

TITLE: 7C Energy, Fuels and Efficiency

Adaptations from previous MTP (25.26):

Lesson	KS3 Appropriate?	Action
7C.01 Energy Stores	✓	Limit number of stores to – thermal, kinetic, gravitational potential, elastic, chemical.
7C.02 Transferring Energy	✓	No change
7C.03 Power	⚠	Keep conceptual, avoid formulae
7C.04 Dissipation	⚠	Reduce quantitative demand
7C.05 Efficiency	⚠	Remove calculations
7C.06 Comparing Efficiency	✓ / ⚠	Use qualitative comparisons
7C.07 Conduction	✓	No change
7C.08–7C.10 Investigation	✓	No change
7C.11 Radiation	✓	No change
7C.12 Fossil Fuels	✓	No change
7C.13 Renewable Resources	✓	No change
7C.14 Choosing Resources	✓	No change

Unit Overview (Linked to the KS3 Programme of Study)

Students will be taught:

- Energy as a quantity that can be stored and transferred
- Different energy stores and ways energy can be transferred
- The concept of power and how it relates to everyday appliances
- The principle of conservation of energy
- The idea that energy can be dissipated to less useful stores
- How to calculate and compare efficiency
- The transfer of thermal energy by conduction and radiation
- The differences between conductors and insulators
- How scientific investigations can be used to test insulation materials
- The use of fossil fuels and renewable energy resources
- The advantages and disadvantages of different methods of electricity generation
- How evidence can be used to evaluate energy resources in real-world contexts

Prior Learning (KS2)

Students have learnt previously about properties and changes in materials. This has involved:

- Comparing and grouping everyday materials based on their thermal properties.
- Recognising that some materials are better thermal insulators than others.
- Investigating which materials are most suitable for particular purposes.
- Working scientifically to plan simple tests and make observations.
- Using evidence to answer questions such as which materials are best for thermal insulation.

Future Learning (KS4)

At GCSE students will build on their knowledge of energy stores and transfers by studying energy changes quantitatively and applying the law of conservation of energy to a wide range of physical systems. Students will investigate efficiency calculations in greater depth and learn how energy resources are used to meet changing energy demands. They will study national and global energy issues, including the environmental impact of electricity generation, sustainability and climate change. Students will also develop a more detailed understanding of thermal energy transfer, including conduction, convection and radiation, and use mathematical relationships to calculate energy, power and efficiency.

Misconceptions

1. Energy Stores

- Energy is "used up" rather than transferred.
- Energy is a substance that disappears.
- Different types of energy are unrelated.

2. Energy Transfer

- Energy can be created.
- Energy only transfers when something moves.
- Useful energy and wasted energy are different amounts of energy.

3. Power

- Larger appliances are always more efficient.
- Power and energy mean the same thing.
- A higher power rating means lower electricity use.

4. Dissipation and Efficiency

- Dissipated energy is destroyed.
- Inefficient appliances lose energy completely.
- Efficiency can be greater than 100%.

5. Thermal Energy Transfer

- Cold can move between objects.
- Metals create heat.
- Insulators stop energy transfer completely.

6. Energy Resources

- Renewable resources never run out under any circumstances.
- Fossil fuels are formed quickly.
- Renewable energy has no disadvantages.

Practical Requisitions

Mastery (HPA)

Students explain and justify ideas using evidence about energy stores and transfers. They apply their knowledge to unfamiliar situations, analyse energy transfer diagrams and experimental results, evaluate the efficiency of systems and appliances, and make evidence-based judgements about energy resources and sustainability.

7C.01 Energy Stores		HPA Challenge	Skills	EEF Recommendations
Learning Objectives - Identify examples of different energy stores in everyday situations - Describe how energy can be transferred between stores - Explain simple energy changes using energy store diagrams <i>NB. Avoid using the phrase 'energy transfer diagrams' until lesson 7C.02 as this naturally suggests pathways, which are not being taught in 7C.01.</i>		Analyse energy changes in unfamiliar situations and identify the energy stores involved. Apply knowledge of energy stores to explain how everyday objects and systems work.	Working Scientifically WS 1.2 (Models) Use energy store diagrams as scientific models. WS 1.1 (Development of scientific thinking) Understand that energy models help explain processes that cannot be directly observed. WS 3.6 (Explain using evidence) Explain energy changes using scientific knowledge. WS 4.1 (Scientific vocabulary) Use terms such as energy store, transfer, kinetic and thermal accurately. Maths Skills 1c (Classification) Categorise examples into different energy stores 2c (Patterns and relationships) Identify patterns in energy changes.. 4a (Interpretation) Interpret simple energy store diagrams.	EEF 4 (Memory): Retrieve prior learning about materials, heating and insulation. EEF 3 (Modelling): Model how to identify and represent energy stores using diagrams. EEF 6 (Language): Explicit teaching of energy vocabulary and scientific explanations. EEF 7 (Feedback): Feedback used to improve scientific explanations and diagram interpretation.
Do Now (5 mins)	Purpose Activate prior knowledge about heating, fuels and materials whilst identifying misconceptions about energy. Suggested Structure (teacher adapts) - What happens when a torch is switched on? - Name one fuel used in everyday life. - Give one example of something that becomes warm. Diamond (Challenge) - Where does the energy come from when a torch shines? Teacher Uses Responses To - Identify misconceptions about energy. - Establish prior understanding of fuels and heating. - Reveal whether pupils believe energy is created or used up.	Evaluate how useful energy store diagrams are as scientific models for explaining energy changes.		
Hook / Intro (5 mins)	Introduce Key Idea "Energy surrounds us constantly, but it is always stored somewhere before it can be transferred." Suggested Strategy Demonstrate: - A torch turning on. - A bouncing ball. - A wind-up toy moving. Ask: - Where was the energy before the object started moving or working?			

	- Has the energy disappeared? - Can energy be stored in different ways? Pedagogical Rationale This creates curiosity and begins challenging the common misconception that energy is "made" when devices operate.			
Direct Teaching: (10 – 15 mins)	Content: Energy Stores Introduce the main energy stores encountered at KS3: - Chemical energy store - Thermal energy store - Kinetic energy store - Gravitational potential energy store - Elastic energy store Key Idea Energy is stored in different ways and can move between stores. Energy: - Cannot be created. - Cannot be destroyed. - Can only be transferred between stores. Teacher Modelling (EEF 3) Model simple examples: - Torch: Chemical store (battery) → Thermal store (torch) - Person running: Chemical store (food) → Kinetic store (person) - Bouncing ball: Gravitational potential store (ball) → Kinetic store (ball) - A released stretched elastic band: Elastic store (band) → Kinetic store (band) Teacher explicitly models identifying: - Initial store - Final store - The idea that energy has moved between them Check for Understanding (Hinge Point) - Which energy store is found in food? - What energy store increases when a lamp becomes warm? - What energy store does a stretched elastic band have? - Can energy be destroyed?			

	Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported identification and classification. Pupils • Match situations to energy stores. • Sort examples into different store categories. • Complete partially completed energy store diagrams. Teacher Role • Model first examples. • Correct misconceptions immediately. • Reinforce scientific vocabulary.			
Main Task (20 mins)	Core Task Pupils: • Identify the starting and final energy stores in everyday situations. • Complete energy store diagrams. • Explain energy changes using scientific vocabulary. Suggested Contexts • Torch • Bicycle • Kettle • Bouncing ball • Wind-up toy • Food and exercise Teacher Flexibility Teachers select format based on class need: • Card sort • Annotated diagrams • Structured table • Written explanations Success Criteria • Correctly identify energy stores. • Describe energy changes accurately. • Explain that energy is transferred between stores. • Use scientific vocabulary appropriately.			

	Adaptation Prompts If pupils struggle: • Provide energy store word bank. • Use labelled examples. • Provide sentence stems. If secure: • Apply energy stores to unfamiliar situations. • Explain more complex energy changes.			
Support / Diamond (challenge)	Support • Energy store reference sheet. • Energy store diagrams. • Sentence starters. Example: "Energy is transferred from a _____ store to a _____ store." Diamond (Challenge) • Explain the energy changes in an unfamiliar device. • Compare energy transfers in different scenarios. • Evaluate how useful energy store diagrams are for explaining real-life situations.			
Common misconceptions	• Energy is used up. • Energy can be created. • Electricity is an energy store. • Heat is a substance. • Energy disappears when motion stops.			
Assessment (5 mins)	Quick Check Options • Identify an energy store in a given scenario. • Complete an energy store diagram. • Explain how energy changes from one store to another. • Match everyday examples to the correct energy store. Diagnostic Focus Can pupils: • Identify different energy stores? • Describe where energy is stored before and after a change? • Explain that energy is transferred between stores? • Apply the energy store model to unfamiliar situations?			

