GCSE

Edexcel GCSE in Science
Space and its Mysteries

(Concept approach)

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Support material

Edexcel GCSE in Science
Space and its Mysteries
(Concept approach)

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Authorised by Jim Dobson
Prepared by John Crew

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Scheme of work for Topic 12: Space and its Mysteries

LESSON 1: The difference between mass and weight							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
P1b 12.3 P1b 12.4 P1b 12.11 P1b 12.10 (part)	7K Forces and their effects. 9J Gravity and space.	The difference between mass and weight. Be able to use the equation W=mg. Be able to use the unit of gravitational field strength – Newton per kilogram (N/kg). The nature of gravity and its role in space.	**Starter** Give the example of the student in the Catholic school who explained 'mass is what we have with Father Tony and wait is what you do at the bus stop'. Ask students to explain why she wasn't giving the physics definition of these words and go on to explain the difference. Discuss that when you jump on the Moon you come back down again, evidence that there is some gravity on the Moon, but you can jump higher which is evidence that the gravity is less. **Main** Students compare the weights and masses of different objects using scales measuring kg and Newtons. Ask them to discover a way of working out the weight if they know the mass. Emphasise the correct use of units. Explain that the factor they use is the gravitational field strength (approximately 10N/kg on Earth). Ask them to predict if this field strength will be greater or less on the moon. **Plenary** Test on the difference between mass and weight, the gravitational field strength on Earth and other places, and the units used.	Scales in Newtons and kg. Selection of objects to weigh.	Explain the difference between mass and weight. Use the equation: weight = mass × acceleration of free-fall W = mg. Use the unit of gravitational field strength – Newton per kilogram (N/kg). Explain the role of gravity on Earth.	N 2.2	
Homework: Students could practise questions using W=mg and rearranging the equation from, eg, Longman Science worksheets 2 K11 or K11.1 from Teacher's pack.							

Scheme of work for Topic 12: Space and its Mysteries

LESSON 2: The solar system and beyond							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
P1b 12.17 P1b 12.15 P1b 12.10 (part)	7L Solar system and beyond.	Planets in our solar system have different characteristics. Know which structures form the solar system and universe. How fast space vehicles travel. How long it takes to travel to Mars and other planets. Discuss the timescale of a journey to Mars and another galaxy. The nature of gravity and its role in space.	**Starter** Introduce ideas about the solar system testing prior knowledge of terms using a mind map. Put pictures of the Universe, our galaxy, solar system and the Sun in correct size order and explain there are other galaxies and other solar systems in the universe. **Main** Introduce idea of scale by using a video or making a scale model eg on the school playing field. Demonstration 12.2: scale of the solar system. Students find out facts about one of the planets in our solar system, the Moon or the Sun. **Plenary** Discuss distances from Earth to our moon, the nearest planet, the Sun, the edge of the solar system, our nearest neighbouring star, the centre of the galaxy, our nearest neighbouring galaxy and the size of the universe and approximate times to travel these distances. Use website http://janus.astro.umd.edu to calculate times needed to travel in space at chosen speeds.	Access to computers. www.scienceyear.com/wired/index.html?page=/planet10/index.html Planet 10 interactive software relating to the planets and possible 'designer planets'. 'Is there life' CD-ROM from www.sycd.co.uk/is_there_life/startfil/intro.htm The IOP video 'Powers of ten' from the IOP may be useful. Physics for You support pack research sheets: Ideas about the Solar System. Longman Foundation/Higher Physics 2 worksheet.	Describe the solar system as part of the Milky Way galaxy and discuss how this is related to other galaxies and the universe. Use data sources to compare the relative sizes of and distances between Earth, our Moon, the planets, the Sun, galaxies and the universe. Explain the role of gravity both on Earth and in astronomy.	N 2.1 2.2 C 2.2 2.3 ICT 2.1 2.2 2.3 WO 2.2 2.2 2.3 LP 2.1 2.2 2.3 PS 2.1 2.2 2.3	
Homework: Students could write a postcard home to Earth from the place researched, describing what it is like, how long it took to get there and any interesting facts. Activity 12.2: Postcard home.							

