Teaching Plan
Unit 2: Analysis at Work

The following teaching plan is based on 12 weeks at 5 hours per week. The learning activities are suggestions only. Teachers may wish to develop alternative strategies. The plan should be read alongside the unit specification, and in particular the assessment evidence grid which for reference is reproduced at the end of this document.

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
1	2.2.1: Qualitative Chemical Analysis AO3b • carry out chemical tests (including flame tests) to identify the cations: Fe^{2+}, Fe^{3+}, Cu^{2+}, Al^{3+}, Na^{+}, K^{+}, Ca^{2+}, Zn^{2+} and NH_4^{+} • carry out chemical tests to identify the following anions: Cl^{-}, Br^{-}, I^{-}, SO_4^{2-}, NO_3^{-} and CO_3^{2-}	Teacher introduction to the chemical reactions involved in the tests for cations and anions and practical work on compounds containing known cations and anions. Practical work on the identification of unknown compounds by means of tests for cations and anions.	Teacher hand out notes and/or resource based introduction notes. Detailed worksheets showing tests for anions and cations. Appropriate small apparatus for this test tube scale work. Known and unknown materials and reagents.

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
2	2.2.1: Qualitative Chemical Analysis AO3b • carry out chemical tests to identify the organic functional groups: >C=C<, -CH_2OH, -CHO, >C=O and –COOH • use infrared spectroscopy to identify the presence of –CH_2OH, –CHO and –COOH • groups in organic compounds • carry out and report on a qualititative analysis linked to a vocational context.	Teacher introduction to the chemistry behind the tests for these organic functional groups. Practical work to identify these groups in known and unknown materials. The use of infrared spectroscopy (either paper based or with the use of an infrared spectrophotometer) to identify the presence of –CH_2OH, –CHO and –COOH and the differences between these spectra. Assignment 4. Practical work and a detailed report of a qualitative chemical analysis linked to a vocational context in which risk assessments have been used.	Teacher hand out notes and/or resource based introduction notes. Detailed worksheets showing tests for the required functional groups. Appropriate small apparatus for this test tube scale work. Known and unknown materials and reagents. Use of an infrared spectrophotometer or provided spectra. Assignment Brief 2.4 (A Preservative for Mummies) and materials necessary for this exercise.
3	2.2.2: Quantitative Chemical Analysis AO3c • prepare standard solutions • carry out a normal titration • carry out the necessary calculations	Basic theory and ideas behind volumetric work including simple work on equations and moles. The preparation of a standard solution and the use of this solution in an acid-base titration.	Teacher produced hand out notes and/or resource based introductory material. Apparatus appropriate for acid-base titration exercises.

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4	2.2.2: Quantitative Chemical Analysis AO3c • carry out further titrations (acid-base, redox and complexometric) • carry out the necessary calculations • interpret the results of simple volumetric analyses • find the limits of detection of a volumetric analysis • carry out and report on a quantitative chemical analysis linked to a vocational context.	Continuation of practical work involving titrations of acid-base, redox and complexometric type linked to a vocational context. Calculations involving stoichiometry and moles. Appreciate the range of concentrations used in volumetric work. Assignment 5 Practical work and a detailed report of a quantitative chemical analysis linked to a vocational context in which risk assessments have been used.	Apparatus for titrimetric analysis including reagents and materials for more complex work. Assignment Brief 2.5 (Power Station Emissions) and materials appropriate to this exercise.
5	2.2.3: Physical Analysis AO3a • explain the basic principles of chromatographic separation, its uses and limitations • carry out chromatographic separations using thin layer chromatography and paper chromatography	Theory of separation using chromatography. Advantages and disadvantages of thin layer and paper chromatography and the limitations of each method. Simple separations using the two methods.	Teacher produced worksheets or candidate resourced materials outlining the theory of chromatography and the interpretation of its results. Materials and equipment appropriate to simple separations using paper and thin layer chromatography.

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
6	2.2.3: Physical Analysis AO3a • use chromatography to separate mixtures and identity their components • interpret simple chromatograms • describe gas-liquid chromatography and high performance gas-liquid chromatography and their applications in industry • describe the principles of colorimetric analysis • use colorimetric analysis to find the percentage of a particular metal in an alloy • carry out and report on two physical analyses linked to a vocational context	Further practical work on TLC and paper chromatography, including component identification. Use provided chromatograms to interpret components present. Theory and research based work on the application of GLC and HPLC in industry. Discuss the theory behind colorimetric analysis. Research the uses of colorimetric analysis in industry. Practical colorimetric analysis using a two metal alloy Assignment 2 Practical work and a detailed report of two different physical analyses, each linked to a researched vocational context in which risk assessments have been used.	Teacher produced worksheets or candidate resourced materials outlining the theory of chromatography and the interpretation of its results. Candidate generated material on gas-liquid chromatography and HLPC and their uses in industry. Teacher or candidate produced materials outlining the principles of colorimetry and its application in industry. Apparatus and materials appropriate to a simple colorimetric determination. Assignment Brief 2.3 (Finding the Percentage of Copper in a Brass Alloy) and materials appropriate to this exercise. Candidate produced resources outlining the vocational context of this exercise. Cross-linking to Unit 1, AO3.

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
7 and 8	2.2.4: Energy Transfer AO2a and b • use ideas of transfer of energy during breaking and making chemical bonds between particles to explain why some reactions are exothermic and some are endothermic • assess simple data on calorific values and fuel prices • describe how cycles of expansion and contraction of gases can be used to do work in systems such as power stations and car engines • show the forms of energy transfer involved in the generation of electricity and display information on the calorific values and costs of fuels • display calculations, using provided data, on the costs involved in generating electricity • briefly compare the relative benefits and problems of large-scale and small-scale electricity generation.	General discussion work on the bullet points listed in 2.2.4 This should include work on energy changes during the combustion of simple alkane hydrocarbons Use provided and researched data to compare the calorific values of fuels and hence the relative cost of different fuels. Research work on the generation of electricity in power stations and how the burning of fossil fuels in car engines provides energy for the vehicle to move. Assignment 2 A report that outlines the forms of electricity transfer in electricity generation. Displayed information on the calorific values and costs of different fuels. Calculations on the costs of electricity generation Comparisons of large and small-scale electricity generation	Teacher or candidate produced material outlining enthalpy changes with particular reference to alkane combustion. Provide worksheets on calorific values and/or candidate generated resources outlining the calorific values of fuels and energy transfer systems in power stations and in cars. Assignment Brief 2 (Producing Electricity) and materials appropriate to this exercise. Book and/or electronic candidate produced materials as appropriate to this assignment. Some the material in this assignment could be cross-linked to required material in Unit 1, assignment objective AO1.

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
9 to 12	2.2.5: Efficiency AO1 • explain what is meant by the efficiency of a system • explain why actual efficiency will always be less than the theoretical maximum • explain the importance of temperature difference to the efficiency of energy transfer between simple systems • describe how combined heat and power systems make use of energy that would be otherwise uselessly dissipated • investigate steps that could be taken by a non-domestic consumer to maximise their efficiency of electrical supply • show selected information from a non-domestic consumer that describes their energy policy • show that energy efficiency has been considered • show that economic and environmental impacts have been considered.	General discussion of the meaning and effect of the bullet points 2.2.5 Assignment 1 A report of an organisation that details their energy policy and considers the energy efficiency and the environmental impact of this policy The report demonstrates relevant research and shows understanding	Teacher or candidate based paper or electronic materials that outline the efficiency of electrical power generating processes. Possible use of SATIS 16-19 material-energy. Assignment Brief 1 (Energy Policy). Electronic or paper based research on appropriate organisations that detail their energy policy and who consider the implications outlined in the assignment brief and accompanying task sheets.

The assessment evidence grid from the unit specification is reproduced on the following pages.

Unit 2: Analysis at work

What you need to do:

You need to produce a portfolio related to information on organisations that use science to analyse processes [**50** marks].

This evidence needs to include:

AO1 relevant research, understanding and detail in a study of **one** organisation to produce a report for that organisation which considers their energy policy and includes considerations of their energy efficiency and environmental impact [**19**];

AO2 an in-depth study of a chosen method of producing electricity – the study needs to include relevant calculations of the energy transfers involved and concise comparison of large-scale and small-scale generation [**10**];

AO3 evidence that you have safely completed **four** practical analyses – **two** physical (**one** using colorimetry and **one** using chromatography) and **two** chemical (**one** qualitative and **one** quantitative) – each needs to be appropriately recorded, processed and evaluated [**21**].

