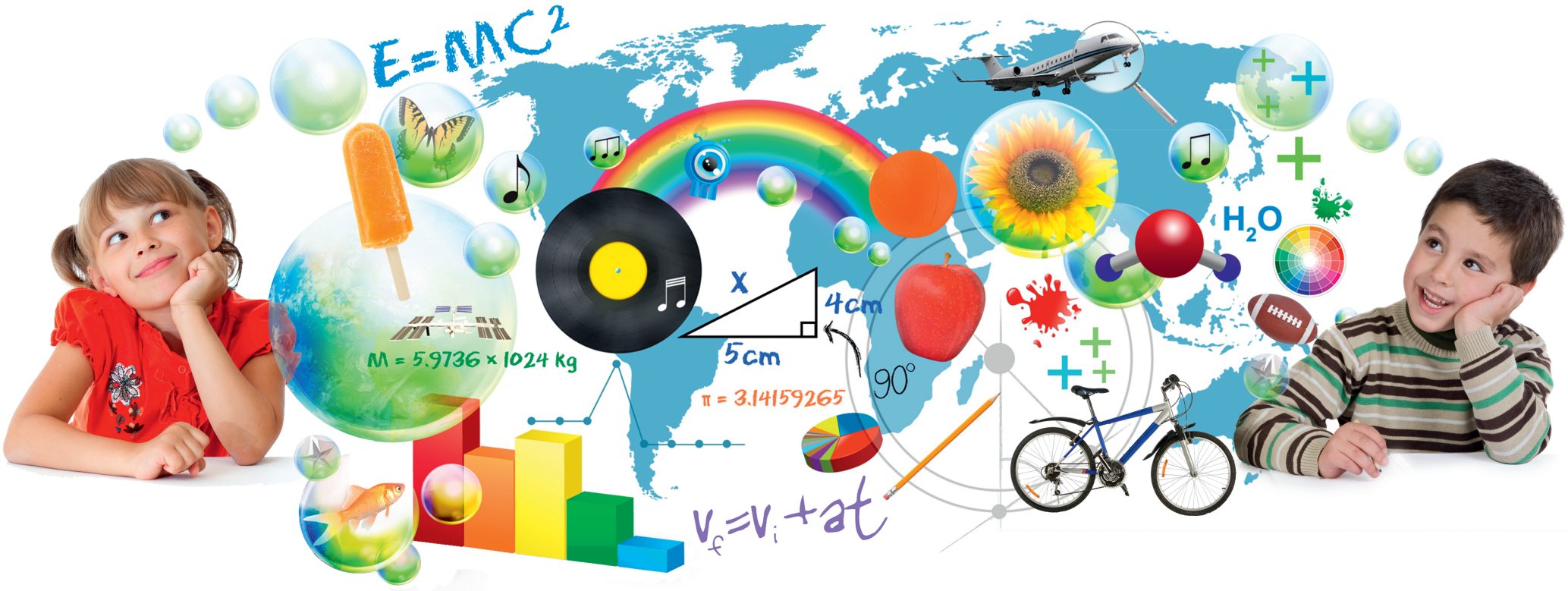
Inspiring Science

Lancashire Planning Support Disc



Lancashire County Council

www.lancashire.gov.uk/**lpds**

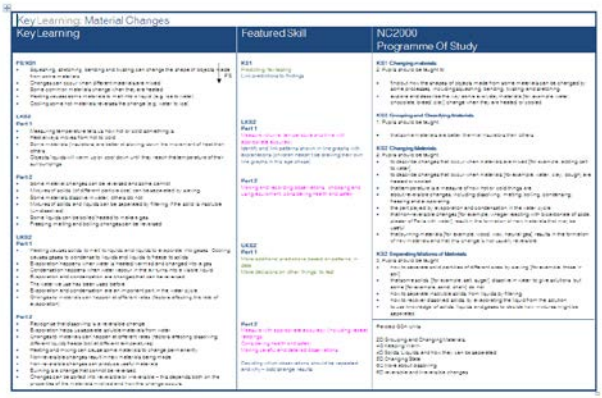
Inspiring Science
Lancashire Planning Support Disc
Updated for the new National Curriculum 2014

