabereyir			Mohammed Adam	
Ms. Shirley Dankwa	African Studies		Dr. Emmanuel Adjei-Boateng	
Prof. S.Y. Annor	Agriculture		Dr. Yaw Nyadu Offei	Special Education
Dr. Salome praise Otami			Prof. Samuel Hayford	
Dr. Samuel Frimpong			Dr. Awuni	
Robert Quansah	Early Grade		Rev.(Dr) Nyueko Avotri	Technical Vocational Education and Training
Dr. Abraham Kwadwo Okrah			Elizabeth Lani Ashong	
Dr. Sarah Emma Eshun	English Language			
Vivian Acquaye			Michael Tsorgali	
Felix A. Odonkor			Frnacis Donkor	
Dr. Cecilia Esinam Agbeh			Dr. Maxwell Nyatsikor	
Ibrahim Osmanu	French		Prof. Salomey Essuman	
Dr. Kofi Adu-Boahen			Dr. Paul Kwadwo Addo	
Dr. M. Kusimi			Dr. Winston Kwame Abroampa	
Dr. Aboagye Dacosta			Mr. Kwaku Esia-Donkoh	
Mr. Alexander Otoo	Geography		Mohammed Z. Abdulmumin	Pedagogy
Dr. Yvonne A.A. Ollennu	Ghanaian Language		Dr. Mohammed Hafiz	Arabic
Kwasi Adomako			Iddris Mohammed	
Dr. Akwasi Kwarteng Amoako-Gyampah			Mohammed Almu Mahaman	
Anitha Oforiwah AduBoahen			Murtada M. Muaz	
Gertrude Nkrumah	History		Dr M. Q. Adjahoe	Music

Prof Charles Owu-Ewie	Literacy		Prof Cosmas Mereku	
Dr. Ahmed Amihere	Mathematics		Prof. Reginald Ocansey	Physical Education
Zakaria Sadiq			Dr. Emmanuel Osei Sarpong	
Dr. R. Addai-Mununkum	RME		E. Kwaku Kwaa-Aidoo	ICT
Dr Charles Nyarko Annobil			Victor Anyamful	
Mr. Owusu Afiriyie				
Dr. V. Ankamah-Lomotey	Science			
Jonathan Ayelsoma Samari				
Prof. Ruby Hanson				

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

Particulate nature of Chemistry

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 basic 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 instil 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	**Particulate nature of Chemistry**					
Pre-requisite	**Introduction to Integrated Science I and Introduction to Integrated Science II (from year 1)**					
Course Level	**200**	**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 Junior HighSchool level.

2. Course Description

The course for semester one of year two uses the universal design for learning approach to extend the basic science concepts of the student teacher on the following content areas: Periodicity- Electron configuration, Chemical bond and compound formation, Chemical equations, Nature of Solutions, Colloids, Energy changes and separation of mixtures. 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 assessment modes such as concept mapping, using checklist to identify values and attitudes and, mind maps that provide for the teachers' intention to ensure equity and 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 and Supported Teaching in School (STS) (NTS, 2e). Student teachers should as well manage the transition from Upper Primary to the JHS (NTS, 2e, p.13), (NTS, 1a-c, p. 12), (NTS, 2c, P. 13).

3. Key Contextual Factors

The Government,in its desire to improve the teaching and learning environment in the Junior High School has initiated several on-going interventions. However, Junior High School education still face a number of challenges including the lack of commitment and involvement of parents, financial constraints and inadequate infrastructure. Some of the attendant challenges are:

- the lack of qualified teachers at the Junior High School level in the various subject areas.
- some school do not have sufficient number of teachers trained to identify, manage and support the learning challenges of adolescents.
- the school system lacks mechanisms to identify and support pupils with learning disabilities and other SEN
- many Junior High School teachers have low ICT competency and are unable to integrate ICT into their teaching and learning
- there are cultural practices and prejudices that prevent the creation of a learning environment conducive to supporting the learning of all learners. An example is the belief that STEM subjects are male specific and home economics is female specific.
- teaching at the Junior high school at the moment mostly focuses on passing the Basic Education Certificate Examination (BECE) and not on quality and depth in learning and personal development: this leads to teaching and learning by rote
- There is a lack of parental involvement in 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 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 to middle childhood (Upper Primary) to early adolescent (Junior High School)

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**
O1 Explain the need for Junior High School students to learn about specific chemistry concepts in the JHS**(**NTS 2c, p.13 & 21)	• Produce reflective reports about links between Junior high school chemistry future careers and lifelong learning.

CLO2 Develop creative learning activities that can make the JHS school learner distinguish between metals and non-metals (NTS 2c, p.13 & 21)	• Create charts, concept mapsand mind maps about metals and non-metals
CLO3Recognize that some metals and objects made from iron when exposed to moisture in the presence of air will form rust and explain the effect of rusting on iron and demonstrate methods of preventing rust (NTS 2c, p.13 & 21), (NTS 2c, p.13 & 21)	• Present a mini project work on the conception of metals, non-metals and rusting in the immediate environment.
CLO4 Develop and use developmentally appropriate TLMs from locally available materials for teaching JHS school measurement (NTS 3j, pg. 14)	• Prepare improvised, developmentally appropriate materials for teaching at the primary school level
CLO5 Demonstrate an understanding of the principles of professional development observed during STS through reflective reporting. (NTS, 2c & 3e, Pg. 14 & 24)	• Prepare a reflective report on observations during STS for a seminar
CLO6 Demonstrate knowledge and application of the Teachers' Standards, for primary school curriculum, laws protecting children and all relevant regulations, and model positive values, attitudes and behaviours.Student teacher will be working towards meeting the NTS. (NTS 1b p14 & 18, 14)	• Provide a checklist to identify values such as patience, critical thinking, precision and accuracy in a peer review exercise • Prepare a list of some examples of professional needs and some characteristics of professional teachers

7. Course Content

Unit (Week)	Topic	Subtopic (if any)	Teaching and learning activity to achieve the learning outcomes
Week 1	Review of Year 1 integrated science	Recap of year 1 lessons and challenges thereof.	i. Demonstrations and discussions ii. Reflections, presentations and designing iii. Role playing/song creations iv. Simulations, video and Computer presentation v. Produce charts and illustrations of forms and sources of energy
	Teaching Periodicity- Electron configuration	Arrangement of electron around the central nucleus of an atom, Properties of elements	
Week 2	Teaching Chemical bond and compound formation	Periodic trends, Covalent and ionic bonds formation	i. Demonstrations and group discussions ii. Reflections, presentations and designing/game development iii. Concept mapping iv. Simulations, video and Computer presentation
Week 3	Teaching Chemical Equations	Chemical equations	**Face-to Face:** Discussion, Role Playing, Construction of games,about plants and animals **e-learning:** Video and Computer simulation on teaching activities and assessment strategies.
Week 4	Teaching Chemical Reactions	Balancing Chemical equations	**Face-to-face:** Mixed group discussions and demonstrations/role plays, Concept Mapping and Cartooning. **e-learning/Reflections:** Video presentations from MOOCs with reflections on values such as Honesty, Accuracy, Precision and critical thinking.
Week 5	TeachingNature of Solutions	i. Types of solutions (Unsaturated, Saturated, Supersaturated) ii. Express concentration of a solution (percent by weight, mole fraction, molarity,	**Face-to-face:**Discussion, Talk for learning approaches with student teacher presentations, Independent Face-to-face: Discussion, Talk for learning approaches with student teacher presentations, Independent Study: problem-based teaching, **e-learning opportunities:** multimedia

		parts per million, parts per billion)	presentations, problem-based teaching, **e-learning opportunities:** multimedia presentations
Week 6)	Course Review I and STS Seminar	i. Reviewing and reflecting on lessons 1-5 ii. STS Seminar	**Face-to-Face:** Pyramid discussions, Presentations **e-learning:** OERs and MOOCs **Independent Study:** reflection on observations made during STS and problem-based learning: on National Teacher's Standards
Week 7	TeachingSolubility	Solubility and factors that affect it	**Face-to-face:** Discussion, Talk for learning approaches with student teacher presentations, Practical work.
Week 8	Teaching Colloids I	i. Concepts on colloid formation ii. Types of colloids	**Face-to-face** discussions, demonstration, mixed group work Computer simulations and OERs sources
Week 9	Teaching Colloids II	Environmental and industrial importance	Independent Study: Inquiry and reflections **Face-to-Face:** Discussions, Role playing and Game e-learning: OERs and MOOCs with report writing
Week 10	TeachingEnergy changes	Energy Changes	**Face-to-Face:** Think, Pair, Share, Share discussions, Reflections **e-learning:** OERs and MOOCs with report writing
Week 11	Teaching separation of mixtures	Separation of a named mixture	**Face-to-Face:** Modelling, Role playing and developing games.
Week 12	Course Review II with STS seminar	i. Reviewing and reflecting on lessons 8-11 ii. STS Seminar	**Face-to-face:** Discussion, Talk for learning approaches with student teacher presentations, Independent Study: problem-based learning on National Teacher's Standards and reflection on observations made during STS.

