# Secondary Science PGCE at the University of Roehampton

***Useful information to build your pedagogical content knowledge before starting the course***

Congratulations on your offer to study PGCE Science at Roehampton. We very much look forward to welcoming you in September on what will be an exciting and busy year. If you have any questions, please feel free to contact the subject tutors: steve.abrams@roehampton.ac.uk Nicklas.lindstrom@roehampton.ac.uk

Use your subject knowledge audit (completed prior to interview but a blank one is attached here) to help you identify key and address key gaps in order to get ready for the course. Here are some suggestions:

1. Look at the national curriculum KS2, 3 and 4 across the science to get a better idea of what you will be teaching: https://www.gov.uk/government/publications/national-curriculum-in-england-science-programmes-of-study/national-curriculum-in-england-science-programmes-of-study
2. Use these online resources to revisit, revise key and test yourself: https://mathsmadeeasy.co.uk/gcse-science-revision/ https://app.senecalearning.com/courses?Price=Free&text=science
3. Familiarise yourself with the latest science exam board specs and past papers: AQA GCSE and A level: https://www.aqa.org.uk/subjects/science Edexcel: https://qualifications.pearson.com/en/qualifications/edexcel-gcses/sciences-2016.html
4. Visit the professional association for your specialism to find out the latest news and resources: https://www.rsb.org.uk/ https://www.rsc.org/ https://www.iop.org/
5. Listen to some science podcasts such as the infinite monkey cage or others here: http://www.bbc.co.uk/podcasts/category/scienceandnature
6. Build your awareness of science current affairs by reading online magazines such as: https://www.science.org/
7. Watch and evaluate some remote teaching of science lessons from the Oak National Academy website: https://www.thenational.academy/

# Science Pre-Course Reading

Read the highlighted texts and in addition choose one or two from each list. A wider reading list will be provided once the course begins. All these works are available on Amazon and/or in the library at Roehampton. There will be a library orientation tour towards the start of the course to familiarise you with the facilities and services available.

**Subject knowledge:**

Bryson, B. (2004) *A Short History of Nearly Everything*, London, Black Swan

Bryson, B. (2019) *The Body: A Guide for Occupants*, London, Doubleday

Dawkins, R. (ed) (2008) *The Oxford Book of Modern Science Writing*, Oxford, OUP

Driver, R. (1989) Students' conceptions and the learning of science, *International Journal of Science Education*, 11(5), 481-490

Goldacre, B. (2008) *Bad Science*, London, Fourth Estate

Gribbin, J. (2002) *Science a History*, London, Penguin

McComas, W. (2017) Understanding how science work: The nature of science as they foundation for science teaching and learning, *School Science Review,* 98(365) 71-76

Podcast: Infinite Monkey Cage - What makes science a science?
https://www.bbc.co.uk/programmes/b036twt5

**Teaching and learning:**

Cullingford, C. (2010) *The Art of Teaching*, Abingdon, Routledge

Dweck, C. (2012) *Mindset: How you can fulfil your potential* London, Robinson

James, G. (2016) *Transforming Behaviour in the Classroom*, London, Sage

Harlen, W (2010 and 2015) *Principles and big ideas of science education*:
https://www.ase.org.uk/bigideas

Toplis, R (2015) *Learning to teach science in the secondary school* London, Routledge

William, D. (2011) *Embedded formative assessment* Bloomington: Solution Tree

Willingham, D. (2010) *Why don't students like school?* London, Jossey Bass

Wright, T. (2008) *How to be a Brilliant Trainee Teacher* Abingdon, Routledge

# Science Subject Knowledge Audit

Name:

You will use this form throughout the PGCE course as you develop your subject and pedagogical knowledge.

| Topic | At what level and where did you study this topic | Tick if additional work required |
|---|---|---|
| **Biology**<br>Using a light microscope to observe cells and the role played by the electron microscope | | |
| Cell structures in both animal and plant cells | | |
| Role of diffusion, osmosis and active transport in cell biology | | |
| Hierarchical organisation of multicellular organisms | | |
| Biomechanics and muscle structure and function | | |

| | | |
|---|---|---|
| Skelton and functions of bone | | |
| Balanced diet and consequences of poor diet | | |
| Tissues, organs and function of the human digestive system | | |

| | | |
|---|---|---|
| Enzymes as biological catalysts Understand the kinetics and rate calculations of enzyme reactions | | |
| Plant nutrition | | |
| Photosynthesis – to include its role in atmosphere composition and adaptations in plants to facilitate it. Understand the role of limiting factors in determining the rate of photosynthesis and the process of transpiration. | | |
| Human reproduction (including reproductive systems, hormonal control of | | |

