**PGCE Science - University of Bristol**

Pre-course development of subject knowledge

Introduction:

Even though you have a science degree it does not ensure that you are familiar with the science that is currently studied by pupils in school. It will be a while since you studied such topics or perhaps never studied them, and the curriculum is continuously changing.

For effective science teaching it is important that pedagogical content knowledge is developed, i.e. what are the best methods to enable children to learn particular science topics? To a large extent development comes with experience of teaching, however it will not develop without sound subject knowledge and we would like you to start our PGCE Science programme with a firm foundation in place.

Spending time in science classrooms will also help to develop your subject knowledge and make you aware of what children struggle to understand. We recommend therefore that you try to gain additional experience in a secondary school before you commence the programme with us, particularly if your experience has been limited.

Reading to develop your subject knowledge:

By the time children begin secondary school they will already have completed seven years of studying science at primary school! It is important therefore that you familiarise yourself with the Science Programmes of Study for Key Stages 1 and 2 which came into operation in September 2014. They can be found at:

[Science programmes of study: key stages 1 and 2 (publishing.service.gov.uk)](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/425618/PRIMARY_national_curriculum_-_Science.pdf)

The current Key Stage 3 Programme of Study for Science also came into force in September 2014 and can be found at:

[Science programmes of study: key stage 3 (publishing.service.gov.uk)](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/335174/SECONDARY_national_curriculum_-_Science_220714.pdf)

For Key Stage 4 science content is specified in the DfE document “Combined science: GCSE subject content” (first taught from September 2016):

[Combined science: GCSE subject content (publishing.service.gov.uk)](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/800339/Combined_science_GCSE_updated_May_2019.pdf)

This curriculum will be delivered through the GCSE exam specifications and it would therefore be worth familiarising yourself with the subject knowledge requirements of the three sciences at this level by going to one of the GCSE exam providers: OCR (www.ocr.org.uk), Edexcel ([www.edexcel.com](http://www.edexcel.com)), or AQA ([aqa.org.uk](https://www.aqa.org.uk/)).

Alongside this we advise that you purchase and read the following books which will help you to explore the issues of teaching biology, chemistry and biology:

Biology: Reiss, M. (ed) (2011). ASE Science Practice: *Teaching secondary biology* (2nd Edition) Hodder Education. (new edition to be published in April 2020)

Chemistry: Taber, K. (ed) (2012) ASE Science Practice: *Teaching secondary chemistry (2nd edition).* Hodder Education*.*

Physics: Sang, D. (ed) (2011) ASE Science Practice: *Teaching secondary physics* (2nd edition). Hodder Education

We would like you to purchase the following text:

**Wellington, J.J. and Ireson, G.(2017) *Science Learning, Science Teaching* (4th edition) Routledge**

This is a book that we will be using a good deal during your PGCE year as it encourages reflection on the processes of teaching and learning science.

Other useful preparative reading:

Allison, S. (2017) *Making Every Science Lesson Count: six principles to support great science teaching.* Crown House Publishing

Banner, I & Hillier, J. (ed) (2018) ASE Guide to Secondary Science Education. Hatfield. Association for Science Education (essential reading for everyone concerned with the practice of secondary science education)

Driver, R., Squires, A., Rushworth, P. and Wood-Robinson, V. (1994) *Making Sense of Secondary Science: Research into children’s ideas*. Oxford: Routledge Falmer

Dillon, J. and Osborne, J. (2010) *Good Practice in Science Teaching: What research has to say*: Open University Press

Written tasks

Please use the questions below to guide your reading, but feel able to read anything that you find interesting or challenging. These questions are representative of the topic areas that you may be teaching in your autumn placement. **Record your answers and bring them with you to your first tutor session when you start the course. You will be asked to discuss the answers with your colleagues in small groups.**

**Biology:**

1. Describe the roles of the heart, arteries, veins and capillaries in the circulation of blood. Suggest why the heart is described as a double pump.

2. Describe the role of the following parts of an animal cell: cell surface membrane, cytoplasm, nucleus. Explain how the structure of the cell of a leaf differs from that of an animal cell.

3. Explain the differences between these terms: DNA, chromosome, genome, nucleus.

4. Explain why plants are called producers.

5. Describe the characteristic features of a typical fungus, bacterium and virus. Give an example of each type of organism.

**Chemistry:**

1. Explain why magnesium is not used to make cutlery.

2. Describe the arrangement of particles within a solid, liquid and a gas (without use of diagrams)

3. Distinguish between these pairs of terms: oxidation and reduction, acids and bases, metals and non-metals.

4. What is the “Greenhouse Effect”? Explain how carbon dioxide contributes to it.

5. Explain why the periodic table is important in chemistry.

**Physics:**

1. Explain the difference between mass and weight. Compare the mass and weight of an astronaut on Earth and on the Moon.

2. Draw an electrical circuit containing one battery (cell), a bulb and a switch in series. Draw a second circuit with one battery and two bulbs connected in parallel. Explain why the bulbs in the parallel circuit will have similar brightness to the one bulb in the series circuit.

3. Describe Newton’s three laws of motion.

4. Distinguish between the following pairs of terms: speed and velocity, weight and gravity, heat and temperature.

5. What is meant by radioactive decay?

It would also be useful to try out GCSE/A-level papers, particularly in your specialist subject, and highlight strengths and weaknesses in your subject knowledge.