8. Teaching and Learning Strategies:

Think, Pair, Share, Square, Group Discussions, Checklist, Role Play activities, Multimedia presentations, Concept mapping, concept cartoons, video presentations, simulations and Computer assisted instructions, inquiry learning and field trips and seminars, rhyming and song constructions

9. 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**: Assessment of Learning (End of Semester Examination)~~

~~Summary of Assessment Method:Exams on key concepts as shown in the lessons/ Presentations of group work activities and inquiry assignments~~

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

~~Weighting: 40%~~

CLO1, CLO4

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

2b) Has comprehensive knowledge of the official school curriculum, including

learning outcomes
2c) Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in.
3e) Employs a variety of instructional strategies that encourages student participation and critical thinking.
3i) Explains concepts clearly using examples familiar to students.
3j) Produces and uses a variety of teaching and learning resources including ICT, to enhance learning

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 2**: Assessment for Learning (Presentations)~~
~~Summary of Assessment Method: Practical Activities/Reflective Notes/ evidence of values learned/Group work/Evidence of equity and inclusivity/transferable skills during practical activities~~
~~Core skills to be acquired: Honesty, carefulness, accuracy and tolerance~~
~~**Weighting:** 30%~~
CLO3, 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
2c) Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in.
3e) Employs a variety of instructional strategies that encourages student participation and critical thinking.
3j) Produces and uses a variety of teaching and learning resources including ICT, to enhance learning

Component 3: End of Semester Examination – (40% overall Semester Assessment)
~~**Component 3**: Assessment as Learning (Review of Reports)~~
~~Summary of Assessment Method: Peer Review / Evidence of report from school visits for portfolio/Reflective notes~~
~~Core skills to be acquired: Pedagogical, observational and cooperative skills~~
~~**Weighting**: 30%~~
CLO1 - CLO6
1b) Improves personal and professional development through lifelong learning and Continuous Professional Development.
2c) Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in.
3e) Employs a variety of instructional strategies that encourages student participation and critical thinking.
3j) Produces and uses a variety of teaching and learning resources including ICT, to enhance learning

9. Required Reading and Reference List

Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). *Ghana association of science teachers integrated science for senior high schools*. Accra: Unimax MacMillan.

Abbey, T. K., &Essiah, J.W. (1995). *Ghana association of science teachers physics for senior high schools*. Accra: Unimax Macmillan.

Ameyibor, K., & Wiredu, M. B. (2006). *Ghana association of science teachers' chemistry for senior high schools*. Accra: Unimax MacMillan.

Asabere-Ameyaw, A., & Oppong, E. K. (2013). *Integrated science for the basic school teacher I*. Winneba: IEDE.

Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V.& Obeng-Ofori, D. (2011). *SWL integrated science for senior high schools: Students book*. Accra, Ghana; Sam-Woode Ltd.

10. Teaching and Learning resources

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

11. Course related professional development for tutors/ lecturers
• 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.	2	Semester	1	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Teaching Periodicity- Electron configuration	Lesson Duration	3 Hours
Lesson description	In this lesson, a review of year one Introduction to science is initiated to place the student teacher in a position to benefit from this lesson and the subsequent lessons for this semester. A discussion of Periodicity (Electron configuration/arrangement and properties of elements) is done with Student-teachers. Mainly, periodicity refers to the occurrence of similar properties in elements occupying similar positions in the periodic table with increasing atomic number. Studentteachers will look at electron configuration, which involves the arrangement of electrons within an atom (the structure of the Periodic table of elements is partly based on electron configuration) and properties of elements with the view to making it simple and meaningful to the Junior High school learner. This lesson will enable studentteachers to appreciate the possible existence of several solids, liquids and gaseous substances in nature and also help them to teach Periodicity (Electron configuration/arrangement and properties of elements) to the basic school learner. This first lesson introduces student teachers to the course learning outcomes and the three assessment components of the course		
Previous student teacher knowledge, prior learning (assumed)	Studentteachers are conversant with the orderly arrangement of things like clothes, provisions and books.		
Possible barriers to learning in the lesson	Studentteachers may: • Have meanings of Periodicity (Electron configuration/arrangement and properties of elements) that may be different from the descriptions scientists use • Not have the skills in teaching Periodicity (Electron configuration/arrangement and properties of elements) to the junior highschool learner.		

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, Practical Activity: Manipulations of models and designing models to reflect electron configuration. Independent Study: Inquiry and reflections e-learning opportunities: Use of internet MOOC, simulations and 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.** • **Write in full aspects of the NTS addressed**	• Proper scientific description of Electron configuration/arrangement and properties of elements • Demonstrate the skill and knowledge to teach the subject matter NTS, The Teacher: 1c) Demonstrates effective growing leadership qualities in the classroom and widerschool. 3e) Employs a variety of instructional strategies that encourages studentparticipation and critical thinking. 3j) Produces and uses a variety of teaching and learning resources including ICT, toenhance learning.

• **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
	• 1. Demonstrate the understanding of elements, and electron configuration, and use it to explain the periodic trends and bond formation.	• Provide samples of exercises explaining and predicting periodic trends (atomic size, ionic size, ionisation energy and electronegativity) across periods 2 and 3, and down groups 1 and 2 by student teachers • Draw a chart to show the detailed configuration of the first 20 elements by student teachers. • Provide samples of exercises on how student teachers describe two common types of bonds –covalent and ionic bonds- are formed and explain their characteristics	Correct/ handling and uses of devices, good identification of tools for measurements, sharing ideas in class, conversion of temperature from degree Celsius to degree Fahrenheit, Student-teachers develop skills of communication, collaboration and mutual respect while appreciating individual difference and abilities, critical thinking and responsibility through careful 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**
Review of Year 1 Integrated Science and Teaching Periodicity- Electron configuration	Recap of Year 1 lessons and challenges thereof	**60 minutes**	Face-to-face: Tutor initiates a Pyramid discussion on the year 1 concepts with student teachers, and encourages them to reflect on the new concepts, the challenges and unique lessons. The lessons on chemical symbols and elements should be highlighted to link the starting concepts of periodicity	Face-to-face: Student teachers work individually and in groups to discuss year one lessons, the challenges, unique values and produce a concept map of possible expectations in the content of the upper primary science lessons
	Arranging electrons around the central nucleus of an atom		**Face-to-face:** Tutor introduces the lesson by reviewing student teachers relevant previous knowledge on Periodicity. **Face-to-face:** Open-ended questions to elicit misconceptions/incorrect ideas about Periodicity (Electron configuration/ arrangement and properties of elements) **Face-to-face:** Tutor allows studentteachers to form mixed groups (gender-based) of 3 members to discuss about the arrangement of electron around the central nucleus of an atom.	**Face-to-face**: Studentteachers tell their previous knowledge on Periodicity. **Face-to-face:** Studentteachers answer open-ended questions to bring their incorrect ideas on Periodicity (Electron configuration/arrangement and properties of elements) **Face-to-face:** Studentteachers in mixed groups (gender-based) of 3 members discuss about the arrangement of electron around the central nucleus of an atom.

	Properties of elements	**60 minutes**	Face-to-face/e-learning: Tutor allows studentteacher to from mixed groups (gender-based) of 3 members to discuss about the properties of elements and use the properties to develop learning materials. Require of the student teachers to produce written reports/charts on them. The discussion should be based on video resources from MOOCs such ashttps://www.youtube.com/watch?v=5SmndBRDU6s https://www.youtube.com/watch?v=zzbXwkUwqkc (Accessed 22/06/2019)	Face-to-face: In mixed groups (gender-based) of 3 members, studentteachers discuss about the properties of elements and how to make materials to teach JHS they will produce written reports/charts on them.
	Teaching how to teach Periodicity (Electron configuration/ arrangement and properties of elements) to the Basic school learner	**60 minutes**	Face-to-face/E-learning opportunities: Tutor allows studentteachers to do short power point/poster presentation on how to teach Periodicity (Electron configuration/arrangement and properties of elements) to the Basic school learner (Mixed intellectual ability Groups of 3 members).	Face-to-face/E-learning opportunities: Studentteachers in groups of 3 members (Mixed intellectual ability Groups), do power point/poster presentation on how to teach Periodicity (Electron configuration /arrangement and properties of elements) to the Basic school learner.