Exit ticket (5 mins)	Purpose Inform the starting point for Lesson 7C.02. Example Questions • Name two energy stores. • A person begins running. Which energy store decreases and which energy store increases? • Explain why scientists say energy is transferred rather than used up. Teacher uses responses to identify misconceptions before introducing energy transfer pathways.			
Adaptive teaching	• Retrieval identifies prior misconceptions. • Hinge questions determine pacing. • Visual models reduce cognitive load. • Vocabulary explicitly taught and revisited. • Challenge extends application to unfamiliar situations. • Exit ticket informs planning for Lesson 7C.02 Transferring Energy.			
British Values	• Individual Liberty - Students develop independent scientific thinking by using energy store models to explain energy changes in everyday situations. • Democracy - Students share and justify their explanations of energy changes, using evidence and scientific vocabulary to support their ideas. • Mutual Respect - Students listen to, evaluate and build upon the scientific explanations of others during discussion and collaborative activities. These align naturally with the lesson focus on introducing scientific models, discussing ideas about energy, and developing accurate explanations of energy stores.			
Teacher Notes for MTP adaptations				

7C.02 Transferring Energy		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- Identify energy stores and transfer pathways in a range of situations - Describe energy transfers using scientific vocabulary - Explain how energy is transferred in everyday devices and systems	Analyse energy transfers in unfamiliar situations and identify both the energy stores and transfer pathways involved. Apply knowledge of energy transfers to explain how	Working Scientifically WS 1.2 (Models) Use energy transfer diagrams as scientific models. WS 1.1 (Development of Scientific Thinking)	EEF 4 (Memory): Retrieve understanding of energy stores from Lesson 7C.01 before introducing pathways. EEF 3 (Modelling): Model the construction and interpretation of energy
Do Now (5 mins)	Purpose Retrieve knowledge of energy stores and prepare pupils			

	to understand how energy moves between stores. Suggested Structure (teacher adapts) - Name three energy stores. - What energy store is found in food? - What energy store increases when an object becomes warmer? Diamond (Challenge) - A torch contains a battery. What energy store does the battery contain and where might the energy end up? Teacher Uses Responses To - Check understanding of energy stores. - Identify pupils who still think energy is "used up". - Assess readiness for introducing pathways.	everyday devices and systems work. Evaluate how useful energy transfer diagrams are for explaining real-world energy changes.	Understand that energy models help explain processes that cannot be directly observed. WS 3.6 (Explain using evidence) Explain energy changes using scientific knowledge. WS 4.1 (Scientific vocabulary) Use terms such as energy store, pathway, transfer, electrical and mechanical accurately.	transfer diagrams step-by-step. EEF 6 (Language): Explicit teaching of scientific vocabulary including pathway, electrical transfer and radiation. EEF 7 (Feedback): Provide feedback on the accuracy of energy transfer explanations.
Hook / Intro (5 mins)	Introduce Key Idea "If energy moves from one store to another, how does it get there?" Suggested Strategy Display a torch, bicycle and kettle. Ask: - All of these transfer energy, but do they transfer it in the same way? - How does energy get from a battery to a lamp? - How does energy move from food to a moving cyclist? Introduce the idea of transfer pathways. Pedagogical Rationale Builds directly on Lesson 7C.01 and provides a reason for introducing scientific models of energy transfer.		Maths Skills 1c (Classification) Categorise examples according to transfer pathways. 2c (Patterns and Relationships) Identify links between stores and pathways. 4a (Interpretation) Interpret energy transfer diagrams correctly.	
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Transfer Pathways Recap: Energy moves: Energy store → Energy store Introduce the full model: Energy store → Transfer pathway → Energy store Common Transfer Pathways - Electrically - Mechanically			

	• By heating • By radiation 1. Torch: Chemical store (battery) → Electrical pathway → Thermal store (lamp) 2. Cyclist: Chemical store (food) → Mechanical pathway → Kinetic store (cyclist) 3. Kettle: Chemical store (Power station fuel) → Electrical pathway → Thermal store (water) 4. Sun warming the ground: Thermal store (Sun) → Radiation pathway → Thermal store (ground) Key Idea Energy transfers occur through specific pathways. Scientists use these pathways to explain how energy moves between stores. Teacher Modelling (EEF 3) Model a worked example: Battery-powered fan Teacher identifies: 1. Starting store 2. Transfer pathway 3. Final store Then demonstrates how to convert the diagram into a written explanation. Example: “Energy is transferred from the chemical store of the battery through an electrical pathway to the kinetic store of the moving fan.” Check for Understanding (Hinge Point) • What is the transfer pathway in a torch? • Which transfer pathway is used when a person throws a ball? • What is the final store when a kettle heats water? Mini whiteboards / cold calling			
Guided	Task Type			

Practice (10 mins)	Supported interpretation and explanation. Pupils • Match energy transfer diagrams to everyday situations. • Identify stores and pathways. • Complete partially completed diagrams. Example: Chemical store → _____ pathway → Kinetic store Teacher Role • Model first examples. • Reinforce correct use of scientific language. • Correct misconceptions immediately.			
Main Task (20 mins)	Core Task Pupils: • Construct energy transfer diagrams. • Identify stores and pathways. • Explain energy transfers using scientific vocabulary. Suggested Contexts • Torch • Kettle • Bicycle • Speaker • Wind-up toy • Falling object Teacher Flexibility Teachers select format based on class need: • Card sort • Diagram completion • Structured explanation • Energy transfer table Success Criteria • Correctly identify energy stores. • Correctly identify transfer pathways. • Construct accurate energy transfer diagrams. • Explain energy transfers using scientific vocabulary. Adaptation Prompts			

	If pupils struggle: • Provide word banks. • Use partially completed diagrams. • Provide sentence stems. If secure: • Explain multiple energy transfers. • Apply knowledge to unfamiliar situations.			
Support / Diamond (challenge)	Support • Energy stores and pathways reference sheet. • Scaffolded diagrams. • Sentence starters. Example: “Energy is transferred from a _____ store through a _____ pathway to a _____ store.” Diamond (Challenge) • Explain the energy transfers in an unfamiliar device. • Compare energy transfers in different systems. • Evaluate the usefulness of energy transfer diagrams as scientific models.			
Common misconceptions	• Electricity is an energy store. • Pathways and stores are the same thing. • Energy disappears after being transferred. • All energy transfers occur electrically. • Energy can be created during a transfer.			
Assessment (5 mins)	Formative and Summary Quick Check Options • Identify the transfer pathway in a scenario. • Complete an energy transfer diagram. • Explain the energy transfer in an everyday device. Diagnostic Focus Can pupils: • Distinguish between stores and pathways? • Correctly identify pathways? • Explain energy transfers using scientific vocabulary? • Apply the model to unfamiliar situations?			
Exit ticket (5 mins)	Purpose Inform planning for Lesson 7C.03 (Power).			

	Example Questions - Name two energy transfer pathways. - What pathway transfers energy in a kettle? - Complete: Chemical store → _____ Pathway → Thermal store Teacher uses responses to identify misconceptions before introducing power and rates of energy transfer.			
Adaptive teaching	Adaptive Teaching - Retrieval secures understanding of energy stores from Lesson 7C.01. - Hinge questions identify misconceptions about pathways. - Visual models support explanation of abstract concepts. - Explicit vocabulary instruction supports literacy. - Challenge extends application to unfamiliar contexts. - Exit ticket informs planning for Lesson 7C.03.			
British Values	⚖️ Individual Liberty – Students independently identify and explain energy transfers in a range of familiar and unfamiliar situations. ⚖️ Democracy – Students discuss and justify explanations of energy transfers using scientific evidence. ⚖️ Mutual Respect – Students listen to and build upon the scientific ideas and explanations of others.			
Teacher Notes for MTP adaptations				
7C.03 Power		HPA CHALLENGE	Skills	EEF Recommendations
Leaning Objectives	- Describe what is meant by an appliance power rating - Compare the power ratings of different appliances - Explain why appliances with different power ratings transfer energy at different rates	Analyse appliance data to explain why some devices transfer energy more quickly than others.	Working Scientifically WS 1.2 (Models) Use appliance ratings and data as models of energy transfer.	EEF 4 (Memory): Retrieve understanding of energy stores and pathways from previous lessons.
Do Now (5 mins)	Purpose Retrieve knowledge of energy stores and transfer pathways whilst preparing pupils to think about the speed of energy transfers. Suggested Structure (teacher adapts) - Name two energy stores. - Name two transfer pathways.	Apply knowledge of power ratings to everyday situations involving energy use in the home. Evaluate whether a higher power rating always makes an appliance better for a	WS 3.5 (Interpret Data) Analyse and compare power ratings from real-life appliances. WS 3.6 (Explain using Evidence) Use evidence from	EEF 3 (Modelling): Model how to interpret appliance power ratings and compare devices. EEF 6 (Language): Explicit teaching of power, watt, kilowatt and rating.

	- How is energy transferred in a torch? Diamond (Challenge) - Why might a kettle heat water faster than a lamp heats a room? Teacher Uses Responses To - Assess understanding of stores and pathways. - Identify misconceptions about energy transfer. - Introduce the idea that some devices transfer energy faster than others.	particular purpose.	appliance data to explain differences in energy transfer rates.	EEF 7 (Feedback): Provide feedback on interpretation and explanation of data.				
Hook / Intro (5 mins)	Introduce Key Idea “Why does a kettle boil water quickly while a phone charger takes much longer to transfer energy?” Suggested Strategy Display labels or images of: - Kettle (3000 W) - Hairdryer (2000 W) - Phone charger (20 W) Ask: - Which appliance transfers energy most quickly? - What do the numbers mean? - Does a larger number always mean a better appliance? Pedagogical Rationale Introduces the concept of power as the rate of energy transfer through real-world examples familiar to students.		WS 4.1 (Scientific Vocabulary) Use terms such as power, appliance, watt and kilowatt accurately. Maths Skills 1c (Comparisons) Compare numerical power ratings. 2c (Patterns and Relationships) Identify relationships between power and energy transfer rate. 4a (Data Interpretation) Interpret tables and appliance labels.					
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Power Ratings Introduce: Power = how quickly energy is transferred. Explain: - Appliances are given power ratings. - Power is measured in watts (W). - Larger power ratings mean energy is transferred more quickly. Examples <table><tr><th>Appliance</th><th>Power Rating</th></tr><tr><td>LED Lamp</td><td>10 W</td></tr><tr><td>Television</td><td>100 W</td></tr></table>		Appliance		Power Rating	LED Lamp	10 W	Television
Appliance	Power Rating							
LED Lamp	10 W							
Television	100 W							