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LESSON 3: Comets and asteroids							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
P1b 12.14 P1b 12.13 P1b 12.10 (part)	9J Gravity and space.	The nature of gravity and its role in space.	**Starter** Ask students to explain what an orbit is. Draw diagrams of the orbits of planets. (Pluto's is so elliptical it sometimes is not the furthest planet away.) **Main** Give definitions of an asteroid and a comet and show ICT demonstration of their orbits and/or sketch their orbits. Show a clip from the film 'Deep Impact' and discuss the likelihood of this ever happening. (NB possible role of comets in the demise of dinosaurs, the comet that impacted on Jupiter in recent years, the fact that asteroid impacts on Earth do occur etc.) **Plenary** Students role play comets, asteroids and planets to the rest of their class.	Data projector and internet connection. Red shift software. Or see http://neo.jpl.nasa.gov/orbits/2003ub313.html	Describe how the orbit of a comet differs from that of a planet or an asteroid. Discuss the risks of a global catastrophe such as a comet hitting the Earth, taking account of the consequences, the chance of it occurring and any uncertainties. Explain the role of gravity in astronomy.	C 2.1 WO 2.1 2.2	
Homework: Use worksheet K15.1 from Longman Foundation/Higher Physics 2 Teacher's Pack or questions from Physics for You, Chapter 20 or Reactive Science, Chapter 11.							

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LESSON 4: Astronauts and space travel							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
P1b 12.1 P1b 12.2 P1b 12.9	9J Gravity and space.	Requirements for travelling in space and taking a holiday on different planets. The social and physical problems of living in an enclosed space, close to others and in a non-gravity, artificial atmosphere for prolonged periods of time.	**Starter** Start the lesson with a brainstorming activity to consider the possible conditions in space (refer to work to be done in this lesson and consider temperature, weightlessness and radiation hazards). Explain the problems of supplying basic needs and removing waste products in space. Also explain the timescale, weight and space limits involved. **Main** Research these problems and their possible solutions eg a gym on board spaceships enables travellers to exercise their muscles, shielding can keep out the effects of cosmic rays and temperature extremes and acclimatising astronauts to weightlessness. Note that these problems are, in general, solved in space stations. **Plenary** Students discuss, in groups, how to make a cup of tea in a spaceship, the problems they might encounter and how these problems can be overcome. They can then present their findings to the rest of the class as a dramatisation.	www.spacepix.net has pictures and information about the planets and stars. www.nasa.gov/missions/solarsystem/explore_main.html is the main web page for NASA with information on missions, space travel. http://hubblesite.org/ has images of various objects in the sky and information on how the telescope gathers data. www.solarviews.com/eng/mars.htm has further information on the physics of Mars through applications. http://hyperphysics.phy-astr.gsu.edu/hbase/solar/soldata2.html has useful data, which students could incorporate into posters, presentations, leaflets, etc.	Describe conditions in interplanetary space in terms of atmosphere, temperature and weightlessness due to lack of gravity. Describe how these conditions can be partly allowed for in spacecraft, including supply of air, heating/cooling, artificial gravity, exercise machines, etc. Discuss how scientists are devising ways to overcome the problems of long space flights, including the deterioration of bones and heart, and the dangers of radiation.	C 2.2 2.3 ICT 2.1 2.2 2.3 WO 2.2 2.3 LP 2.1 2.2 2.3 PS 2.1 2.2 2.3	
Homework: Students could research and prepare a poster highlighting the health risks (and how they are minimised) of long space flights.							

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LESSON 5: Rockets							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
P1b 12.6 P1b 12.5	7K Forces and their effects. 9K Speeding up.	Understanding action and reaction. Be able to use the equation, F=ma (Newton's second and third laws).	**Starter** Class discussion about stepping off a skateboard (you step forwards and the reaction pushes it backwards) and why a balloon moves when air inside is released (air shoots back so the balloon reacts by moving forwards). Make reference to rockets moving in space. Demonstrate how the mass of water in a rocket affects its height/range. **Main** Discuss Newton's third law: every action has an equal and opposite reaction that acts on a different body. Introduce the formula F=ma. Students complete questions to practise using the formula. Ensure they rearrange it and use the correct units. **Plenary** Look at animation/video showing a spacecraft being powered in terms of action and reaction.	Balloons. Water rocket kits. Foot pumps. Clinometers to measure angle and calculate height. Tapes for ranges. Physics through Applications: Space Flight – History, rockets. Physics for You, Chapter 20. Reactive Science, Chapter 11. Longman Higher Science 2 K10.1 worksheet from Teacher's pack. Physics for You, Chapter 20 questions. Reactive Science, Chapter 11 using the formula F=ma.	Describe how force = mass × acceleration, can be used to predict how an object behaves. Explain how a spacecraft might be powered in terms of action and reaction.	N 2.2 2.3	Ensure students do not stand in front/near to rockets being launched. Limit the number of launches taking place simultaneously. Spread students out in a large outside area.
Homework: Students could learn formula F=ma, the units used, and how to rearrange it for a test in the next lesson.							

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LESSON 6: Information about the Universe							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
P1b 12.8 P1b 12.16	7L Solar system and beyond.	How we explore the universe and the benefits this can bring.	**Starter** Ask how can we find out about distant objects in the solar system and in the more distant parts of the universe without travelling to them. We use satellites, telescopes and unmanned probes to explore the planets and provide information of what other parts of the universe are like. The search for planets around neighbouring stars, as an example of Earth based observations of conditions in the near galaxy. Discuss the relative merits of manned and unmanned probes for discovering information about the universe. **Main** Set up a 'planet' to be investigated in the classroom without the students going near it. Ask students for ideas on how to collect samples and monitor water and temperature. Students set up data loggers and then use remote controlled toy cars/diggers as the conditions are altered. **Plenary** Students discuss findings about the 'planet' and how any problems would relate to space exploration.	www.seti-inst.edu www.nasa.gov Physics through Applications - Radiotelescopes Longman Foundation/Higher Physics 2. Physics for You, Chapter 20 Reactive Science, Chapter 11. Remote controlled cars/toy diggers. Large soil tray with sand, water and rock samples, and heater. Data loggers and probes as available.	Describe ways of discovering information about the universe other than humans travelling there, including soil experiments on landers (Viking/NASA Spirit and Opportunity rovers) and Search for Extraterrestrial Intelligence (SETI). Show an understanding of how data logging and remote sensing can provide information about the universe without us travelling there.	WO 2.1 2.2 2.3 PS 2.1 2.2 2.3	Care with heater.
Homework: Worksheet K19.1 from Longman Foundation/Higher Physics 2 Teacher's pack or questions from Physics for You, Chapter 20.							

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LESSON 7: Life in the Universe							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
P1b 12.18 P1b 12.8 (part) P1b 12.19 (part) P1b 12.21 (part)	7L Solar system and beyond.	Predicting whether intelligent life exists in the universe and suggesting ways to find proof of this. How we explore the universe and the benefits this can bring.	**Starter** Quick test on formula F=ma and some calculations. Ask what conditions are required for life (brainstorm ideas). **Main** Refer to data used in lesson two about physical conditions on planets and discuss where else in our solar system life may exist. Relate this to position of planets relative to the sun ie too close and conditions are too hot (Venus), too far and conditions are too cold (Mars) but Earth is just right for life, as we know it. More able students may like to discuss Drake's equation for the probability of life on other planets. Consider what form life may take and what stage it is at relative to us. Will we recognise life (eg single celled organisms). Discuss signs to look out for. How could other life forms signal their existence to us? Why is it likely we could miss or misinterpret signs of life? **Plenary** Explain why scientists cannot be sure whether there is life on other planets.	Poster 'Is there life out there?' from www.pparc.ac.uk www.seti-inst.edu. This comes with its own worksheet. www.darvill.clara.co.uk. www.seti-inst.edu www.nasa.gov Physics through Applications – Radiotelescopes. Longman Foundation/Higher Physics 2. Physics for You, Chapter 20. Reactive Science, Chapter 11.	Discuss and develop an argument for and against the idea that intelligent life exists elsewhere in the galaxy, using scientific evidence and propose ways to find such life. Describe ways of discovering information about the universe other than humans travelling there, including the Search for Extraterrestrial Intelligence (SETI). Be able to recognise that there are scientific questions which remain unanswered, such as the existence of extraterrestrial life. Describe how the existence of life on a planet is determined by the position of the planet in its solar system and the position of its star in its life cycle.	C 2.3	
Homework: Students could research some of the costs involved in space exploration, the technological advances that have affected them and claims of extraterrestrial life.							

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LESSON 8: The life of a star							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
P1b 12.12 P1b 12.10	7L Solar system and beyond. 9J Gravity and space.	The formation and evolution of the universe and its stars. The nature of gravity and its role in space.	**Starter** Remind students that gravity attracts all bodies in the universe, even over massive distances, and its effects can be felt if the bodies are massive enough (eg size of stars/planets). Explain that bodies moving through the universe may be trapped by the gravitational field of a more massive body and remain orbiting the larger body or may just be pulled off course but continue travelling on. Brief demonstration is to heat a small metal sphere in a Bunsen burner and watch its colour change as the temperature increases. **Main** Give students jumbled cards illustrating the stages of development of small and massive stars and the effect the different developmental stages would have on humans/life in general. The students could then put these cards in the correct order by referencing textbooks and websites. Students could work in groups to produce a large poster for display purposes. **Plenary** Explain that where black holes exist, the gravitational field is so strong that light cannot escape from it. They are formed when a massive star collapses on itself after its nuclear fuel is used up at the end of its life cycle.	www.gcse.com www.bbc.co.uk Longman Foundation/Higher Physics 2. Physics for You, Chapter 20. Reactive Science, Chapter 11. Channel 4 ‘Life and Death of a Star’ video. Bunsen burner, heatproof mat, tongs, iron sphere. Most textbooks have a good description of star lifecycles.	Describe stellar evolution from the nebula stage for small stars like our Sun and for more massive stars. Explain the role of gravity both on Earth and in astronomy, including the idea of black holes.	C 2.2 2.3 ICT 2.1 2.2 2.3	Temperatures can be high. Use heatproof gloves and goggles.
Homework: Use worksheet K16.1 from Longman Foundation Physics 2 Teachers Pack or questions from Reactive Science, Chapter 11.							

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LESSON 9: The beginning of the universe							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
P1b 12.20	9J Gravity and space.	The formation and evolution of the universe and its stars. Recognising uncertainty in scientific topics.	**Starter** Ask students to imagine what the universe was like in the past and what might the universe be like in the future. **Main** Discuss the theories comparing how the Universe came into existence, eg the Big Bang, which explained Hubble's observation, based on red shift data that all galaxies are moving away from us. Use a balloon with dots on it to represent galaxies, and blow it up to show the idea of the expanding fabric of space. Other evidence comes from background radiation information such as the echo of the explosion. Spectrographs or diffraction gratings can be used to examine spectral lines from different light sources eg discharge tube, lamps, the Sun. Another theory is the steady state – the universe has no beginning or end, but gently expands with new matter continuously created in the gaps between existing matter. **Plenary** Explain why the final fate of the universe depends on its total mass. Compare open/closed and flat universe models.	www.nasa.gov Video: Science in Focus 'The Big Bang' 'Hubble's expanding Universe'. Websites used for lessons one and two. Physics for You Support Pack Extension Sheet: The Expanding Universe or research sheet 'Ideas about the Universe'. Reactive Science, Chapter 11. Physics through Applications — Big Bang. Longman Higher Physics 2 worksheet. Spectrographs, diffraction gratings, and light sources. Poster 'Is there life out there?' from www.pparc.ac.uk Useful websites: www.seti-inst.edu www.darvill.clara.co.uk	Describe the origin, current state and fate of the universe using the main theories (Big Bang, oscillating and steady state). Explain the supporting evidence for these theories, including microwaves and red shift.		Care when looking at bright light or if working in a darkened laboratory. Never look directly at the sun.
Homework: Students do the worksheet K18.1 from Longman Higher Physics 2 Teachers Pack or Physics for You questions from Chapter 20.							

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LESSON 10: The mysteries of space							
Spec. code	**Links and concept building from KS3**	**Learning objectives**	**Teaching activities**	**Resources**	**Learning outcomes**	**Key skills**	**Safety issues**
P1b 12.7 P1b 12.19 (part)	7L Solar system and beyond.	How we explore the universe and the benefits this can bring.	**Starter** Discuss astronomical research. Why do we need to know what the universe is like — how does this help us on Earth? For example, explore the issues surrounding the economic benefits of space exploration as a means of, or even the driving force, for developing new technologies and as a means of providing minerals that are depleted on Earth. **Main** Explain that up to 90% of the mass of galaxies is invisible, as it does not emit light. Scientists measuring the rotation of galaxies know that the matter must be there, and call it 'dark matter', but cannot detect it directly so there are many theories of what dark matter is eg it is made from unknown particles. **Plenary** Discuss the amounts of money involved in putting a man in space for a single day. Do the benefits merit this or could the money be better spent?	http://www.thespaceplace.com/nasa/spinoffs.html has some benefits of space exploration. http://www.astro.queensu.ca/~dursi/dm-tutorial/dm1.html has information on dark matter and includes an experiment that may be done on line.	Be able to recognise that there are scientific questions which remain unanswered, such as the nature of 'dark matter' that makes up much of the universe's mass. Discuss the possible social and economic benefits of knowledge about the universe and the technological advances which might accrue from its exploration.		
Homework: Students do questions from past papers or textbooks.							

Experiment 12.1: Mass and weight

Notes for students

What you will learn from this experiment

How weight varies in the solar system.

What you will know when you finish this experiment

1 On which planets you weigh more.

2 On which planets you weigh less.

3 The values of weight/mass ratio for different planets.

What you do

1 Collect a set of spring balances for the different planets.

2 You are provided with five objects. Find the mass of each object using a top pan balance and record the value in the table below.

3 Weigh each object in turn, using the spring balances for all five planets.

4 Record your results in the table below.

5 Calculate the fraction weight/mass for each planet, and record this in the table (you could use a spreadsheet to do this if one is available).

6 What do you notice about the weight/mass ratio for each planet?

7 Write down the planets on which you would weigh more.

8 Write down the planets on which you would weigh less.

9 What are the units for weight/mass?

		Weight on					**Weight/mass**				
Object	Mass	Earth	Mars	Jupiter	Neptune	The Moon	Earth	Mars	Jupiter	Neptune	The Moon
a	1										
b	2										
c	3										
d	4										
e	5										

10 How could you check that your results are correct?

Health and safety issues

Do not drop heavy weights on your toes!

Be careful of the hooks on the ends of spring balances.

Suggestions for further work/homework

Research the data for all planets using the internet. The site www.wikipedia.org may be useful.

Experiment 12.1: Mass and weight

Notes for teachers and technicians

Aim

How weight varies in the solar system.

Previous skills, knowledge and understanding required

How to operate a top pan balance.

Skills, knowledge and understanding to be gained

1 Practice in weighing.

2 Awareness of weight variation.

3 Knowledge that mass is not the same as weight.

Equipment and chemicals required

1 Top pan balance (electrical preferred to measure mass of your range of objects).

2 Five objects x number of student groups.

3 Five doctored spring balances x number of student groups.

4 Access to PCs or printed-out sheets and calculators.

Each group should have five spring balances with stuck on scales as follows:

Earth	The Moon	Mars	Neptune	Jupiter
1Newton graduations marked as 1N	1Newton graduations marked as 0.17N	1Newton graduations marked as 0.37N	1Newton graduations marked as 1.15N	1Newton graduations marked as 2.3N

It may be easier to work with 10N balances depending on the objects you choose to weigh.

Health and safety issues

Not dropping heavy weights.

Attention to the hooks on the ends of spring balances.

Delivery strategies

- This is a short practical and does not need a formal write-up. Students can write in the spaces provided and put the sheet in their notebook
- Discussion should bring out ideas of:
  - how weight varies from planet to planet
  - the weight/mass ratio constant for any one planet.
- More-able students can continue with research on other planetary data.

Assessment strategies

Students mark their own work and make corrections during the discussion that follows the practical work.

Experiment 12.1: Mass and weight

Links with key stage 3 (KS3)

This experiment builds on the following skills, knowledge and understanding from KS3:

- 7L The solar system and beyond
- 7K Forces and their effects.

Resources

- Plato Learning Multimedia science school Planet Analyser.
- www.bbc.co.uk/science/space/
- www.solarviews.com/eng/edu/weight.htm

Activity 12.2: Postcard home

Notes for students

What you will learn from this activity

In this activity you will compare another planet in the solar system with the Earth.

What you will know when you finish this activity

1 Which structures form the solar system and universe.

2 The planets in our solar system have different characteristic.

How you may be assessed

Your teacher will mark your work according to your efforts to find out interesting and relevant information, the neatness of your presentation and the correct use of scientific terminology.

What you do

1 Refer to any work you have already done so far on this topic.

2 Choose a planet from our solar system that you are going to travel to.

3 Find out additional information about this planet and space travel using books or the internet.

4 Write a postcard home, including what it is like on your planet, how long it took you to get there and any other interesting facts.

Suggestions for further work/homework

You could travel to a moon instead of a planet.

Activity 12.2: Postcard home

Notes for teachers and technicians

Aim

In this activity students will find out about the conditions on one of the planets in our solar system.

Skills, knowledge and understanding to be gained

1 Which structures form the solar system and universe.

2 The planets in our solar system have different characteristics.

Previous skills, knowledge and understanding required

The names of the planets in the solar system.

Materials required

1 Blank postcards.

2 Data about planets, website references and pictures of the planets.

3 Information from the unit so far.

Delivery strategies

- Tell students they are going on an imaginary school trip to one of the planets in our solar system and they are going to write a postcard home to Earth.
- Discuss what should be included on a good postcard and make suggestions if necessary (eg a picture, facts about the weather, what you can do on this planet).
- This activity is good for students with lower abilities as long as they are provided with data. Students with higher abilities can find the data for themselves.
- Give students a word limit for the postcard.
- More able students could look at a moon or the Sun and should be given more points to cover.

Assessment strategies

Students should be marked on the relevance of their information, originality, accuracy of science, and presentation.

Links with key stage 3 (KS3)

This activity builds on the following skills, knowledge and understanding from KS3:

- 7L Solar system and beyond.

Activity 12.2: Postcard home

Resources

- Physics for You support pack
- Longman Foundation/Higher Physics 2
- Physics through Applications
- Reactive Science
- www.bbc.co.uk
- www.gcse.com
- http://hubblesite.org/
- www.nasa.gov/missions/solarsystem/explore_main.html
- www.scienceyear.com/wired/index.html?page=/planet10/index.html
- www.solarviews.com/eng/mars.htm.
- www.spacepix.net
- www.sycd.co.uk/is_there_life/startfil/intro.htm
- www.upd8.org.uk/activity.php?actid=80

Demonstration 12.2: Scale of the solar system

Notes for students

What you will learn from this demonstration

In this demonstration you will find out the relative distances between the planets in our solar system.

What you do

1 Your teacher will divide your class into small groups. Each group will represent one of the planets in the solar system. Your group will be given a card or banner showing the name and/or a picture of the planet that you represent.

2 On the school playing field pace out the scaled down distance between the sun and the planet allocated to your group, as shown in the table. Our scale assumes that the nearest planet to the Sun, Mercury, is six steps away from the Sun (on this scale, one pace is equivalent to 10 million kilometres).

Object	Distance from the sun (million km)	Number of steps to take
Sun		
Mercury	58	6
Venus	108	11
Earth	150	15
Mars	228	23
Jupiter	778	78
Saturn	1427	143
Uranus	2871	287
Neptune	4497	449
Pluto	5914	591
Oort Cloud	11200000	1120000
Proxima Centauri	40493000	4050000

3 When your group reaches the scaled down distance for your planet, hold up your card or banner.

When all the groups are in position, your teacher will take a picture to show the position of all the groups in the class. This will give you some idea of the distances involved.

Demonstration 12.2: Scale of the solar system

4 The following table shows what the size of the planets would be if the Earth were 1 cm in diameter (about the size of a 1p coin).

Object	Diameter of object (million km)	Scaled size (cm)
Sun	1392000	108.75
Mercury	4880	0.38125
Venus	12100	0.9453125
Earth	12800	1
Mars	6800	0.53125
Jupiter	143000	11.171875
Saturn	121000	9.453125
Uranus	51000	3.984375
Neptune	50000	3.90625
Pluto	2300	0.1796875
Proxima Centauri	376000	29.375

Make a poster to show the diameters of the planets using the above scale sizes. You may not be able to fit our Sun or Proxima Centauri on your poster.

Suggestions for further work/homework

Visit the website www.solarsystem.org.uk/model2.html for an ICT tour of the solar system.

Demonstration 12.2: Scale of the solar system

Notes for teachers and technicians

Aim

In this demonstration students will explore the relative distances between the planets in our solar system.

Previous skills, knowledge and understanding required

Key Stage 3 physics and maths topics.

Equipment and chemicals required

1 Playing field.

2 The name of each planet and the Sun written on large cards. The cards could include pictures of each planet.

3 Materials for drawing a coloured poster. Ideally, the paper should be large enough for students to be able to draw the Sun according to the scale on the previous page.

Health and safety issues

Students will be walking away from the teacher. Suitable risk assessments need to be done to check it is safe for students to do this.

Delivery strategies

- Take other staff outside.
- Divide the class into small groups. Each group represents one of the planets in our solar system.
- Give each group a large banner or card with the name and/or a picture of one of the planets in our solar system.
- Each group should pace out the correct distance for their planet from a starting point that represents the Sun (it may not be possible to pace out the distance for all the planets in our solar system).
- When the groups are in the correct position use a digital camera to photograph the position of all the groups.
- More able students could calculate the number of steps to take and the scaled size of the diameter of the Sun and planets.
- A spreadsheet could be used to calculate scaled sizes for less able students.

Links with key stage 3 (KS3)

This demonstration builds on the following skills, knowledge and understanding from KS3:

- 7L Solar system and beyond.

Suggestions for further work/homework

Students could find out the diameter of the Moon, work out is scaled size, and add this to their poster.

Resources

- www.solarsystem.org.uk/model2.html

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