Which cross cutting issues will be addressed or developed and how	Equity and SEN: through setting ground rules to protect vulnerable studentteachers and establishing an interactive and inclusive classroom atmosphere. By practicing with the drawings of the electronic configuration studentteachers' difficulties in drawing skills of the electronic configuration will be addressed.
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	Assessment as learning: Written reports/charts produced by studentteachers on properties of elements. NTS 2c) Has secure content knowledge, pedagogical knowledge and pedagogicalcontent knowledge for the school and grade they teach in. NTS 3j) Produces and uses a variety of teaching and learning resources including ICT, toenhance learning Assessment of learning: Student teachers doing short presentations (3-5 minutes each) on how to teach Periodicity (Electron configuration, and properties of elements) to the Basic school (Reflection on presentations). NTS1c) Demonstrates effective growing leadership qualities in the classroom and widerschool. NTS 3e) Employs a variety of instructional strategies that encourages studentparticipation and critical thinking. NTS 3j) Produces and uses a variety of teaching and learning resources including ICT, toenhance learning.
Teaching Learning Resources	Pen, paper, manila cards for charts, https://www.youtube.com/watch?v=5SmndBRDU6s, https://www.khanacademy.org/science/chemistry/periodic-table/copy-of-periodic-table-of-elements/v/periodic-table-introduction (Accessed 22/06/2019),
Required Text (core)	Abbey, T. K., Alhassan, B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). *Ghana association of science teachers integrated science for senior high schools*. Accra: Unimax MacMillan; Handbook for PD Coordinators Themes 1- 10
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). *Ghana association of science teachers physics for senior high schools*. Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). *Ghana association of science teachers' chemistry for senior high schools*. Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). *Integrated science for the basic school teacher I*. Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., & Obeng-Ofori, D. (2011). *SWL integrated science for senior high schools: Students book*. Accra, Ghana; Sam-Woode Ltd.
CPD Requirement	i. Working on materials to teach JHS Periodicity ii. Practicing how to draw electronic configuration/arrangement around central atom accurately

	iii. Tolerating others in group work
Course Assessment	[1]**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)** [2]**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 3: End of Semester Examination – (40% overall Semester Assessment**

[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.	2	Semester	1	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Teaching Chemical bond and compound formation					Lesson Duration	3 Hours
Lesson description	In this lesson, Tutor discusses Periodicity as a recap and discuss Chemical bonds, which deals with a lasting attraction between atoms, ions or molecules that enables the formation of chemical compounds. This lesson will enable student-teachers to model strategies that can be used to teach chemical bonds and compound formation to the JH school learner.						
Previous student teacher knowledge, prior learning (assumed)	Studentteachers are conversant with the electronic configuration and draw the electronic arrangements of the first-20 elements from lesson 1						
Possible barriers to learning in the lesson	Studentteachers may: • Have meanings of Periodicity (Periodic trends, Chemical bond and Compound formation) that may be different from the descriptions scientists use • Not have the skills in teaching Periodic trends, Chemical bond and Compound formation to the Basic School learner.						
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, Demonstrations, role play Independent Study: Inquiry and reflections e-learning opportunities: Use of internet, simulations and 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.** • **Write in full aspects of the NTS addressed**	• Proper scientific description of Periodic trends, Chemical bond and compound formation • Demonstrate the skill and knowledge to teach the subject matter NTS: The Teacher: 1c) Demonstrates effective growing leadership qualities in the classroom and widerschool. 3e) Employs a variety of instructional strategies that encourages studentparticipation and critical thinking. 3j) Produces and uses a variety of teaching and learning resources including ICT, toenhance learning.						
• **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	
	Demonstrate the understanding of elements and electron configuration, and use it to explain the periodic trends and bond formation.		• Provide samples of exercises explaining and predicting periodic trends (atomic size, ionic size, ionisation energy and electronegativity) across periods 2 and 3, and down groups 1 and 2 by student teachers • Draw a chart to show the detailed configuration of the first 20 elements by student teachers. • Provide samples of exercises on how student teachers describe two common types of bonds – covalent and ionic bonds- are formed and explain their characteristics			Correct/ handling and uses of devices, good identification of tools for measurements, sharing ideas in class, conversion of temperature from degree Celsius to degree Fahrenheit. Studentteachers develop skills of communication, collaboration and mutual respect while appreciating individual difference and abilities, critical thinking and responsibility through careful participation ingroup 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**
Periodicity- Chemical bond and compound formation II	Periodic trends	**60 minutes**	Face-to-face: Tutor introduces the lesson by reviewing Studentteachers drawing on the electronic configuration of the first 20 elements. Face-to-face: In mixed groups (gender-based) of 3 members, student-teachers discuss periodic trends (atomic size, ionic size, ionisation energy and electronegativity, across periods 2 and 3, and down groups 1 and 2) and produce charts of the periodic trends of the first-20 elements.	Face-to-face: Studentteachers show their previous knowledge by drawing the electronic configuration of the first 20 elements. Face-to-face: Studentteachers discuss periodic trends (atomic size, ionic size, ionisation energy and electronegativity across periods 2 and 3, and down groups 1 and 2) and produce charts of periodic trends of the first-20 elements.
	Covalent and ionic bonds, and compound formation	**60 minutes**	Face-to-face: Allow studentteachers to brainstorm (in groups of 3 members of mixed intellectual ability) to come out with the formation of covalent and ionic bonding and some compound formation.	Face-to-face: Studentteachers brainstorm to come out with the formation of covalent and ionic bonds, and compound formation. Studentteachers produce samples of exercises on the description/explanation of the formation of ionic and covalent bonds and their characteristics.
	Teaching how to teach Periodicity(Covalent and ionic bonds, and compound formation) to the Basic school learner	**60 minutes**	Face-to-face/E-learning opportunities: Tutor allows studentteachers to do short power point/poster presentation on how to teach Periodicity (Periodic trends, Chemical bond and compound formation) to the JH school learner (Mixed intellectual ability Groups of 3 members).	Face-to-face/E-learning opportunities: Studentteachers in groups do power point/poster presentation on how to teach Periodicity (Periodic trends, Chemical bond and compound formation) to the JH school learner.
Which cross cutting issues will be addressed or developed and how	Equity and SEN: through setting ground rules to protect vulnerable studentteachers and establishing an interactive and inclusive classroom atmosphere.			
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	Assessment as learning: Samples of exercises on how studentteachers describe/explain ionic and covalent bonds formation and their characteristics. 1c) Demonstrates effective growing leadership qualities in the classroom and widerschool. 3e) Employs a variety of instructional strategies that encourages studentparticipation and critical thinking. Assessment of learning: Charts produced by student-teachers on the periodic trends of the first-20 elements. NTS2c) Has secured content knowledge, pedagogical knowledge and pedagogicalcontent knowledge for the school and grade they teach in. Assessment for learning: Student teachers doing short presentations (3-5 minutes each) on how to teach Periodicity (Periodic trends, Chemical bond and compound formation) to the Basic			

	school Learner (Reflection on presentations).NTS3j) Produces and uses a variety of teaching and learning resources including ICT, toenhance learning
Teaching Learning Resources	Pen, paper, manila cards for charts, https://www.khanacademy.org/science/chemistry/periodic-table/copy-of-periodic-table-of-elements/v/valence-electrons-lewis (Accessed 22/06/2019)
Required Text (core)	Abbey, T. K., Alhassan, B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). *Ghana association of science teachers integrated science for senior high schools*. Accra: Unimax MacMillan; Handbook for PD Coordinators Themes 1- 10
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). *Ghana association of science teachers physics for senior high schools*. Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). *Ghana association of science teachers' chemistry for senior high schools*. Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). *Integrated science for the basic school teacher I*. Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., & Obeng-Ofori, D. (2011). *SWL integrated science for senior high schools: Students book*. Accra, Ghana; Sam-Woode Ltd.
CPD Requirement	i. Practicing how to form chemical bonds and compounds accurately ii. Practicing how to analyse periodic trends accurately/correctly iii. Tolerating others in group work

LESSON 3

Year of B.Ed.	2	Semester	1	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Teaching Chemical Equations					Lesson Duration	3 Hours
Lesson description	The lesson is designed to provide chemistry student-teachers with the relevant learning experiences and technological skills that will enable them to teach chemical equations creatively through hands-on exploratory learning activities and effective authentic assessment. It is also structured to enable them to learn how to cater for age grade specialisms, physical and biological transitions and the necessary pedagogical skills to solve such problems.						
Previous student teacher knowledge, prior learning (assumed)	Studentteachers have been introduced to the particulate nature of matter, mixtures, chemical bonding and compound formation.						
Possible barriers to learning in the lesson	Inability to comprehend the microscopic behaviour of particles during chemical bonding for symbolic representation.						
Lesson Delivery chosen to support students in achieving the outcomes	**Face-to-face √**	**Practical Activity √**	**Work-Based Learning**	**Seminar**	**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: Mixed group discussions and demonstrations on chemical reactions. Practical Activity: Studentteachers carry out about three chemical reactions and write the reaction equations Independent Study: Reflections and Inquiry e-learning opportunities: Video simulations and 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.** • **Write in full aspects of the NTS addressed**	• Ascertain the level of understanding and writing of word chemical equations • Provide basic skills for writing out word chemical equations • Correct misconceptions and misinformation about chemical equations • Acquire pedagogic skills to teach chemical equations NTS, The Teacher: 2c) Has secure content knowledge, pedagogical knowledge and pedagogicalcontent knowledge for the school and grade they teach in. 3e) Employs a variety of instructional strategies that encourages studentparticipation and critical thinking..						
• **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**	
	• Demonstrate awareness and understanding of chemical equations and be able to teach same • Demonstrate appropriate skills required for writing word chemical equations and be able to teach same. • Correct misconception/misinformation about chemical equations that are identified			• Present charts on chemical equation and word descriptions of common reactions • Provide illustrations (in e-form or other) to show chemical equations for some reactions and describe how such can be taught to learners. • Present concept maps or models that link misconceptions to new insights PD Theme 3, pg 63 – 81		Communication and Research: through group work and presentations PD Theme 4, pg. 23-30 Equity and Reflection is developed from reflective activities Creativity and critical thinking are developed in creating models and concept maps PD Theme 5, pg 37	

