GRADUATE SCHOOL OF EDUCATION

College of Social Sciences and International Studies

PGCE SECONDARY SCIENCE STUDY GUIDE

ACADEMIC YEAR 2019-2020

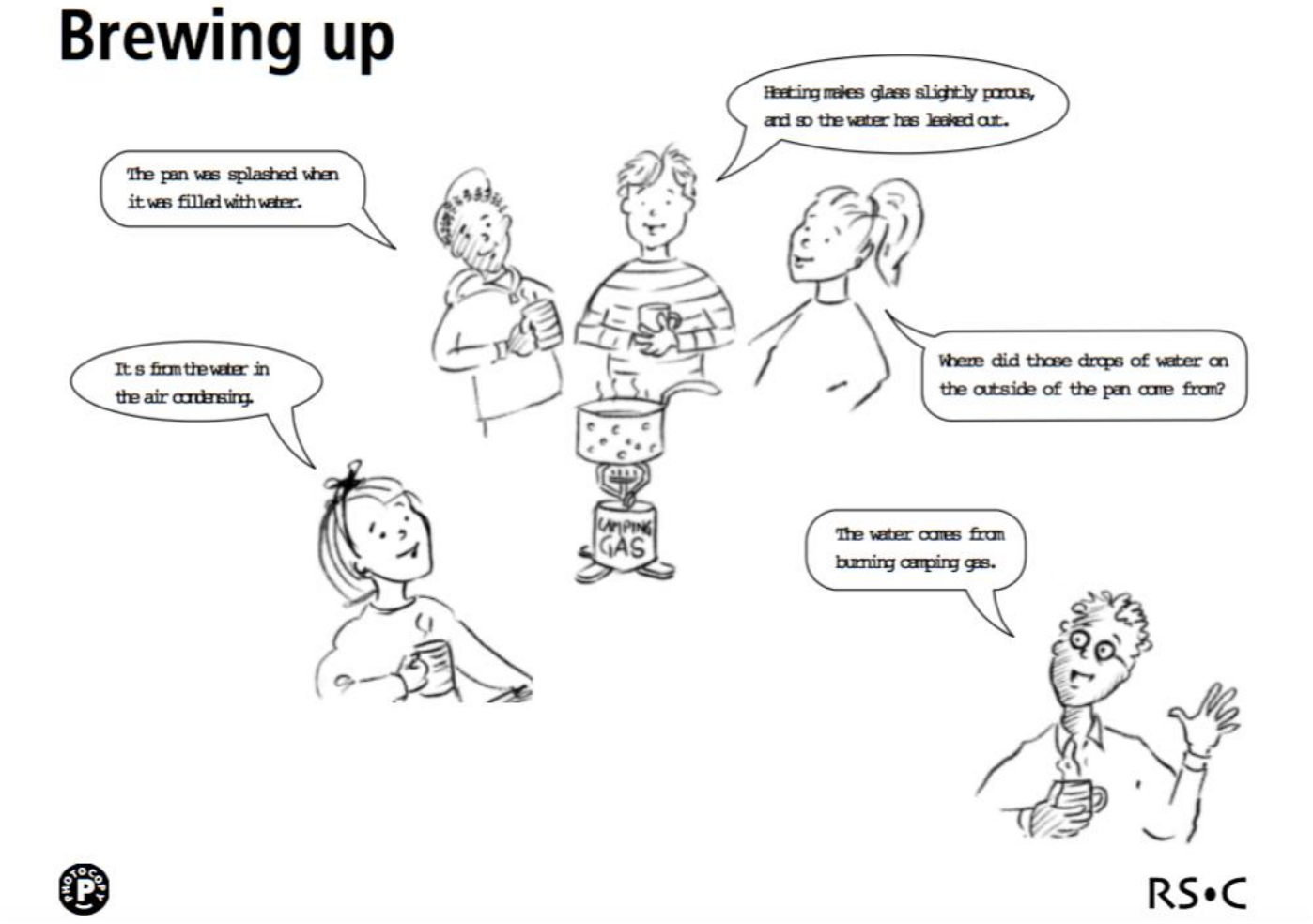

Illustration from 'The Nature of Science: Concept Cartoons' http://www.rsc.org/learn-chemistry/resource/res00001277/concept-cartoons?cmpid=CMP00002676

Contents

WELCOME

Welcome to the PGCE Secondary Science course. We hope you will enjoy what will be a challenging and exciting year. Our aim is to support you in your development as outstanding teachers. The PGCE secondary science course at Exeter is designed to help you to understand how pupils learn science and how you can teach it effectively, safely and in an interesting way to secondary school pupils of all ages and abilities. Both university-based and school-based elements of the course are essential in achieving this aim, and we encourage you to be analytical, creative and critical about what you are learning through both course components and how they relate to each other.

This Study Guide should be read in conjunction with the Secondary PGCE Programme Handbook and the EPS Handbook which contain detailed information about all aspects of your PGCE and information about University of Exeter procedures. Please refer to the Secondary PGCE Programme Handbook for everything other than subject specific guidance and to the Module Descriptors for the module aims and intended learning outcomes.

Education policy changes regularly and rapidly and we aim to prepare you to become adaptable teachers who are able to respond thoughtfully and creatively to such changes. Schools and teachers are adjusting to the new Ofsted Education Inspection Framework (EIF) this year: you will need to participate in debates about these changes and others, and what they mean for pupils learning science. Science is a core subject in the curriculum and is seen as being crucial to the UK's economy. However, uptake of Science in post-compulsory education remains problematic. We aim to train science teachers who will inspire all pupils to engage with science, whether they intend to be scientists or not.

The wide variety of taught sessions alongside the range of teachers you work with in schools will ensure you see and experience a range of different approaches to teaching and learning science. Some of these will deliberately model good school classroom practice, whilst others use approaches designed for University study. Please be thoughtful about these experiences and use them to think about *why* the material is being taught in these particular ways. This reflective approach underpins the 'Exeter Model' and we expect you to capitalise on all opportunities to reflect on teaching and learning. Critically reflective thinking to understand not just *how* to teach science, but *why* different approaches are effective, underpinned by research, is fundamental to your development as an independent, innovative science teacher who will continue to learn throughout their career.

We hope you enjoy a varied, interesting and exciting year and wish you luck in your learning.

Darren Moore, Lindsay Hetherington, Luke Graham, Ed Horncastle, Justin Dillon, Nasser Mansour

PGCE SCIENCE TEAM

The course is taught by a team of experienced University staff, specialising in a wide range of science subjects. The core University team is ably supported by associated University Visiting Tutors who are all experienced teachers of science.

