SCIENCE
YEAR 3-4
Cycle B – Unit 12

Material properties: thermal insulation

Richard Watkins, GwE
richardwatkins@gwegogledd.cymru
@DrRWatkins

RANGE

Sustainable Earth

3. a comparison of the features of some natural and man-made materials
4. the properties of materials related to their uses

KEY VOCABULARY

thermal
insulate/insulation
temperature
rate
degree Celsius
heat
table
bar chart
axis
prediction
factors/variables
scale

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 term)

Year Group	**3-4**	Term	**Cycle B – Unit 12**	Unit Title	**Material properties – thermal insulation**

RANGE
Sustainable Earth
3. a comparison of the features of some natural and man-made materials
4. the properties of materials related to their uses – **thermal insulation**

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 comparisons and identify and describe trends*** Make careful observations and measurements **REFLECT**	**1. Big Question: What do you already know about thermal insulation?** Intro to topic and discussion of what pupils understand. Discuss science vocabulary linked to this topic. **Introduce the skill – forming testable questions** • Review what the pupils already know about materials, temperature and how to measure temperature. • Show pupils either the 'teapot' or 'snowman' concept cartoons as stimulus. What do they think? • Sort true-false statements associated with materials and temperature. • What questions can pupils raise that are testable in the classroom setting? Consider the variety of equipment with which they are familiar. Record diagnostic assessment – mind map, KWL grid or ideas poster etc. **To write to inform and explain** **Text type: notes/diagrams**	Selection of magnets: horse, bar, circular. Iron filings Various materials http://resources.hwb.wales.gov.uk/VTC/2009-10/science/cripsat/e23-properties-and-uses/index.html http://www.echalk.co.uk/	Use preferred diagnostic strategy/tool ***Can pupils identify simple patterns and trends? (Level 3)*** Can pupils explain using scientific ideas? (Level 4)

PLAN Plan the observations and measurements to take **DEVELOP** ***Make careful observations and accurate measurements, using ICT equipment*** **REFLECT** Linking learning to similar situations within and outside school	**2. Big Question: How do we measure temperature?** Allow pupils to explore a range of thermometers. Ask them to list a range of 'what if' questions on post-it notes related to the thermometers and temperature. **Introduce the skill – Measuring with standard equipment** • Demonstrate using a thermometer to measure temperature. Introduce degree Celsius as a measure of temperature. **Practise the skill – Measuring with standard equipment** • Activity 3.1 and 3.2 from NFER 'Let's Think Through Science' book. • Use datalogger to record temperatures in given localities around school, or • Use datalogger/thermometer to record temperatures in 5 contrasting locations around school. Tabulate results. • What are pupils' findings? Are there any patterns in temperature around school? • Consider graphing the results.	http://resources.hwb.wales.gov.uk/VTC/2009-10/science/cripsat/e23-properties-and-uses/index.html http://www.woodlands-junior.kent.sch.uk/revision/Science/physical.htm http://resources.hwb.wales.gov.uk/VTC/carroll_diagrams/eng/introduct/default.htm http://mrcrammond.com/games/carrollv4.swf Localities around school Dataloggers Thermometers	***Can pupils gather findings using simple equipment? (Level 3)***

PLAN ***Plan the method to be used in an investigation, recognising key variables.*** **DEVELOP** Make careful observations and measurements. Make comparisons and identify patterns and trends **REFLECT** Link learning to similar situations within and outside school.	**3. Big Question: How do we keep things cool?** Ask pupils Ask children to suggest ways things are kept cool eg cold drinks as part of a packed lunch, or taking frozen food home. **Introduce the skill – Identifying key variables and planning** • Ask them to think about how they could find out in school about how to keep something cold eg using an ice cube as a cold object and trying out different wrappings (bubble wrap, sponge sheeting, aluminium foil, polythene), • Can pupils construct a plan/method? What equipment do they need in order to carry out the enquiry? • For example, leave all the wrapped ice cubes for half an hour or observe every fifteen minutes. • Help children to think about what they will record and ask them to tabulate their results. Ask children to make a record of what they did in drawing and writing. • Pupils use part-complete planning sheet. Can pupils sequence steps to carry out investigation? **Practise the skill – Identifying key variables and planning** • Test two materials and record start and finish temperature. • More able: record how quickly temperature falls over 10 min intervals and/or introduce real-time datalogging (temperature versus time). • Pupils gather required information to answer chosen questions. • Help pupils identify patterns and trends in findings. Model a conclusion. • Consider communicating findings using either a letter, email or oral presentation. **To write to inform** **Text type: science write-up/report/letter/email**	http://www.bbc.co.uk/learningzone/clips/ http://www.woodlands-junior.kent.sch.uk/revision/Science/physical.htm Selections of insulating materials Dataloggers Thermometers Interactive planning templates	***Can pupils plan with some support? (Level 3)*** ***Can pupils recognise the basic variables in a fair test? (Level 4)*** Can pupils make decisions by weighing up evidence? (Level 3) Can pupils link learning to familiar situations? (Level 3)
PLAN ***Plan the method to be used in an investigation, recognising key variables.*** **DEVELOP** Make careful observations and measurements Make comparisons and identify patterns and trends **REFLECT** Suggest how the method could have been improved	**4. Big Question: How do we keep things warm?** Use Concept Cartoon template to create a scenario around pupils' ideas about thermal insulation of liquids. 'How do we keep things warm?' or 'Design and test an insulating cup sleeve'. **Introduce the skill – Recording measurements and tabulating results** • Ask children to think about the sort of materials they use to keep themselves warm in winter. • How they could investigate which materials help keep things warm. Ask how they will judge whether something is keeping warm or not. • Introduce contextualised question focused on investigating the 'best' material to use to keep liquids and/or food warm. Help children to plan an investigation to find out what materials will keep *eg a container of water* warm for the longest time. • List variables that may affect the investigation. More able: list own variables on post-it notes and identify key variables to change, measure and control. **Practise the skill – Recording measurements and tabulating results** • Carry out the investigation in small groups. • Ask children to recap how the test will be kept fair. List equipment. • Pupils to record their results in tables they create and to interpret findings. • Discuss results in relation to predictions.	http://www.bbc.co.uk/learningzone/clips/ Selections of insulating materials Dataloggers Thermometers Interactive planning templates	***Can pupils record using a given format? (Level 3)*** ***Can pupils create their own tables? (Level 4)*** ***Can pupils gather findings using simple equipment? (Level 3)***