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	
			Teacher Activity	Student Activity
Topic /Title **Teaching Chemical equations**	Chemical equations in word form	40minutes	Face-to-face: Initiate a recap on previous lesson on periodicity. Put student-teachers into special-ability groups to discuss their understanding of word equations	Face-to-face: Special-ability group discussions on the concept of chemical equations and provide word descriptions of their understanding
	Break time	10 minutes	Break for students to relax	Students go out for breather
	Skills required in representing chemical equations	60minutes	Face-to-face/E-learning: Put studentteachers into mixed groups to discuss the key components of chemical equations	Discussion/E-learning: Demonstrate through hands-on and e-activities and discuss the formation of compounds and represent the reactions in word form.
	Break time	15 minutes	Teacher breaks lecture for relaxation	Students go out for breather/interact to catch up on lessons
	Dealing with misconceptions about chemical reactions	55minutes	Work-based learning: Group student teachers into mixed-ability groups with instructions on how to do identify key components that could be missed out in writing equations Provide web addresses and links for videos and computer simulations on writing word equations	Work-based learning: Students work in mixed-ability groups to enumerate identified misconceptions in class. Watch videos/computer simulations on how to write word equations Produce concept maps of common misconceptions, possible causes, and how to correct them PD Theme 3, pg. 121; PD Theme 5, pg. 33.
Which cross cutting issues will be addressed or developed and how	Equity and SEN: through mixed and same ability group work to protect vulnerable students. Student teachers establish an interactive and inclusive learning environment through group work.			
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	Assessment of Learning: End of lesson assessment: Reports, posters, charts, internet-based scientific reports 2c: Has secure content, pedagogical and pedagogicalcontent knowledge for the school and grade they teach in Assessment as Learning: Student teachers' presentations during group work presentation to assess their learning NTS 1c: Demonstrates effective growing leadership qualities in the classroom in wider school 3e: Employs a variety of instructional strategies that encourage student participation and critical thinking			
Teaching Learning Resources	Poster paper, computer with internet access, smart phone, tablets, 0.05M sodium hydroxide and HCl solutions.			
Required Text (core)	Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). *Ghana association of science teachers integrated science for senior high schools*. Accra: Unimax MacMillan. Handbook for PD Coordinators Themes 1- 10			
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). *Ghana association of science teachers physics for senior high schools*. Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). *Ghana association of science teachers, chemistry for*			

	senior high schools. Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). *Integrated science for the basic school teacher I*. Winneba: IEDE.
CPD Requirement	Training in writing word equations

LESSON 2

Year of B.Ed.	2	Semester	1	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Teaching Chemical Reactions			**Lesson Duration**		**3 Hours**	
Lesson description	The lesson is designed to provide chemistry student-teachers with the relevant learning experiences and technological skills that will enable them to teach chemical reactions creatively through hands-on exploratory learning activities and effective authentic assessment. It is also structured to enable them to learn how to cater for age grade specialisms, physical and biological transitions and the necessary pedagogical skills to solve such problems as they perform practical activities. (2b & c; 3e & 3j; NTECF p.20)						
Previous student teacher knowledge, prior learning (assumed)	Student-teachers have been introduced to the particulate nature of matter, mixtures, chemical bonding, compound formation and how to write word chemical equations, with justification.						
Possible barriers to learning in the lesson	Inability to comprehend the microscopic behaviour of particles during chemical bonding, their symbolic representation and ensuring entities (ions, atoms, and molecules) are balanced.						
Lesson Delivery chosen to support students in achieving the outcomes	**Face-to-face √**	**Practical Activity √**	**Work-Based Learning√**	**Seminar**	**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: Mixed group pyramid discussions and demonstrations on chemical reactions. Practical Activity: Student-teachers carry out about three chemical reactions and write the reaction equations e-learning opportunities: Video simulations and 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.** • **Write in full aspects of the NTS addressed**	• Ascertain the level of understanding and writing of word chemical equations • Correct misconceptions and misinformation about chemical equations • Provide basic skills for writing out symbolic (representational)chemical equations and balancing them • Acquire pedagogic skills to teach learners how to write and balance chemical equations, using the inspection or other innovative method NTS: The Teacher: 2b) Has comprehensive knowledge of the official school curriculum including learning outcomes 2c) Has secured content knowledge, pedagogical knowledge and pedagogicalcontent knowledge for the school and grade they teach in. 3e) Employs a variety of instructional strategies that encourages studentparticipation and critical thinking. 3l) Listens to learners and gives constructive feedback.						
• **Learning Outcome for the lesson, picked and developed**	**Learning Outcomes**		**Learning Indicators**		**Identify which cross-cutting Issues, core and transferable skills, inclusivity, and equity issues to address diversity. How will these be developed**		

from the course specification	• Demonstrate understanding of word chemical equations and be able to teach same • Demonstrate knowledge of chemical symbols that make up given compounds and be able to teach same. • Correct misconception/misinformation about chemical equations that are identified • Balance given chemical equations in symbolic form (using the inspection method or other innovative method) adding correct coefficients where necessary, with justification • Perform practical activity on neutralisation and balance equation		• Explain key components necessary for writing word equations • Provide knowledge (in e-form or other) of chemical compounds and their constituents • Present concept maps or models that link misconceptions to new insights PD Theme 3, pg 63 – 81 • Explain the processes for balancing chemical equations and exhibit them correctly with reasons • Provide balanced equation (in symbolic form) from practical activity	Communication and presentation skills PD Theme 4, pg. 23-30 Equity and Reflection is developed from reflective activities Creativity and critical thinking are developed in creating models and concept maps PD Theme 5, pg 37 Write chemical equations for different types of reactions and balance them using inspection method. Communication, analytical, deductive and reflective skills developed Manipulative, analytical, communication, deductive and reflective skills developed
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**	
			Teacher Activity	**Student Activity**
Topic Title Teaching Chemical Reactions	Chemical equations in word form	40minutes	Face-to-face: Put studentteachers into special-ability groups to discuss their understanding and practice of word equations and encourage them to identify elemental constituents	Face-to-face: Special-ability group discussions on the concept of chemical equations and provide word descriptions of their understanding
	Dealing with misconceptions about chemical reactions (Subtly introduce symbolic representations)	40 minutes	Work-based learning: Group student teachers into differentiated groups with instructions on how to do identify key components that could be missed out in writing equations Provide web addresses and links for videos and computer simulations on writing word equations	Work-based learning: Students work in differentiated groups enumerate identified misconceptions in class. Watch videos/computer simulations on how to write word equations Produce concept maps of common misconceptions, possible causes, and how to correct them PD Theme 3, pg. 121; PD Theme 5, pg. 33.
	Skills required in representing chemical equations	50minutes	Face-to-face/E-learning: Put studentteachers into mixed groups to discuss the key components of chemical equations	Discussion/E-learning: Demonstrate through hands-on and e-activities and discuss the formation of compounds with representation in symbolic form.
	Balancing chemical equations in symbolic form from practical activities	50minutes	Work-based learning: Group student teachers into mixed-ability groups with instructions on how to carry out a practical activity and write	Produce laboratory reports from exercises and activities on balanced chemical equations.

			balanced equations Provide web addresses and links for videos and computer simulations on symbolic chemical word equations	
Which cross cutting issues will be addressed or developed and how	Equity and SEN: through mixed and same ability group work to protect vulnerable students. Student teachers establish an interactive and inclusive learning environment through group work.			
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• Assessment of Learning: End of lesson assessment: Reports, posters, charts, internet-based scientific reports NTS 2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes. NTS 2c) Has secure content knowledge, pedagogical knowledge and pedagogical content • Assessment as Learning: Student teachers' presentations during group work to assess their learning NTS3e) Employs a variety of instructional strategies that encourages studentparticipation and critical thinking. NTS 3l Listens to learners and gives constructive feedback.			
Teaching Learning Resources	Balancing chemical equations Worksheet, computer with internet access, smart phone, tablets, 0.05M sodium hydroxide and HCl solutions.			
Required Text (core)	Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). *Ghana association of science teachers integrated science for senior high schools*. Accra: Unimax MacMillan; JHS Science Curriculum; Handbook for PD Coordinators Themes 1- 10			
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). *Ghana association of science teachers physics for senior high schools*. Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). *Ghana association of science teachers, chemistry for senior high schools*. Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). *Integrated science for the basic school teacher I*. Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V.& Obeng-Ofori, D. (2011). *SWL integrated science for senior high schools: Students book*. Accra, Ghana; Sam-Woode Ltd.			
CPD Requirement	Training in writing and balancing representational (symbolic) chemical equations and training in the use of pyramid discussions. Training in the use of micro science equipment for chemistry activities.			