How to use the resource

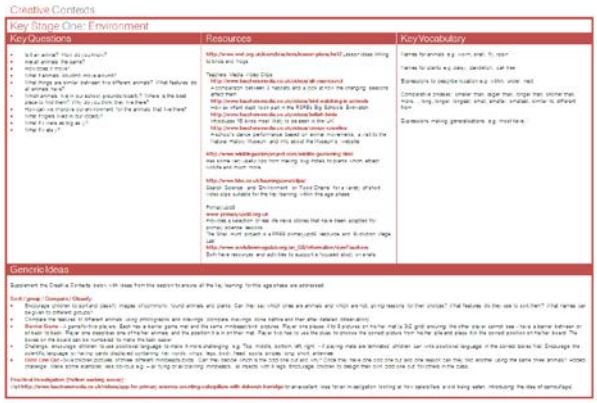
An overview
This resource is a collection of ideas and creative projects for making science more engaging and to link it to real world scenarios, problems and issues within the ever changing world in which we live today. The different projects described encourage a more independent approach to learning, encouraging the children to be researchers, investigators, analysers and good collaborators and communicators.

There are two main sections to the disc:

Key Learning Progression Sheets
'What to teach'



Creative Contexts
'How to teach it'



Key Learning
The Key Learning outlines the important concepts to be developed across the primary age phase. Each key learning document shows the progression of key concepts within each of the different areas of Science. We have divided the Key Learning into 10 areas:

- Animals
- Health
- Plants
- Environment
- Material Properties
- Material Changes
- Light and Astronomy
- Sound
- Electricity
- Forces

Key stage one, lower key stage two and upper key stage two Key Learning have been showed on one sheet so progression across the primary phase can be seen at a glance. These key learning sheets can be printed and enlarged onto A3 to use in whole school planning to ensure coverage, breadth and depth of Science.

Some specific health and safety points have been noted in some of the Creative Contexts but it is the statutory requirement of all schools to follow the guidelines for all areas of science as outlined in the 'Be Safe' booklet for Health and Safety in School Science and Technology for Teachers of 3 to 12 year olds. This document was last updated in Jan 2011 and revised copies are available from the Association of Science Education online bookshop www.ase.org.uk**.** It is assumed that schools will consider all the aspects of health and safety in relation to the work carried out by their pupils during science activities in accordance with the guidelines in the 'Be Safe' documentation.

Creative Contexts

Key Stage One: Health (Y2 Animals, Incl. Humans – How We Grow and Stay Healthy)

Key Questions	Resources	Key Vocabulary
• Why do we eat and drink? • What do we eat? What makes a healthy choice? • Why do we need to exercise? • What happens to our bodies when we exercise? • How can we look after ourselves? • What if the only food we could eat was sweets? • What if the only food we could eat was bread? • What if the only food we could eat was cheese? • Is it living? What do we need to stay alive? • What can human babies do?	**http://www.emas4success.org/TeachingMaterials/CurriculumMaterials/Science/index.htm** 'Food classification' provides a selection of 60 colourful pictures about different food types which can be used for discussion. **http://www.bbc.co.uk/learningzone/clips/how-do-we-change-as-we-grow-older/56.html** **http://www.bbc.co.uk/learningzone/clips/human-growth-and-change/2245.html** two short videos about human life cycles. **http://www.bbc.co.uk/learningzone/clips/** Search this site for 'Science' and 'Health, Grow and Eating' for a variety of short video clips to support this unit.	Words relating to health e.g. diet, variety, germ, healthy/unhealthy, medicines, safety, packaging, exercise.

Suggested Contexts

Generic Ideas

For either of the **Real Outcomes** described here, learning opportunities should be taken from *each* of the three different columns to ensure all the key learning for this age phase are addressed. (NB Learning about medicines has not been included as statutory requirements for KS1 but it is still included in this unit to link with PSHE and to enrich learning). Life cycles and observing growth of ***other animals*** (besides humans) is included in the 'YR2 Environment: Living Things and their Habitats' unit. The opportunities below just consider human health, growth and change. Life cycles of other animals can either be taught here alongside human life cycles and changes during growth or alongside the Y2 'Living Things and their Habitats' unit.