	<table><tr><td>Microwave</td><td>1000 W</td></tr><tr><td>Kettle</td><td>3000 W</td></tr></table> Key Idea A higher power rating means an appliance transfers more energy each second. However: A higher power rating does not always mean better, as suitability depends on purpose. Teacher Modelling (EEF 3) Model comparison: LED Lamp: 10 W Kettle: 3000 W Explanation: “The kettle transfers energy much faster than the lamp because its power rating is higher.” Model how to interpret appliance data and write scientific explanations. Check for Understanding (Hinge Point) • What does a power rating tell us? • Which appliance transfers energy faster: 50 W or 500 W? • Why would a kettle need a high power rating? Mini whiteboards / cold calling	Microwave	1000 W	Kettle	3000 W			
Microwave	1000 W							
Kettle	3000 W							
Guided Practice (10 mins)	Task Type Supported data interpretation. Pupils • Compare appliance power ratings. • Rank appliances from lowest to highest power. • Explain differences using scientific vocabulary. Teacher Role • Model the first comparison. • Reinforce key terminology. • Address misconceptions immediately.							
Main Task (20 mins)	Core Task Pupils:							

	• Interpret appliance power ratings. • Compare different devices. • Explain why devices have different power ratings. • Decide which appliance is most suitable for particular situations. Suggested Contexts • Kettle vs toaster • Hairdryer vs fan • LED bulb vs traditional bulb • Microwave vs oven Teacher Flexibility Teachers select format based on class need: • Comparison tables • Appliance cards • Data interpretation worksheet • Written explanation task Success Criteria • Describe what a power rating tells us. • Compare power ratings accurately. • Explain differences using scientific vocabulary. • Apply understanding to real-life situations. Adaptation Prompts If pupils struggle: • Provide scaffolded tables. • Highlight numerical comparisons. • Use sentence stems. If secure: • Analyse unfamiliar appliance data. • Evaluate suitability for different purposes.			
Support / Diamond (challenge)	Support • Appliance data sheet. • Vocabulary reference sheet. • Sentence starters. Example: “The _____ has a higher power rating than the _____, so it transfers energy more quickly.” Diamond (Challenge) • Explain why a higher power rating is not always			

	an advantage. • Compare energy transfer rates in unfamiliar appliances. • Evaluate which appliance would be most suitable for a given scenario.			
Common misconceptions	• Power and energy mean the same thing. • A higher power rating always means an appliance is better. • Power tells us how much energy is stored. • Larger appliances are always more powerful.			
Assessment (5 mins)	Formative and Summary Quick Check Options • Define power rating. • Identify the most powerful appliance from a table. • Explain why one appliance transfers energy faster than another. Diagnostic Focus Can pupils: • Interpret appliance ratings? • Link power to energy transfer rate? • Explain comparisons using evidence?			
Exit ticket (5 mins)	Purpose Inform planning for Lesson 7C.04 (Dissipation). Example Questions • What is measured in watts? • Which transfers energy faster: a 100 W appliance or a 1000 W appliance? • Explain what an appliance power rating tells us. Teacher uses responses to identify misconceptions before introducing energy conservation and dissipation.			
Adaptive teaching	• Retrieval secures understanding of stores and pathways. • Hinge questions identify misconceptions about power. • Numerical comparisons support mathematical development. • Data interpretation develops analytical skills. • Challenge promotes evaluation of real-world scenarios. • Exit ticket informs planning for Lesson 7C.04.			
British Values	⌚ Individual Liberty – Students interpret appliance power ratings and make informed decisions about energy use. ⌚ Democracy – Students compare evidence and justify conclusions when discussing appliance performance			

Teacher Notes for MTP adaptations

7C.04 Dissipation		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- State that energy is conserved during transfers - Describe what is meant by energy dissipation - Explain why some energy becomes less useful during energy transfers	Analyse energy transfers in everyday situations and identify where energy is dissipated.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Understand the scientific principle of conservation of energy. WS 1.2 (Models) Use energy transfer diagrams to represent useful and dissipated energy. WS 3.6 (Explain using Evidence) Explain energy dissipation using scientific knowledge. WS 4.1 (Scientific Vocabulary) Use terms such as conserved, dissipated, useful and thermal accurately.	EEF 4 (Memory): Retrieve understanding of energy stores and pathways from previous lessons. EEF 3 (Modelling): Model energy transfer diagrams showing useful and dissipated energy. EEF 6 (Language): Explicit teaching of conservation, dissipation and useful energy. EEF 7 (Feedback): Feedback used to improve explanations of energy transfers.
Do Now (5 mins)	Purpose Retrieve prior learning about energy stores, pathways and power. Suggested Structure (teacher adapts) - Name two energy stores. - Name two energy transfer pathways. - What does a power rating tell us? Diamond (Challenge) - When a lamp is switched on, does all of the energy become light? Teacher Uses Responses To - Assess understanding of energy transfers. - Identify misconceptions about energy being "used up". - Prepare pupils for the concept of dissipation.	Apply the principle of conservation of energy to explain why energy is never lost during transfers. Evaluate why some energy transfers are more useful than others.	Maths Skills 1c (Comparisons) Compare useful and dissipated energy transfers. 2c (Patterns and Relationships) Identify trends in energy transfers. 4a (Interpretation) Interpret simple energy transfer diagrams.	
Hook / Intro (5 mins)	Introduce Key Idea "Where does the energy go when it is not useful?" Suggested Strategy Demonstrate: - A lamp that becomes warm. - A mobile phone charger warming up. - A bicycle brake becoming warm after use. Ask: - Why have these objects become warm? - Was this the intended purpose? - Has the energy disappeared? Pedagogical Rationale Challenges the misconception that energy is lost and introduces the concept of dissipation in a relatable context.			
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Conservation of Energy Introduce: Conservation of Energy Energy cannot be created.			

	• Energy cannot be destroyed. • Energy can only be transferred between stores. Content: Dissipation Introduce: Energy Dissipation • During energy transfers, some energy spreads into the surroundings. • Dissipated energy usually ends up in thermal stores. • Dissipated energy is less useful because it is harder to transfer to where it is needed. Example: Bicycle brakes Useful transfer: Kinetic store decreases Dissipated transfer: Thermal store of brakes increases Key Idea Energy is never lost. Energy becomes less useful because it is dissipated into the surroundings. Teacher Modelling (EEF 3) Model explanation: “The lamp produces light, which is useful. However, it also becomes warm. The energy has not disappeared. It has been dissipated into the thermal store of the surroundings.” Model use of simple energy transfer diagrams showing useful and dissipated transfers. Check for Understanding (Hinge Point) • Can energy be destroyed? • What does dissipated mean? • Where does dissipated energy usually end up? • Why is dissipated energy often described as less useful? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported analysis of energy transfers. Pupils • Identify useful and dissipated energy transfers.			

	- Annotate simple energy diagrams. - Explain where dissipated energy goes. Teacher Role - Model first examples. - Reinforce distinction between useful and dissipated transfers. - Address misconceptions immediately.			
Main Task (20 mins)	Core Task Pupils: - Analyse a range of everyday devices. - Identify useful and dissipated energy transfers. - Explain why energy is conserved. - Describe why some energy becomes less useful. Suggested Contexts - Lamp - Kettle - Mobile phone charger - Bicycle brakes - Loudspeaker Teacher Flexibility Teachers select format based on class need: - Energy transfer diagrams - Annotated images - Scenario cards - Written explanations Success Criteria - State the principle of conservation of energy. - Identify useful and dissipated energy transfers. - Explain where dissipated energy goes. - Use scientific vocabulary accurately. Adaptation Prompts If pupils struggle: - Provide labelled diagrams. - Use structured examples. - Provide sentence stems. If secure: - Analyse unfamiliar scenarios. - Explain why dissipated energy is harder to use.			
Support /	Support			

Diamond (challenge)	- Useful vs dissipated energy examples. - Vocabulary mat. - Sentence starters. Example: “Some energy is useful because it _____. Some energy is dissipated because it _____.” Diamond (Challenge) - Explain why a perfectly efficient device is difficult to achieve. - Analyse energy transfers in unfamiliar systems. - Evaluate whether dissipated energy is ever completely useless.			
Common misconceptions	- Dissipated energy is destroyed. - Energy can disappear. - Useful energy and dissipated energy are different amounts of energy. - Dissipated energy no longer exists. - Energy conservation means saving electricity.			
Assessment (5 mins)	Formative and Summary Quick Check Options - Define dissipation. - Explain the conservation of energy. - Identify useful and dissipated energy transfers in a diagram. Diagnostic Focus Can pupils: - Apply conservation of energy correctly? - Explain where dissipated energy goes? - Distinguish between useful and dissipated transfers? - Use scientific vocabulary accurately?			
Exit ticket (5 mins)	Purpose Inform planning for Lesson 7C.05 (Efficient Devices). Example Questions - What does it mean for energy to be conserved? - What is energy dissipation? - Where does dissipated energy usually end up? Teacher uses responses to identify misconceptions before introducing efficiency.			
Adaptive teaching	Retrieval secures understanding of stores,			

	- pathways and power. - Hinge questions identify misconceptions about energy conservation. - Teacher modelling supports abstract concepts. - Vocabulary explicitly taught and revisited. - Challenge develops deeper reasoning about usefulness of energy. - Exit ticket informs planning for efficiency.			
British Values	⌘ Tolerance – Students consider and refine different explanations for energy transfers using scientific evidence. ⌘ Individual Liberty – Students independently explain and justify how energy becomes dissipated during transfers.			
Teacher Notes for MTP adaptations				