LESSON 2

Year of B.Ed.	2	Semester	1	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Teaching Nature of Solutions					**Lesson Duration**	**3 Hours**
Lesson description	In this lesson, Tutor discusses Nature of Solutions with studentteachers. Basically, Types of solutions (Unsaturated, Saturated, and Supersaturated) and how to form/measure the different concentrations of solutions (percent by weight, mole fraction, molarity, parts per million, parts per billion) will be looked at. This lesson will help studentteachers to recognize the composition of many solutions and most common way to express concentration. This lesson will further enable studentteachers to demonstrate the skill in teaching Solutions to the basic school learner.						
Previous student teacher knowledge, prior learning (assumed)	Studentteachers are aware that a mixture of solute and solvent constitutes a solution.						
Possible barriers to learning in the lesson	Studentteachers may: • Have meanings of Types of Solutions and way of expressing concentrations of solutions that may be different from the descriptions that scientists use • Not have the skills in teaching Nature of Solutions I (Types of solutions- unsaturated, saturated, and supersaturated, and how to form/measure different concentrations of solutions) to the Basic School learner						
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, Tutor and studentteachers' interactions on the functions of simple machines Practical Activity: Practical manipulation of simple machines Independent Study: Inquiry and reflections e-learning opportunities: Use of internet, simulations and 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.** • **Write in full aspects of the NTS addressed**	• Proper scientific description of the characteristics of solutions and how to measure the form/measure different concentrations of solutions • Demonstrate the skill and knowledge to teach the subject matter NTS: The Teacher: 2c) Has secure content knowledge, pedagogical knowledge and pedagogicalcontent knowledge for the school and grade they teach in. 3e) Employs a variety of instructional strategies that encourages studentparticipation and critical thinking. 3l) Listens to learners and gives constructive feedback.						
• **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**		
	• Describe the characteristics of solutions and how to measure their concentrations quantitatively, importance(NTS 2c)		• Engage in collaborative and experiential learning approaches to prepare solutions of different concentrations to facilitate learning in an inclusive and multi-grade classroom.		Proper skills of preparing solutions of different concentrations, sharing ideas in class, studentteachers develop skills of communication, collaboration and mutual respect while appreciating individual difference and abilities, critical thinking and responsibility through careful 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**
Teaching Nature of Solutions	Types of solutions (Unsaturated, Saturated, Supersaturated)	**60 minutes**	**Face-to-face:** Tutor introduces the lesson by reviewing Student teachers relevant previous knowledge on Solutions. **Face-to-face:** Open-ended questions to elicit misconceptions/incorrect ideas about Solutions (Types and how to form/measure different concentrations of solutions) **Face-to-face:** Tutor allows studentteacher to form mixed groups (intellectual ability) of 3 members to discuss the types of solutions that can be formed by mixing solutes and solvents (Unsaturated, Saturated, and Supersaturated). Studentteachers should produce a written report on how types of solutions are formed.	**Face-to-face:** Student teachers come out with their previous knowledge on Solutions. **Face-to-face:** Student teachers answer open-ended questions to bring their incorrect ideas on solutions (Types and how to form/measure different concentrations of solutions) **Face-to-face:** Student teachers in mixed groups (gender-based) of 3 members discuss about the arrangement of electron around the central nucleus of an atom. Studentteachers produce a written report on how types of solutions are formed.
	Express concentration of a solution (percent by weight, mole fraction, molarity, parts per million, parts per billion)	**60 minutes**	Practical Activity/E-learning: Tutor allows studentteacher to from mixed groups (gender-based) of 3 members to discuss about how different concentrations of solutions are formed/ measured (percent by weight, mole fraction, molarity, parts per million, parts per billion). Student-teachers should produce videos narrating how different concentrations are formed/measured.	Practical Activity/E-learning: In mixed groups (gender-based) of 3 members, student-teachers discuss how different concentrations of solutions are formed/ measured (percent by weight, mole fraction, molarity, parts per million, parts per billion). Student-teachers produce videos to narrate how different concentrations are formed/measured.
	How to Teach Solution I (Types of solutions- unsaturated, saturated, and supersaturated, and how to form/measure/prepare different concentrations of solutions)to the Basic school learner	**60 minutes**	Face-to-face/E-learning opportunities: Tutor allows studentteachers to do short power point/poster presentation on how to teach Solutions(Types of solutions- unsaturated, saturated, and supersaturated, and how to form/measure different concentrations of	Face-to-face/E-learning opportunities: Studentteachers in groups of 3 members (Mixed intellectual ability Groups), do power point/poster presentation on how to teach Solutions (Types of solutions- unsaturated, saturated, and supersaturated, and how to

			solutions)to the Basic school learner (Mixed intellectual ability Groups of 3 members).	form/measure different concentrations of solutions)to the Basic school learner.
Which cross cutting issues will be addressed or developed and how	Equity and SEN: through setting ground rules to protect vulnerable studentteachers and establishing an interactive and inclusive classroom atmosphere. By practicing with the preparation of solutions of different concentrations, studentteachers' difficulties in skills of forming/measuring/preparing different concentrations of solutions will be addressed.			
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• Assessment of learning: Written reports produced by studentteachers on how types of solutions are formed. • NTS 2c:Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in • Assessment as learning: Videos produced by student-teachers on practical activity of forming/measuring different concentrations of solutions. • NTS 3e: Employs a variety of instructional strategies that encourages student participation and critical thinking. • Assessment for learning: Teachers doing short presentations (3-5 minutes each) on how to teach Solution I (Types of solutions- unsaturated, saturated, and supersaturated, and how to form/measure different concentrations of solutions) to the Basic school (Reflection on presentations). NTS 3l: Listens to learners and gives constructive feedback.			
Teaching Learning Resources	Pen, paper, manila cards for charts, salts, sugar, water, beakers, stirring rods.			
Required Text (core)	Abbey, T. K., Alhassan, B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). *Ghana association of science teachers integrated science for senior high schools*. Accra: Unimax MacMillan; Handbook for PD Coordinators Themes 1- 10			
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). *Ghana association of science teachers physics for senior high schools*. Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). *Ghana association of science teachers' chemistry for senior high schools*. Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). *Integrated science for the basic school teacher I*. Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., & Obeng-Ofori, D. (2011). *SWL integrated science for senior high schools: Students book*. Accra, Ghana; Sam-Woode Ltd.			
CPD Requirement	i. Practicing how to draw form/measure/prepare different concentrations of solutions accurately ii.Tolerating others in group work			

LESSON 6

Year of B.Ed.	2	Semester	1	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Course Review 1 and STS Seminar				Lesson Duration	3 Hours
Lesson description	To review and audit the lessons for the first half of the semester. It is also expected that studentteachers will reflect during this lesson on their own progress in the course so far.					
Previous student teacher knowledge, prior learning (assumed)	Lessons learnt from Week1 through Week 5 in all learning approaches.					
Possible barriers to learning in the lesson	Misconception on some concepts not adequately dealt with and lesson inadequately understood by studentteachers.					
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, Demonstration **Independent Study:** Reflections, Modelling concept maps and cartoons Seminar: Presentations of models, cartoons and maps of the concepts e-learning opportunities: Computer simulations and OERs on content and teaching activities for contents.						
• **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**	• Ascertain the level of understanding of concepts. • Test various skills and cross-cutting issues • Provide remedial tuition where necessary • Correct misconceptions and misinformation • Build the necessary support going forward on SEN and Gender issue NTS: 2c) Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in 3j:.Produces and uses a variety of teaching and learning resources including ICT, to enhance learning.						
• **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, equity and inclusivity. would address diversity. How will these be addressed or developed?	
	• Identify weaknesses and strengths in learning the science lesson for the period under review • Reflect on lessons learnt so far and state new insights and/or grey areas needing remedies • Correct misconception/misinformation for earlier (lesson 1 – 5) lessons		• Make a list of weaknesses and strengths on poster papers for sharing PD Theme 4, pg 111 • Provide a reflective report and answer questions on topics learnt so far through demonstrations and illustrations on a given media • Present concept maps and/or models linking misconceptions/misinformation to new insights		Collaborations, Communication and Research through group work and presentation Equity and Reflection is developed from reflective activities PD Theme 1. Pg 12-15; pg 41 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 **Course Review 1 and STS Seminar**			**Teacher Activity** Facilitate and provide the necessary tools for students' activities.	**Student Activity**
	Reviewing lessons on Periodicity, chemical bonding, compound formation, and chemical equations	50 minutes	Face-to-face: Tutor led brainstorming session with student teachers to unearth the weaknesses and strengths of student teachers in lessons 1-5. Initiate discussion /Talk for learning approach using groupings (Differentiated groups) to identify student teachers strengths and weakness in the lessons learnt so far.	Face-to-face:Student teachers discuss their problems in the previous lessons and provide a checklist identifying and recording all possible weaknesses and strengths
	Break time	10 minutes	Teachers allows 10-minute break for students' relaxation	Student teachers take a break
	Remedies to course topics	40minutes	Face-to-Face: Tutor groups student teachers according to remedy need and provide specific task assistance in the areas on concept needing remedy	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
	Break time	20 minutes	Teachers allows 20-minute break for students' relaxation	Student teachers take a break
	Discussion of observations during STS	60 minutes	Seminar: Tutor 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	Seminar:Student teachers listen to various presentations. Student teachers then discuss observations made during STS based on the National Teacher's Standards, reflect and provide a checklist of lessons learned and problems identified and how they can be addressed. Student teachers then provide a reflection report on STS
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	• Assessment as learning: Student teachers' presentations during group work and model work presentation helps to assess their learning (Presentations to last for each group a 3-5mins) working in groups. NTS 2c:Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in. • Assessment of learning: Studentteachers working in groups on remedial tutoring helps to assess them for learning NTS 3j: Produces and uses a variety of teaching and learning resources including ICT, to enhance learning • Written assessment will be used to assess as learning			

