

# GCSE Outreach Practicals



# Awards

We're proud of our awards including winning the first Global Teaching Excellence Award.



## Global Teaching Excellence Award

We won the first Global Teaching Excellence Award. It recognised the University's commitment to world-class teaching and its success in developing students as independent learners and critical thinkers (HEA, 2017).



THE QUEEN'S  
ANNIVERSARY PRIZES  
FOR HIGHER AND FURTHER EDUCATION  
2019

## The Queen's Anniversary Prize

In 2019 we won a Queen's Anniversary Prize. It's one of the most coveted honours in UK Higher Education and was earned in recognition of the innovations made by our Institute of Railway Research. This follows our 2015 Prize for expanding the global boundaries of new music.



## University of the Year

The Times Higher Education named us as University of the Year in November 2013. The award recognises a university that has demonstrated exceptional performance. They liked our "bold, imaginative and innovative initiatives."



## A Five Star University

QS Stars has given us Five Stars overall. This international benchmarking system renders Five Star universities as world-class in areas such as Teaching, Employability, Facilities, Innovation, Internationalisation and Inclusiveness.



## Athena Swan

We're serious about gender equality. We want an equal number of men and women on our science and engineering courses, for instance. Our commitment was recognised in 2015 and again in 2020 with the Athena SWAN Bronze Award.

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# Welcome

At the University of Huddersfield, we are committed to inspiring the next generation of scientists through our relationships with schools and colleges. We are always looking at ways to establish, build and strengthen these relationships by offering innovative and relevant activities which are of value to both teachers and students.

**We are delighted to introduce our range of GCSE Outreach Practicals. These are a new suite of GCSE Practicals, for your learners, that correspond to targeted specification requirements.**

**We aim to provide sessions that will broaden learner knowledge by sparking interest and encouraging scientific enquiry.**

## GCSE Practicals

- Want to provide something different for your learners? Whether you want them to have a fully immersive practical experience or need additional access to resources, we offer carefully designed Biology and Chemistry practical investigations that meet targeted requirements.
- They can be used in place of a practical usually taught by a teacher, or be used in addition to practicals taught in school.
- The sessions are delivered on our campus by our University staff and provide opportunities to use specialist equipment in a laboratory setting.

**All our practicals are free of charge. Subsidies for travel or staff cover may be available on request and will be considered on an individual basis.**

## In this guide

You'll find details of each of the GCSE Outreach Practicals and why each practical is relevant for your learners.

# How to book

To book and arrange your GCSE Outreach Practical please email the science outreach office:

**science.outreach@hud.ac.uk**

For queries about practical pedagogy please contact:

**Kayleigh Hopkins**

Outreach Lead

Email: **k.a.hopkins@hud.ac.uk**

## Course information

If you'd like information about Biological Sciences, Chemical Engineering, Chemistry, Forensic Science, Optometry, Pharmacy and Science Extended Degree courses here at Huddersfield please contact:

### Biological Sciences

Dr Anke Bruning-Richardson

Admissions Tutor

Email: a.bruning-richardson@hud.ac.uk

### Dr Anna Murphy

Admissions Tutor

Email: a.murphy2@hud.ac.uk

### Chemical Engineering

Dr Daniel Belton

Admissions Tutor

Email: d.belton@hud.ac.uk

### Chemistry and Forensic Science

Dr David Cooke

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Email: d.j.cooke@hud.ac.uk

### Optometry

Dr Niall Hynes

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Email: n.j.hynes@hud.ac.uk

### Pharmacy

Dr Kofi Asare-Addo

Email: k.asare-addo@hud.ac.uk

### Science Extended Degree

Mrs Rukhsana. R. Din

Admissions Tutor

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### Microscopy:

*Use a light microscope to observe, draw and label biological specimens.*

Microscopy is both a powerful biological tool and an invaluable skill for learners to develop. Seeing the microscopic living world helps to promote a deeper understanding of the things that we cannot see. In this investigation learners will have the opportunity to observe live algal species, using powerful light microscopes, in our University laboratory. They will make scientific observational drawings, locate and name both subcellular structures and specific taxa. There will also be opportunity for learners to observe premade slides for other animal and plant cells.

*How this practical meets specification requirements.*

- Use a light microscope to observe, draw and label a selection of plant and animal cells.
- Use of magnification scales.
- Recognise, draw and interpret images of cells.
- Use estimations to judge the relative size or area of subcellular structures.

**Mystery Vomit:** *Using qualitative reagents to test for a range of carbohydrates, lipids and proteins.*

There have been several cases of unidentified vomiting across the University, can your learners help to find the culprit? In this investigation learners will have the opportunity to explore a forensics style application to the identification of carbohydrates, lipids and proteins, in our University laboratory. They will create their own hypothesis and use several food tests to identify the vomiting culprit, suggesting potential hazards and drawing their own conclusions from this process.

*How this practical meets specification requirements.*

- Use qualitative reagents to test for a range of carbohydrates, lipids and proteins.
- Know that the products of digestion are used to make new carbohydrates, lipids and proteins.
- Testing foods for the presence of biological molecules.

### Physiological Responses:

*Planning and carrying out an investigation into the effect of a factor on human reaction time.*

Put down the meter ruler and step into the world of modern technology. PowerLab© is a data acquisition device that has been engineered for the precise, consistent and reliable recording of physiological responses. It is used widely in both educational and clinical settings. In this investigation learners will have the opportunity to design their own reaction time experiment to visual, aural, predictable and distracting cues, using state of the art technology and see real time physiological responses in graphical format on their computer screen.