7C.05 Efficient Devices		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- Describe what is meant by an efficient device - Compare the efficiency of different energy transfers using energy diagrams - Explain why some devices are more efficient than others	Analyse energy transfer diagrams to compare the efficiency of different devices.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Understand how efficiency is used to compare devices and systems. WS 1.2 (Models) Use energy transfer diagrams as models to compare energy changes. WS 3.5 (Interpret Data) Interpret information presented in energy diagrams. WS 3.6 (Explain using Evidence) Use evidence from diagrams to explain efficiency. WS 4.1 (Scientific Vocabulary) Use terms such as efficiency, useful, dissipated and transfer accurately.	EEF 4 (Memory): Retrieve understanding of conservation of energy and dissipation from Lesson 7C.04. EEF 3 (Modelling): Model how to interpret energy diagrams and compare efficiency qualitatively. EEF 6 (Language): Explicit teaching of efficiency vocabulary and scientific explanations. EEF 7 (Feedback): Feedback used to improve evaluation and comparison skills.
Do Now (5 mins)	Purpose Retrieve knowledge of energy conservation and dissipation. Suggested Structure (teacher adapts) - What is meant by energy conservation? - What is energy dissipation? - Where does dissipated energy normally end up? Diamond (Challenge) - If two appliances perform the same task, why might one waste less energy than the other? Teacher Uses Responses To - Assess understanding of useful and dissipated energy. - Identify misconceptions before introducing efficiency. - Link previous learning to the concept of efficient energy transfers.	Apply knowledge of energy transfers to explain why some appliances are more efficient than others. Evaluate whether the most efficient device is always the best choice for a particular purpose.		
Hook / Intro (5 mins)	Introduce Key Idea “Why do some devices waste less energy than others?” Suggested Strategy Show images of: - An LED light bulb - A traditional filament bulb Ask: - Which would be better for lighting a room? - Which might waste more energy? - Why? Pedagogical Rationale Provides an authentic context for discussing efficiency and encourages students to think about useful and wasted energy.		Maths Skills 1c (Comparisons) Compare useful and dissipated energy transfers. 2c (Patterns and Relationships) Identify relationships between efficiency and energy dissipation. 4a (Interpretation) Interpret information from energy transfer diagrams.	
Direct Teaching: Cell	Content: Efficiency Introduce:			

Structure (10 – 15 mins)	Efficient Device A device is efficient if a large proportion of the energy transferred is useful. Key Idea All devices transfer energy. Some transfers are useful. Some energy becomes dissipated into the surroundings. More efficient devices: • Transfer a greater proportion of energy usefully. • Dissipate less energy. Example: Kettle Energy transfer diagram: Electrical energy transfer Useful – thermal energy in the water Dissipated – Thermal energy to the surroundings Teacher Modelling (EEF 3) Compare two devices: Device A • Large useful transfer • Small dissipated transfer Device B • Smaller useful transfer • Larger dissipated transfer Model explanation: “Device A is more efficient because more of the energy transferred is useful, while less is dissipated to the surroundings.” Check for Understanding (Hinge Point) • What is meant by an efficient device? • Which device is more efficient: one that dissipates a lot of energy or a little energy? • Why is an LED lamp more efficient than a filament lamp? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported comparison and interpretation.			

	Pupils • Compare energy transfer diagrams. • Identify useful and dissipated transfers. • Decide which device is more efficient. Teacher Role • Model first comparisons. • Reinforce scientific language. • Support pupils in justifying decisions.			
Main Task (20 mins)	Core Task Pupils: • Interpret energy transfer diagrams. • Compare the efficiency of different devices. • Explain why some devices are more efficient. • Evaluate which appliance would be preferable in different situations. Suggested Contexts • LED bulb vs filament bulb • Electric heater • Kettle • Hairdryer • Mobile phone charger Teacher Flexibility Teachers select format based on class need: • Comparison tables • Annotated diagrams • Appliance evaluation cards • Written explanations Success Criteria • Describe what efficiency means. • Identify useful and dissipated energy transfers. • Compare devices using evidence. • Explain why one device may be more efficient than another. Adaptation Prompts If pupils struggle: • Provide labelled diagrams. • Highlight useful and dissipated transfers using colour coding. • Provide sentence stems.			

	If secure: • Compare multiple devices. • Evaluate efficiency in unfamiliar contexts. • Consider trade-offs when selecting appliances.			
Support / Diamond (challenge)	Support • Energy transfer diagrams. • Vocabulary mat. • Comparison scaffold. Example: “This device is more efficient because more energy is transferred _____ and less energy is dissipated as _____.” Diamond (Challenge) • Explain why 100% efficiency is difficult to achieve. • Evaluate whether the most efficient appliance is always the best choice. • Compare efficiency in unfamiliar systems.			
Common misconceptions	• Efficiency means using less energy overall. • Dissipated energy disappears. • Efficient devices do not dissipate any energy. • A device with a higher power rating is always more efficient. • Efficiency and power are the same thing.			
Assessment (5 mins)	Formative and Summary Quick Check Options • Define efficiency. • Identify the most efficient device from a diagram. • Explain why a device is efficient. • Diagnostic Focus Can pupils: • Describe efficiency accurately? • Compare devices using evidence? • Explain the relationship between efficiency and dissipation? • Apply knowledge to unfamiliar examples?			
Exit ticket (5 mins)	Purpose Inform planning for Lesson 7C.06 (Comparing Efficiency).			

	Example Questions • What is meant by an efficient device? • Why are efficient devices desirable? • How is energy dissipation linked to efficiency? Teacher uses responses to identify misconceptions before pupils evaluate appliances in the next lesson.			
Adaptive teaching	• Retrieval secures understanding of conservation and dissipation. • Hinge questions identify misconceptions about efficiency. • Teacher modelling develops comparison and explanation skills. • Visual diagrams reduce cognitive load. • Challenge develops evaluation and decision-making. • Exit ticket informs planning for Lesson 7C.06.			
British Values	⌵ Individual Liberty – Students evaluate the efficiency of devices and justify decisions using scientific evidence. ⌵ Democracy – Students discuss and defend different viewpoints when comparing appliances and energy use.			
Teacher Notes for MTP adaptations				

7C.06 Comparing Efficiency		HPA Challenge	Skills	EEF Recommendations						
Leaning Objectives	- Compare the efficiency of a range of household appliances - Explain how efficiency affects energy use in the home - Evaluate the suitability of different appliances using evidence provided	Analyse information about different appliances to determine which is most efficient. Apply knowledge of efficiency to recommend appliances for different household situations. Evaluate whether the most efficient appliance is always the most suitable choice.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Use evidence to make informed decisions about energy use. WS 3.5 (Interpret Data) Compare efficiency information from tables, diagrams and product information. WS 3.6 (Explain using Evidence) Justify decisions using evidence about useful and dissipated energy transfers. WS 3.7 (Evaluation) Evaluate competing solutions and reach evidence-based conclusions. WS 4.1 (Scientific Vocabulary) Use terms such as efficiency, dissipated, transfer, appliance and suitable accurately.	EEF 4 (Memory): Retrieve understanding of efficiency and energy dissipation from Lesson 7C.05. EEF 3 (Modelling): Model how to compare appliances and justify choices using evidence. EEF 6 (Language): Explicit teaching of evaluative language including efficient, suitable, advantage and disadvantage. EEF 7 (Feedback): Feedback used to improve evaluation and justification skills.						
Do Now (5 mins)	Purpose Retrieve understanding of efficiency and prepare pupils for evidence-based evaluation. Suggested Structure (teacher adapts) - What is meant by an efficient device? - Why do appliances dissipate energy? - Why are efficient devices desirable? Diamond (Challenge) - Can two appliances perform the same task but have different efficiencies? Teacher Uses Responses To - Assess understanding of efficiency. - Identify misconceptions about power and efficiency. - Prepare pupils for comparing real-world examples.									
Hook / Intro (5 mins)	Introduce Key Idea “If you were buying a new appliance, how would you decide which one to choose?” Suggested Strategy Display two light bulbs: <table border="1"><thead><tr><th>Bulb A</th><th>Bulb B</th></tr></thead><tbody><tr><td>Cheaper</td><td>More expensive</td></tr><tr><td>Less efficient</td><td>More efficient</td></tr></tbody></table> Ask: - Which bulb would you buy? - Is the cheapest option always best? - Is the most efficient option always the best choice? Pedagogical Rationale Introduces evaluation and decision-making using	Bulb A	Bulb B	Cheaper	More expensive	Less efficient	More efficient		Maths Skills 1c (Comparisons) Compare the efficiency of different appliances. 2c (Patterns and Relationships) Identify links between efficiency and energy use. 4a (Interpretation) Interpret appliance data and energy information.	
Bulb A	Bulb B									
Cheaper	More expensive									
Less efficient	More efficient									

	authentic contexts that pupils recognise.			
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Comparing Efficiency Recap: • Efficient devices transfer a greater proportion of energy usefully. • Less efficient devices dissipate more energy. Key Idea When choosing appliances, people often consider: • Efficiency • Purpose • Cost • Energy use • Environmental impact Example Appliance A • High efficiency • Higher purchase cost Appliance B • Lower efficiency • Lower purchase cost Discuss: • Which may be better in different situations? • Why might people make different choices? Teacher Modelling (EEF 3) Model an evaluation: LED bulb • More efficient • Less energy dissipated • More expensive initially Filament bulb • Less efficient • More energy dissipated • Cheaper initially Model a scientific conclusion: “The LED bulb is more suitable because it transfers more energy usefully and wastes less energy, even			

	though it costs more to buy.” Check for Understanding (Hinge Point) • Which appliance is likely to waste less energy? • Why might a more efficient appliance be preferable? • Can the cheapest appliance still be the best choice? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported comparison and evaluation. Pupils • Compare appliance information. • Identify advantages and disadvantages. • Justify appliance choices. Teacher Role • Model the first comparison. • Reinforce justification using evidence. • Develop appropriate evaluative language.			
Main Task (20 mins)	Core Task Pupils: • Compare a range of household appliances. • Identify the most and least efficient options. • Explain how efficiency affects energy use. • Evaluate which appliance would be most suitable for different households. Suggested Contexts • Light bulbs • Kettles • Heaters • Refrigerators • Televisions Teacher Flexibility Teachers select format based on class need: • Decision-making task • Appliance comparison table • Scenario cards • Structured written evaluation Success Criteria • Compare appliances using evidence. • Explain how efficiency affects energy use.			

	- Evaluate options using scientific reasoning. - Justify conclusions clearly. Adaptation Prompts If pupils struggle: - Provide comparison tables. - Highlight key pieces of evidence. - Use sentence starters. If secure: - Consider multiple factors when evaluating. - Explain trade-offs between cost and efficiency. - Evaluate unfamiliar appliance data.			
Support / Diamond (challenge)	Support - Appliance information sheet. - Comparison scaffold. - Evaluation sentence stems. Example: “This appliance is more suitable because _____. ” “Although this appliance _____, it also _____.” Diamond (Challenge) - Evaluate whether the most efficient appliance is always the best choice. - Justify recommendations for different households. - Consider environmental and financial impacts when making decisions.			
Common misconceptions	- The most expensive appliance is always the most efficient. - Higher power ratings mean greater efficiency. - Efficient appliances do not dissipate energy. - There is always one correct appliance choice. - Efficiency is the only factor people should consider.			
Assessment (5 mins)	Formative and Summary Quick Check Options - Identify the most efficient appliance from a table. - Explain why an appliance may be suitable. - Justify a recommendation using evidence. Diagnostic Focus			

	Can pupils: • Compare efficiency using evidence? • Explain the impact of efficiency on energy use? • Evaluate options rather than simply describe them? • Justify decisions scientifically?			
Exit ticket (5 mins)	Purpose Inform planning for Lesson 7C.07 (Transferring Energy by Conduction). Example Questions • Why are efficient appliances desirable? • What evidence would you use when comparing appliances? • Explain why the most efficient appliance may not always be chosen. Teacher uses responses to assess evaluation skills before moving into thermal energy transfer.			
Adaptive teaching	• Retrieval secures understanding of efficiency. • Hinge questions identify misconceptions about appliance choice. • Modelling develops evaluative thinking. • Structured comparisons reduce cognitive load. • Challenge develops justification and evidence-based reasoning. • Exit ticket informs progression to thermal energy transfer.			
British Values	⌘ Democracy – Students use evidence to discuss and justify different appliance choices. ⌘ Individual Liberty – Students make informed decisions about energy use and appliance selection. ⌘ Mutual Respect – Students consider and evaluate the viewpoints of others when discussing recommendations.			
Teacher Notes for MTP adaptations				
7C.07 Transferring Energy by Conduction		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	• Describe how thermal energy can be transferred by conduction • Explain why gases do not conduct thermal energy very well • Explain what is meant by thermal equilibrium	Analyse how conduction occurs in different materials using the particle model. Apply knowledge of	Working Scientifically WS 1.1 (Development of Scientific Thinking) Use particle theory to explain	EEF 4 (Memory): Retrieve prior learning from 7B Particle Theory and previous energy lessons.

Do Now (5 mins)	Purpose Retrieve prior learning about particles and energy transfers before introducing conduction. Suggested Structure (teacher adapts) - Describe the particles in a solid. - What happens to particles when they are heated? - Give one example of an energy transfer. Diamond (Challenge) - Why does a metal spoon become hot when left in a cup of hot tea? Teacher Uses Responses To - Assess understanding of particle theory. - Identify misconceptions about heat and temperature. - Establish links between particles and energy transfer.	conduction to explain everyday situations involving heat transfer. Evaluate why some materials are better thermal conductors than others.	thermal energy transfer. WS 1.2 (Models) Apply the particle model to conduction and thermal equilibrium. WS 3.6 (Explain using Evidence) Explain thermal energy transfer using scientific reasoning. WS 4.1 (Scientific Vocabulary) Use terms such as conduction, conductor, insulator and thermal equilibrium accurately. Maths Skills 1c (Comparisons) Compare conducting and insulating materials. 2c (Patterns and Relationships) Identify relationships between particle arrangement and heat transfer. 4a (Interpretation) Interpret diagrams showing thermal energy transfer.	EEF 3 (Modelling): Model conduction using particle diagrams and animations. EEF 6 (Language): Explicit teaching of key terminology including conduction, conductor, insulator and thermal equilibrium. EEF 7 (Feedback): Provide feedback on explanations linking particle behaviour to thermal energy transfer.
Hook / Intro (5 mins)	Introduce Key Idea "Why does one end of a metal rod become hot even when only one end is heated?" Suggested Strategy Demonstrate: - A metal spoon in hot water. - A metal rod heated at one end (or video demonstration). Ask: - Why does the heat spread? - How can energy move through a solid if the particles cannot move from place to place? Pedagogical Rationale Creates curiosity and allows pupils to apply their particle model understanding to a new phenomenon.			
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Conduction Introduce: Conduction is the transfer of thermal energy through particles in a material. Explain using solids: Particles in solids are closely packed.			

- Heated particles vibrate more.
- Vibrations are passed between neighbouring particles.
- Thermal energy moves through the material.

Particle Model Explanation

When one end of a metal bar is heated:

1. Particles gain energy.
2. Particles vibrate faster.
3. Energy is transferred to nearby particles.
4. Thermal energy spreads through the material.

Conductors and Insulators

Introduce:

Conductors

- Transfer thermal energy easily.
- Usually metals.

Insulators

- Transfer thermal energy slowly.
- Often contain trapped air.

Examples:

Conductors	Insulators
Copper	Wool
Aluminium	Polystyrene
Steel	Foam

Why Gases Are Poor Conductors

Explain:

- Gas particles are far apart.
- Fewer collisions occur between particles.
- Thermal energy is transferred less effectively.

Thermal Equilibrium

Introduce:

Thermal Equilibrium

When two objects reach the same temperature and there is no overall transfer of thermal energy between them.

	Example: - A hot drink left in a room eventually reaches the temperature of the room. Teacher Modelling (EEF 3) Model a particle diagram showing: - Heating at one end. - Increased vibration. - Energy transfer through neighbouring particles. Model explanation: “The particles do not travel along the metal. Instead, they transfer energy through collisions and vibrations.” Check for Understanding (Hinge Point) - What is conduction? - Why are metals good conductors? - Why do gases conduct thermal energy poorly? - What is thermal equilibrium? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported explanation and application. Pupils - Annotate particle diagrams. - Label conductors and insulators. - Explain conduction using sentence stems. Teacher Role - Model first examples. - Reinforce correct particle-language explanations. - Address misconceptions immediately.			
Main Task (20 mins)	Core Task Pupils: - Explain conduction using the particle model. - Compare conductors and insulators. - Explain why gases are poor conductors. - Apply understanding to everyday contexts. Suggested Contexts - Saucepan handles - Hot drinks - Insulated jackets - House insulation			

	• Metal spoons in hot liquids Teacher Flexibility Teachers select format based on class need: • Diagram annotation • Structured explanation • Comparison table • Everyday application task Success Criteria • Define conduction accurately. • Explain conduction using the particle model. • Explain why gases are poor conductors. • Describe thermal equilibrium. • Use scientific vocabulary correctly. Adaptation Prompts If pupils struggle: • Provide labelled particle diagrams. • Use sentence starters. • Highlight key vocabulary. If secure: • Apply particle theory to unfamiliar materials. • Explain why insulation materials contain trapped air. • Compare different materials using scientific reasoning.			
Support / Diamond (challenge)	Support • Particle model diagrams. • Vocabulary mat. • Conduction explanation scaffold. Example: “Particles gain energy and vibrate more. This energy is transferred to nearby particles by _____. ” Diamond (Challenge) • Explain why vacuum flasks reduce energy transfer. • Evaluate why metals are useful in some situations and unsuitable in others. • Apply particle theory to explain unfamiliar examples of conduction.			
Common misconceptions	Common Misconceptions • Heat is a substance that flows between objects.			

	• Particles move along the solid during conduction. • Metals create heat. • Gases contain no particles. • Thermal equilibrium means energy transfer has stopped completely.			
Assessment (5 mins)	Formative and Summary Quick Check Options • Define conduction. • Explain why metals conduct thermal energy well. • Describe thermal equilibrium. • Complete a particle-model explanation. Diagnostic Focus Can pupils: • Apply particle theory to conduction? • Explain why gases are poor conductors? • Distinguish conductors from insulators? • Use scientific vocabulary accurately?			
Exit ticket (5 mins)	Purpose Inform planning for Lesson 7C.08 (Investigating Insulators: Planning). Example Questions • What is conduction? • Why are gases poor thermal conductors? • What is thermal equilibrium? Teacher uses responses to identify misconceptions before pupils begin planning an insulation investigation.			
Adaptive teaching	• Retrieval strengthens links with particle theory. • Hinge questions identify misconceptions about heat and particles. • Diagrams reduce cognitive load when explaining conduction. • Explicit vocabulary instruction supports scientific literacy. • Challenge develops application of particle theory. • Exit ticket informs planning for the insulation investigation.			
British Values	⌘ Individual Liberty – Students independently apply particle theory to explain thermal energy transfer. ⌘ Tolerance – Students refine scientific explanations using evidence and discussion, recognising that understanding develops through testing ideas.			

Teacher Notes for MTP adaptations

7C.08 Investigating Insulators (Planning)		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- Identify independent, dependent and control variables in a scientific investigation - Design a valid investigation to determine which material is the best insulator - Justify decisions made when planning an investigation	Evaluate different methods for investigating insulation and determine which would produce the most reliable results.	Working Scientifically WS 2.1 (Scientific Attitudes) Pay attention to objectivity and evidence when planning investigations. WS 2.2 (Experimental Skills and Strategies) Identify variables and plan fair tests. WS 2.3 (Risk) Recognise hazards and work safely. WS 3.7 (Evaluation) Consider reliability, accuracy and improvements during planning. WS 4.1 (Scientific Vocabulary) Use terms such as independent variable, dependent variable, control variable, fair test and insulator accurately.	EEF 4 (Memory): Retrieve understanding of conduction, conductors and insulators from Lesson 7C.07. EEF 3 (Modelling): Model how to identify variables and construct a valid method. EEF 5 (Practical Work): Practical planning explicitly linked to scientific understanding of insulation. EEF 6 (Language): Explicit teaching of investigative vocabulary. EEF 7 (Feedback): Feedback used to refine methods before practical work.
Do Now (5 mins)	Purpose Retrieve prior learning about conduction and insulation before planning an investigation. Suggested Structure (teacher adapts) - What is conduction? - Why are gases poor conductors of thermal energy? - What is an insulator? Diamond (Challenge) - Why might some materials keep a cup of tea warmer for longer than others? Teacher Uses Responses To - Assess understanding of thermal energy transfer. - Identify misconceptions about insulators. - Prepare pupils for designing an investigation.	Justify the choice of variables, equipment and method using scientific reasoning. Predict how different materials will affect thermal energy transfer and explain your reasoning.		
Hook / Intro (5 mins)	Introduce Key Idea “How could we scientifically prove which material makes the best insulator?” Suggested Strategy Show a selection of materials: - Bubble wrap - Cotton wool - Foam - Aluminium foil - Fabric Ask: - Which do you think is the best insulator? - How could we test that fairly? - Would everyone's method produce the same result? Pedagogical Rationale		Maths Skills 1c (Classification) Identify and classify variables. 2c (Patterns and Relationships) Predict possible relationships between variables. 4a (Interpretation) Interpret experimental plans and tables.	

	Students quickly realise that opinions are not enough and that a scientific method is needed to collect evidence.			
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Fair Testing Introduce the purpose of the investigation: <i>To determine which material is the most effective thermal insulator.</i> Variables Independent Variable The factor changed deliberately. Example: - Type of insulating material Dependent Variable The factor measured. Example: - Temperature decrease of water Control Variables Factors kept the same. Examples: - Starting temperature - Volume of water - Time allowed for cooling - Type of container Key Idea A fair test changes only one variable. This allows scientists to determine which factor caused any differences observed. Teacher Modelling (EEF 3) Model the planning process. Question: Which material is the best insulator? Teacher identifies:			

	<table><tr><th>Variable Type</th><th>Example</th></tr><tr><td>Independent</td><td>Material used</td></tr><tr><td>Dependent</td><td>Final temperature</td></tr><tr><td>Control</td><td>Starting temperature, volume, time</td></tr></table> Then model a simple method. Check for Understanding (Hinge Point) • What is the independent variable? • What should be measured? • Why must control variables be kept the same? • What would make the investigation unfair? Mini whiteboards / cold calling	Variable Type	Example	Independent	Material used	Dependent	Final temperature	Control	Starting temperature, volume, time			
Variable Type	Example											
Independent	Material used											
Dependent	Final temperature											
Control	Starting temperature, volume, time											
Guided Practice (10 mins)	Task Type Supported variable identification and planning. Pupils • Identify variables in example investigations. • Complete planning templates. • Discuss how to ensure a fair test. Teacher Role • Model first example. • Check variable identification. • Reinforce fair-testing principles.											
Main Task (20 mins)	Core Task Pupils: • Plan an investigation into insulating materials. • Identify variables. • Produce a method. • Explain how reliability and fairness will be maintained. Suggested Context Investigating which material best reduces thermal energy transfer from hot water. Teacher Flexibility Teachers select format based on class need: • Structured planning sheet. • Group planning task. • Method sequencing activity. • Independent written plan.											

	Success Criteria • Correctly identify all variables. • Design a fair test. • Produce a logical method. • Use scientific vocabulary accurately. • Justify planning decisions. Adaptation Prompts If pupils struggle • Provide planning framework. • Use partially completed method. • Highlight variable types. If secure • Justify choices in detail. • Consider reliability and repeat measurements. • Suggest improvements before practical work begins. •			
Support / Diamond (challenge)	Support / Diamond (Challenge) Support • Variable identification guide. • Planning scaffold. • Vocabulary mat. Example sentence stems: “The independent variable is _____.” “To make the investigation fair I will keep _____ the same.” Diamond (Challenge) • Evaluate two alternative methods and identify the stronger design. • Explain how repeat readings improve reliability. • Predict results and justify predictions using knowledge of conduction and insulation.			
Common misconceptions	• A fair test means all variables are changed. • The independent variable is what is measured. • Control variables do not matter. • One result is enough to draw a conclusion. • The material expected to work best does not need testing.			
Assessment (5 mins)	Formative and Summary Quick Check Options			

	- Identify variables from an investigation. - Explain why a control variable is important. - Spot flaws in a method. Diagnostic Focus Can pupils: - Identify all three variable types? - Explain the purpose of a fair test? - Design a valid method? - Use scientific vocabulary accurately?			
Exit ticket (5 mins)	Purpose Inform planning for Lesson 7C.09 (Investigating Insulators: Results) Example Questions - What is an independent variable? - Why are control variables important? - How can reliability be improved? Teacher uses responses to check readiness for practical work.			
Adaptive teaching	- Retrieval links particle theory, conduction and insulation. - Hinge questions identify misconceptions about variables. - Planning scaffold supports less confident learners. - Extension encourages evaluation of scientific methods. - Feedback improves investigation design before data collection. - Exit ticket informs preparation for the practical lesson.			
British Vales	⌘ Rule of Law – Students follow the principles of fair testing and scientific enquiry when planning investigations. ⌘ Democracy – Students discuss, justify and refine methods using scientific evidence. ⌘ Mutual Respect – Students value the ideas and contributions of others when designing investigations.			
Teacher Notes for MTP adaptations				

7C.09 Investigating Insulators (Results)		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- Follow a method safely to investigate thermal insulation - Collect and record data accurately	Evaluate the quality of data collected during the investigation.	Working Scientifically WS 2.1 (Scientific Attitudes)	EEF 5 (Practical Work): Practical activities explicitly linked to scientific

	Present results appropriately			
Do Now (5 mins)	Purpose Retrieve understanding of insulation, conduction and planning investigations before carrying out practical work. Suggested Structure (teacher adapts) - What is an insulator? - What is the dependent variable in our investigation? - Why do we need control variables? Diamond (Challenge) - Why should we repeat measurements during an investigation? Teacher Uses Responses To - Assess understanding of fair testing. - Check readiness for practical work. - Address misconceptions about variables and reliability.	Apply knowledge of thermal energy transfer to predict which material will be the most effective insulator. Explain how reliability can be improved when collecting experimental results.	Make objective observations and collect evidence systematically. WS 2.2 (Experimental Skills and Strategies) Follow a method accurately and safely. WS 2.3 (Risk) Identify hazards and use equipment safely. WS 3.1 (Recording Data) Record observations and measurements appropriately. WS 3.2 (Presenting Data) Construct suitable results tables. WS 4.1 (Scientific Vocabulary) Use terms such as insulator, conductor, results, observation and reliability accurately. Maths Skills 1c (Classification) Organise results systematically. 2c (Patterns and Relationships) Identify patterns in collected data. 4a (Data Interpretation) Read and record measurements accurately.	understanding of insulation and thermal energy transfer. EEF 3 (Modelling): Model how to record results accurately and consistently. EEF 6 (Language): Explicit teaching of key practical vocabulary. EEF 7 (Feedback): Feedback used to improve accuracy of data collection and recording.
Hook / Intro (5 mins)	Introduce Key Idea “Scientists collect evidence before reaching conclusions.” Suggested Strategy Display the insulating materials selected during the planning lesson. Ask: - Which material do you think will be the best insulator? - How can we collect reliable evidence to test this prediction? - Why should scientists avoid guessing? Pedagogical Rationale Reinforces the importance of evidence-based science and links directly to the planning completed in Lesson 7C.08.			
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Collecting Reliable Results Recap: - Independent variable = insulating material - Dependent variable = temperature change - Control variables = factors kept the same			

	Key Idea Good scientific investigations require: • Accurate measurements • Consistent methods • Careful observations • Reliable recording of data Recording Results Discuss: • Why tables are useful • How to label columns correctly • Why units must be included Example: <table><tr><th>Material</th><th>Starting Temperature (°C)</th><th>Final Temperature (°C)</th><th>Temperature Change (°C)</th></tr><tr><td></td><td></td><td></td><td></td></tr></table> Teacher Modelling (EEF 3) Model: • Taking a temperature reading • Recording results accurately • Entering data into a results table • Recognising anomalous or unexpected results Check for Understanding (Hinge Point) • Why do all groups need the same starting temperature? • Why should measurements be recorded carefully? • What makes a result reliable? • Why are tables useful? Mini whiteboards / cold calling	Material	Starting Temperature (°C)	Final Temperature (°C)	Temperature Change (°C)							
Material	Starting Temperature (°C)	Final Temperature (°C)	Temperature Change (°C)									
Guided Practice (10 mins)	Task Type Practical preparation and data recording. Pupils • Set up equipment correctly. • Prepare results tables. • Practise taking measurements. Teacher Role • Check equipment setup. • Verify variable control. • Monitor recording procedures.											

Main Task (20 mins)	Core Task Pupils: • Carry out the insulation investigation safely. • Measure temperature changes. • Record results accurately. • Observe patterns and trends. Suggested Investigation Determine which material best reduces thermal energy transfer from hot water. Materials might include: • Cotton wool • Bubble wrap • Fabric • Foam • Aluminium foil Teacher Flexibility Teachers select format according to available equipment: • Full practical investigation • Circus-style practical stations • Teacher demonstration with class data collection • Shared class dataset if required Success Criteria • Follow the method safely. • Record results accurately. • Use correct units. • Complete a results table appropriately. • Collect sufficient evidence for analysis. Adaptation Prompts If pupils struggle • Provide scaffolded results tables. • Support with temperature reading. • Use teacher checkpoints. If secure • Repeat measurements independently. • Identify possible anomalies. • Consider reliability while collecting data.			
Support /	Support			

Diamond (challenge)	• Practical checklist. • Results table template. • Equipment guide. Sentence stems: “The temperature changed by _____. ” “The material appears to be a good insulator because _____. ” Diamond (Challenge) • Suggest ways to improve reliability during data collection. • Identify potential sources of error. • Predict the outcome before analysing results.			
Common misconceptions	• One measurement is enough to draw a conclusion. • Equipment always gives exact readings. • Recording results is less important than collecting them. • An unexpected result is always wrong. • Fair tests no longer matter once the practical has started.			
Assessment (5 mins)	Formative and Summary Quick Check Options • Check a completed results table. • Identify a control variable. • Explain why repeat measurements are useful. Diagnostic Focus Can pupils: • Follow a method accurately? • Record results correctly? • Use units appropriately? • Recognise the importance of reliable data?			
Exit ticket (5 mins)	Purpose Prepare students for Lesson 7C.10 (Analysis). Example Questions • Which material appeared to be the best insulator? • Why should scientists record results carefully? • What makes a set of results reliable? Teacher uses responses to assess readiness for data			

	analysis.			
Adaptive teaching	• Retrieval links planning and conduction concepts. • Hinge questions identify misconceptions before practical work begins. • Teacher modelling reduces errors during data collection. • Practical scaffolds support less confident learners. • Challenge encourages thinking about reliability and evidence quality. • Exit ticket informs planning for analysis and evaluation.			
British Vales	• Rule of Law – Students follow agreed practical procedures and safety expectations when carrying out an investigation. • Mutual Respect – Students work collaboratively and value the contributions of others when collecting evidence. • Democracy – Students discuss observations and share evidence to support conclusions.			
Teacher Notes for MTP adaptations				

7C.10 Investigating Insulators (Analysis)		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- Analyse the data to identify the most effective insulator - Explain the results of the investigation using scientific knowledge - Evaluate the quality of the investigation and suggest improvements	Analyse patterns in data to determine which material is the most effective insulator. Apply knowledge of conduction and particle theory to explain the results obtained. Evaluate the reliability of the investigation and justify improvements that could increase confidence in the conclusions.	Working Scientifically WS 3.3 (Analysing Data) Identify patterns and trends in data. WS 3.5 (Interpret Data) Draw conclusions from evidence collected. WS 3.6 (Explain using Evidence) Explain results using scientific knowledge. WS 3.7 (Evaluation) Evaluate methods and suggest improvements. WS 4.1 (Scientific Vocabulary) Use terms such as insulator, conduction, reliability, conclusion and uncertainty accurately. Maths Skills 1c (Classification) Rank materials according to insulating effectiveness. 2c (Patterns and Relationships) Identify relationships between materials and temperature change. 4a (Data Interpretation) Interpret tables, graphs and experimental results.	EEF 4 (Memory): Retrieve understanding of conduction, insulation and particle theory before interpreting results. EEF 3 (Modelling): Model how to move from results to conclusions and evaluation. EEF 5 (Practical Work): Practical work linked explicitly to scientific explanations. EEF 6 (Language): Explicit teaching of analysis and evaluation vocabulary. EEF 7 (Feedback): Feedback improves the quality of scientific conclusions and evaluations.
Do Now (5 mins)	Purpose Retrieve understanding of insulation and remind pupils of the investigation completed in Lesson 7C.09. Suggested Structure (teacher adapts) - What is an insulator? - Why are gases poor conductors? - Why did we keep control variables the same? Diamond (Challenge) - What evidence would allow us to decide which material was the best insulator? Teacher Uses Responses To - Assess understanding of the investigation. - Identify misconceptions about fair testing. - Prepare pupils to interpret data.			
Hook / Intro (5 mins)	Introduce Key Idea “Collecting results is only useful if we can turn them into evidence.” Suggested Strategy Display a set of results from the investigation. Ask: - Which material appears to be the best insulator? - How do you know? - Can we justify that conclusion using evidence? Pedagogical Rationale Highlights the difference between collecting data and analysing data.			
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Analysing Data Explain: Scientists analyse results by: - Looking for patterns. - Comparing results.			

- Identifying anomalies.
- Using evidence to reach conclusions.

Example Data

Material	Temperature Change (°C)
Cotton Wool	8
Bubble Wrap	10
Foam	6
Aluminium Foil	14

Teacher asks:

- Which material reduced thermal energy transfer most effectively?
- Which material was the least effective?

Drawing Conclusions

Model:

“Foam was the best insulator because it had the smallest temperature decrease and therefore transferred the least thermal energy.”

Explaining Results Scientifically

Link back to previous learning:

- Insulators reduce thermal energy transfer.
- Many insulators contain trapped air.
- Gas particles are far apart and transfer thermal energy less effectively.

Model:

“Foam contains trapped air. Because gas particles are spread out, conduction occurs more slowly, reducing thermal energy transfer.”

Evaluation

Introduce:

Good scientists evaluate investigations by considering:

- Reliability
- Accuracy
- Fairness
- Improvements

Examples:

- Repeat measurements

	• Larger sample sizes • More accurate equipment • Better control of variables Teacher Modelling (EEF 3) Model the full sequence: Results → Conclusion → Scientific Explanation → Evaluation Example: “Foam was the best insulator. This is because it reduced temperature change the most. Foam contains trapped air, which is a poor conductor. Reliability could be improved by repeating the investigation more times.” Check for Understanding (Hinge Point) • Which result provides evidence for your conclusion? • What makes an investigation reliable? • Why might one result not be enough? • How could reliability be improved? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported interpretation and explanation. Pupils • Identify patterns in the data. • Construct conclusions using evidence. • Link results to conduction and insulation. • Suggest improvements. Teacher Role • Model first examples. • Support construction of evidence-based conclusions. • Reinforce scientific vocabulary.			
Main Task (20 mins)	Core Task Pupils: • Analyse investigation results. • Identify the best insulator. • Explain findings using particle theory and conduction. • Evaluate the investigation. • Suggest valid improvements.			

	Teacher Flexibility Teachers select format based on class need: • Structured analysis worksheet. • Graph interpretation task. • CER task (Claim, Evidence, Reasoning). • Extended written conclusion. Success Criteria • Identify patterns correctly. • Use evidence from the results. • Explain results scientifically. • Evaluate reliability and fairness. • Suggest realistic improvements. Adaptation Prompts If pupils struggle • Provide sentence stems. • Highlight patterns in tables. • Scaffold conclusion writing. If secure • Analyse anomalies. • Compare multiple sets of data. • Evaluate the relative importance of different improvements.			
Support / Diamond (challenge)	Support • Results summary sheet. • Conclusion framework. • Evaluation scaffold. Example sentence stems: “The best insulator was _____ because _____.” “The evidence for this conclusion is _____.” “Reliability could be improved by _____.” Diamond (Challenge) • Explain results using detailed particle theory. • Evaluate the most significant source of uncertainty. • Suggest and justify multiple improvements. • Consider why scientists repeat investigations.			
Common misconceptions	• The result with the largest value is always the best. • A conclusion is an opinion.			

	• One result proves something completely. • Fair tests guarantee perfect results. • Reliability and accuracy mean the same thing.			
Assessment (5 mins)	Formative and Summary Quick Check Options • State the best insulator from a results table. • Explain a conclusion using evidence. • Suggest one improvement and justify it. Diagnostic Focus Can pupils: • Identify patterns in data? • Use evidence to support conclusions? • Explain results scientifically? • Evaluate the quality of an investigation?			
Exit ticket (5 mins)	Purpose Inform planning for Lesson 7C.11 (Transferring Energy by Radiation). Example Questions • Which material was the most effective insulator? • Why are insulators useful? • How could the investigation be improved? Teacher uses responses to assess understanding of analysis and evaluation before moving on to radiation.			
Adaptive teaching	• Retrieval links conduction, insulation and practical work. • Hinge questions identify misconceptions about evidence and conclusions. • Structured frameworks support scientific writing. • Challenge encourages deeper evaluation and reasoning. • Feedback improves analysis and evaluation skills. • Exit ticket informs progression into thermal radiation.			
British Vales	↗ Democracy – Students use evidence to justify conclusions and discuss different interpretations of results. ↗ Individual Liberty – Students independently analyse data and evaluate the quality of evidence. ↗ Tolerance – Students recognise that scientific conclusions may be refined when new evidence becomes available.			