Real Outcome

Healthy Heroes

You have been asked to find out how healthy your class is. You need to share what you find out with the Head teacher/school nurse/team of scientists and talk about the healthy choices you can make. Perhaps you could organise a healthy picnic or healthy breakfast and invite parents or other children and share your ideas. A fictitious email could be sent each lesson with a scientist/person asking the children a different question about keeping healthy. This unit lends itself to making selections for learning opportunities from each of the three columns based on children's interests / resources / time, etc.

Alternative Real Outcome:

Fairy Tale Heroes

The children are asked to help different characters from various fairy tales linked to each of the themes below.

e.g. What do we eat?: Little Red Riding Hood brings her grandma cakes and biscuits everyday but this is not really a healthy way to help her get better. Can the children think of healthier things that Little Red Riding Hood could take instead? OR Goldilocks is inviting the 3 Bears to her house for breakfast as part of her apology for eating all of their porridge. She would like to ensure it is a healthy breakfast but there are so many different cereals she is not sure which to choose. Can you help her?

e.g. Looking After Ourselves: Little Red Riding Hood wants to take some medicine to her grandmas to help her get better but she has been told medicines are dangerous. What should she do? Can you tell her all about medicines and how they can be dangerous but can also be very helpful too? Little Red Riding Hood is also worried in case she gets poorly too. What can she do to stop herself getting the cold as well?
Little Red Riding Hood thinks the Big Bad Wolf has bad breath and ugly teeth. She wants to help him look after them better. How can you help? What advice can she give?

e.g. What happens to our bodies when we exercise? This could be linked to the tale of 'The Three Little Pigs'. After the Big Bad Wolf chases the pigs and tries to blow their house down he is very hot and huffs and puffs a lot. Can the children help to explain to the Big Bad Wolf about how bodies change during and after exercise?

Alternative Real Outcome linked to growth:

Robbie The Robot:

Real Outcome: A robot has come to visit the class. Pre-record a voice of it asking questions. It could ask a different question each week for the children to try to answer. Choose some of the activities below.

Sort / group / compare / classify: Does a robot grow as it gets older? How do we change as we get older? What can a robot do when it is made? Compare what a baby can do when it is born with what they can do now, compared with an adult. Look at the life cycle of a human. How do we change / grow as we get older?

Group Discussion: How do you work? The robot needs batteries because it is not alive. What makes us alive? What can we do that the robot cannot? What does a human need to stay alive? Children could be given a list/pictures of some things (one idea per card) and sort them into the most important and the least important thing needed to help us stay alive. The robot came from a toy shop and lived in a box. Could we live in a box? What could you manage without if you lived on a desert island? Or got stranded at the airport (link to airport strikes). Give the children different suggestions on cards and get them to rank them (triangle or diamond ranking) by which they think is the most important and why. What if there was no water? What if there were no parents? What would we need to stay alive?

Creative Contexts

Upper Key Stage Two: Light and Astronomy (Y5 Earth and Space)

Key Questions	Resources	Key Vocabulary
• What do we know about the Earth, Sun and Moon? • How do the Earth, Sun and Moon fit within our solar system? • How do we get day and night? • What do we know about the shape and movement of the Earth? • Why does the moon appear to change shape? • How do shadows, created by the sun, change during a day? • How were shadows used in the past to help people tell the time?	**http://www.bbc.co.uk/learningzone/clips/** search 'Science' and 'Earth, Sun and Moon' to find various short videos exploring this area of science. **https://www.sgsts.org.uk/SupportForVulnerablePupils/EMTAS/SitePages/Science.aspx** The Solar System' is an 'information gap' collaborative activity linking to the key facts about our solar system. Primaryupd8 **www.primaryupd8.org.uk** provides a selection of real life news stories that have been adapted for primary science lessons. Additional teaching materials are available to download with an annual subscription of £120 (***or £50 if you are a Lancashire school*** – contact the science team for reduced subscription codes) **www.lancsngfl.ac.uk/curriculum/science** 'What happened to Pluto', 'New Earth' and 'Time Traveller' have been linked to the themes below.	Sphere/spherical, revolve, orbit, spin, rotate, axis, sunrise, sunset, north, south, east, west, rotate around, rotate on its axis Solar system, Sun, Moon, star, Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, planet Sundial, shadow clock Model, compare, evidence

Suggested Contexts

Generic Ideas

This unit is best done when nights go darker earlier. This will allow children to observe the different moon phases during early evening as homework tasks (cloud cover permitting)!

