UNIT 1 - PHYSICAL CHEMISTRY

ADV. CHEMISTRY 2

Content

- Born-Haber cycle & lattice enthalpy
- Thermal decomposition
- Solubility of group II sulphates
- Electrochemical cell
- Standard electrode potential
- Constructing redox equations
- The Faraday constant and its uses
- The ionic product of water
- pH calculations with strong and weak species
- Buffer solutions
- Titration curves & indicators
- Solubility product
- Common ion effect
- Measuring rates of reaction
- Rate equations
- Zero & first order reactions
- Experiments to find order
- Mechanism & kinetics
- Homogeneous & heterogeneous catalysts
- Pollutants in the air, acid rains & catalytic converters

Resources & ICT

- Textbook
- Study guide
- Keynote
- Online resources available from BM website
- Internet research

Types of assessment

- Exercises from study guides and online textbooks
- Structured questions from past papers
- Questions from A-Level paper 5
- Judgements on effort and attitude towards learning

Students to Know

- How to determine a lattice enthalpy using a Born-Haber cycle
- The meaning of a standard electrode potential
- The different kind of electrodes
- The advantages and drawbacks of fuel cells
- The definition of the common ion effect
- Examples of catalysts: Haber process, catalytic converters, acid rains

Students to Understand

- The influence of the size and the charge of ions on the lattice enthalpy
- The consequence of non standard conditions on the electrode potential values
- The shape of titration curve including strong and weak species
- The use of acid base indicators

Students to be able to Do

- Recall the trend in solubility of group II sulphates and decomposition of group II nitrates and carbonates
- Perform calculations using the Faraday constant
- Calculate pH values with strong and weak species
- Choose the experimental setup required to find the order of a reaction

Cross curricular links

- Biology; importance of buffers; influence of pH on biological processes; consequces of acid rains on fauna and flora
- Mathematics; logarithms, negative exponential
- PSHE; consequences of pollution on human health

Differentiation incl. EAL

- Extension tasks for students who previously studied material or have a good grasp of it
- Group work considerations; mixed ability

Learning styles activities

- Lectures
- Individual and group exercises
- Quizzes
- Test
- Presentation production
- Poster production

Smog in New York City

Dr. Edwin P. Ewing, Jr. / Public domain

Global citizenship, internationalism, local environment

- Raising awareness on the global impact of human-generated pollutants in the atmosphere
- Use of acids or bases to adjust pH in agriculture

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September-October - 6 weeks

UNIT 2 - ORGANIC CHEMISTRY

ADV. CHEMISTRY 2

Content

- Electron delocalisation in benzene rings
- Arenes & their reactions
- Electrophilic substitutions: formation of nitroarenes, halogenoarenes, Friedel-Crafts reaction
- Side-chain oxidation
- Phenols & acidity
- Phenols reactions
- Carboxylic acids
- Acyl chlorides & their reactions
- Comparison of hydrolysis reactions
- Amines & basicity
- Reaction of phenylamine
- Amides & polyamides
- Amino-acids & peptide link
- The triiodomethane reaction
- Addition and condensation polymers
- Uses of polymers
- Plastics & pollution

Resources & ICT

- Textbook
- Study guide
- Keynote
- Online resources available from BM website
- Internet research

Types of assessment

- Exercises from study guides and online textbooks
- Structured questions from past papers
- Questions from A-Level paper 5
- Judgements on effort and attitude towards learning

Students to Know

- Structure and reactions of: arenes, nitroarenes, halogenoarenes, phenols, phenylamides, acyl chlorides, amines, amides, amino-acids
- The pathways connecting the previous homologous series

Students to Understand

- Electrophilic substitutions as exemplified by the formation of nitroarenes, halogenoarenes and the Friedel-Crafts reaction
- The relative acidity or basicity of phenol and phenylamine
- The diazotisation reaction
- The triiodomethane test
- The consequences of using polymers, the need for recycling plastics

Students to be able to Do

- Identify functional groups and name organic chemicals when given a displayed or skeletal formula
- Recall the mechanism of electrophilic substitutions, diazotisation reaction, triiodomethane reaction

Cross curricular links

- Biology; peptide bonds and proteins
- Economy; volatility of the price for benzene between 2002 and 2013

Differentiation incl. EAL

- Extension tasks for students who previously studied material or have a good grasp of it
- Group work considerations; mixed ability

Learning styles activities

- Lectures
- Individual and group exercises
- Quizzes
- Test
- Presentation production
- Poster production

Plastic waste at Coco Beach, India

Haji0 ms / CC BY-SA 3.0

Global citizenship, internationalism, local environment

- Local and international consequences of plastic pollution
- Reflection on ways to reduce uses of polymers and discussion of alternative solutions
- Reflection on chemical toxicity, example of benzene and the 2005 Jilin chemical plant explosions in China

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November-December - 6 weeks

UNIT 3 - INORGANIC CHEMISTRY

ADV. CHEMISTRY 2

Content

- Group IV elements: structure and bonding
- Trends in physical and chemical properties of oxides and tetrachlorides of group IV elements
- The inert pair effect
- Expanded octet
- Ceramics based in silicon(IV) oxide
- Transition elements
- Properties of TE: variable oxidation states, catalytic effect, coloured compounds
- Complexes of TE
- Ligand substitution