PLAN Ask relevant questions **DEVELOP** Communicate findings using relevant scientific language ***Form considered opinions and make informed decisions*** **REFLECT** Suggest how the method could have been improved	**5. Big Question: How do we keep things warm? …cont.** Review findings from previous activity. **Introduce the skill – Conclusions and decisions** • Review findings from groups. Discuss which material(s) kept the items warmest for longest. • Did the same materials keep things cool and also keep things warm? What can pupils conclude from this? • What makes a good conclusion? Use KS2 science guidance document for examples of pupils' work. **Practise the skill – Conclusions and decisions** • Pupils write conclusions and swap between groups to self assess • Consider challenging pupils to write an email or letter to a factory manager explaining which material the company should use for a new range of insulated outdoor clothing. Use writing template if required. • More able: work without template and select genre to communicate. **To write to inform** **Text type: science write-up/report**	KS2 science guidance document Ginn Star Science – teaching scientific enquiry book	***Can pupils say what they have found out from their work and make decisions by weighing up evidence? (Level 3)*** ***Can pupils suggest simple improvements? (Level 3)***
PLAN Select success criteria **DEVELOP** Make careful observations and measurements ***Organize findings and display them using tables and bar charts*** **REFLECT** Begin to evaluate outcome against success criteria	**6. Big Question: How do we construct a bar chart?** Challenge pupils to review their findings from the previous two investigations. Was the same material the 'best' for keeping things cool and also warm? Which material was least effective? How can we communicate our results? **Introduce the skill – Using tables and bar charts** • Model how bar charts are constructed – interactive planning boards are valuable tools here. Also, ideas from Ginn Star Science – 'Teaching Scientific Enquiry' book. **Practise the skill – Using tables and bar charts** • Use pre-labelled bar chart axes for pupils/groups to add data. • More able: construct own axes • Pupils peer asses bar charts • What makes a good bar chart? List simple success criteria.	http://www.mrnussbaum.com/coolgraphing.htm http://www.amblesideprimary.com/ambleweb//mentalmaths/grapher.html Interactive planning templates Ginn Star Science – 'Teaching Scientific Enquiry' book	Can pupils agree on some basic success criteria? (Level 3) ***Can pupils display findings using tables and bar charts with axes given? (Level 3)*** ***Can pupils create their own tables? (Level 4)***

PLAN ***Plan the method to be used in an investigation, recognising key variables.*** **DEVELOP** Make careful observations and measurements Make comparisons and identify patterns and trends **REFLECT** Suggest how the method could have been improved	**7. Big Question: How can we keep our homes warm?** You may consider allowing pupils to carry out an insulation investigation by testing the effectiveness of different materials in the loft of a doll's house (by placing a datalogger probe inside the house to recording changes in temp. over time). **Introduce the skill – planning and investigation** • Recap on science planning template. Discuss pupils' ideas and model some whole-class examples. **Practise the skill – planning and investigation** • Pupils select a range of everyday materials to 'insulate' the loft in the doll's house. • Make observations using standard equipment and tabulate findings • Discuss findings and discuss patterns and trends. • Can pupils explain findings using any scientific ideas? **To write to inform** **Text type: science write-up/report**	Selections of insulating materials Doll's house or shoe box to model a loft space. Dataloggers Thermometers Interactive planning templates http://www.amblesideprimary.com/ambleweb//mentalmaths/grapher.html	***Can pupils plan with some support? (Level 3)*** ***Can pupils recognise the basic variables in a fair test? (Level 4)*** Can pupils record measurements using simple equipment? (Level 3)
COMMUNICATION ***Communicate clearly by writing, tables and charts, using relevant scientific vocabulary*** **PLAN** Select success criteria **DEVELOP** Distinguish between fact, belief and opinion **REFLECT** Suggest how the method could have been improved	**8. Big Question: Can you use your knowledge of insulating materials to produce an advert promoting home insulation?** Challenge groups to play 'just-a-minute' game where they note their new ideas and vocabulary. Give groups task of creating a promotional advert from the Council to persuade homeowners to insulate their lofts. **Introduce the skill – Communicating using science ideas** • Model examples of success criteria involved in writing leaflets/letters etc. • What science words do pupils need to use? • Do they need to include any data/graphs? • How will they plan the layout of their advert? **Practise the skill – Communicating using science ideas** • Pupils agree/select some basic success criteria • Pupils may follow given format. • More able: allow pupils to select the most appropriate method of presentation, e.g. Powerpoint, letter, poster etc. **To write to inform and explain** **Text type: science write-up/report/letter/email**	Examples of adverts containing scientific claims	Can pupils agree on some basic success criteria? (Level 3) ***Can pupils display findings using tables and bar charts with axes given? (Level 3)*** ***Can pupils create their own tables and use science vocabulary? (Level 4)***

REFLECT ***Describe how they have learned, and identify the ways that worked the best.*** Link the 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? Can pupils create fact cards about magnets? Can pupils add new knowledge to the class learning tree?	Use preferred AfL strategy	***Can pupils say what worked and didn't work? (Level 3)***
Evaluation			