Supplement the Creative Contexts below with ideas from this section to ensure all the key learning for this age phase is addressed.

Real Outcome:
Make a video with facts about Earth, Sun and Moon. Your video will be sent on the next space launch. Your video needs to explain about the Earth, Sun and Moon, their relationship to one another and how they form part of the wider solar system. You never know! It might reach an alien planet far off in another galaxy so make sure it is accurate and factual and ensure you engage your audience! (NB You could even vote for the best in class and send it to NASA with a letter asking if it could be included in a real space launch – you never know!)

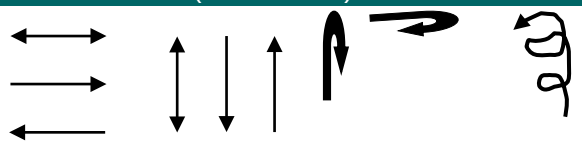
Questioning/Prior Learning:
Rather than ask the children what they would like to know about Earth and Space it is better to encourage them to ask what they already know and what they would like to know about ***Day and Night***. This ensures the questions are more focused and these are more likely to link to the NC PoS. Other general questions about space can be added later to encourage research and engage the learner but should not be the focus of the unit.

View the video at **http://www.teachersmedia.co.uk/videos/ks1-ks2-science-earth-in-space-1** to observe how one teacher approaches this unit and includes some imaginative drama, modelling techniques and annotated diagrams to encourage the children to learn collaboratively about the Earth, Sun and Moon. The related links shown below this resource may also be of some use.

Visualisation Activity / Initial Assessment:
Ask the children to imagine that they are on a mission into space. To really get their imaginations working ask them to relax, sit back in their chairs and close their eyes.
Imagine they are strapping themselves into the seat of the rocket on the launch pad. They can hear the commander saying ready for lift off. They hear the countdown from 5 to zero "5....4....3....2....1 we have lift off". They feel the force of the fuel jets lifting the rocket off the ground and forcing them back in their seats. Through their space suit helmet and the small window in the shuttle /rocket, they can see the Earth moving slowly further away from them. As they get further away from Earth, imagine they can see the Moon and the Sun. If they were to video the 3 objects over a period of time say a day, week, month or year what do you think you would see?
Gradually bring the children 'back' to the classroom and ask them to slowly open their eyes. You now want them to draw what that video would show.
Things they might think about...

- What shape are the Earth, Sun and Moon?
- What size are they if compared with one another? Are they all the same size? Is one bigger than another? Which is the biggest? Which is the smallest?
- Are they all equal distances apart or are two closer than the other one?
- Do any of them move? If so, how? Provide children with examples of different arrows they could use to represent the movements.

Generic Ideas (continued)



The children's image can be used as an assessment of their initial understanding and/or misconceptions. They can annotate their picture with any labels or sentences to explain their thinking further using their own words.

Modelling:
Watch 0.48mins to 2.56mins of **http://www.teachersmedia.co.uk/videos/light-show** 'Day and Night'. After watching the clip, challenge children to represent night and day using a strong torch or desk lamp for the Sun and a ball/sphere for the Earth. Can they draw their model and include arrows to show the movement and a description of what is occurring.

Thinking task: Questions: What if the Earth spun more quickly? What if the Earth spun more slowly? What if the sun was closer to the Earth? What if the Earth spun in the opposite direction? What if it took longer for the Earth to orbit the sun? How would the Earth move if England was always in sunshine and Australia was always in daylight? What affect would this have on our planet and the people who live on it? Children could choose 2 of the situations to think about record their thoughts on each one. They could then team up with other children (with the same scenario), share their ideas and then write an improved, group response to the scenario/question.

