CH3F7-15 Energy

20/21

Department
Chemistry
Level
Undergraduate Level 3
Module leader
Ross Hatton
Credit value
15
Module duration
10 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

N/A

Module web page

Module aims

1. To provide an overview of the science that underpins key renewable energy generation and storage technologies.
2. To show how materials chemistry is playing a critically important role in the advancement of emerging energy technologies.
3. To connect the science in this area with broader environmental, economic, social and policy issues.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

1. Introduction to the wider context: climate change, sustainability and energy security and the central role chemists/materials scientists will play in addressing the challenges in this

area.
2. Advanced concepts in solid state chemistry building on years 1 and 2: direct/indirect semiconductors, molecular semiconductors, excitons etc.
3. The solar resource; semi-conductor p-n junctions applied to photovoltaics (PV); the motivation for reverting to thin film PV; operational principles behind perovskite PV, dye-sensitised PV and organic PV (three disruptive classes of emerging PV technologies) and an explanation as to why these cells operate differently to a conventional pn junction PV. Key advances in materials development.
4. Fuel cells; basic principles of catalytic operation; proton exchange fuel cells; oxygen ion exchange fuel cells; key materials issues.
5. Solid state batteries; electrochemical principles, different types of batteries (primary, secondary); alkaline and lithium ion batteries; key materials issues.
6. Inorganic materials for batteries, solid-oxide fuel cells and electrocatalysis
7. Hydrogen; methods of generation (e.g. photoelectrolysis and chemical); importance of storage and transport; importance of new materials (e.g. porous framework materials).
8. Bioenergy; biomass as a fuel; bioenergy sources including crops and waste; production of gaseous and liquid fuels from biomass.

Learning outcomes

By the end of the module, students should be able to:

- Appreciate the connection behind the science and technology of energy, and environmental, economic, social and policy issues.
- Appreciate the complexity of the renewable energy challenge and the central role that chemists do/will play in this growing area.
- Understand the underpinning science behind the operation of different types of photovoltaic device, particularly leading emerging photovoltaic technologies.
- Understand the underlying principles behind different types of fuel cell.
- Understand the underlying principles behind the operation of solid state batteries.
- Understand the underlying principles behind bioenergy and the use of biomass for biofuels.
- Understand the underlying principles and challenges in the area of hydrogen storage.

Indicative reading list

Introductory Nanoscience Physical and Chemical Concepts / Masaru Kuno
London and New York : Garland Science 2012.
Polymer electronics [electronic resource] / edited by Hsin-Fei Meng.
Singapore : Pan Stanford Publishing, c2013.
“Biofuels” eds. W. Soetert, E.J. Vandamme, Wiley, 2009

Subject specific skills

Module leader to add

Transferable skills

Module leader to add

Study

Study time

Type	Required
Lectures	24 sessions of 1 hour (16%)
Practical classes	2 sessions of 1 hour (1%)
Private study	124 hours (83%)
Total	150 hours

Private study description

N/A

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group B1

	Weighting	Study time
Online Examination	100%	

- Online examination: No Answerbook required

Feedback on assessment

Cohort level examination feedback provided via Moodle.

Past exam papers for CH3F7

Availability

Pre-requisites

To take this module, you must have passed:

- All of
  - CH273-15 Properties of Solutions and Foundations of Electrochemistry and Statistical Mechanics

Courses

This module is Optional for:

- Year 4 of UCHA-F107 Undergraduate Master of Chemistry (with Intercalated Year)
- UCHA-F109 Undergraduate Master of Chemistry (with International Placement)
  - Year 3 of F109 MChem Chemistry (with International Placement)
  - Year 3 of F111 MChem Chemistry with Medicinal Chemistry (with International Placement)
- UCHA-4M Undergraduate Master of Chemistry Variants
  - Year 3 of F105 Chemistry
  - Year 3 of F109 MChem Chemistry (with International Placement)
  - Year 3 of F126 MChem Chemistry with Med Chem (with Prof Exp)
  - Year 3 of F125 MChem Chemistry with Medicinal Chemistry
  - Year 3 of F106 MChem Chemistry with Professional Experience
- Year 4 of UCHA-F127 Undergraduate Master of Chemistry with Medicinal Chemistry(with Intercalated Year)

This module is Option list A for:

- UCHA-4 Undergraduate Chemistry (with Intercalated Year) Variants
  - Year 4 of F101 Chemistry (with Intercalated Year)
  - Year 4 of F122 Chemistry with Medicinal Chemistry (with Intercalated Year)
- UCHA-3 Undergraduate Chemistry 3 Year Variants
  - Year 3 of F100 Chemistry
  - Year 3 of F100 Chemistry
  - Year 3 of F121 Chemistry with Medicinal Chemistry
- Year 3 of UCHA-F110 Undergraduate Master of Chemistry (with Industrial Placement)
- Year 3 of UCHA-4M Undergraduate Master of Chemistry Variants