

Module Details	
Module Title:	Nature of Matter and Instrumental Analysis
Module Code:	ARC7045-B
Academic Year:	2019-20
Credit Rating:	20
School:	School of Archaeological and Forensic Sciences
Subject Area:	Archaeology
FHEQ Level:	FHEQ Level 7 (Masters)
Pre-requisites:	
Co-requisites:	

Contact Hours	
Type	Hours
Lectures	35
Practical classes and workshops	11
Tutorials	4
Directed Study	150

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Academic Year (Sept - May)

Module Aims
Semester 1: To develop critical awareness of the relationship between physical and chemical properties and their links to underlying atomic interactions. To provide insight into the relationships between macroscopic measurements and microscopic properties encountered in the archaeological sciences, with particular emphasis on the physical sciences. These insights will also aid the student's understanding of scientific techniques introduced in other modules. Semester 2: This semester covers the fundamental physical and chemical principles of instrumental analytical techniques, the operational requirements and interpretative methods of the techniques of importance to archaeological and forensic science applications.

Outline Syllabus

Semester 1: Introduction. The scientific method. e.g. The structure of the atom. Atomic Structure. Nuclear chemistry. Stable Light isotopes. Electromagnetic Radiation – Waves / Particles? Calculations using waves. A more complicated atom: The quantum atom. A more complicated atom: Orbitals. Absorption and Emission Spectra. Colour. Chemical Bonding 1&2. Introduction to Organic Chemistry 1 – Nomenclature. Introduction to Organic Chemistry 2 – Isomers. Introduction to Biochemistry. Lewis Structures and Organic Molecules. The Elements: The Periodic Table. Moles and Molarity, ppm/ppb. Magnetism. Exam revision. Environmental chemistry. Preservation in situ.

Semester 2: Principles of analytical sciences. Microscopy techniques and instruments. Vibrational spectroscopy including Infra Red and Raman spectroscopy. Trace element techniques. X-ray techniques. Separation science techniques including gas chromatography and mass spectrometry. Isotope mass spectrometry.

Learning Outcomes

1	Master the understanding of the relationships between macroscopic measurements and microscopic properties.
2	They will have gained critical awareness of the relationship between physical and chemical properties and their link to underlying atomic interactions.
3	Review the principles, operational requirements and applications of a range of analytical techniques.
4	Evaluate and compare different instrumental methods in a research context.
5	Develop scientific thinking and improve confidence when dealing with scientific formulae and calculations.
6	Students will have gained knowledge of a variety of scientific concepts that they can apply to different areas of archaeological sciences.
7	Choose appropriate instrumental techniques and critically evaluate data within the disciplinary context.
8	Demonstrate acquired and refined analytical, numerical and problem solving skills. Display powers of logical reasoning and interpretation of scientific data used in publications.
9	Employ critical skills in analysis and synthesis.

Learning, Teaching and Assessment Strategy

Semester 1: Lectures and structured workshops. Office hours for additional support at students' request. Past questions and model answers provided on the VLE (Canvas) for self-assessment. Assessment of semester 1 is by coursework and open book exam. Feedback of assessed work within 4 working weeks: opportunity to consult marked work and discuss comments.

Semester 2: Lectures cover the principles of analytical approaches in general and in detail for selected instruments, and include quality control, sample preparation, data analysis and interpretation. The use of case studies based on recently published research. Preparation is given in the tutorials for the assessment, which is a written proposal for analysis. Written

feedback is given on the assessment. Directed study will be used by students for reading literature detailed in the module documentation, and for researching and preparing for coursework.

Mode of Assessment				
Type	Method	Description	Length	Weighting
Summative	Examination - open book or seen paper	A formal exam (open book) covering the taught syllabus in semester 1. Short questions followed by longer essay-type questions.	1.5 hours	50%
Summative	Coursework	Critical Analysis: A detailed proposal for analysis of your choice of objects or material, which employs - by design - several techniques and proceeds along a process of logical elimination to determine the chemical composition of the object(s).	-2000 words	50%

Reading List

To access the reading list for this module, please visit <https://bradford.rl.talis.com/index.html>.

Please note:

This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.