This could link to some work on time-zones. Use the video clip from **http://www.bbc.co.uk/learningzone/clips/** search primary/science/earth sun and moon 'The sun - day and night (pt 2/3)' for a demonstration and explanation.

Questioning/Research:
How do we know the Earth is approximately a sphere? Let the children discuss their ideas then show the video from **http://www.bbc.co.uk/learningzone/clips/** search primary/science/earth sun and moon 'How do we know the Earth is spherical?' This provides an opportunity to look at a famous scientist / philosopher from the past.

Questioning:
What shape is the moon? Does it always appear as a circle in the sky? Does the moon *actually* change shape or *appear* to change shape? Why do you think that?

Modelling:
Explain to the children the fact 'the moon also spins as it orbits the Earth. However, the moon spins so that the same face of the moon is always facing the Earth.' Encourage the children to model this in a large space using different sized balls to represent the Earth and the Moon.

Why does the moon appear to change shape? Ask them to think about this with their models Where is the light from the sun touching the moon? You can model this with a child sat in a swivel chair being slowly spun around. They can hold a sphere to represent the moon orbiting the Earth. If they hold the sphere on a stick, the same face of the moon will always face them as they spin. Use a strong torch in a darkened room to represent the light from the sun. As the child spins they can see that different parts of the moon are lit by the sun. (Remind children that the Earth will also be orbiting the sun as well as spinning on its axis but that you haven't shown this movement to keep the model simpler).

Children can keep a diary of the changes to the moon's appearance over several weeks. Can they spot the moon's cycle? How many days is it? Can they guess the shape of the moon on the days when it was too cloudy to collect direct evidence? Do other planets have moons? Which ones?

Research: research some facts about the different planets to add to your space video. Find out what their surface temperature is like and what they are made of. Is there a pattern between these and the planets distance from the sun? Make up a Mnemonic to help others remember the order of the planets from the sun. Who can make up the funniest/best one? Have a class competition. (Could be a homework task). How do the planets move, relative to the Sun. How is gravity involved? Further research on Ptolemy, Alhazen and Copernicus could be done at this point. The children could create a poster or science webpage about how thinking about the universe has changed throughout history from one where it was thought that the earth was at the centre to the one where the planets orbit the sun. Also it was once thought that the Earth didn't spin, when did this thinking change?

Create / Invent / Design: Applying the learning (assessment opportunity)
What have we learned about Earth and Space? Design a quiz for classmates to take part in. It must;

- Contain 10 questions for the 10 most important learning points from this unit (let the children discuss what they consider to be the most important points – does this match the intended learning for this unit? Are the children clear about the importance of understanding the movement of the Earth, Sun and Moon and other celestial bodies in relation to each other within the solar system?)
- Contain questions about the link between the Earth, the Sun, the Moon and other planets within the solar system.
- Encourage answers which use the key vocabulary from this unit for our working/vocab wall.
- Encourage answers that require a sentence rather than a one word answer.

Which group can come up with the best test to use for next year's Y5 class? The best quizzes will be uploaded onto the school website for others to see.

Initially, allow every child to individually come up with their best 6 questions (this can then be used for assessment) and then pool these together and share ideas to come up with 10 improved questions per table/group. You could even provide a couple of SATs type questions on Earth and Space as a stimulus This will help the learning move on and progress from their initial ideas which are then shared and modelled so their final attempts are improved.

Generic Ideas (continued)

After this task the children could try answering the questions on the best test, first individually (for assessment) and then pool their ideas to get the 'best' answer for their group.

Practical Investigation / Looking for patterns:
What happens to the sun or what changes occur during the day? Ask the children how they could answer this question (Safety: remind them it would not be safe to look directly at the sun or to look through a camera/video viewfinder straight at the sun). Allow for some creative thinking and then let the children plan how they will record changes during the day (they might focus on position, temperature, apparent movement across the sky, cloud cover, apparent 'height' above the horizon and so on. How many different ways can they come up with? Gather a list and then ask groups to choose which they will do (you can add a few too from the list here if the children struggle to provide a variety of answers). This activity is more to do with creative thinking and suggesting ideas on how things can be tested than simply setting up a fair test. This can be done in a more structured way with the investigation below.

