SCIENCE
YEAR 3-4
Cycle B – Unit 8

Force - friction

Richard Watkins, GwE
richardwatkins@gwegogledd.cymru
@DrRWatkins

RANGE

How things work

2. forces of different kinds – **surface friction and water resistance**
3. the ways in which forces can affect movement and how forces can be compared - **newtons (N), forcemeters**

KEY VOCABULARY

friction
forcemeter (newtonmeter)
pushmeter
abrasive
reduce
increase
properties

table
bar chart
axis
tally
scale
newtons (N)

Developing thinking
(Plan-Develop-Reflect integrated into activities)

LNF – Main Numeracy Strands covered*

Strand:
Developing numerical reasoning
Elements:
Identify process and connections
Represent and communicate
Review

Strand:
Using data skills
Elements:
Collect and record data
Present and analyse data
Interpret results

**Refer to LNF numeracy framework for details of specific skills within each element.*

LNF – Literacy (writing) opportunities

Element: Organising information and ideas
Writing accurately

Writing to inform, instruct and find out

Developing ICT

School to identify and provide opportunities for developing this skill within the scope of the unit.

Curriculum Cymreig

School to identify and provide opportunities for developing this skill within the scope of the unit.

Personal and social education

School to identify and provide opportunities for developing this skill within the scope of the unit.

Science – Medium Term Planning (half termly)

Year Group	**3/4**	Term	**Cycle B – Unit 8**	Unit Title	***Force - friction***

Range: *How things work*
2. forces of different kinds – **friction between surfaces and water resistance**
3. the ways in which forces can affect movement and how forces can be compared - **newtons (N), forcemeters**

Cross Curricular Links:

Skills (Principal skills in bold italics)	**Suggested activities**	**Resources and web links**	**Assessment Opportunities**
PLAN Identify gaps in prior knowledge **DEVELOP** ***Make careful observations and measurements*** ***Begin to check observations*** **REFLECT** Suggest how the method could have been improved	**1. Big Question: What do you know about forces?** • Show concept cartoon and/or play true/false game sorting statements. Review children's prior learning by asking questions to elicit ideas about forces they have already encountered *e.g. push, pull, magnetism.* • Complete ideas sheet/KWL grid diagnosing pupils' ideas and/or create a graffiti board of pupils' ideas. • Record diagnostic assessment – mind map, KWL grid or ideas poster etc. **2. Big Question: How do we measure force?** **Introduce the skill – Observe and measure. Demonstrate forcemeter** • Show children forcemeters and point out the spring inside them. Ask them to suggest how they work. Help children to practise reading the forcemeter. • Use a graphic organiser to consider the parts of a forcemeter and their function. • Ask children to suggest whether it would be more or less difficult to get an object moving on a smooth or rough surface. Ask children how they might answer this question. Groups to record qualitative results, e.g. 1-10 scale. Tabulate findings. • Use a forcemeter attached to an object (eg a weighted margarine tub or a weighted shoe) to demonstrate how this question might be investigated. Discuss with the children what different forcemeter readings show. Introduce newtons (N). • Tabulate results and draw bar graph. • Discuss findings and model how to make a conclusion. • More able: Create own table and bar chart. **To write to inform and explain** **Text type: notes**	http://resources.hwb.wales.gov.uk/VTC/2009-10/science/cripsat/e32-forces/index.html http://www.echalk.co.uk/ http://www.woodlands-junior.kent.sch.uk/revision/Science/physical.htm True-false card sort ideas Selection of forcemeters 0-5 and 0-10 N scales Graphic organiser template	Use preferred diagnostic strategy/tool ***Can pupils record measurements using simple equipment? (Level 3)*** Can pupils record findings into a blank table format? (Level 3)

PLAN Ask relevant questions **DEVELOP** ***Make careful observations and measurements*** **REFLECT** Linking learning to similar situations within and outside school	**3. Big Question: Can you use a forcemeter and record measurements?** **Practise the skill – Observe and measure. Using newtons (N) to record pushes and pulls** • Show pupils bathroom scales – who can push the most? • Convert bathroom scales into a giant pushmeter using the conversion 1kg is approx. 10N (Note: kg is unit of mass, N is unit of force). • Tabulate class results and draw bar chart. • Challenge pupils to predict and investigate: - Do taller people produce the greatest push force? - Do older pupils produce the greatest push force? • Introduce science pushmeter. Relate to bathroom scales. • More able: create own bar chart. Convert g to N scale (100g is approx. 1N).	http://resources.hwb.wales.gov.uk/VTC/2009-10/science/cripsat/e32-forces/index.html Selection of forcemeters 0-5 and 0-10 N scales	***Can pupils record measurements using simple equipment? (Level 3)***
PLAN Make predictions using prior knowledge **DEVELOP** ***Make careful observations and measurements.*** Check observations by repeating them **REFLECT** ***Suggest how the method could have been improved***	**4. Big Question: What is friction?** **Introduce the skill – Observe and measure. 'Forces': NGfL KS2 science** • Ask children to investigate on which surfaces objects slide most easily. Present children with at least three different surfaces *eg wood, vinyl, carpet* and ask them what they think will happen. • What are the key factors that make a material high friction? Play card sort activity. **Practise the skill – Observe and measure. Recording measurements and introducing reliability** • Discuss planning ideas: help children to decide what to do eg measuring the force needed just to start an object moving on a flat surface or measuring the height of a slope on which it will start to slide. • Discuss how to ensure their test is fair eg by keeping the object to be moved identical on each surface or by keeping the same surface. • Groups card sort variables and identify factors to change and measure. • Carry out investigation and collect findings. Create bar chart of results. • Discuss need for checking results (reliability). • More able: introduce median value of 3 readings. • Ask children to present results in a bar chart. Use template to model structure. • Discuss with the children the different methods they chose to investigate the question, and whether some were better than others for answering the question. • Ask children to draw simple conclusions from their work and link learning to road surfaces. • Write short letter/email to school council indicating best material for non-slip floor. **To write to inform and explain** **Text type: letter/email**	http://resources.hwb.wales.gov.uk/VTC/2009-10/science/cripsat/e32-forces/index.html http://www.woodlands-junior.kent.sch.uk/revision/Science/physical.htm Selection of forcemeters 0-5 and 0-10 N scales Variable card sort Interactive planning templates Post-it planning boards Blank table templates	Can pupils plan with some independence? (Level 3) Can pupils create a bar graph with axes provided? (Level 3) ***Can pupils record measurements using simple equipment? (Level 3)*** Can pupils begin to organize findings, including simple tables and bar charts? (Level 3) ***Can pupils suggest simple improvements to their method? (Level 3)***