Name	Role	Biography	Contact
Dr Darren Moore (DM)	PGCE Secondary Science Course Leader and Psychology tutor	Darren taught Psychology at an FE College for 6 years. He joined the PGCE team while completing a PhD in Education at the University of Exeter researching the transitions of hard to reach pupils at the end of Secondary School. Since completing his PhD in 2011, Darren has combined contributing to the PGCE programme with research work at the University of Exeter Medical School and more recently in the Graduate School of Education, primarily researching school mental health.	D.Moore@exeter.ac.uk 01392 727405 NC135
Dr Lindsay Hetherington (LH)	PGCE Secondary Science Course Leader, Head of Initial Teacher Education and Chemistry tutor	Lindsay taught science in state comprehensive schools for 5 years and was Head of Chemistry and Deputy Head of Year, before moving to Exeter University to join the PGCE team and complete a PhD in Education. She is currently researching creativity within Science Education, the role of the material in teaching and learning science, and the implications of an ecological view of teacher agency on teacher development and retention. .	L.Hetherington@exeter.ac.uk 01392 725826 NC124
Luke Graham (LG)	PGCE Secondary Science and Biology tutor	Luke has spent over 20 years working in schools and colleges along the south coast. He has been a science teacher, head of department and deputy head in that time. Luke has worked with the University of Exeter for the last 7 years. He is an associate for the exam board AQA and serves as an appointed member to the National College for Teaching and Leadership.	L.Graham@exeter.ac.uk 01392 724789 NC125
Ed Horncastle (EH)	PGCE Secondary Science and Physics tutor	Ed spent 6 years teaching in state comprehensive schools where he has been a head of year and head of Physics. He joined Exeter Mathematics School 4 years ago where he teachers A level Physics and Computer Science as well as running teaching Physics courses for specialist and non-specialist teachers. Before becoming a teacher, Ed completed a PhD in magnetohydrodynamics studying the Earth's core and how the magnetic field is produced in it.	E.Horncastle@exeter.ac.uk

Professor Justin Dillon (JD)	PGCE Secondary Science tutor	Justin taught science in six London schools before joining King's College London in 1989 as a teacher educator and researcher where he spent 26 years. Justin is currently President of the National Association for Environmental Education and a trustee of the Council for Learning Outside the Classroom. He has written many chapters aimed at trainee teachers.	J.S.Dillon@exeter.ac.uk 01392 724912 BC102
Dr Nasser Mansour (NM)	PGCE Secondary Science tutor	Nasser qualified as a teacher in Egypt before going on to study Education at Tanta University, Egypt and at the University of Exeter. His research is focused around Science teachers' beliefs about education and he regularly presents at international conferences.	N.Mansour@exeter.ac.uk 01392 722842 BC108
Simon Beard	University Visiting Tutor	All our associated UVTs have had substantial experience teaching science and leading science departments in the UK. Working to support trainees in schools for between 4 and 10 years, they have a great deal of wisdom to share.	s.beard@exeter.ac.uk
Lorraine Becker	University Visiting Tutor		l.becker@exeter.ac.uk
Lyndsay Chell	University Visiting Tutor		l.chell@exeter.ac.uk
Andrew Maxwell	University Visiting Tutor		a.maxwell@exeter.ac.uk
Willie Young	University Visiting Tutor		w.j.young@exeter.ac.uk

COURSE STRUCTURE

The PGCE secondary science course has several distinct but related elements:

Education and Professional Studies Programme (EDUM036).

The Secondary Programme Handbook and Education and Professional Studies Handbook provide details of this module. It includes both university and school-based work for all secondary trainees. This programme is arranged in five themes. You are expected to attend lead lectures for the whole PGCE secondary cohort on alternate Thursday afternoons. There will also be science-specific EPS workshops at other times on Thursdays and sometimes invited guests, often teachers, will share some of their teaching and learning approaches on different topics. You are also asked to engage in self-study by listening to some online mini-lectures on topics within a theme. You will need to access these mini-lectures via ELE here https://vle.exeter.ac.uk/course/view.php?id=7930. It is crucial that you engage with the mini-lectures as directed so that they have been accessed before any associated science session in order that you bring knowledge and understanding to a science session and so we can manage the amount of mini-lectures expected at any one time. The date by which you should have completed each mini-lecture is shown on pages 19-20.

Secondary Science Subject Knowledge and Pedagogy (EDUM037, EDUM038, EDUM039, EDUM048).

The sessions in science are designed to help you to teach broad and balanced science in Key Stage 3 and Key Stage 4 and your specialist subject at post-16 level. It has the following elements:

Science snap lectures	The programme of short lectures during the Autumn Term includes sessions on research informed issues in science teaching.
Subject specialism practical pedagogy sessions	A series of workshops attended with others who share your subject specialism will address issues connected with subject knowledge and practical work within your subject specialism. In addition to developing your subject knowledge, you will apply a range of teaching approaches and strategies to use in the science lab to promote effective learning.
Subject specialism classroom pedagogy sessions	These non-practical sessions will each take a key teaching and learning theme and introduce ideas to build your pedagogical skills using examples from your own subject specialism. However, the themes covered will be equally relevant for your teaching across the sciences.
Non-subject specialism practical pedagogy sessions	You will follow a course in each of your non-specialist science subjects. For example, a chemistry specialist will have lab-based sessions for biology and physics. In these courses, you will have the opportunity to review and refresh your science subject knowledge as well as developing ideas for teaching practical science to pupils.
Explaining Science: Peer Teaching	Peer teaching gives you the chance to: build confidence by teaching your peers before teaching in school; familiarise yourself with the evidence tools you will use in school; develop your subject knowledge as others teach topics they are confident in. Key Stage 3 and Key Stage 4 sessions are mixed subject specialism groups to help cover the range of science topics. Key Stage 5 sessions are with groups of subject specialists.
Directed Tasks	There are particular directed study tasks to complete, as well as working on your subject knowledge development and independent study towards the M-level assignments.
Seminar Days	At intervals during your main blocks of school-based work, you will return to the university for an intensive training day when you will reflect upon your progress and consider developments in your practice as a teacher. It is also a chance for you to share experiences with peers.

COURSE MATERIALS

Teaching resources

There are a range of teaching resources in the Labs that can be used throughout the Autumn Term – please sign them out with PGCE Secondary Science Technical Support PGCESciTech@exeter.ac.uk and return them after use. If you need any practical materials for your peer teaching in the labs, these can be requested from PGCE Secondary Science Technical Support, with at least one week's notice. Please note that our science technician Chris Smith is on a leave of absence as the course commences. His work will be covered, but please bear with us as we all get used to a new way of accessing technical support.