How do shadows change during the day?
Allow the children some freedom in how they will go about this rather than leaping straight into setting up a shadow clock. Let them try their ideas first and then follow this up with a more structured investigation using the shadow clock idea.

Presenting data as line graphs:
How can we present the data to help us spot a pattern?

- Plot the data from the shadow clock experiment (time of day against length of shadow). Ask the children to carry the graph on beyond the start and finish times they actually collected readings for. Do they realise the time of day when there will be no shadow?
- Plot the graph of sunrise and sunset times across a year (they will need to do some research on this first but the data is easy to find using an internet search engine). What pattern can you spot from the graph? They could be challenged to write 3 sentences about the graph. This would be better than just answering questions about the graph as it requires them to apply their learning and use their own words thus making a better assessment opportunity. Can they say something about day length linked to the seasons from their graph? Can they predict what the graph would be like for somewhere in Australia? Let them have a go at plotting a graph and then do some research to collate actual evidence.

Research:
Explore different time zones across Earth explaining why they are used/how they work. Visit this blog http://antarcticapuppet.primaryblogger.co.uk/2011/01 **"Diary Update Posted on January 28, 2011 by Ricky"**

Extending the more able:
The main parts of this resource that could be used to stretch your more able (Once you are clear they understand the related movements and sizes of Earth, Sun and moon) include....

Questions to get them thinking: Let the more able have a go individually with one question then share their answers as small group to make a poster called **"Ever Wondered....?"**

What if the Earth spun more quickly? What if the Earth spun more slowly? What if the sun was closer to the Earth? What if the Earth spun in the opposite direction? What if it took longer for the Earth to orbit the sun? The Earth's axis is at an angle of 23.4 degrees (just enough to give us our seasonal changes of temperature) What if the Earth's axis got larger or smaller? What would the consequence be? How would the Earth move if England was always in sunshine and Australia was always in daylight? What affect would this have on our planet and the people who live on it?
This could link to some work on time-zones. Use the video clip from **http://www.bbc.co.uk/learningzone/clips/** search primary/science/earth sun and moon 'The sun - day and night (pt 2/3)' for a demonstration and explanation.
Can your more able group come up with more 'What if...?' scenarios for the rest of the class?

Questioning/Research:
How do we know the Earth is approximately a sphere? Let the children discuss their ideas then show the video from **http://www.bbc.co.uk/learningzone/clips/** search primary/science/earth sun and moon 'How do we know the Earth is spherical?'
This provides an opportunity to look at a famous scientist / philosopher from the past. People used to think the world was flat. What evidence did they have in the past that helped them come to this conclusion/misconception? The new curriculum 2014 suggests finding out about '*Pupils should find out about the way that ideas about the solar system have developed, understanding how the geocentric model of the solar system gave way to the heliocentric model by considering the work of scientists such as Ptolemy, Alhazen and Copernicus*' Could this group find some good web links and explain how the understanding of the planetary movements has changed over time?

Rockets

Real Outcome:
As space cadets you have been asked to use your science investigative skills to find out all about rockets and space travel. Report you findings to your Space Cadet leader in the most interesting way possible.

Adding a creative link such as rockets provides an excellent opportunity for developing practical skills and those skills linked to fair testing. The rocket theme lends itself to a focus on measuring and repeat readings to improve the validity/reliability of results.

This needs to be supplemented with other opportunities linked to ALL the key learning for this unit. Be selective as to which rocket experiment to focus on. The main focus of this unit is about the movement of celestial bodies in space not rockets but it can be added for the practical element it provides.

The Solar System and Beyond

Real Outcome:
Write a magazine article about living on another planet. What is it like compared to living on Earth.
OR
Produce a non-fiction text about The Solar System and Space Exploration. Work as a group (about 8-10) and decide what chapters your text will have. Divide the task up so that different pairs are doing different chapters. How will you ensure a consistency with regard to presentation standards and style?

