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**Knowledge Rich Curriculum Plan**

Btec Forensic Science – Unit 2 Practical Scientific Procedures and Techniques – Learning Aim A – Undertake titration and colorimetry to determine the concentration of solutions



| **Lesson/Learning Sequence**  | **Intended Knowledge:***Students will know that…* | **Prior Knowledge:***In order to know this, students need to already know that…* | **Working Scientifically** | **Tiered Vocabulary and Reading Activity** | **Assessment**  | **Support** |
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| **Lesson 1:** **Learning Aim A1****Calibration of a pH meter and electronic balances** | * Students will be able to explain why it is important to calibrate a Ph meter and electronic balance
* Students will be able to compare the two types of electronic balance: a rough balance and an analytical balance
* Students will be able to state the importance of having standard calibration documentation for the equipment we are calibrating
* Students will be able to explain why a pH meter and probe has a higher degree of accuracy than a colour changing indicator
 | * ***Students will already know that the Ph scale is a measure of an acid and alkalis strength***
* ***Students will already know how to measure mass on an electronic balance***
* ***Students will already know the units of mass***
 | Analyse – Be able to discuss limitations of colour changing indicators and rough balances Analyse – Present data on calibrated pH meters and electronic devices*Learners’ work draws on varied information,**themes or concepts to consider aspects such**as:**• strengths or weaknesses**• advantages or disadvantages**• relevance or significance.**Learners’ enquiries should lead to a supported**judgement showing relationship to its context.**This will often be in a conclusion.* | *Calibrate - correlate the readings of (an instrument) with those of a standard in order to check the instrument's accuracy.* | Tracking assessment tasksUnit A1 booklet | Refer to class booklets and logbooksEbooks on student driveLesson resources on Teams |
| **Lesson 2:** **Learning Aim A1****Calibrating pipettes and biurets** | * Students will be able to explain why it is important to calibrate volumetric equipment such as pipettes and biurets
* Students will be to apply the density equation p=m/v (density = mass/volume)
* Measure (calibrate) 25cm3 of water using a graduated pipette
* Measure (calibrate) 50cm3 of water using a biuret
* Compare experimental results to published data and evaluate their findings
 | * ***Students will already know how to measure volumes of liquids using a measuring cylinder***
* ***Students will already know the equation for density and a description of density***
* ***Students will already know how to convert units***
 | Determine - Learners use quantitative and/or qualitativeinformation to help analyse and compare findings from published data |  | Tracking assessment tasksUnit A1 booklet | Refer to class booklets and logbooksEbooks on student driveLesson resources on Teams |
| **Lesson 3:** **Learning Aim A1****Calibrating volumetric equipment**  | * Students will be able to explain why it is important to calibrate volumetric equipment
* Students will be able to identify volumetric equipment
* Students will be able to state and apply the density equation p= m/v
* Students will be able to measure the mass of 25cm3 of water using a 2 d.p balance
* Compare experimental results to published data and evaluate their data
 | * ***Students will already know how to measure volumes of liquids using a measuring cylinder***
* ***Students will already know the equation for density and a description of density***
* ***Students will already know how to calibrate equipment.***
 | Determine - Learners use quantitative and/or qualitativeinformation to help analyse and compare findings from published data |  | Tracking assessment tasksUnit A1 booklet | Refer to class booklets and logbooksEbooks on student driveLesson resources on Teams |
| **Lesson 4:** **Learning Aim A1****Errors in procedures** | * Students will be able to calculate percent error for volumetric equipment
* Students will be able to calculate range, Standard Deviation and standard error
 | * ***Students will already know how volumetric equipment is calibrated***
* ***Students will already know about different errors that occur in practical investigations e.g. Systematic errors – Zero errors, random errors***
* ***Students will already know how to determine the mean from a set a data***
 | *Determine - Learners use quantitative and/or qualitative**information to help analyse and compare**findings.* | 1. *Standard Deviation - a quantity expressing by how much the members of a group differ from the mean value for the group.*
 | Tracking assessment tasksUnit A1 booklet | Refer to class booklets and logbooksEbooks on student driveLesson resources on Teams |
| **Lesson 5:** **Learning Aim A2****Titration part 1** | * Students will be able to explain the role of a lab book and accurate recording of methods and calculations used during an investigation.
* Students will be able to state the role of primary and secondary trimetric standards
* Students will be able to prepare a primary standard
* Students will be able to describe the role of titrations.