The Exeter Learning Environment (ELE)

This is Exeter's Virtual Learning Environment. All course documents and information regarding science taught sessions (this includes EPS sessions on a Thursday for science trainees) will be uploaded here https://vle.exeter.ac.uk/course/view.php?id=919. Please get into the habit of checking it regularly and before and after all taught sessions so that you can access preparatory and follow-up materials.

Other useful materials can be found on the following pages:

EPS ELE site https://vle.exeter.ac.uk/course/view.php?id=7930 (for lead lecture recordings, EPS tasks and mini-lectures)

PGCE Primary and Secondary Core Documents https://vle.exeter.ac.uk/course/view.php?id=2516

Various evidence tools and forms (username and password both: exeterpartner)
https://socialsciences.exeter.ac.uk/education/partnership/handbooksreportsanddocuments/secondary/

Library resources

See

https://libguides.exeter.ac.uk/libraryinduction

https://libguides.exeter.ac.uk/education

https://libguides.exeter.ac.uk/gettingstarted

THE TAUGHT COURSE

Timetable for first teaching week – w/b 30/09/19

	9	10	11	12	13	14	15	16
Monday	**9.00-11.00** All: Induction Morning (labs)			**11.30-12.20** All: Welcome Talk (G18)		**13.30-16.00** All: Preliminary Experience Share (labs)		
Tuesday	**09.30-11.30** P: Action Planning & Assignments DM (labs) C: Action Planning & Assignments DM (labs) B: Biology Ped LG (labs)/Action Plans & Assignments DM (labs) BP: Biology Practical Pedagogy LG (labs)			**11.50-12.20** All: Science Snap Lecture (G18) Why Teach Science? JD		**13.30-16.00** All: Peer teach intro and planning DM (labs)		
Wednesday	**09.30-11.30** P: Physics Classroom Pedagogy JD (BC126) C: Chemistry Classroom Pedagogy [non-practical] (labs) **09.30-11.30** B: Biology Ped LG (labs)/Action Plans & Assignments DM (BC201) BP: Action Planning and Assignments DM (BC201)			**11.50-12.20** All: Science Snap Lecture (G18) ASE - Frances Evans	**12.30-14.00** B: Biology Pedagogy LG (BC112) OR BP: Biology Pedagogy LG (BC112)	**13.30-15.30** P: Physics Practical Pedagogy EH (labs) C: Chemistry Practical Pedagogy LH (labs) **14.00-15.30** B: Biology Pedagogy LG (BC112)	**15.30-16.00** All: Meet your tutor (Staff House)	
Thursday	**09.30-10.30** Optional Library intro DM (labs)	**10.30-12.30** All: The Learned Societies (labs) RSC and IoP speakers				**13.30-15.30** EPS Lead Lecture: Curriculum and Educational Ideology (NC12/SC3.06)	**15.30-16.00** All: NQT Advice (Labs)	

Timetable for weeks 2-6 and 9-11: 07/10/19-08/11/19 & 25/11/19-13/12/19

	9	10	11	12	13	14	15	16
Monday	**9.30-11.30** P: Chemistry Practical Pedagogy LH (labs) C: Explaining Science - KS5 Peer Teach (BC06, BC09) B: Physics or Chemistry Practical Pedagogy (labs) BP: Physics or Chemistry Pracical Pedagogy (labs)			**12.30-14.30** P: Explaining Science - KS5 Peer Teach (BC06, BC09) C: Physics Practical Pedagogy EH (labs) B: Physics or Chemistry Practical Pedagogy (labs) BP: Physics or Chemistry Practical Pedagogy (labs)		**15.00-16.00** All: Explaining Science - KS4 Peer Teach (BC08, BC201, BC212*, BC218)	
Tuesday	**09.30-11.30** P: Independent Study C: Independent Study B: Biology Practical Pedagogy LG (labs)/Indpt Study BP: Biology Practical Pedagogy LG (labs)		**11.50-12.20** All: Science Snap Lecture (G18) SEE BELOW		**13.30-15.30** P: Biology Practical Pedagogy LG (labs) C: Biology Practical Pedagogy LG (labs) B: Explaining Science - KS5 PT (BC03,212*,217,218) BP: Psychology Pedagogy DM (BC201)		**15.45-16.30** All: Explaining Science - KS3 Peer Teach (BC03, BC101 BC201, BC217)	
Wednesday	**09.30-11.30** P: Physics Classroom Pedagogy JD (BC126)* C: Chemistry Classroom Pedagogy LH (labs)		**11.50-12.20** All: Science Snap Lecture (G18) SEE BELOW		**13.30-15.30** P: Physics Practical Pedagogy EH (labs) C: Chemistry Practical Pedagogy LH (labs)		Independent Study~	
	09.30-11.30 B: Biology Practical Pedagogy LG (labs)/Indpt Study BP: Explaining Science - KS5 Peer Teach (BC201)			**12.30-14.30** B: Biology Classroom Pedagogy LG (BC112)/Indpt Study BP: Biology Classroom Pedagogy LG (BC112)		**14.30-16.30** B: Biology Classroom Pedagogy LG (BC112)/Indpt Study BP: Independent Study		
Thursday	Additional Input & Independent Study SEE BELOW				**13.30-15.30** Alternate weeks - EPS Lecture (NC12) OR EPS tutor led sessions (Labs) SEE BELOW		Independent Study$	

* Note these room changes if they affect you:

Monday 15.00 KS4 Peer Teach BC212 is moved to EMS/F19 on 25/11

Tuesday 13.30 Biology KS5 Peer Teach BC212 is moved to SCL1.24 on 15/10, 5/11, 26/11, 10/12

Wednesday 09.30-11.30 Physics Classroom Pedagogy - please join with Chemistry in labs on 16/10, 23/10, 30/10, 4/12

Optional M Level Writing session Tuesday 3rd December 12.30-13.30 G18

$ Optional Science and PE Cross Curriculum Activities 7/11, 28/11, 5/12 all 15.30-17.30

~ Optional Challenging Schools Enrichment Lecture: Lee Elliot Major on socioeconomic disadvantage and education. Wednesday October 9th, 16.30-17.30, BC114.