PLAN Ask relevant questions **DEVELOP** ***Use some science knowledge to explain cause and effect*** **REFLECT** Linking the learning to similar situations within and outside school	**5. Big Question: How does friction help us?** **Introduce the skill – Explaining. Using force arrows** • Talk with children about surfaces between which there is low or high friction and make a list showing everyday situations where high friction is helpful eg tyres on cars and bicycles, goal keeper's gloves, tying shoe laces and everyday situations where low friction is useful eg skating, playground slides. • Show children how forces are represented by arrows on diagrams. **Practise the skill – Explaining. Using force arrows** • Sort picture or word cards into high, medium and low friction. Encourage use of Venn diagrams. • Groups swap ideas and compare. Discuss. • Challenge pupils to add force arrows on pictures/diagrams. • Focus on pupils producing labels and notes. **To write to inform and explain** **Text type: notes and diagrams**	http://www.bbc.co.uk/learningzone/clips/ http://resources.hwb.wales.gov.uk/VTC/2009-10/science/cripsat/e32-forces/index.html http://www.woodlands-junior.kent.sch.uk/revision/Science/physical.htm	***Can pupils explain using everyday experience? (Level 3)*** ***Can pupils explain using scientific language/ideas? (Level 4)*** Can pupils identify simple patterns? (Level 3)
PLAN ***Set up and control a fair test controlling key variables*** ***Make predictions using prior knowledge*** **DEVELOP** Make comparisons and identify and describe trends in data **REFLECT** Link learning to similar situations within and outside school.	**6. Big Question: What is water resistance?** **Introduce the skill – Controlling variables 'Forces activity 4': NGfL KS2 science** • Show pupils pictures/videos of objects travelling through water. • What do pupils notice – list common features of boats and submarines. • Complete compare-and-contrast graphic organiser comparing features of whale and submarine. • Pupils explore with different plasticine shapes falling through water – introduce concept of water resistance. Which shape has the best streamlining properties? Why? **Practise the skill – Controlling variables** • Help pupils create testable question, e.g. 'What shape creates the most/least water resistance?' • Pupils identify and sort basic variables and make prediction. • Model planning template – focus on aspects of fair testing. • More able: consider independent planning. **To write to inform** **Text type: science write-up/report**	http://resources.hwb.wales.gov.uk/VTC/2009-10/science/cripsat/e32-forces/index.html Plasticine Cylinders Rulers Timers Graphic organiser Planning template example Variable cards to sort	***Can pupils plan with some independence? (Level 3)*** ***Can pupils use everyday ideas to make predictions? (Level 3)***

PLAN ***Select success criteria*** Search for, access and select relevant scientific information from a range of sources **DEVELOP** ***Use some science knowledge to explain cause and effect*** **REFLECT** ***Begin to evaluate outcome against success criteria***	**7. Big Question: Can you write about your new science ideas?** **Choose from:** **Produce a forces fact-file** **Write a forces poem** **Produce an annotated cartoon strip about forces** **Introduce the skill – Determining success criteria.** • Review pupils' knowledge about forces, friction and forcemeters. • Show pupils a fact-file on another science topic. What makes a 'good' example of the chosen genre. • Agree basic success criteria with pupils. • Groups share ideas and plan. • More able: select their own success criteria and justify. **To write to inform and explain** **Text type: fact file/poem/cartoon**	Examples of science books, information cards and fact files. http://www.nhm.ac.uk/kids-only/life/ http://www.bbc.co.uk/education http://www.primaryscience.ie/index.php	***Can pupils agree on some basic success criteria? (Level 3)*** ***Can pupils explain using everyday experience? (Level 3)*** ***Can pupils explain using scientific language/ideas? (Level 4)***

REFLECT ***Linking their learning to similar situations within and outside school***	Revisit initial diagnostic assessment. Can pupils demonstrate understanding at end of topic and discuss new skills learned and/or practised?	Use preferred AfL strategy	***Can pupils say what worked and didn't work? (Level 3)***
Evaluation			