*How this practical meets specification requirements.*

- Use appropriate equipment to record time and measure reaction time.
- Consider safe and ethical use of humans to measure physiological function of reaction time and responses to a chosen factor.
- Explain the structures of the reflex arc.
- Extract and interpret data from graphs about the functioning of the nervous system.
- Translate information about reaction times between numerical and graphical forms.

### **Biodiversity:** *Investigating the distribution and abundance of organisms in an ecosystem.*

Every species plays a vital role within an ecosystem. Different species support clean water, breathable air, fertile soils, climate stability, pollution absorption, prevention of disease and more. Maintaining species diversity is vital for medicine, with over 3,000 plants discovered to have cancer-fighting properties. In this investigation learners will closely examine leaf litter from different forest habitats to estimate the abundance and distribution of organisms. They will calculate the mean, median and mode for different species and consider the safe and ethical uses of these organisms.

*How this practical meets specification requirements.*

- Safe and ethical use of organisms.
- Application of appropriate sampling techniques to investigate the abundance and distribution of organisms.
- Estimate population size based on sampling.
- Understand the principles of sampling.
- Understand the terms mean, median and mode as applied to ecological data.
- Record first hand observations of organisms.

### **Enzymes in Action:** *Investigating the effect of pH on the rate of reaction of different enzymes.*

Enzymes are important practical tools for medicine, agriculture and industry. The ability to measure enzyme activity allows diagnostics for many diseases as they are often related to altered or absent enzymes. Many drugs, vitamins and toxins are modulators of enzymes. In this investigation learners will explore the activity of different enzymes after exposure to differing pH levels. They will use pH meters to accurately measure pH levels and present their observations in graphical form.

*How this practical meets specification requirements.*

- Use appropriate apparatus to record volumes of liquids, time and pH.
- Make and record observations.
- Present a graph of enzyme activity against pH.
- Know the function of carbohydrases, lipases and proteases within the digestive system.
- Relate knowledge of enzymes to metabolism.



### Titration: Determination of the reacting volumes of solutions of a strong acid and a strong alkali by titration.

Titration is an essential skill for the budding chemist. In this investigation learners will have the opportunity to solve the problem of the pH of a 'mystery' substance whilst handling equipment, including pH meters, in order to accurately measure pH, in our University laboratory. There will be opportunity to discuss the merits of quantitative vs. qualitative approaches to chemistry. Learners will record the data that they collect and use it to calculate the pH of the 'mystery' substance.

*How this practical meets specification requirements.*

- Use appropriate equipment to make and record a range of measurements accurately (e.g. volume of liquid, pH).
- Carry out experiments appropriately by correctly manipulating apparatus.
- Make accurate measurements.
- Make and record measurements.
- Discuss the appropriate use of different apparatus and methods (instrumental vs qualitative).
- Use ratios, appropriate significant figures, rearrange equations and manipulate values in decimal form.

### Chemical tests: Use of chemical tests to identify the ions in unknown single ionic compounds covering the ions from flame tests and sulphates.

There have been some chemicals found in an old storage cupboard in the University, can your learners solve the mystery of what the substances are? In this investigation, learners will have the opportunity to explore identifying chemicals using qualitative tests and with the opportunity to use Atomic Absorbance Spectroscopy. They will process the data gathered and present the conclusions that they draw, supplying the evidence that they use to identify these 'unknown' substances.

*How this practical meets specification requirements.*

- Use of appropriate qualitative reagents and techniques to analyse and identify unknown samples or products.
- Discuss the appropriate use of different apparatus and methods (instrumental vs qualitative).
- Make and record observations and measurements using a range of apparatus and techniques.

### Titration: Analysis and purification of water samples from different sources. To include pH measurement, removal of dissolved solids and distillation.

Water samples have been gathered from different locations and your learners will be asked to investigate the water quality from these different sites and determine the dissolved solid content. They will have the opportunity to use instrumental techniques in our University laboratory to determine parameters of the sample, before offering their conclusions on ways the water could be treated to clean up the site.

*How this practical meets specification requirements.*

- Select appropriate equipment carry out the experiment.
- Understanding of sampling techniques to ensure any samples collected are representative.
- Make and record observations using a range of methods and apparatus.
- Evaluate methods and suggest possible improvements and further investigations.
- Careers in science.

### Paper Chromatography: Investigating how paper chromatography can be used to separate and tell the difference between coloured substances.

The owner of a large company has left a signed handwritten will, found amongst his papers shortly after his death, detailing his wishes concerning the disposition of the company. There is a dispute as to whether amendments have been made after his death. The document is submitted for examination, but analysis of the handwriting proves inconclusive. Can an analysis of the ink used to write the document throw any light on the case? In this investigation learners will have the opportunity to use several chromatography

techniques used by forensic scientists in our University laboratory setting.

*How this practical meets specification requirements.*

- Use of appropriate qualitative reagents and techniques to analyse and identify unknown samples or products.
- Manipulation of equipment.
- Make and record observations using a range of methods and apparatus.
- Evaluate methods and suggest possible improvements and further investigations.
- Select equipment appropriate to the carry out the experiment.
- Careers in Science.

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