Creative Contexts

Upper Key Stage Two: Forces A (Y6 Friction, Air/Water Resistance, Gravity)

Key Questions

- What is friction?
- When is friction useful?
- When is friction a disadvantage?
- What if there was no friction?
- How can objects be moved more easily? i.e. reduce the friction (rollers, lubricants, shiny surfaces, wet surfaces)
- How can we slow down a moving object?
- How can you slow down the movement of an object through the air?
- Why does everything fall to the ground when thrown in the air?
- How can you measure a force?

Resources

https://www.sgsts.org.uk/SupportForVulnerablePupils/EMTAS/SitePages/Science.aspx and scroll down to 'Friction Game' which encourages collaborative discussion and 'Forces' which is a true/false/not sure card sort activity which can challenge children's thinking.

http://www.teachersmedia.co.uk/videos/great-primary-lesson-ideas-forces-and-motion-activities for some great lesson ideas on 'Jelly chopsticks', 'Rocket Balloons' and 'Paper Helicopters'

http://www.teachersmedia.co.uk/videos/action This video is a resource to use with pupils in the classroom and looks at forces involved in skateboard designs, BMX riding, snowboarding and sky diving.

http://www.thenakedscientists.com/HTML/content/kitchenscience/wierd/exp/separating-books/ Find out how nothing but a little bit of friction can stick two books together.

http://www.bbc.co.uk/learningzone/clips/an-investigation-of-friction/2451.html a humorous short video about a friction investigation introducing the idea of repeat readings.

http://www.bbc.co.uk/learningzone/clips/ Search 'Science' and 'Forces and Friction' for a variety of short video clips suitable for the key learning within this age phase.

Primaryupd8
www.primaryupd8.org.uk provides a selection of real life news stories that have been adapted for primary science lessons. Additional teaching materials are available to download with an annual subscription of £120 (***or £50 if you are a Lancashire school*** – contact the science team for reduced subscription codes) **www.lancsngfl.ac.uk/curriculum/science**
'Paper planes: a perfect performer' and 'Sports Day Superstar' have been linked to the themes below.

Key Vocabulary

Friction, air resistance, water resistance, forcemeter, Newtons, surface area, gravity, movement, between surfaces

Suggested Contexts

Generic Ideas

The forces unit in LKS2 includes a unit on magnets and comparing how things move on different surfaces. The children will have looked at the effect of different surfaces on movement rather than being introduced to the term friction which is introduced and explored further in this unit for UKS2 (introducing more specific scientific language and more abstract concepts). The FORCES unit has 2 elements to it; one on 'Friction, Air/water resistance and Gravity' (described here in FORCES A) and one on 'Forces working together: Pulleys, Levers, Gears and Simple Machines' (FORCES B). Ideas from both of these can be combined to make one unit of work on FORCES for year 5. If time was limited, use the generic ideas to introduce friction, air resistance and water resistance then move onto FORCES B without doing one of the creative contexts below. (if this was the case, then some of the ideas in the creative context below could be given to Y3 linked to things moving on different surfaces).

Each Creative Context below has a different theme and a different focus. After you have selected the learning opportunities you would like to provide, check back at the key learning for this unit and ensure it is all statutory learning is covered. This 'Generic Ideas' section provides support for ***introducing*** different forces and the' Creative Contexts' look at ***applying these forces in different contexts and suggesting focused practical investigations***. Choose the creative contexts you wish to follow below and supplement them with the generic ideas for introducing the different forces.

Introducing Forces

Wow Launch - Explore / Observe / First Hand Experiences:
How can you get a lolly stick to move? (See also work on making things move from Yr 3 unit 'Forces and Magnets' – some of these ideas could be revisited as a reminder of previous learning). How many different ways of moving the lolly stick can they come up with through discussion? Get them to discuss if they are using pushes or pulls? Show them how forces can be used to create of change a movement. Demonstrate the lolly stick chain reaction experiment. (Search 'lolly stick chain reaction' or 'popsicle stick chain reaction' online for information and instructions). Let the children have a go and then annotate drawings/video/photographs with what this shows about forces.

Children could also explore forces around the home or school which can be categorised as a push or a pull force.

The rest of the unit will be about exploring different forces and their effects on movement.