Snap Lectures

Tuesday and Wednesday 11.50-12.20

	Tuesday	**Wednesday**
1/10&2/10	Why Teach Science - JD	Association for Science Education - FE
8/10&9/10	Misconceptions - JD	The Science Curriculum - LH
15/10&16/10	Cognitive Load Theory - JD	Metacognition - DM
22/10&23/10	Formative Assessment - LH	Dialogic Education in Science - NM
29/10&30/10	Numeracy in Science - LG	Practical Science - LH
05/11&06/11	Summative Assessment - JD	Health and Safety - NM
26/11&27/11	Learning Outside the Classroom - JD	Questioning - NM
03/12&04/12	Reading and Writing in Science - JD	Differentiation in Science - AB
10/12/&11/12	Science Capital - JD	PSHE - LH

Thursday EPS content
03/10/2019 10.30-12.30 The learned societies (labs); **13.30-15.30** EPS Lecture: Educational Curriculum and Ideology (NC12/SC3.06)
10/10/2019 10.30-12.30 Planning workshops LG (labs); **13.30-15.30** Optional Formative Assignment work DM (labs)
17/10/2019 11.00-12.30 Teacher Workshop: Working Memory - Mel Bourne (labs); **13.30-15.30** EPS Lecture: Learning (NC12/SC3.06)
24/10/2019 13.30-15.30 Workshops on motivation and diaglogic education - LH & NM; **15.30-16.30** Optional Challenging Schools Enrichment Seminar BC202
31/10/2019 09.30-12.30 UVT peer teach (labs); **13.30-15.30** EPS Lecture: Digital Literacy (NC12/SC3.06); **15.30-16.30** Teacher Workshop: Classroom Presence - Liz Jones (labs)
07/11/2019 10.00-12.00 Preparing for school-based work DM (labs); **12.30-15.30** UVT peer teach (labs); **15.30-16.30** Optional Challenging Schools Enrichment Seminar BC202
28/11/2019 10.30-12.30 EAL and Assessment Workshops NM & SR (labs); **13.30-15.30** EPS Lecture: Professionalism & Leadership (NC12/SC3.06)
05/12/2019 11.00-12.30 Teacher Workshop: Disadvantaged students - Tristan Evans (labs); **13.30-15.30** Applying for jobs LH (labs); **15.30-16.30** Optional Challenging Schools Seminar BC202
12/12/2019 11.00-12.30 Behaviour for Learning DM & LH (labs); **13.30-15.30** EPS Lecture: Addressing individual needs (NC12/SC3.06)

Seminar Days

Five Seminar Days occur on Fridays during your school-based work, where you will return to St Lukes for the day. They provide an opportunity for you to reflect on practice in school with tutors and peers, review taught content in light of working in school, develop understanding of how to conduct school-based research. The content of the seminar days have some flexibility in order to enable us to respond to your developing needs as well as any changes in national education policy and practice. Below is our initial plan for content on each of the seminar days.

Seminar Day	Themes/Sessions
1 17th Jan 2020	Close-to-practice Research - what can it tell you and why is it useful? **(All standards, particularly S3)** *This seminar day will consider the use of research to inform practice, in particular your own research to be undertaken for the EPS Assignment.* ***You will need to bring your draft formative assignment for the EPS Assignment to this session.***
2 28th Feb 2020	Adapting teaching to pupils' needs and to school contexts (drawing on the SEN Task); Analysing research data **(S2, S5)** *This seminar day will consider strategies to ensure all pupils make progress in your lessons, and how you can judge what progress is being made. We will also share progress with the EPS SEN Task.*
3 20th Mar 2020	Evidence base for teaching; understanding and using research **(All Standards)** *This session is focused around an analysis of what makes excellent teaching in Science, drawing on a range of sources to discuss this question. This day will also include critical discussion of research findings and a panel discussion involving teachers using and conducting research in schools.*
4 22nd May 2020	Adapting teaching to pupils' needs and contexts (drawing on the EAL Task); Curriculum planning, sequencing, teaching and impact **(S4, S5)** *This seminar day will include sharing experiences of working with support staff, parents, tutees and EAL students. Recent NQTs will also offer advice for your NQT year. The seminar day is likely to be held at a Forest School and consider the opportunities for science education outside the classroom.*
5 30th June 2020	Being a Teacher - what to expect as an NQT; the Early Career Framework **(All Standards)** *During this final seminar day, we will discuss your individual Career Entry Development Profiles (CEDPs) and consider the support you will need to continue to develop as a teacher during your NQT year and early career.*

Subject Specialism Classroom Pedagogy Sessions

Physics, Chemistry and Biology students attend two pedagogy sessions per week in their specialism. One is a practical, lab-based session the other is a non-practical, classroom session and introduces a key pedagogical theme for teaching science. Biology with Psychology students attend the Biology sessions as subject specialists and one Psychology pedagogy session per week. These subject specialism classroom pedagogy sessions help to prepare you to teach in your subject specialism up to and including A Level. We expect that you will come to the sessions with good knowledge of the subject topics and some knowledge of how they fit the curriculum.

Each week in the classroom session there will be a pedagogical focus that will be introduced and examples relevant to your subject specialism provided. The pedagogical topics are below.

Week 1 – Planning for thinking

Week 2 – Misconceptions

Week 3 – Good explanations

Week 4 – Teaching for Climate Emergency

Week 5 – Modelling

Week 6 – Sequencing concepts

Week 9 – Using digital technologies

Week 10 – Literacy

Week 11 – Numeracy

Non-subject Specialism Practical Pedagogy Sessions

You will attend pedagogy sessions in your two non-specialist subjects. Physics and Chemistry practical pedagogy sessions take place in two separate groups, to which you have been assigned. These sessions will often cover the same topics as the practical subject-specialist sessions, although only covering content in Key Stage 3 and 4. We anticipate that you might not be as confident in your subject and curriculum knowledge outside of your subject specialism.