| | | |
|---|---|---|
| the menstrual cycle, gametes, fertilisation, gestation & birth) | | |
| Plant reproduction (including pollination, fertilisation, dispersal and germination). Plant structure including xylem and phloem. Understanding of plant hormones | | |
| Effects of recreational drugs | | |
| Aerobic and anaerobic respiration in multi-cellular organisms | | |
| Fermentation in microorganisms | | |

| | | |
|---|---|---|
| Interdependence or organisms in ecosystems, the importance of biodiversity and biological factors affecting food security. | | |
| Importance of insect pollination to food security | | |
| The work of Watson, Crick. Wilkins and Franklin on DNA | | |

| | | |
|---|---|---|
| structure. The role played by DNA in protein synthesis. | | |
| Simple heredity including mitosis and meiosis, the work of Mendel, genetic disorders and the Human Genome Project | | |
| The significance of differences between specifies and within species | | |
| The work of Darwin and Wallace and natural selection, including and understanding of human evolution | | |
| The significance of biodiversity and how our understanding of genetics has led to the suggestions of three domains rather than the five kingdoms | | |
| Demonstrate an understanding of the relationships between quantitative units in relation to cells, including milli (10 -3) , | | |

| | | |
|---|---|---|
| micro(10 -4) , nano (10 -5) and pico(10 -6) | | |
| Explain structure and function of nervous system including reflex arc. and the eye | | |
| An understanding of the basics of genetic engineering and the role played by GM organisms | | |
| To understand the principles of health, disease (in humans and plants) and the development of medicines | | |
| Describe the production and use of monoclonal antibodies. | | |
| Have a good understanding of animal coordination, control and homeostasis including the principal human hormones. | | |
| The water, carbon, nitrogen cycles. | | |

| | | |
|---|---|---|
| **Chemistry**<br>Explanations of changes in states of matter using the particle model | | |
| The Dalton atomic model | | |

| | | |
|---|---|---|
| Chemical symbols and formulae for elements and compounds<br><br>Transition metals and alloys | | |
| Techniques for separating mixtures.<br><br>Methods of purification | | |
| Representing chemical reactions using formulae and equations<br><br>Overarching concepts of chemistry types of Bonding | | |
| Combustion, thermal decomposition, oxidation & displacement reactions<br><br>Dynamic Equilibria and calculations involving gases | | |

| | | |
|---|---|---|
| Chemistry of acids and alkalis including the properties of metal and nonmetal oxides<br><br>Quantitative Analysis :tests for ions | | |
| Catalysts<br><br>Rates of Reaction. | | |
| Energetics in chemical reactions<br><br>Heat energy changes /Fuels | | |

| | | |
|---|---|---|
| The development of use of the Mendeleev Periodic Table<br><br>Groups 1,7,0 | | |
| The order and implications of metals and carbon in the reactivity series | | |
| ceramics, polymers and composites (qualitative)<br><br>Hydrocarbons, Alcohols and Carboxylic acid | | |
| The composition and structure of the Earth and its atmosphere<br><br>Atmospheric Science | | |
| The carbon cycle<br><br>Surface properties of matter including Nanoparticles | | |

| | | |
|---|---|---|
| **PHYSICS**<br>Calculation of fuel uses and costs in the domestic context | | |
| Fuels and energy resources<br><br>Conservation of Energy | | |
| Energy changes and transfers in simple machines | | |
| Heating and thermal equilibrium | | |
| Energy changes within a system | | |

| | | |
|---|---|---|
| Quantitative relationship between speed, distance and time | | |

| | | |
|---|---|---|
| Interaction of and representation of forces between objects | | |
| Moments | | |
| Measuring forces<br>Forces and Matter | | |
| Hooke's Law | | |
| Work done and energy changes | | |
| Non-contact forces | | |
| Pressure in fluids | | |
| Newton's laws of motion | | |
| Transverse waves<br><br>Sound | | |
| Electromagnetic Induction | | |
| Ultrasound | | |
| Light waves travelling through a vacuum<br><br>Light and the EM Spectrum | | |
| Reflection and refraction of light: The Human Eye:<br>Coloured Light | | |
| Magnetism and the motor effect | | |

| | | |
|---|---|---|
| Particle Model- 1.The Kinetic theory model | | |
| Current electricity and simple circuits | | |
| The definition and measurement of current, potential difference and resistance and the relationship between them. | | |
| Static electricity | | |
| Particle Model-2 Explaining the Gas Laws | | |
| DC motors | | |
| Melting, freezing, evaporation, sublimation, condensation, dissolving | | |
| Brownian motion | | |

| | | |
|---|---|---|
| Gravity, weight and mass | | |
| Energy in matter | | |
| Seasons<br><br>Structures in the universe<br><br>Astronomy | | |
| Radioactivity<br><br>Types, Uses Dangers | | |