* Students will be able to demonstrate a titration E.g. 0.1 mol dm 3 HCl with 0.1 mol dm 3 of NaOH
* Students will be able to demonstrate safe working practice
 | * ***Students will already know how to measure volumes of liquids using a biuret***
* ***Students will already know the symbol equations for hydrochloric acid and sodium hydroxide***
* ***Students will already know how to calculate moles using = conc x volume***
* ***Students will be able to calculate RAM for given compounds***
* ***Students will already know how to balance chemical equations***
 | *Demonstrate - Learners’ work, performance or practice evidences the ability to carry out and apply knowledge, understanding and/or skills in a practical situation.**Prepare - Used with a standard to demonstrate**competence in preparation of testing materials* |  | Tracking assessment tasksUnit A1 booklet | Refer to class booklets and logbooksEbooks on student driveLesson resources on Teams |
| **Lesson 6:** **Learning Aim A2****Titration part 2** | * Students will be able to complete an individual titration and calculate the concentration of an unknown concentration
* Students will be able to complete an individual titration and calculate the concentration of an unknown concentration using a standard solution
* Students will be able to demonstrate safe working practice
 | * ***Students will already know how to take accurate measurements using a biuret***
* ***Students will already know how to calculate RMM***
* ***Students will already know how to calculate moles using = conc x volume***
* ***Students will already know how to balance chemical equations***
 | *Demonstrate - Learners’ work, performance or practice evidences the ability to carry out and apply knowledge, understanding and/or skills in a practical situation.**Prepare - Used with a standard to demonstrate**competence in preparation of testing materials* |  | Tracking assessment tasksUnit A1 booklet | Refer to class booklets and logbooksEbooks on student driveLesson resources on Teams |
| **Lesson 7:** **Learning Aim A2****pH titration** | * Students will be able to state the colour change for different indicators
* Students will be able to state what is meant by the end-point/equivalence point
* Students will be able to state which indicator is used for which titration
* Students will be able to demonstrate a titration E.g. 0.1 mol dm 3 HCl with 0.1 mol dm 3 of NaOH using a Ph meter/probe
* Students will be able to use their data to construct a pH-titration graph
 | * ***Students will be able to carry out titrations***
* ***Students will know the role of an indicator in the identification of acids and alkalis***
* ***Students will be able to know how to plot a graph of pH vs volume added***
* ***Students will know how to extrapolate data from graph***
 | *Demonstrate - Learners’ work, performance or practice evidences the ability to carry out and apply knowledge, understanding and/or skills in a practical situation.* | *Equivalence point - the point at which equal quantities of reactants are mixed chemically.* | Tracking assessment tasksUnit A1 booklet | Refer to class booklets and logbooksEbooks on student driveLesson resources on Teams |
| **Lesson 8:** **Learning Aim A3****Colourimetry** | * Students will be able to identify the seven colours of the visible light spectrum
* Students will be able to describe how the wavelength and frequency of light waves change through the visible light spectrum
* Students will be able to state that light can pass through translucent materials but some light is absorbed by semi-translucent materials.
* Students will be able to differentiate between absorption and transmission of light
* Students will be able to explain the role of light filters within colorimetry
 | * ***Students will already know the seven colours of the visible light spectrum***
* ***Students will already know that light travels as a transverse wave, in straight lines***
* ***Students will already know that visible light waves are part of the electromagnetic spectrum.***
 | *Explain - Learners’ work shows clear details and gives**reasons and/or evidence to support an**opinion, view or argument. It could show how**conclusions are drawn (arrived at). Learners**show that they comprehend the origins,**functions and objectives of a subject, and its**suitability for purpose.* | *Absorption – the transfer of the energy of a wave to matter as the wave passes through it.*  | Tracking assessment tasksUnit A1 booklet | Refer to class booklets and logbooksEbooks on student driveLesson resources on Teams |
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| **Lesson 9:** **Learning Aim A3****Colorimetry investigating the concentration of copper sulphate solution** | * Students will be able to calibrate a colourimeter using a blank cuvette
* Students will be able to determine the correct filter to use for determining the concentration of Copper Sulphate solution
* Students will be able to carry out dilutions using a known concentration of solution in order to plot a calibration plot
* Students will be able to determine the concentration of an unknown solution from their calibration plots
 | * ***Students will be able to carry out a colourimetry investigation using the correct colour filter***
* ***Students will know how to dilute solutions to produce different concentrations***
* ***Students will know how to extrapolate data***
* ***Students will know how to analyse their data e.g. Standard Deviation***
 | Determine - Learners use quantitative and/or qualitativeinformation to help analyse and compare findings from published dataExplain - Learners’ work shows clear details and givesreasons and/or evidence to support anopinion, view or argument. It could show howconclusions are drawn (arrived at). Learnersshow that they comprehend the origins,functions and objectives of a subject, and itssuitability for purpose. | *Calibrate - correlate the readings of (an instrument) with those of a standard in order to check the instrument's accuracy.* | Tracking assessment tasksUnit A1 booklet | Refer to class booklets and logbooksEbooks on student driveLesson resources on Teams |
| **Lesson 10:** **Assignment Lesson Learning Aim A** | * Students use the intended knowledge from previous lessons to evaluate the accuracy of procedures and techniques used in titration and colorimetry in relation to outcomes and also to suggest improvements
 |  |  | See Tiered vocabulary from previous lessons | Completion of assessment booklets A1-3 and write-up of findings using various presentation methods | Refer to class booklets and logbooksEbooks on student driveLesson resources on Teams |
| **Lesson 11:** **Assignment Lesson Learning Aim A** | * Students use the intended knowledge from previous lessons to evaluate the accuracy of procedures and techniques used in titration and colorimetry in relation to outcomes and also to suggest improvements
 |  |  | See Tiered vocabulary from previous lessons | Completion of assessment booklets A1-3 and write-up of findings using various presentation methods | Refer to class booklets and logbooksEbooks on student driveLesson resources on Teams |