Explaining Science: Peer Teaching

In weeks 2-6 and 9-11 there will be the opportunity to practice your teaching, with peers taking the role of willing pupils. This can help build your confidence in teaching ahead of your school placement in November as you will likely have delivered at least three of these sessions by then. Peer teaching has also been very popular with previous trainees as it provides experience in using Exeter Model teaching tools before school-based work, gives a chance to pick up a range of teaching ideas your peers use and helps to build subject and curriculum knowledge as peers deliver topics they are confident in mapped to curriculum or exam specification content. It is critical that you attend and engage in sessions where others are teaching. “Pupils” should be eager to learn, participate readily and be supportive of the “teacher”. We will plan the Key Stage 3-5 peer teaching during a session in week 1. Therefore it will be helpful to have access to your subject knowledge audit, exam specifications and any textbooks for this planning session. There are four different peer teaching sessions:

Explaining Science – Key Stage 4 Peer Teaching

On Monday 15.00-16.00 you will meet in a group of around 16 with a mix of subject specialisms. Over weeks 2-6 and 9-11 you will each teach one twenty minute episode on an area of Key Stage 4 content that you feel comfortable delivering. Aim to present your episode at a level suitable for a Key Stage 4 class. Prepare a lesson plan as well as an ‘Agenda’ for the peer teaching episode. Guidance for how to do this will be given during the first week. There is additional guidance about constructing Agendas in both the Programme Handbook and on ELE. Please remember that you are not attempting to give a whole lesson, or need to deliver 20 minutes that would be the start of a longer lesson. The idea is to teach a short episode with a particular focus on the aspect of your teaching that you want to improve – see the Programme handbook, page 34, for a list of possible areas to focus on. During the 20 minute episode you should aim to include some content where you are explaining science and also some content that would help you to assess whether your “pupils” have understood the topic. Beyond this the delivery is flexible. This peer teaching taking place in regular teaching rooms so lab-based practical work cannot be incorporated. The rooms that you use should have a PC and screen available. You need to bring an additional copy of your agenda. At the

beginning of the episode you teach give this copy to one of your peers who will 'annotate' the agenda for you. Make sure that everyone annotates at least one agenda over the eight weeks. At the end of each session, peers should ask any questions they have about the subject content; teachers may wish to invite some specific feedback on aspects of their teaching. You should complete an agenda evaluation (page 2 of the agenda form) after the episode, you should think about any differences between what you planned to do and what actually happened. The annotated Agenda will be helpful here. The agenda and evaluation for your first Key Stage 3 or 4 Peer Teaching episode forms one of the directed tasks, see page 15.

Explaining Science – Key Stage 3 Peer Teaching

On Tuesday 15.45-16.30 you will meet in the same group of around 16 with a mix of subject specialisms. Over weeks 2-6 and 9-11 you will also each teach one twenty minute episode on an area of Key Stage 3 content that you feel comfortable delivering. Although there should be time for two sessions per week, you may wish to start earlier as rooms are booked from 15.35. Otherwise the format and expectations should be the same as the Key Stage 4 peer teaching.

Explaining Science – Key Stage 5 Peer Teaching

The Key Stage 5 peer teaching in weeks 2-6 and 9-11 are set up to provide the opportunity to carry out longer peer teaching focused on A Level content and share teaching ideas with fellow subject specialists in smaller groups.

The A Level peer teaching will involve using the lesson plan template in more detail and you evaluating the lesson on the form you will use in school. You will select an area of the A Level specification in your subject specialism (psychology for biology with psychology specialists) to teach for 30 minutes. The main aims of the teaching session are to increase knowledge amongst the group, practice A Level teaching and to use a suitable learning activity that can then be shared with the group. As a group you will take the opportunity to practice using the evidence tools used in school (the rest of the group will need to complete an observation form briefly).

The content and exact focus of the session is up to the teacher.

But your session should:

- Be pitched at A Level (2015 onwards specification)
- Have learning objectives
- Present information designed to increase knowledge of the topic
- Include at least one learning activity for your "pupils" to complete
- Check that learning has taken place
- Last for 30 minutes

Everyone should prepare and teach at least two sessions of 30 minutes during the term. For each session, start by telling the group your specific learning objectives (what you hope the group will learn). Use teaching strategies appropriate for a post-16 group - methods of delivery are likely to vary with different presenters. Keep your teaching resources simple. The rooms that you use should have a PC and screen available. ***Complete the planning sheet as a group and send a copy electronically to Darren before you start your teaching sessions.***

While you are free to organise the sessions in the way that best suits the group, please bear in mind that the rooms are booked for two hours and must be used each week until everyone has taught at least two sessions. A suggested format is for two topics to be addressed per meeting, each lasting 30 minutes, with a 10-minute discussion after each presentation. After the session peers will give verbal feedback and complete a lesson observation form for the 'teacher'. After you have delivered a Key Stage 5 peer teaching episode you should reflect on the session using a lesson evaluation form. The first reflection you complete is one of the Directed Tasks (see page 15).

Thursday Peer Teaching

Thursday peer teaching is the term we use for a 10-minute episode of teaching planned and delivered by you in the science labs to others in the PGCE science group who act as your students. Aim to present your episode at a level suitable for a KS3 or KS4 class. These sessions are attended by your university visiting tutors. They will give you feedback on your teaching and on the opportunities for learning that were planned and delivered.

As for the Key Stage 3 and 4 peer teaching sessions, prepare a lesson plan as well as an 'Agenda' for the peer teaching episode. Although you will be teaching for only 10 minutes, you should aim for changes of approach and pace during your delivery. It is most important to avoid long monologues, so do not learn from a pre-written script or read from notes. It is essential to work to a 10-minute limit for this peer-teaching episode. You will have to stop after 10 minutes whether or not you have completed your planned delivery. Include estimated timings for the various activities of your episode, but remember that these estimates are to give you practice in developing an awareness of pace in a lesson, not a straightjacket to worry about. It is best to choose a science topic that you know thoroughly to avoid any anxieties about the adequacy of your subject knowledge. You may choose a topic linked to another peer teach you have completed, but must deliver new content and activities. Scripting essential questions is helpful and clear notes of any board work will help the episode to run smoothly. You will be in the labs for this peer teaching. If you need any equipment or resources to support your teaching, you should email our PGCE Secondary Science Technical Support PGCESciTech@exeter.ac.uk who will do their best to supply any reasonable requests, but do let them know **at least one week** in advance of your session. You can use the computer, screen and 'visualiser' if you wish although this is optional. If you would like to practice or to try out the visualiser before your peer teaching session, feel free to do so whenever the laboratories are not in use for teaching – please liaise with PGCE Secondary Science Technical Support PGCESciTech@exeter.ac.uk about this.

Make an additional copy of both your lesson plan and agenda. At the beginning of your session give these copies to your University Visiting Tutor who will 'annotate' the Agenda.

Challenging Schools Enrichment

In the autumn term, all trainees are invited to attend an enrichment programme aimed to develop your understanding of and sensitivity to the demands of working in 'challenging' schools. This is attached to a project funded by the DfE which aims to support schools in a specific area of low social mobility (North/Mid Devon). The programme will cover issues related to social mobility, rural and coastal disadvantage, and teacher and student resilience, and starts with a lecture by Professor Lee Elliot Major, part of our Research Centre in Social Mobility. We are looking for one Science trainee to spend their summer term placement in one of our enrichment schools – you will find out more by attending the sessions (listed in the course timetable and below).

