Topic: Radioactivity

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Issues tackled:

1. **Key ideas, language and terminology – Ensuring trainees' subject knowledge is at the standard required for teaching radioactivity at KS4.**
2. **Models and analogies – Using models and computer simulations to model radioactive phenomena .**
3. **Practical work (including health and safety) – Handling radioactive sources.**
4. **Ideas and evidence – History of the discovery of radioactivity.**

Issue 1: Key ideas, use of language and terminology – Ensuring trainees' subject knowledge is at the standard required for teaching radioactivity at KS4

Trainees have already covered on their PGCE course:

Tasks for trainees:

Preparation for tutorial:
1. Compile a list of uses for radioactive isotopes.
2. Produce a worksheet about the types of ionising radiation.

Possible activities during tutorial:
1. Share the list of uses and discuss the type of radiation used in each one.
2. Present the worksheet.

Mentor Input:

- Describe the 3 types of radiation, what they are and what their key features are e.g. what stops them, effect of a magnetic or electrical field etc..
- Link these to their uses e.g. smoke alarms, radiotherapy.
- Reinforce that radioactive decay is a random process.
- Get trainees to complete a few examination questions to appreciate the knowledge required by pupils.

Reading:

Subject knowledge and understanding

Any KS4 physics text book.

Subject pedagogy

Dorling,G., Hunt, A. and Monger, G., (1988), Nuffield Co-ordinated Sciences: Physics, Longman, Harlow. Worksheet on radioactivity

Useful websites and applications

Multimedia Science School: Radioactive Penetration. A useful interaction about the 3 main types of ionising radiation and their penetration. For information see www.platolearning.co.uk

Resources:

Issue 2: Models and analogies – Using models and computer simulations to model radioactive phenomena

Trainees have already covered on their PGCE course:

Tasks for trainees:

Preparation for tutorial:
1. Find and trial a model or an analogy to explain half-life.
2. Use a computer simulation to model nuclear fission or to show radioactive decay with various half lives.

Possible activities during tutorial:
1. Demonstrate the model or explain the analogy.
2. Explain how the computer simulation could be used during a lesson.

Mentor Input:
- Evaluate models or analogies and feedback to trainee(s).
- Evaluate effectiveness of the simulation produced.
- Suggest other models or analogies that could be used.
- Discuss which models would be appropriate for SEN or less able pupils.

Reading:

Subject knowledge and understanding

Any A level physics textbook.

Subject pedagogy

Useful websites and applications

http://www.hazelwood.k12.mo.us/~grichert/sciweb/nuclear.htm
http://www.phy.olemiss.edu/PhysSci/PhysSci108/Experiment22.pdf
http://einstein.byu.edu/~masong/HTMstuff/C24A1.html
http://www.ukaea.org.uk/wagr/schools/main.html
http://www.physicslessons.com/radiocon.htm
Worldmaker and Modellus models of radioactive decay and fission on the A2 CDROM for Advancing Physics, Chapter 10.

Resources:

Task 1
Trainee's choice of half life model, this might include half life dice or cubes with one face marked.

Task 2
Trainee's choice of simulation, a recommended one is on the New Media Science School CD Rom – Half Lives. For information look at www.platolearning.com Other ideas can be found in the useful websites and applications section above.

Tutorial
Computer with software/internet connection to show simulations of half life (and nuclear fission).

Issue 3: Practical work (including health and safety) – Demonstrations with radioactive sources

Trainees have already covered on their PGCE course:

Tasks for trainees:

Preparation for tutorial:

1. Using relevant scheme of work, research possible demonstrations. NB trainees should not practise these demonstrations without a physics teacher present.
2. Research and make notes on the important safety issues involved in teaching radioactivity.
3. Find out what causes background radiation and its effects on experimental results.

Possible activities during tutorial:

1. With the aid of the mentor set up and use some of the demonstrations that could be shown to a KS4 class.
2. Discuss the safety implications of using radioactive sources with pupils.
3. Use a Geiger counter to detect background radiation and discuss how to deal with it in results.

Mentor Input:

- Clarify safety issues and correct any unsafe practice.
- Participate in the setting up and demonstration of the equipment.
- Go through the sources of background radiation and ensure that trainee appreciates that we cannot get rid of it.

Reading:

Subject knowledge and understanding

Subject pedagogy

Sang, D. (Ed), (2000), **Teaching Secondary Physics**, ASE publications, Hertford. Section 6.

CLEAPSS manual.

Useful websites and applications

http://www.hse.gov.uk/radiation/ionising/index.htm

Resources:

Tutorial

Geiger Muller tube and suitable counter or sensor of ionising radiation, school radioactivity kit (sources, mount, absorbers), radioactive rocks.

Issue 4: Ideas and evidence – History of the discovery of radioactivity

Trainees have already covered on their PGCE course:

Tasks for trainees:

Preparation for tutorial:
1. Research the discovery of radioactivity (Rutherford, Curie, Becquerel, Compton).
2. Produce a timeline for the discovery of radioactivity, from 1900 to present day.
3. Prepare a debate into the pros and cons of nuclear power. (See resources list).

Possible activities during tutorial:
1. Feedback to mentor/other trainee(s) the significance of the contribution of their scientist(s) to the development of radioactivity.
2. Explain the significance of each entry on the timeline.
3. Discuss the pros and cons of nuclear power.

Mentor Input:
- Discuss what sections of their research are relevant to KS4 specification.
- Discuss how this work might be integrated into a lesson.

Reading:

Subject knowledge and understanding

Sang, D. (Ed), 1997, **Henri Becquerel and the Discovery of Radioactivity**, ASE publications, Hatfield.

Fullick, P., (1994), **Heinemann Advanced Science: Physics**, Heinemann, Oxford. Page 508.

Subject pedagogy

SEP "Radiation in the environment" student activities. See www.sep.org.uk click on **curriculum resources**.

Useful websites and applications

http://www.ehso.com/nuclear-radiation.htm

Resources: