



# BRIDGING TO CHEMISTRY FOR CONSERVATION

## A DISTANCE STUDY COURSE

COURSE INSTRUCTOR: DR CHRISTIAN DREYER

DURATION: 4 MONTHS (*recommended*)



THE SOUTH AFRICAN INSTITUTE FOR HERITAGE SCIENCE & CONSERVATION

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The course covers the themes indicated below. Each theme is subdivided into units and sub-units, as indicated.

Theme	Units	Sub-units
Particles and bonding	Atomic structure and ion formation	<ul style="list-style-type: none"> <li>The nucleus of an atom</li> <li>Isotopes</li> <li>Electron configurations</li> <li>Ion formation</li> </ul>
	The Periodic Table	
	Chemical bonding and related physical properties	<ul style="list-style-type: none"> <li>Covalent bonds</li> <li>Ionic bonds</li> <li>Metallic bonds</li> </ul>
	Electronegativity and intermolecular forces	<ul style="list-style-type: none"> <li>Electronegativity, polar and nonpolar covalent bonds</li> <li>Polar and nonpolar molecules</li> <li>Intermolecular forces</li> </ul>
The mole concept and stoichiometry	Balanced equations for chemical reactions	
	The mole concept	
	Stoichiometric calculations	
	Molarity of a solution	
Acids and bases	Acids	<ul style="list-style-type: none"> <li>Formation of hydronium ions</li> <li>Strong and weak acids</li> <li>Ionization of water</li> <li>The pH scale regarding acids</li> <li>Indicators for pH</li> <li>Reactions of acids with metals, metal oxides, metal hydroxides, metal carbonates and ammonia</li> <li>Acidic oxides</li> <li>Acidic buffer solutions</li> </ul>
	Bases and alkaline solutions	<ul style="list-style-type: none"> <li>Strong and weak bases</li> <li>The pH scale regarding bases</li> <li>Alkaline buffer solutions</li> <li>Neutralization</li> </ul>
	Salt hydrolysis	<ul style="list-style-type: none"> <li>Acidic salt solutions with <math>\text{pH} &lt; 7</math></li> <li>Nearly neutral salt solutions with <math>\text{pH}</math> approximately 7</li> <li>Alkaline salt solutions with <math>\text{pH} &gt; 7</math></li> </ul>
	Acid-base titrations	



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Theme	Units	Sub-units
Reaction kinetics and equilibrium	Reaction kinetics	<ul style="list-style-type: none"> <li>Reaction mechanism</li> <li>Main factors influencing reaction rate</li> </ul>
	Chemical equilibrium	<ul style="list-style-type: none"> <li>Dynamic equilibrium of a reversible reaction in a closed system</li> <li>Equilibrium constant for a dynamic equilibrium</li> </ul>
	Le Chatelier's Principle	<ul style="list-style-type: none"> <li>Applied to a change in concentration</li> <li>Applied to a change in pressure</li> <li>Applied to a change of temperature</li> </ul>
	Equilibrium in buffer solutions	<ul style="list-style-type: none"> <li>Acidic buffer solutions</li> <li>Alkaline buffer solutions</li> </ul>
Solubility & Precipitation	Dissolution of solids	<ul style="list-style-type: none"> <li>Dissolution of molecular solids</li> <li>Dissolution of ionic salts</li> </ul>
	Precipitation	
	The common ion effect	<ul style="list-style-type: none"> <li>A qualitative discussion</li> <li>A quantitative discussion</li> </ul>
	Complex ions and solubility	<ul style="list-style-type: none"> <li>The diammine silver (I) ion</li> <li>Increase in the solubility of silver bromide by complex ion formation</li> </ul>
Redox Chemistry	Balancing redox reactions by using half reactions	<ul style="list-style-type: none"> <li>The net ionic equation for a redox reaction</li> <li>Basic terms regarding redox chemistry</li> <li>Balancing a redox reaction taking place in an acidic medium</li> </ul>
	Spontaneous and non-spontaneous redox reactions	
	Electrochemical cells which release energy	<ul style="list-style-type: none"> <li>The zinc copper cell</li> <li>The use of the standard hydrogen electrode as reference electrode</li> </ul>
	Electrolysis and electroplating	
Basic Organic Chemistry	Hydrocarbons	<ul style="list-style-type: none"> <li>Alkanes as saturated hydrocarbons</li> <li>Saturated cyclic compounds</li> <li>Unsaturated hydrocarbons</li> <li>Unsaturated cyclic compounds</li> </ul>
	Halogenated compounds	
	Oxygenated compounds	<ul style="list-style-type: none"> <li>Alcohols</li> <li>Ethers</li> <li>Carbonyl compounds</li> <li>Carboxylic acids</li> <li>Esters</li> </ul>
	Nitrogen containing compounds	





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Distance Study Course

Course Instructor: Dr Christian Dreyer

Duration: 4 months (recommended)



This course was developed for conservators and conservation students emerging from the humanities, or any candidate lacking an adequate foundation in the physical sciences.

### EACH of this course's seven themes includes the following:

1. an introduction which includes outcomes for the theme
2. study material for each of the units into which the theme is subdivided
3. a number of projects which the student needs to complete and submit
4. an online test, in which a mark of 60% must be attained in order to pass

No fixed calendar schedule is prescribed: Rather, the student largely works through the course material in their own time and pace - a process in which they are matched and accompanied by their course instructor. This accompaniment accordingly occurs on an entirely individualized basis.

The majority of the projects (*point 3*) entail questions / problems to which the student must submit the answers, followed by tutor feedback - provided to students in short succession to their respective submissions.

In addition to providing ongoing, written feedback on the student's completed projects, the course instructor also engages each student in at least six one-on-one video exchanges via the Zoom platform. The first of these video sessions is of an orientational nature, scheduled once the student signifies his/her readiness to engage the course material - or upon submission of the first project.

A further three video sessions serve the purpose of providing guidance and discussion, along with feedback on assessments. A further two video sessions serve to conduct certain practical exercises, coordinated between the student and two faculty members from the Institute.

These, in-lab sessions are initiated by the course instructor once the required progress milestone has been reached by the student.

Note that these intermittent live sessions are each scheduled quite independently to ensure the student's practicable convenience - also readily yielding to time zones - while flexibly stepping around any occasional and/or fixed commitments or occupied days on the part of the student.

### COURSE DETAILS

**A distance study course**

**Enrolment prerequisites: None**

**Course duration: 4 months (recommended maximum)**

**Tutor: Dr Christian Dreyer**

**Starting date: Registration open throughout the year**

**Course fee: USD 795.00 / € 700.00 / GBP 625.00**

***Please enquire about the availability of part-bursaries.***

**Certificate of attainment & scored Course Report follow completion.**

***(Digital versions are furnished)***

[email / questions / enrol](#)