Lead Session:

Socio-economic disadvantage and education with Lee Elliot Major. Wednesday October 9th, 16.30-17.30, BC114.

Enrichment Sessions:

Thursday 24th October, 15.30-16.30, BC202.

Thursday 7th November, 15.30-16.30, BC202.

Thursday 5th December, 15.30-16.30, BC202.

Directed Tasks

You will be set a number of tasks which will help to provide feedback about your use of the evidence tools, work you have completed during your November school placement and initial help with securing a teaching post. These tasks are a compulsory part of the course but they are not part of the formal assessment process.

There are six specific PGCE Science directed tasks which are designed to help you make connections between university and school-based content and receive feedback from your personal tutor on key aspects of the Autumn term content. Complete these tasks as appropriate throughout the term.

Task	Requirements
1	**Pre-course tasks:** Please email your personal tutor a copy of your CV and written reflection on why teach science. Email these documents to your personal tutor by Friday 4th October for feedback.
2	**Explaining Science Key Stage 5 Peer Teaching:** Complete a lesson evaluation form for the first session that you taught. Use the lesson observation feedback from peers, guidelines about reflective practice on ELE and appropriate aspects of the 'Framework for Dialogue about Teaching' to help you complete this. Email the form to your personal tutor within two days of your first KS5 peer teach, for feedback by email or in a tutorial.
3	**Explaining Science Key Stage 3 or 4 Peer Teaching:** Write up your agenda evaluation from your first peer teaching episode (whether Key Stage 3 or 4). Guidance about reflective practice, evaluating teaching and the use of Agendas can be found on ELE. Email the agenda, including your peer's annotation and the evaluation to your personal tutor within two days of your first KS3/4 peer teach, for feedback by email or in a tutorial.
4	**Challenging the Gap Framework for Dialogue:** During your 2 week November placement, as part of the EPS task complete the Challenging the Gap Framework for Dialogue based on information you find out about the context of your school placement and how they work to support disadvantaged pupils, both generally and in Science. Bring this to your second tutorial.
5	**Literacy and Numeracy in Science:** During your 2 week November placement make notes on at least one example each of how teachers you observe are developing pupils' literacy or numeracy skills within science lessons. Bring these notes to your non-lab subject specialism pedagogy sessions in weeks 10 and 11.
6	**Securing Employment:** During Week 10 the focus is on applying for and securing a teaching post. Prepare a personal statement (maximum 2 sides of A4) for an application for a teaching post advertised on TES, eTeach or https://teaching-vacancies.service.gov.uk/ for a job in the sort of school you are interested in working in. Email this by 6th December to your personal tutor for feedback.

MANAGING THE COURSE

The PGCE year is intensive and challenging. It is important, from the outset, to find strategies which will help you to thrive and enjoy the course. The unpredictability and varied nature of teaching attracts many to the career, but can also be stressful.

Managing stress:

Stress *can* be a positive thing - it can heighten your responses, help you to think quickly, to act efficiently, to be alert. It can be motivating, help you to feel ready for a challenge - and succeeding within stressful situations is extremely rewarding. You will definitely encounter stressors as a teacher, but as long as you are managing challenges with optimism and enthusiasm for your learning and your teaching, and as long as you feel as though you can cope and achieve, it is likely that this will be positive stress. Feeling nervous or anxious before a lesson or meeting is *normal* and can even be beneficial!

It is important to pre-emptively think about how to manage the demands of the course, and to think about ways of working which best suit you.

Some recommendations:

- Be organised from the outset. Set up a clear system for your files – both paper and on the computer – and as far as possible try to operate a 'one touch' policy – respond to and file paper or electronic documents as soon as possible after your receive them, or if you need to come back to them later, develop a system for where you will put these so that you don't forget about them.
- Do not underestimate the importance of sleep and exercise - finding ways to wind down and making sure that you get enough sleep are both important.
- Try to ensure that you make a clear distinction between work and home life. Set time in evenings and/or weekends where you don't do any work. Consider what activities help you to cope and try to ensure that you make time for them and do them.
- Talk to people about stress or challenges – don't feel that you have to cope on your own.
- Be selective in your use of social media and notifications. Teachers rarely spend much of their free time in school on their phone. You will need to exercise professionalism and caution in line with the expectations of your role as a teacher, but should also think ahead to what are the important messages you want to see when you check your phone.
- Avoid perfectionism – the teaching workload will increase gradually and therefore you need to learn when to stop once something is good enough (particularly when creating resources).
- Distinguish between free time and independent study time. Particularly in school, there is a need to make the most of time available for planning, marking and evaluating teaching etc, but also make the most of breaks between teaching.

Wellbeing Services

There is information in the **Programme Handbook** pages 74-75 about how to access Wellbeing support at the university. It is worth making yourself aware of the support available now. Much of this is self-help, but if you feel as though you would benefit from some more help please do discuss with your personal tutor or UVT, or get in touch with wellbeing services directly.

If you think you would benefit from an Individual Learning Profile or need any adjustments to the course you must contact AccessAbility. There is information about this in the Programme Handbook.

Please note that information shared with Occupational Health through the Fitness to Teach assessment is not automatically shared with your tutors. It is worth having a conversation with us to check the information we have if you have an ILP or would like any additional support. Occasionally people think that we are aware of their medical history when we aren't!

ASSIGNMENTS

You are required to write two formative assignments (1500 words) and two summative assignments (6000 words) during the year. These assignments are assessed at Masters Level and the assessment criteria can be found on page 68 of the Secondary Programme Handbook. A brief outline of the subject knowledge and pedagogy assignments is given below. The Education and Professional Studies assignments are described in the EPS handbook. You will be given detailed guidance about each piece as the course progresses and the guidance will also be uploaded onto ELE. The assignments are intended to blend the theoretical and practical elements of the course.

Both assignments require evidence that you have critically engaged with the literature available. Where you refer to books, journals etc. in an assignment you must use the **Harvard system for referencing**. Please see the guide on the Assignment Submission Information section of the Primary and Secondary Core Documents page on ELE (http://vle.exeter.ac.uk/course/view.php?id=2516) or this library guide https://libguides.exeter.ac.uk/ld.php?content_id=32456245.

Secondary Science Subject Knowledge and Pedagogy: Design and Critical Analysis of lesson plans (Summative deadline Tuesday 7th January 2020)

All trainees will address standards S3, S4, S5 and S6 in this assignment, with further standards addressed depending on choices made in the summative assignment.