Teaching Learning Resources	JHS Science Syllabus
Required Text (core)	Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). *Ghana association of science teachers integrated science for senior high schools*. Accra: Unimax MacMillan. Handbook for PD Coordinators Themes 1- 10
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). *Ghana association of science teachers physics for senior high schools*. Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). *Ghana association of science teacher's chemistry for senior high schools*. Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). *Integrated science for the basic school teacher I*. Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V.& Obeng-Ofori, D. (2011). *SWL integrated science for senior high schools: Students book*. Accra, Ghana; Sam-Woode Ltd.
CPD Requirement	Training on preparation of checklist, reflection guides and pyramid discussions

LESSON 7

Year of B.Ed.	2	Semester	1	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Teaching Solubility					**Lesson Duration**	**3 Hours**
Lesson description	In this lesson, Tutor discusses Nature of Solutions as recap and links it with solubility and factors affecting solubility. Studentteachers will have the conceptual understanding of solubility as a measure of the maximum amount of solute that can be dissolved in a given amount of solvent to form a stable solution. Again, studentteachers should be able to identify factors/conditions that affect the solubility of a solute in this lesson. Lastly, this lesson will enable studentteachers teach solubility and factors affecting solubility to the JH school learner.						
Previous student teacher knowledge, prior learning (assumed)	Studentteachers are conversant with the how types of solutions are formed and can prepare solutions of different concentrations.						
Possible barriers to learning in the lesson	Studentteachers may: • Have misconceptions on solubility and the factors that affect solubility • Not have the skills in teaching Nature of Solutions II (solubility and factors affecting solubility) to the Basic School learner.						
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, Tutor and student-teachers' interactions on the functions of simple machines Practical Activity: Practical manipulation of simple machines Independent Study: Inquiry and reflections e-learning opportunities: Use of internet, simulations and 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.** • **Write in full aspects of the NTS addressed**	• Proper scientific description of Solubility • Correct identification of factors/conditions that affect the solubility of solutes. • Demonstrate the skill and knowledge to teach the subject matter NTS, The Teacher: 1a) Critically and collectively reflects to improve teaching and learning 2c) Has secure content knowledge, pedagogical knowledge and pedagogicalcontent knowledge for the school and grade they teach in.						
• **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		
	• Demonstrate knowledge and understanding on the effects of temperature, particle size and agitation on solubility. (NTS 2c, 2c)		• Provide a chart on how temperature, particle size and agitation affect solubility		In identifying factors that affect solubility and sharing ideas in class, student-teachers develop skills of communication, collaboration and mutual respect while appreciating individual differences, abilities, critical thinking and responsibility through 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**
Teaching Solubility	Solubility	**60 minutes**	**Face-to-face:** Tutor introduces the lesson by reviewing student teachers previous knowledge on Nature of Solutions (types of Solutions and formation/measuring/ preparation of solutions of different concentrations). **Face-to-face:** Open-ended questions to elicit misconceptions/incorrect ideas about Nature of Solutions II (types of Solutions and formation/measuring/ preparation of solutions of different concentrations). **Face-to-face:** Tutor allows studentteacher to form mixed groups (gender-based) of 3 members to discuss about the solubility of different solutes. Studentteachers should produce written reports on the meaning of solubility.	**Face-to-face:** Student teachers disclose their previous knowledge on Nature of Solutions II (types of Solutions and formation/measuring/ preparation of solutions of different concentrations... **Face-to-face:** Studentteachers answer open-ended questions to bring their incorrect ideas on Nature of Solutions II (types of Solutions and formation/measuring/ preparation of solutions of different concentrations). **Face-to-face:** Student teachers in mixed groups (gender-based) of 3 members discuss about the solubility of different solutes. Studentteachers produce written reports on the meaning of solubility.
	Factors that affect Solubility(temperature, pressure stirring and particle size).	**60 minutes**	Practical Activity: Tutor allows studentteachers to from mixed groups (gender-based) of 3 members to identify the factors (temperature, pressure stirring and particle size) that affect the solubility of some known solutes and produce charts on these factors	Practical Activity: In mixed groups (gender-based) of 3 members, perform activities the factors (temperature, pressure stirring and particle size) that affect the solubility of a known solute. Student-teachers produce charts on factors that affect solubility of solutes.
	How to teach Solubility and Factors affecting Solubility to the Basic school learner	**60 minutes**	Face-to-face/E-learning opportunities: Tutor allows studentteachers to do short power point/poster presentation on how to teach Solubility and Factors affecting Solubilityto the Basic school learner (Mixed intellectual ability Groups of 3 members).	Face-to-face/E-learning opportunities: Studentteachers in groups of 3 members (Mixed intellectual ability Groups), do power point/poster presentation on how to teach Solubility and Factors affecting Solubility to the Basic school learner.
Which cross cutting issues will be addressed or developed and how	Equity and SEN: through setting ground rules to protect vulnerable studentteachers and establishing an interactive and inclusive classroom atmosphere. By practicing with the determination and identification of the solubility of solutes and factors that affect solubility, studentteachers' difficulties in identification and practicing skills of the solubility will be addressed.			
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	Assessment as Learning: Written reports produced by studentteachers on the meaning of solubility. NTS 1a: Critically and collectively reflects to improve teaching and learning. Assessment for learning: Studentteachers producecharts on the factors/conditions that affect solubility of solutes.			

	NTS 2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in. Assessment of learning: Student teachers makeshort presentations (3-5 minutes each) on how to teach Solubility and factors/conditions affecting solubility of solutesto the Basic school (Reflection on presentations). NTS 2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in.
Teaching Learning Resources	Pen, paper, manila cards for charts, salts, sugar, water, beakers, stirring rods, heater/burner.
Required Text (core)	Abbey, T. K., Alhassan, B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). *Ghana association of science teachers integrated science for senior high schools*. Accra: Unimax MacMillan; Handbook for PD Coordinators Themes 1- 10
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). *Ghana association of science teachers physics for senior high schools*. Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). *Ghana association of science teachers' chemistry for senior high schools*. Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). *Integrated science for the basic school teacher I*. Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., & Obeng-Ofori, D. (2011). *SWL integrated science for senior high schools: Students book*. Accra, Ghana; Sam-Woode Ltd.
CPD Requirement	• Practicing how to determine solubility of solutes correctly/accurately. • Tolerating others in group work

LESSON 8

Year of B.Ed.	2	Semester	1	Place of lesson in semester	1 2 3 4 5 6 7 **8** 9 10 11 12

Title of Lesson	Teaching Colloids I				**Lesson Duration**	**3 hours**	
Lesson description	This lesson deals with the concept of colloids and their properties and the types.						
Previous student teacher knowledge, prior learning (assumed)	Studentteachers have had encounters with solutions of various kinds.						
Possible barriers to learning in the lesson	Misconception about colloids.						
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, Same ability, mixed ability and gender based group works. Practical Activity: Preparing colloids and other sample solutions. Independent Study: Tutor and studentteacher reflections (individually and collectively) and inquiry e-learning Opportunities: OERs and 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.** • **Write in full aspects of the NTS addressed**	• Appreciate the Nature of Colloids • Correct misconceptions and misinformation about colloids NTS, The Teacher: 2c) Has secure content knowledge, pedagogical knowledge and pedagogicalcontent knowledge for the school and grade they teach in. 3e) Employs a variety of instructional strategies that encourages studentparticipation and critical thinking..						

