

Topic: The Solar System

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Issues tackled:

1. Models and analogies - Using models to aid understanding of the solar system.
2. Ideas and evidence – The historical development of understanding about the solar system.
3. Applications, relevance and cross-curricular issues – Space research and its application.

Issue 1: Models and analogies – Using models to aid understanding of the solar system

Prior knowledge and experience:

Possible tasks:

Preparation for tutorial:

1. Design a model of the solar system which could be made as a class project.
2. Produce a model to demonstrate geo-stationary and polar orbits.
3. Prepare a model to explain the phases of the moon.

Possible activities during tutorial:

1 2 and 3, Present the model researched and developed. Discuss how they will be used/created in a lesson. Discuss the advantages and limitations of the model proposed.

AST Input:

- Lead a discussion on the scale of the solar system and its place in the universe. This could develop into a discussion on large and small numbers. Ensure trainees have good understanding of scale of universe – 10⁻²⁵ up to 10²⁵.
- Discuss the use (and potential misuse!) of models in this topic e.g. phases of the Moon, seasons, day and night and eclipses.

Reading: Subject knowledge and understanding

Milner, B. (2000) 2nd edition. **Cosmology**, Cambridge University Press, Cambridge. Chapter 2.

Eureka and Catalyst KS3 schemes are useful.

Subject pedagogy

Tebbutt, M. (1994) Ideas for teaching earth and space in 'class time'. *School Science Review*, 75, 272, pages 51-60.

Useful websites and applications

The nine planets:

<http://www.ex.ac.uk/Mirrors/nineplanets/>

This is a comprehensive website with over 100 web pages about the Solar System.

This web site "Amazing Space" has a range of on-line activities, especially useful for reviewing basic astronomy concepts.

<http://amazing-space.stsci.edu/eds/>

CD ROM on 'The Solar System'

Platform: Windows 95, Windows 98, Windows NT: Dorling Kindersley Ltd.

Resources: Tasks 1 2 and 3

Equipment to construct models as requested by trainees.

There is a helpful section on 'Using and making models' in

Tebbutt, M. (1994) Ideas for teaching earth and space in 'class time'. **School Science Review**, 75,

272 pages 51-60.

AST Input

For the tutorial a torch or slide projector, various spheres and a globe may be useful and a solar system model if available.

Issue 2: Ideas and evidence – The historical development of understanding about the solar system

Prior knowledge and experience:

Possible tasks:

Preparation for tutorial:

1. Prepare an illustrated timeline (for wall display or on computer) about the development of our ideas about the solar system. Scientists referred to should include Ptolemy, Copernicus, Galileo, Kepler and Newton.
2. Find out how you could make observations of Jupiter and its moons as Galileo did.

Possible activities during tutorial:

1. Present and discuss the timeline. Select the key evidence offered by each scientist and the role of the church.
2. Describe how to observe Jupiter and explain the significance of the observations.

AST Input:

- Discuss how these tasks relate to “*Ideas and evidence in science*”. E.g. think about how key figures used observation and evidence to further understanding. What were the issues/problems facing scientists in their day?
- Go through the historical development of our ideas about the solar system and continue to include the discoveries of the planets.
- Introduce some current areas of debate about the solar system. For example is there a planet Sedna and is Pluto really a planet?

Reading: Subject knowledge and understanding

Chapter 1 of the following is good.

Milner, B. (1995) **Cosmology**. Cambridge Modular Sciences A-level. Cambridge University Press, Cambridge.

Subject pedagogy

Tebbutt, M. (1993), **Problems with teaching earth and space within the National Curriculum** *School Science Review*, 75, 271 pages 7-14. A bit dated but good background reading for some of the problems associated with this topic.

Sang, D. and Wood-Robinson, V. (Eds), (2002), **Teaching Secondary Scientific Enquiry**, ASE/John Murray, London.

This book is the fourth in the "ASE/John Murray Science Practice" series, a companion volume to "Teaching Secondary Physics", "Teaching Secondary Chemistry" and "Teaching Secondary Biology". Whilst the three previous volumes looked at ways of teaching the subject content of science courses in secondary schools, this book looks at a complementary aspect of science: scientific enquiry. This is a good source for the topic of Sc1 in general – Chapter 8 Learning from History is particularly relevant.

Useful websites and applications:

The aim of this web site is to make available electronically some aspects of the early history of astronomy. It was produced by the Department of History and Philosophy of Science of the University of Cambridge, for the use of trainees studying the History and Philosophy of Science in the University.

www.hps.cam.ac.uk/starry

The national grid for learning contains a lot of good resources for this topic. Go to www.ngfl.gov.uk

and type solar system into the search.

A useful CD-ROM is

Eyewitness Encyclopaedia Of Space & The Universe, available from: Dorling Kindersley Ltd.

Redshift 4

A definitive Desktop Planetarium, which brings the exploration of the universe to the science classroom computer.

Resources:

Issue 3: Applications, relevance and cross-curricular issues – Space research and its application

Prior knowledge and experience:

Possible tasks:

Preparation for tutorial:

1. Prepare a display or an article for a school magazine on what's new in the field of astronomy or space exploration. The NASA web site would be a useful starting point.
2. Research and be prepared to discuss some of the benefits of spending seemingly exorbitant amounts of money on space research, exploration and experimentation.
3. "Houston we have a problem" –design an activity for your class about Apollo or a similar space flight.

Possible activities during tutorial:

1. Present the display or article developed.
2. Discuss how the information collected will be used to run a debate on the motion that 'Space exploration is a waste of money'.
3. Demonstrate how the activity will be used in the lesson and show how you expect to overcome some of the anticipated challenges it will involve.

AST Input:

- Discuss the fascination that space holds for some pupils and how to involve these pupils in a lesson without leaving out the others.
- Consider how this topic might impinge on religious beliefs.
- Discuss possible visits that could be made e.g. Jodrell Bank Centre or the Space Centre in Leicester.

Reading: Subject knowledge and understanding

A visit to the NASA website would be worthwhile at: <http://www.nasa.gov/home/>

Subject pedagogy

Controversy and discussion are central to this area. Teachers need to get away from the idea of "expert" to one of exploration of an issue and protection of diverse pupil views. – more info in: Sang, D. and Wood-Robinson, V. (Eds.), (2002), **Teaching Secondary Scientific Enquiry**, ASE/John Murray, London.

Useful websites and applications

'Why fund space exploration?' and other resources http://www.sycd.co.uk/is_there_life - click on the link for assemblies.

This will take you straight to search results – lots of stuff!

<http://uk.dir.yahoo.com/science/Astronomy>

Song about the solar system:

<http://www.songsforteaching.com> - click on links for science and then look under physical science, astronomy.

Resources: Task 1

NASA website: <http://www.nasa.gov/home/>

Task 2

This section of the Science Year CD –ROM is on-line and provides suggestions for an assembly on "Why fund space exploration?" and other resources

http://www.sycd.co.uk/is_there_life, click on the link for assemblies.