The assignment takes place in multiple stages which models a range of different assessment including peer feedback, tutor formative feedback and self-assessment. This means it is crucial to start the assignment early in the term.

1. **Select a Key Stage 3 or Key Stage 4 topic of your choice and design a way of teaching one lesson on an aspect of that topic to a group of students.** You should use a lesson plan to detail the teaching and learning that you have designed. You should use the input from the course to consider how theories of learning and any relevant ideas such as misconceptions, motivation, health and safety, differentiation and assessment inform the lesson. You may wish to design resources that you would use as part of the planned teaching and learning.
2. **Share your lesson plan and any resources with two peers to gain and offer peer feedback.**
3. **You may wish to revise your planning and resources at this point. Then write your formative assignment (1500 words) on the following area:**

   Analyse and explain the pedagogical rationale for your lesson plan, drawing on critical analysis of literature and reflection on peer feedback.

   With a limited word count, we suggest you focus on *three or four* key selected elements of the lesson (for example, lesson starts, assessment points, development activities, or explanations).

   This written account should be emailed to your personal tutor, along with an appendix that includes your lesson plan and any resources you wish to provide, by end of **Friday 1st November 2019,** for formative feedback.

4. **Ahead of the summative assignment you need to select two different classes of learners and produce a general lesson plan (which may be the one used for the formative assignment), and two adapted lesson plans which tailor your general approach for their particular needs.** To make this as realistic as possible, we suggest you discuss with your PST during your November placement which two classes you have met (and/or may be teaching from January) to use for this assignment. With your summative assignment you need to submit appendices including the three lesson plans (and any resources you wish to include). One lesson plan is the general plan, with the second and third plans tailored for your selected classes, which should be briefly described using the Secondary PGCE Context Sheet proforma without using pupil names.

The descriptions of the classes should inform different pedagogical approaches that you would take to teaching these classes. It is important that the three lessons include different pedagogical ideas as the summative assignment will ask you to contrast the different teaching and learning. To facilitate this comparison, we suggest you choose contrasting classes. To help you, we have identified potentially important topics from the course input and literature, where the classes you select *may* differ:

- Different attainment levels between the classes, or different sets
- Different range of attainment levels within the classes
- Different levels of SEN needs
- Different literacy levels or amount of EAL pupils or pupils whose English is weak
- Different levels of numeracy skills
- Different levels of practical science skills
- Different levels of interest in science
- Different levels of motivation and engagement more generally
- Different class management needs or social dynamics within classes

5. **Summative Assignment (6000 words)**
   a. *(approx. 1500 words)* Provide a **rationale** for the content of your general lesson plan, drawing on your subject knowledge, your curriculum knowledge, your pedagogical knowledge and your knowledge of likely difficulties in teaching and learning this topic.
   b. *(approx. 4000 words)* Discuss the **pedagogical decisions** made in the two lesson plans that respond to the two classes you have selected and described with reference to differences across the three lesson plans. In doing so you should take 3-4 key pedagogical decisions for the two classes and discuss in depth the relationship between the theoretical ideas from the Education and Professional Studies and Subject Knowledge and Pedagogy programmes, your reading of the education research literature and the practical realities of the classroom using your lesson plans to exemplify the points that you make.
   c. *(approx. 500 words)* Provide a short **summary of the implications** of this assignment for your professional development – i.e. a summary of key things that you have learnt and of issues that you feel you now need to address.

Education and Professional Studies (EPS) Assignment: Critical Investigation of an Issue in Education

Refer to the EPS Handbook for details of this assignment. The EPS research series of mini lectures will also provide useful background.

TUTORING

You will have a **personal tutor** who will meet with you individually on two occasions in the Autumn term. In the first week you will get to know your tutor. During week 1 you will be introduced to some of the evidence tools and begin to outline an Action Plan, focusing largely on the development of subject knowledge. Your tutor will support you with this during the Autumn Term. In the first individual tutorial you will discuss your Formative Reflection on Achievement and Progress (FRAP) 2 part A draft and work on your Autumn Term Action Plan. In the second individual tutorial you will discuss and finalise the whole of your FRAP2. This document needs to be completed (after any revisions) by **Wednesday 11th December 2019** and emailed to exeterpartner@exeter.ac.uk

Please remember that we will be supporting you pastorally as well as academically. You should also share any issues you may be experiencing on the course at any point in time. Don't hesitate to contact your tutor in between tutorials if you want to discuss anything.

When you move on to school based work you will have a University Visiting Tutor (UVT) as well as your personal tutor. Your UVT will observe you teaching in your placement schools and liaise with the school in connection with your progress whilst you are in school. Your UVT may or may not be your personal tutor – if not, then both tutors will liaise closely to make sure you receive the support you need.

KEY TASK LIST WITH DEADLINES

This is not an exhaustive list of tasks. You should set up a calendar so you can add these deadlines along with peer teaching dates, ad hoc tasks from other sessions. Most school-based tasks have deadlines given in your quality assurance record.

TASK	DEADLINE
Watch EPS mini-lectures	See Table below for dates
FRAP1 Send forms from each preliminary experience school to exeterpartner@exeter.ac.uk	Friday 4th October
Directed Task 1 - Send 'CV' and 'Why Teach Science' from Science Preliminary Experience Tasks to your Personal Tutor	Friday 4th October
Directed Task 2 - Write up teaching evaluation of first Key Stage 5 peer teach	After your first teaching date agreed with your Key Stage 5 peer teaching group. Email form to personal tutor within two days.
Directed Task 3 – agenda and evaluation from first Key Stage 3 or 4 peer teach.	After your first Key Stage 3 or 4 peer teaching date. Email complete agenda and evaluation to personal tutor within two days.
Assignment 1 Formative emailed to tutor	**By end of Friday 1st November**
FRAP2 part A draft	8th November – printed and filed in IDP to take into school
FRAP2 part B	22nd November – check mentor has emailed final version and you have a copy
Directed Task 6 – Personal Statement draft	6th December – email to tutor for feedback
Directed Task 4 – Challenging the Gap Framework Task (EPS)	Bring to your individual tutorial in December
Send whole FRAP 2 draft to Personal Tutor	Two days in advance of individual tutorial in December. Final completion of FRAP 2 by 11th December
Assignment 1 Summative – submit to BOTH turnitin AND eBart	**2pm Tuesday 7th January 2020**