• **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**
	• Explain the concept of colloids • Describe the properties of colloids. • State some misconceptions pupils might have concerning colloids	• Present concept maps of the concept of colloids • Make a chart of the properties of the colloids • Present concept maps and/or models linking misconceptions/misinformation to new insights	Collaborations, Communication and Research: Through group work and presentation Equity and Reflection is developed from reflective activities Creativity and critical thinking is 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 provides the necessary tool for students activities.	**Student Activity**
Colloids I	Concepts on colloid formation	30 minutes 90minutes	**Face-to-Face:** Brainstorming with student teachers to introduce concepts. Use idea about solutions, suspensions and others to help students discuss any misconceptions (thick blurred soapy solutions) **Face-to-Face:** Initiate discussion /Talk for learning approach using groupings (Same ability and then mixed groups) to identify colloids and how they are formed colloids The groups are provided with substances/materials for sample preparations of colloids	**Face-to-Face:**Student teachers observe various solutions and discuss the nature of the solutions to distinguish between colloids and other solutions **Face-to-Face:** Working in groups and with the checklist studentteachers identify the how colloids are formed. Studentteachers presents some prepared samples of colloids as evidence of how colloids are formed.
	Types of colloids	60minutes	Group student teachers according to mixed ability groups and make them take discuss the types of colloids and present a report.	Students work in groups and discuss types of colloids and present a report each.
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	• Assessment as Learning: Student teachers present concept maps for assessment as learning • NTS 2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in. • Assessment for learning: Student teachers working in groups and presenting report • NTS 3e: Employs a variety of instructional strategies that encourages studentparticipation and critical thinking.			
Teaching Learning Resources	Cardboards, Course manual			
Required Text (core)	Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). *Ghana association of science teachers integrated science for senior high schools*. Accra: Unimax MacMillan.			
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). *Ghana association of science teachers physics for senior high schools*. Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). *Ghana association of science teachers chemistry for senior high schools*. Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). *Integrated science for the basic school teacher I*. Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., & Obeng-Ofori, D. (2011). *SWL integrated science for senior high schools: Students book*. Accra, Ghana; Sam-Woode Ltd.			
CPD Requirement	Training on Talk for learning approaches			

LESSON 9

Year of B.Ed.	2	Semester	1	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Teaching Colloids II				**Lesson Duration**	**3 hours**	
Lesson description	This lesson reviews the concepts of colloids and deals with the environmental and industrial importance of colloids. The lesson concludes with how the student teacher can prepare and teach the concept of colloids to the basic school learner.						
Previous student teacher knowledge, prior learning (assumed)	Student teachers were introduced to the concept of colloids in lesson 8.						
Possible barriers to learning in the lesson	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, Same ability, mixed ability and gender-based group works. Practical Activity: Preparing colloids and other sample solutions. Independent Study: Tutor and student-teacher reflections (individually and collectively) and inquiry e-learning Opportunities: OERs and 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.** • **Write in full aspects of the NTS addressed**	• Appreciate the industrial and environmental importance of colloids NTS, The Teacher: 2c) Has secure content knowledge, pedagogical knowledge and pedagogicalcontent knowledge for the school and grade they teach in. 3j) Produces and uses a variety of teaching and learning resources including ICT, toenhance learning.						
• **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				
	• Describe the environmental and industrial importance of colloids.	Write a reflective report on differentiated learning on the environmental and industrial importance of colloids.	Collaborations, Communication and Research: Through group work and presentation				

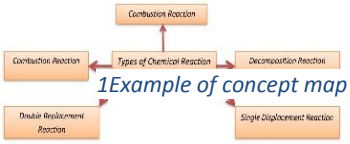
Content of lesson picked and developed from the course specification	Sub Topic	Time or Stage	Teaching and learning to achieve learning outcomes: depending on delivery mode selected. Teacher led, collaborative group work or independent study	
Topic Title Colloids II			**Teacher Activity** Facilitate and provides the necessary tool for students activities.	**Student Activity**
	The Environmental and industrial importance of colloids	90 minutes 40minutes	The lesson should begin with a field trip to an appropriate industry, factory for student – teachers to observe some uses of colloid Initiate discussion Talk for learning approach using groupings (Same ability and then mixed groups) to discuss their reports from the field trip.	Student teachers observe various industrial uses of colloids and write reports for later discussions in the classroom Working in groups, studentteachers discuss findings from their reports from the field trips.
	How to teach Colloids	50minutes	Group student teachers according to mixed ability and allow them to develop activities for teaching the concept of colloids	Students work in the groups to prepare activities for teaching and later do peer teaching with their activities for 10 minutes each.
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	• Assessment for learning: Student teachers present field trip reports for assessment NTS 2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in • Assessment as learning: Student teachers work in groups topeer teach NTS 3j: Produces and uses a variety of teaching and learning resources including ICT, to enhance learning.			
Teaching Learning Resources	Cardboards, Course manual, marker boards			
Required Text (core)	Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). *Ghana association of science teachers integrated science for senior high schools*. Accra: Unimax MacMillan.			
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). *Ghana association of science teachers physics for senior high schools*. Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). *Ghana association of science teachers chemistry for senior high schools*. Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). *Integrated science for the basic school teacher I*. Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., & Obeng-Ofori, D. (2011). *SWL integrated science for senior high schools: Students book*. Accra, Ghana; Sam-Woode Ltd.			
CPD Requirement	Training on planning for field trips			

LESSON 10

Year of B.Ed.	2	Semester	1	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Teaching Energy changes				**Lesson Duration**	**3 Hours**	
Lesson description	The course is designed to provide chemistry student teachers with the relevant learning experiences and technological skills that will enable them to teach energy changes creatively through hands-on exploratory learning activities and effective authentic assessment. Tutor discusses the energy changes and separation of mixtures with Student teachers						
Previous student teacher knowledge, prior learning (assumed)	The previous lesson was on colloids.Student teachers are familiar with reactions and use energy on a daily basis.						
Possible barriers to learning in the lesson	Studentteachers may: • Misconceptions about energy • Not have the skills in teaching energy changes to the junior highschool learner.						
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, Independent study: Reflections and Inquiry e-learning opportunities: Use of internet MOOC, simulations and 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. • **Write in full aspects of the NTS addressed**	• Provide opportunities for adopting a positive outlook for energy and energy changes • Demonstrate the skill and knowledge to teach the subject matter NTS, The Teacher: 1a)Critically and collectively reflects to improve teaching and learning. 1b) Improves personal and professional development through lifelong learning and Continuous Professional Development.						
• **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		
	• Demonstrate the understanding of energy changes • Design age and developmentally appropriate experimental models or designs that can be used to teach energy changes at the JHS		• Provide a concept map of some energy changes in nature. • Provide samples of experimental models or designs for peer review and store in portfolio		Correct/ handling and uses of devices, good identification of tools for measurements, sharing ideas in class, conversion of temperature from degree Celsius to degree Fahrenheit, Studentteachers develop skills of communication, collaboration and mutual respect while appreciating individual difference and abilities, critical thinking and responsibility through careful 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**
Teaching separation of mixtures	Recap of lesson on colloids	**30 minutes**	Face-to-Face: Recap lesson on colloids and link it to the new topic 'energy and energy changes	Face-to-Face: Student teachers respond to questions on previous lesson and identify links between colloids and energy changes

	Energy changes	**60 minutes**	Face-to-Face: Provide online resources on the concept energy changes and initiates a pyramid discussion on everyday activities that involves energy changes such as lighting flames, turning the fan on. Require of student teacher to present concept maps to show the activities	Face-to=Face: Student teachers work in groups, discuss daily activities that present the examples of energy changes while developing the concept maps for review. Online links such as https://www.siyavula.com/read/science/grade-11/energy-and-chemical-change/12-energy-and-chemical-change-01, https://www.youtube.com/watch?v=z8a-L1lkq3w,  *1Example of concept map* (Accessed on 22/06/2019)
	Designing Experiments on Energy changes	**90 minutes**	Face-to-Face/e-learning: Provide examples of experimental models and videos for student teachers to be able to design age and developmentally appropriate experiments that can teach JHS learner. The student teacher remains in their groups and present their work in the last 30 minutes for their peers to critique it. Require of the student teachers to produce written reports for critique.	Face-to-Face/e-learning: Student teachers remain in their groups and using the examples of experimental models and videos, they discuss and design age and developmentally appropriate activities that can be used to teach JHS learner and present their work in the last 30 minutes for their peers to critique it.
Which cross cutting issues will be addressed or developed and how	Equity and SEN: through setting ground rules to protect vulnerable studentteachers and establishing an interactive and inclusive classroom atmosphere. By practicing with readily available experiences for energy changes will reduce studentteachers' difficulties in teaching Energy changes.			
Lesson assessments – evaluation of, for and as learning within the lesson	• Assessment as Learning: concept maps submitted for assessment on energy changes and peer critique on designed experiments NTS 1a: Critically and collectively reflects to improve teaching and learning. 1b) Improves personal and professional development through lifelong learning and Continuous Professional Development.			
Teaching Learning Resources	Some resources that would be required to successfully enable an inclusive integrated science teaching would be Laboratory equipment, Chemicals, Smartphones, Tablets, Laptops, Desktop computer, Productivity tools (software that allow teachers to work better), Subject based instructional tools/applications.https://www.siyavula.com/read/science/grade-11/energy-and-chemical-change/12-energy-and-chemical-change-01, https://www.youtube.com/watch?v=z8a-L1lkq3w, (Accessed on 22/06/2019)			
Required Text (core)	Abbey, T. K., Alhassan, B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). *Ghana association of science teachers integrated science for senior high schools*. Accra: Unimax MacMillan; Handbook for PD Coordinators Themes 1- 10			

Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). *Ghana association of science teachers physics for senior high schools*. Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). *Ghana association of science teachers' chemistry for senior high schools*. Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). *Integrated science for the basic school teacher I*. Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., & Obeng-Ofori, D. (2011). *SWL integrated science for senior high schools: Students book*. Accra, Ghana; Sam-Woode Ltd.
CPD Requirement	Practicing to be familiar with experiences to use for energy changes and using online teaching resources Honesty through reporting actual method best for each mixture.

LESSON 11

Year of B.Ed.	2	Semester	1	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12

Title of Lesson	Teaching Separation of mixtures				**Lesson Duration**	**3 Hours**	
Lesson description	The course is designed to provide chemistry student teachers with the relevant learning experiences and technological skills that will enable them to teach separation of mixtures creatively through hands-on exploratory learning activities and effective authentic assessment. Tutor discusses the energy changes and separation of mixtures with Student teachers						
Previous student teacher knowledge, prior learning (assumed)	The previous lessons were on energy changes.Student teachers have sorted items in their environment.						
Possible barriers to learning in the lesson	Student-teachers may: • Difficulty using online resources • Not have the skills in designing experiments for JHS learners						
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, Practical Activity: Manipulations of models and designing models to reflect separation of mixtures. e-learning opportunities: Use of internet MOOC, simulations and 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. • **Write in full aspects of the NTS addressed**	• Proper Use of Online resources to teach and • Demonstrate the skill and knowledge to teach the subject matter NTS, The Teacher: 2c) Has secure content knowledge, pedagogical knowledge and pedagogicalcontent knowledge for the school and grade they teach in. 3e) Employs a variety of instructional strategies that encourages studentparticipation and critical thinking.						
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**		
	• Demonstrate the understanding of mixtures and their separation methods • Design age and developmentally appropriate experimental models that can be used to teach Mixtures and separations of mixtures at the JHS		• Provide a report on everyday mixtures and the components that form them from the immediate environment • Provide samples of experimental models or designs for peer review and store in portfolio		Correct handling and uses of devices, good identification of tools for measurements, sharing ideas in class, conversion of temperature from degree Celsius to degree Fahrenheit, Studentteachers develop skills of communication, collaboration and mutual respect while appreciating individual difference and abilities, critical thinking and responsibility through careful 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**
Teaching separation of mixtures	Recap of lesson on Energy changes	**30 minutes**	Face-to-Face: Recap lesson on energy changes and link it to the new topic 'separation of mixtures	Face-to-Face: Student teachers respond to questions on previous lesson and identify links between energy changes and separation of mixtures
	Separation of a named mixture	**60 minutes**	Face-to-Face: Tutorinitiates a pyramid discussion on everyday mixtures and how they are formed. Student teachers arerequired to note the components involved in the everyday mixtures	Face-to-face: Student teachers work in groups, discuss daily mixtures and how they are formed with the help of videos form online such as https://www.youtube.com/watch?v=JeaxMKPM8Z8, https://www.youtube.com/watch?v=bkYgqJa5P8w (Accessed on 22/06/2019)
	Designing Experiments on Separation of Mixtures	**90 minutes**	Face-to-Face/e-learning: Provide examples of experimental models and videos for student teachers to be able to design age and developmentally appropriate experiments that can teach JHS learners. The student teacher remains in their groups and presents their work in the last 30 minutes for their peers to critique. Student teachers are required to produce written reports for critique.	Face-to-Face/e-learning: Student teachers remain in their groups and using the examples of experimental models and videos, they discuss and design age and developmentally appropriate experiments that can be used to teach JHS learners and present their work in the last 30 minutes for their peers to critique.
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. By practicing with readily available materials for mixtures will reduce studentteachers' difficulties in teaching separation of mixtures.			
Lesson assessments – evaluation of learning: of, for and as learning within the lesson	• Assessment as Learning: Report submitted for assessment on how mixtures are formed and peers critique designed experiments NTS 2c: Has secure content knowledge, pedagogical knowledge and pedagogical content knowledge for the school and grade they teach in NTS 3e:Employs a variety of instructional strategies that encourages student participation and critical thinking.			
Teaching and Learning Resources	Some resources that would be required to successfully enable an inclusive integrated science teaching would be Laboratory equipment, Chemicals, Smartphones, Tablets, Laptops, Desktop computer, Productivity tools (software that allow teachers to work better), Subject based instructional tools/applications.https://www.youtube.com/watch?v=L7ZQ0o1Gp5Y, https://www.youtube.com/watch?v=JeaxMKPM8Z8, https://www.youtube.com/watch?v=bkYgqJa5P8w (Accessed on 22/06/2019)			
Required Text (core)	Abbey, T. K., Alhassan, B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). *Ghana association of science teachers integrated science for senior high schools*. Accra: Unimax MacMillan; Handbook for PD Coordinators Themes 1- 10			
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). *Ghana association of science teachers physics for senior high schools*. Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). *Ghana association of science teachers' chemistry for senior high schools*. Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). *Integrated science for the basic school teacher I*. Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., & Obeng-Ofori, D. (2011). *SWL integrated science for senior high schools: Students book*. Accra, Ghana; Sam-Woode Ltd.			
CPD Requirement	Learning to make and interpret concept maps Practicing to be familiar with methods of separating mixtures and using online teaching resources Honesty through reporting actual method best for each mixture.			

LESSON 12

Year of B.Ed.	2	Semester	1	Place of lesson in semester	1 2 3 4 5 6 7 8 9 10 11 12

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 on observations made during the supported teaching in schools (STS) within the second half of the semester.						
Previous student teacher knowledge	Lessons learnt from lesson 8 through lesson 11 in all learning approaches and observations/experiences during STS.						
Possible barriers to learning in the lesson	Misconceptionsabout 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.Modelling, Concept Mapping and Cartooning. Independent Study: Tutor and student teacher reflections (individually and collectively) e-learning Opportunities: OERs and Video presentations Seminar: Presentations, Discussions and reflections of STS						
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**	• 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 issue NTS: 1a) Critically and collectively reflect to improve teaching and learning 1c) Demonstrate effective growing leadership qualities in the classroom and wider school 1d) Is guided by legal and ethical teacher codes of conduct in his or her development as professional teachers2a) Demonstrates familiarity with the education system and key policies guiding it. 2b) Has comprehensive knowledge of the official school curriculum, including learning outcomes 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						
• **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	
	• Identify weakness and strengths in learning the science lesson for the period under review • Be able to reflect on lessons learnt so far (STS) and state new insights and/or grey areas needing remedies • Correct misconception/misinformation for earlier lesson (7–11)			• Make a list of Weaknesses and strengths on poster papers for sharing • Provide a reflection report on STS and demonstrations and illustrations on a given media of lessons learnt so far • Present concept maps and/or models linking misconceptions/misinformation to new insights		Collaborations, Communication and Research: Through group work and presentation Equity and Reflection is developed from reflective activities Creativity and critical thinking are deployed 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 tool for students activities.	**Student Activity**
Course Review II with STS seminar	Reviewing the understanding of lessons on Teaching Solubility, Teaching Colloids I and II, Teaching energy changes and Teaching Separation Methods	60 minutes	**Face-to-face:** Tutor led brainstorming session with student teachers to unearth the weaknesses and strengths of student teachers in the lessons 7 – 11. Initiate discussion /Talk for learning approach using groupings (Same ability and then mixed groups) to identify student teachers' strengths and weakness in the lessons learnt so far.	**Face-to-face:**Student teachers discuss their problems in the previous lessons and provide a checklist identifying and recording all possible weaknesses and strengths.
	Remedies to course topics	30 minutes	**Face-to-Face:** Tutor groups student teachers according to remedy need and provide specific task assistance in the areas on concept needing remedy.	**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.
	Discussion of observations during STS	90 minutes	**Seminar:** Tutor 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.	**Seminar:**Student teachers listen to various presentations. Student teachers then discuss observations made during STS based on the National Teacher's Standards, reflect and provide a checklist of lessons learned and problems identified and how they can be addressed. Student teachers then provide a reflection report on STS
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, for and as learning within the lesson	• **Assessment of learning:** Student teachers make presentations on how to model NTS 3a: Plans and delivers varied and challenging lessons, showing a clear grasp of theintended outcomes of their teaching. • **Assessment as learning:** Student teachers engage each other inpeer remedial tutoring NTS 3e: Employs a variety of instructional strategies that encourages studentparticipation and critical thinking NTS 3l: Listens to learners and gives constructive feedback
Teaching &Learning Resources	Cardboards, Course manual, Poster paper, Projectors,
Required Text (core)	Abbey, T. K., Alhassan, M. B., Ameyibor, K., Essiah, J. W., Fometu, E., & Wiredu, M.B. (2008). *Ghana association of science teachers integrated science for senior high schools*. Accra: Unimax MacMillan.
Additional Reading List	Abbey, T. K., &Essiah, J.W. (1995). *Ghana association of science teachers physics for senior high schools*. Accra: Unimax Macmillan. Ameyibor, K., & Wiredu, M. B. (2006). *Ghana association of science teachers chemistry for senior high schools*. Accra: Unimax MacMillan. Asabere-Ameyaw, A., & Oppong, E. K. (2013). *Integrated science for the basic school teacher I*. Winneba: IEDE. Oddoye, E. O. K., Taale, K. D., Ngman-Wara, E., Samlafo, V., & Obeng-Ofori, D. (2011). *SWL integrated science for senior high schools: Students book*. Accra, Ghana; Sam-Woode Ltd.
CPD Requirement	Training on preparation of checklist and Reflection guides