How you will be assessed:

Assessment Objective	Mark Band 1	Mark Band 2	Mark Band 3	Mark Awarded
AO1	You will show information obtained from a non-domestic consumer of energy and give a brief description of their energy policy; **[0 1 2]**	you will show selected information obtained from a non-domestic consumer of energy and give a description of their energy policy; **[3 4]**	you will show selected, relevant information obtained from a non-domestic consumer of energy and give a detailed description of their energy policy. **[5 6]**	**/19**
	You will show some indication that energy efficiency has been considered; **[0 1 2]**	you will show that energy efficiency has been considered in some detail; **[3 4]**	you will show that energy efficiency has been considered and evaluated in some detail, using accurate terminology and nomenclature. **[5 6]**	
	You will show that economic and environmental impacts have been considered; **[0 1 2]**	you will show that economic and environmental impacts have been considered in some detail; **[3 4 5]**	you will show that economic and environmental impacts have been considered in some detail, using accurate terminology and nomenclature. **[6 7]**	
AO2	You will show the forms of energy transfer involved in the generation of electricity, displaying information on calorific values and costs of different fuels; **[0 1]**	you will show the forms of energy transfer involved in the generation of electricity in detail, displaying information on calorific values and costs of different fuels; **[2 3]**	you will show a comprehensive study into the forms of energy transfer involved in the generation of electricity, displaying information on calorific values and costs of different fuels, both renewable and non-renewable. **[4 5]**	**/10**
	You will show a number of straightforward calculations using provided data on costs involved in the generation of electricity, generally obtaining the correct solutions; also, you have included a brief comparison of relative benefits and problems of large-scale and small-scale electrical generation; **[0 1]**	you will show a number of straightforward calculations using researched data on costs involved in the generation of electricity, generally obtaining the correct solutions; also, you have included a comparison of relative benefits and problems of large-scale and small-scale electrical generation, based on quantitative information; **[2 3]**	you will show a number of straightforward and complex calculations using researched data on costs involved in the generation of electricity, obtaining the correct solutions to an appropriate degree of accuracy; also, you have included a comparison and evaluation of relative benefits and problems of large-scale and small-scale electrical generation, based on quantitative information. **[4 5]**	

Unit 2: Analysis at work (continued)				
Assessment Objective	**Mark Band 1**	**Mark Band 2**	**Mark Band 3**	**Mark Awarded**
AO3	You will produce a report of **two** physical analyses you have carried out, linked to a vocational context in which risk assessments have been used; relevant observations or measurements have been made and results suitably processed, with some interpretation; **[0 1 2 3 4]**	you will produce a detailed report of **two** physical analyses you have carried out, linked to a vocational context in which risk assessments have been completed; relevant observations or measurements have been made and results accurately processed and interpreted; the information is presented clearly and logically; **[5 6]**	you will produce a detailed report of **two** physical analyses you have carried out, linked to a vocational context in which risk assessments have been produced with evidence equipment has been used safely and to the appropriate degree of accuracy; relevant observations or measurements have been made with the appropriate precision and results accurately processed and interpreted; the information is presented clearly, logically and has been evaluated. **[7 8]**	**/21**
	You will produce a report of a qualitative chemical analysis you have carried out, linked to a vocational context in which risk assessments have been used; relevant observations have been made and results suitably processed, with some interpretation; **[0 1 2]**	you will produce a detailed report of a qualitative chemical analysis you have carried out, linked to a vocational context in which risk assessments have been completed; relevant observations have been made and results accurately processed and interpreted; the information is presented clearly and logically; **[3 4]**	you will produce a detailed report of a qualitative chemical analysis you have carried out, linked to a vocational context in which risk assessments have been produced with evidence equipment has been used safely and to the appropriate degree of accuracy; relevant observations have been made and results accurately processed and interpreted; the information is presented clearly, logically and has been evaluated. **[5 6]**	
	You will produce a report of a quantitative chemical analysis you have carried out, linked to a vocational context in which risk assessments have been used; relevant observations have been made and results suitably processed, with some interpretation; **[0 1 2]**	you will produce a detailed report of a quantitative chemical analysis you have carried out, linked to a vocational context in which risk assessments have been completed; relevant observations have been made and results processed and interpreted accurately; the information is presented clearly and logically; **[3 4 5]**	you will produce a detailed report of a quantitative chemical analysis you have carried out, linked to a vocational context in which risk assessments have been produced, with evidence that equipment has been used safely and to the appropriate degree of accuracy; relevant observations have been made and results processed and interpreted accurately; the information is presented clearly and logically and has been evaluated. **[6 7]**	
			Total mark awarded:	**/50**