Table of EPS mini-lecture deadlines

Mini-Lecture:	**To be viewed by:**	**Preparation for**
Planning and sequencing, Lindsay Hetherington	**02/10/19**	Subject Specialism Pedagogy
Policy, David Hall	**03/10/19**	EPS Lead Lecture
Reflection, Justin Dillon	**07/10/19**	Explaining Science Peer Teaching
Social Mobility, Lee Elliot Major	**09/10/19**	Challenging Schools Enrichment Seminar
Constructivism, Annabel Watson	**10/10/19**	EPS Science Workshop
Social Constructivism, Annabel Watson	**10/10/19**	EPS Science Workshop
Behaviourism, Annabel Watson	**10/10/19**	EPS Science Workshop
Cognitive Load Theory, Tom Ralph	**15/10/19**	Snap Lecture
Ability, Helen Knowler	**16/10/19**	Snap Lecture
Assessment, Annabel Watson	**22/10/19**	Snap Lecture
Dialogic Theory, Ruth Newman	**23/10/19**	Snap Lecture
Motivation, Will Katene	**24/10/19**	Snap Lecture
Prevent and British Values, Ruth Flanagan	**31/10/19**	EPS Lead Lecture

Mini-Lecture:	To be viewed by:	Preparation for
Behaviour, Chris Boyle	**31/10/19**	EPS Science Workshop
The Exeter Model, Dinah Warren	**07/11/19**	EPS Science Workshop
School structures, Alison Black	**07/11/19**	EPS Science Workshop
International education, George Koutsouris	**28/11/19**	EPS Science Workshop
Thriving and surviving, Alison Pearson	**28/11/19**	EPS Lead Lecture
Stretch and Challenge, Lindsay Hetherington	**04/12/19**	Snap Lecture
Teacher Identity and Agency, Justin Dillon	**05/12/19**	EPS Science Workshop
Teacher Wellbeing, Darren Moore	**05/12/19**	EPS Science Workshop
Child & Adolescent Mental Health, Darren Moore	**11/12/19**	Snap Lecture
Addressing Inequalities, Alison Black	**12/12/19**	EPS Science Workshop
Being Critical, Debra Myhill	**07/01/20**	Summative Assignment 1
Reviewing the Literature, Ruth Newman	**07/01/20**	Summative Assignment 1
Ethics, Justin Dillon	**17/01/20**	EPS Assignment
Qualitative Methods, Annabel Watson	**17/01/20**	EPS Assignment
Quantitative Methods, Tom Ralph	**17/01/20**	EPS Assignment

USEFUL REFERENCES AND WEBSITES

While this is not a reading list, titles are given under a range of headings to provide you with an entry into the literature for topics that you may want to follow up. In many of the sessions you will also be provided with references to appropriate journal articles. This will provide an introduction to the large amount of education research and specifically science education research that is available. When you are writing assignments it is important to read these journals because they provide details of recent ideas and developments which will not yet be found in books. Some of the journals contain mainly research based reports (e.g. International Journal of Science Education, Research in Science Education) whereas others are more professionally orientated with ideas for use in classroom settings (e.g. School Science Review). Many useful books are available through the library as 'ebooks'. Books below amongst others can be found under the general section of the online reading list

Some relatively recent titles that are aimed specifically at beginning science teachers that you may find helpful are listed below.

Toplis, R. (Ed) (2015) Learning to Teach Science in the Secondary School (4th edition) (London: Routledge)

Wellington, J. and Ireson, G. (2018) *Science Learning, Science Teaching (4th edition)* (London: Routledge)

Osborne, J. & Dillon, J. (2010) *Good practice in science teaching: what research has to say.* 2nd Edition. (Maidenhead, Open University Press)

Banner, I. & Hillier, J. (Ed) (2018) ASE Guide to Secondary Science Education. 4th Edition. (Hatfield: Association for Science Education).

Driver, R. (2014). *Making Sense of Secondary Science: Research into children's ideas.* (London: Routledge)

Kind V. & Taber, K. (2005) Science: Teaching School Subjects 11-19. (London: Routledge)

Bishop, K. & Denley, P. (2007) Learning Science Teaching: Developing a professional knowledge base. (Maidenhead: Open University Press)

Titles that you will find very useful when writing assignments are:

Bryan H., Carpenter, C and Hoult, S. (2010) Learning and Teaching at M-Level: A Guide for Student Teachers. (London: Sage)

Oversby, J. (Editor) (2012) ASE Guide to Research in Science Education, Association for Science Education, (Hatfield: John Murray)

Somekh, B. and Lewin, C. (2011) Theory and Methods in Social Research (2nd Edition). (London, Sage)

Wilson, E. (2017) School-based Research: A Guide for Education Students (3rd Edition). London, Sage.

https://www.stem.org.uk/secondary-science - this site is building a very large collection of resources for STEM subjects.

http://www.schoolscience.co.uk/ - resources for science teaching put together by the Association for Science Education (ASE)

The CLEAPSS website http://www.science.cleapss.org.uk/ provides a very useful set of resources with a particular focus on health and safety issues. To login to this resource use the current username: silver and the password: fish19 These log-in details will remain active until the end of January, 2020. Check ELE for the new log-in details then.

Professional organisations for science teachers

Association for Science Education (ASE): http://www.ase.org.uk/ "Teachers helping teachers to teach science"

What ASE offers ...

ASE is for teachers, advisers, technicians, industrialists and others contributing to science education. It has a membership of over 24,000.

ASE promotes, supports and develops science education from primary through to tertiary levels.

ASE is independent in its thinking and in its finance. It is a registered charity, financed by members' contributions and receives no government funding.

ASE provides a forum for the views of members on science education issues through its regional and national committee structures.

ASE is frequently and regularly consulted by those in authority and in government, industry and LEAs.

ASE offers support, advice and information for individual teachers, schools and local colleges.

ASE offers support, advice and information to those involved in industry and commerce.

ASE offers support, advice and information to other societies and associations with similar aims.

ASE provides many links with industry and arranges teacher secondments, visits to industrial sites, and it supports relevant curriculum support materials.

ASE provides its members with free journals, discount on books, and indemnity insurance.

ASE offers a special discounted membership scheme for trainee teachers. You will be given details and application forms during week 1.

Other Professional Bodies you might be interested in joining – all provide useful resources and journals for science teachers.

- The Royal Society of Biology: https://www.rsb.org.uk/teachers
- The Royal Society of Chemistry (RSC): http://www.rsc.org/learn-chemistry/
- The Institute of Physics (IoP): http://www.iop.org/education/teacher/index.html
- The Association for the Teaching of Psychology: http://theatp.org/