Resources & ICT

- Textbook
- Study guide
- Keynote
- Online resources available from BM website
- Internet research

Types of assessment

- Exercises from study guides and online textbooks
- Structured questions from past papers
- Questions from A-Level paper 5
- Judgements on effort and attitude towards learning

Students to Know

- The trends in physical and chemical properties of group IV elements and their oxides and tetrachlorides
- The properties and uses of ceramics based on silica

Students to Understand

- The consequence of the inert pair effect on the stability of the 2+ and 4+ ions
- The expanded octet and hypervalent molecules
- The formation of TE complexes through ligand making coordinate covalent bonds to the metal's d-orbitals

Students to be able to Do

- Explain how the colour of TE compounds is linked to the breaking of degeneracies of electronic orbital states
- Design reaction showing the ligand substation in TE complexes

Cross curricular links

- Biology; porphyrin complexes as in haemoglobin and chlorophyll
- Physics; semi-conductors

Differentiation incl. EAL

- Extension tasks for students who previously studied material or have a good grasp of it
- Group work considerations; mixed ability

Learning styles activities

- Lectures
- Individual and group exercises
- Quizzes
- Test
- Presentation production
- Poster production

Silicon wafer

NASA / Public domain

Global citizenship, internationalism, local environment

- Silicon Valley: high technology thanks to the unique properties of silicon

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January - 3 weeks

UNIT 4 - APPLICATIONS OF CHEMISTRY

ADV. CHEMISTRY 2

Content

- DNA and RNA structure
- Proteins
- Enzymes
- Ion channels
- Metals in biological systems
- Mass Spectrometry
- Nuclear Magnetic Resonance
- X- ray crystallography
- Partition coefficient
- Chromatography methods: paper, TLC, Gas Chromatography, HPLC
- Electrophoresis and genetic fingerprinting
- GC-MS in environmental science
- Medical chemistry
- Polymer science
- Nanotechnology
- Environment and energy

Resources & ICT

- Textbook
- Study guide
- Keynote
- Online resources available from BM website
- Internet research
- CIE-published booklet

Types of assessment

- Exercises from study guides and online textbooks
- Structured questions from past papers
- Questions from A-Level paper 5
- Judgements on effort and attitude towards learning

Students to Know

- The primary, secondary and tertiary structure of proteins
- Enzyme catalysis
- Which metals interact with biological systems: iron in heamoglobin, zinc as an enzyme co-factor, heavy metal toxicity

Students to Understand

- The differences between competitive and non-competitive inhibitors
- How a sodium-potassium pump works
- The principles behind the techniques of mass spectrometry, NMR and X-ray crystallography
- The concept of partition coefficient
- Material science aims and its implications within medical, polymer and environmental sciences
- The concept of nanotechnology

Students to be able to Do

- Interpret spectra obtained from a MS or NMR spectrometer
- Perform calculations involving partition coefficient

Cross curricular links

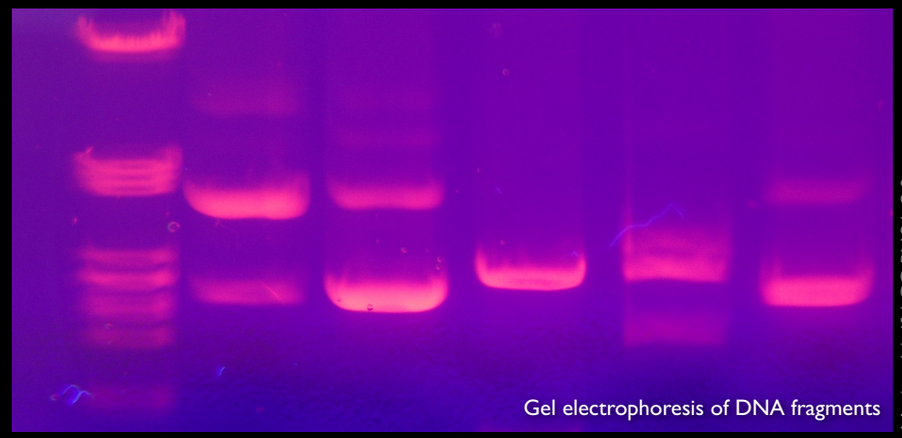
- Physics; nanotechnology
- Biology; biochemistry
- Environmental science; breakthroughs thanks to chemistry, e.g. greener alternative to volatile solvents

Differentiation incl. EAL

- Extension tasks for students who previously studied material or have a good grasp of it
- Group work considerations; mixed ability

Learning styles activities

- Lectures
- Individual and group exercises
- Quizzes
- Test
- Presentation production
- Poster production



Gel electrophoresis of DNA fragments

Global citizenship, internationalism, local environment

- The discovery of DNA structure by Watson and Crick, 1953: what is a paradigm change; discussion about scientific deontology as illustrated by the relative obscurity of Rosalind Franklin
- Material science as a way to improve human technologies and well-being
- Discussion about recent breakthroughs in environmental science and in nanotechnology

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January-February - 5 weeks