Teacher Notes for MTP adaptations

7C.11 Transferring Energy by Radiation		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- Describe, using examples, how thermal energy is transferred by radiation - Explain how the colour of a material affects the absorption and emission of thermal radiation - Apply knowledge of radiation to everyday situations.	Analyse how different surfaces affect the transfer of thermal energy by radiation. Apply knowledge of absorption and emission to explain everyday phenomena. Evaluate which materials and colours are most suitable in situations involving thermal radiation.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Use scientific models to explain thermal radiation. WS 1.2 (Models) Apply energy transfer models to radiation. WS 3.6 (Explain using Evidence) Use evidence to explain absorption and emission of thermal energy. WS 4.1 (Scientific Vocabulary) Use terms such as radiation, absorb, emit, reflect and thermal energy accurately. Maths Skills 1c (Comparisons) Compare the effectiveness of different surfaces. 2c (Patterns and Relationships) Identify relationships between colour and thermal energy transfer. 4a (Interpretation) Interpret diagrams and data involving radiation.	EEF 4 (Memory): Retrieve prior learning about thermal energy transfer and insulation. EEF 3 (Modelling): Model absorption and emission using scientific diagrams and examples. EEF 6 (Language): Explicit teaching of absorption, emission, radiation and reflection vocabulary. EEF 7 (Feedback): Feedback used to improve scientific explanations of thermal radiation.
Do Now (5 mins)	Purpose Retrieve understanding of conduction, insulation and thermal energy transfer. Suggested Structure (teacher adapts) - What is conduction? - What is an insulator? - Why are gases poor conductors? Diamond (Challenge) - Why do people often wear light-coloured clothing on a hot day? Teacher Uses Responses To - Assess understanding of previous thermal energy transfer lessons. - Identify misconceptions about heat and temperature. - Prepare pupils for radiation as a different method of thermal energy transfer.			
Hook / Intro (5 mins)	Introduce Key Idea “How can the Sun warm the Earth when there is no air between them?” Suggested Strategy Ask pupils: - How does heat from a campfire reach your skin? - How does sunlight warm the ground? - Why can thermal energy travel through space? Collect responses and introduce radiation as a transfer mechanism that does not require particles. Pedagogical Rationale Challenges pupils to think beyond conduction and links the lesson to familiar real-world experiences.			
Direct	Content: Thermal Radiation			

Teaching: Cell Structure (10 – 15 mins)	Introduce: Radiation is the transfer of thermal energy by waves and does not require particles. Explain: • Radiation can travel through empty space. • Unlike conduction, radiation does not require particles. • The Sun transfers thermal energy to the Earth by radiation. Teacher explanation "The Sun can warm the Earth even though space contains very few particles. This is because thermal energy can be transferred by radiation." Hinge Questions What is radiation? Does radiation require particles? How does thermal energy from the Sun reach the Earth? Key Idea All objects emit thermal radiation. Some surfaces: • Absorb radiation well. • Emit radiation well. • Reflect radiation well. Surface Colour and Radiation Introduce: Dark, matt surfaces • Good absorbers. • Good emitters. Light, shiny surfaces • Poor absorbers. • Poor emitters. • Good reflectors. Examples Black T-shirt on a Sunny Day • Absorbs more thermal radiation. • Becomes warmer faster. Shiny Survival Blanket • Reflects thermal radiation.			
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	- Reduces energy transfer by radiation. Solar Panels - Often dark coloured. - Designed to absorb radiation efficiently. Teacher Modelling (EEF 3) Model explanations such as: "A black surface absorbs more thermal radiation than a white surface, so it becomes warmer more quickly." "A shiny surface reflects more thermal radiation, so it absorbs less thermal energy." Use diagrams showing absorption, reflection and emission. Check for Understanding (Hinge Point) - What is radiation? - Does radiation require particles? - Which surface absorbs radiation best? - Which surface reflects radiation best? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported explanation and comparison. Pupils - Match surface types to their radiation properties. - Label diagrams showing absorption and reflection. - Complete explanation sentences. Teacher Role - Model first examples. - Reinforce vocabulary. - Address misconceptions quickly.			
Main Task (20 mins)	Core Task Pupils: - Explain how thermal energy is transferred by radiation. - Compare dark and shiny surfaces. - Apply knowledge to everyday situations. - Explain why colour affects absorption and emission.			

	Suggested Contexts • Clothing choices • Solar panels • Radiators • Houses in warm climates • Survival blankets Teacher Flexibility Teachers select format based on class need: • Diagram annotation • Comparison table • Card sort • Structured written explanations Success Criteria • Define radiation correctly. • Describe how thermal energy is transferred by radiation. • Explain the effect of colour and surface finish. • Apply understanding to real-world situations. • Use scientific vocabulary accurately. Adaptation Prompts If pupils struggle • Provide surface-property matching tasks. • Use labelled diagrams. • Provide sentence stems. If secure • Explain unfamiliar scenarios. • Compare absorption, emission and reflection. • Evaluate the suitability of different materials.			
Support / Diamond (challenge)	Support • Radiation vocabulary mat. • Surface comparison table. • Labelled diagrams. Example sentence starters: “Dark surfaces absorb more thermal radiation because _____.” “Shiny surfaces reflect thermal radiation because _____.” Diamond (Challenge)			

	- Explain why radiators are often painted matt rather than shiny. - Evaluate the best colour for a solar water heater. - Apply knowledge of radiation to unfamiliar situations.			
Common misconceptions	- Radiation is the same as radioactivity. - Thermal radiation requires particles. - Black objects create heat. - Shiny objects stop thermal energy transfer completely. - White objects do not absorb any thermal radiation.			
Assessment (5 mins)	Formative and Summary Quick Check Options - Define radiation. - Identify the best absorber of thermal radiation. - Explain why a shiny surface reflects radiation effectively. Diagnostic Focus Can pupils: - Explain radiation accurately? - Apply ideas about absorption and reflection? - Use scientific language correctly? - Distinguish radiation from conduction?			
Exit ticket (5 mins)	Purpose Inform planning for Lesson 7C.12 (Energy from Fossil Fuels). Example Questions - What is thermal radiation? - Which surfaces are the best absorbers of radiation? - Why are shiny surfaces often used to reduce thermal energy transfer? Teacher uses responses to assess understanding before moving into energy resources.			
Adaptive teaching	- Retrieval strengthens understanding of thermal energy transfer. - Hinge questions identify misconceptions about radiation. - Visual modelling supports abstract concepts. - Vocabulary is explicitly taught and revisited. - Challenge develops application and evaluation.			

	Exit ticket informs planning for energy resource lessons.			
British Vales	⌵ Individual Liberty – Students independently apply scientific ideas about radiation to everyday situations. ⌵ Democracy – Students discuss and justify explanations about absorption, reflection and emission using scientific evidence.			
Teacher Notes for MTP adaptations				

7C.12 Energy from Fossil Fuels		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- Identify the main fossil fuels and describe how oil is formed - Explain how energy stored in fossil fuels is used to generate electricity - Evaluate the advantages and disadvantages of fossil fuels	Analyse the advantages and disadvantages of different fossil fuels for electricity generation. Apply knowledge of energy transfers to explain how electricity is generated using fossil fuels. Evaluate whether fossil fuels should continue to play a major role in electricity generation.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Understand how scientific evidence is used to evaluate energy resources. WS 3.5 (Interpret Data) Analyse information about energy resources and environmental impacts. WS 3.6 (Explain using Evidence) Explain electricity generation using scientific knowledge. WS 3.7 (Evaluation) Evaluate the advantages and disadvantages of fossil fuels. WS 4.1 (Scientific Vocabulary) Use terms such as fossil fuel, combustion, turbine, electricity generation and non-renewable accurately. Maths Skills 1c (Comparisons) Compare different fossil fuels. 2c (Patterns and Relationships) Identify links between energy demand and resource use. 4a (Interpretation) Interpret information from diagrams and data tables.	EEF 4 (Memory): Retrieve understanding of energy stores and transfers from earlier lessons. EEF 3 (Modelling): Model the process of electricity generation using clear diagrams and flowcharts. EEF 6 (Language): Explicit teaching of key vocabulary related to fuels and energy generation. EEF 7 (Feedback): Feedback used to improve explanations and evaluations.
Do Now (5 mins)	Purpose Retrieve prior knowledge about energy stores, transfers and energy resources. Suggested Structure (teacher adapts) - Name an energy store found in fuel. - What is meant by energy transfer? - What is a non-renewable resource? Diamond (Challenge) - How might burning fuel eventually lead to electricity in your home? Teacher Uses Responses To - Assess prior understanding of fuels. - Identify misconceptions about electricity generation. - Prepare pupils for energy resource discussions.			
Hook / Intro (5 mins)	Introduce Key Idea “Every time you switch on a light, where did that energy originally come from?” Suggested Strategy Display photographs of: - Coal - Oil - Natural gas - A power station Ask: - Which fuel do you think provides most electricity? - Where did these fuels come from? - Will they ever run out? Pedagogical Rationale Links everyday energy use to large-scale electricity generation and sustainability.			
Direct	Content: Fossil Fuels			

Teaching: Cell Structure (10 – 15 mins)	Introduce: The three main fossil fuels: • Coal • Oil • Natural gas Formation of Fossil Fuels Explain: • Fossil fuels formed from the remains of living organisms millions of years ago. • Heat and pressure gradually transformed the remains into fuels. • They are described as non-renewable because they take millions of years to form. Key Idea Fossil fuels contain energy in a chemical energy store. When they are burned, energy is transferred and can eventually be used to generate electricity. Electricity Generation Simple sequence: Chemical store (fuel) → Thermal store (water / steam) → Kinetic store (turbine) → Electrical transfer Explain: 1. Fuel is burned. 2. Water is heated. 3. Steam turns a turbine. 4. The turbine drives a generator. 5. Electricity is produced. Advantages of Fossil Fuels • Reliable source of energy. • Large amounts of energy available. • Electricity can be generated whenever needed. Disadvantages of Fossil Fuels • Non-renewable. • Will eventually run out. • Burning fuels releases gases into the atmosphere. • Can contribute to environmental problems.			
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	Teacher Modelling (EEF 3) Model explanation: “Coal contains a chemical energy store. When burned, the energy is transferred to water, producing steam. The steam turns a turbine which helps generate electricity.” Model a simple evaluation: “Fossil fuels are reliable but may have environmental disadvantages because they release gases when burned.” Check for Understanding (Hinge Point) • Name the three main fossil fuels. • Why are fossil fuels non-renewable? • How is a turbine involved in electricity generation? • Give one advantage and one disadvantage of fossil fuels. Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported explanation and evaluation. Pupils • Label an electricity generation diagram. • Match advantages and disadvantages. • Sequence the stages of electricity generation. Teacher Role • Model first examples. • Reinforce key vocabulary. • Correct misconceptions immediately. •			
Main Task (20 mins)	Core Task Pupils: • Explain how electricity is generated from fossil fuels. • Identify advantages and disadvantages of different fossil fuels. • Compare their suitability for electricity generation. • Evaluate the continued use of fossil fuels. Suggested Contexts • Coal power station • Natural gas power station			

	- Electricity demand in homes - Environmental impacts Teacher Flexibility Teachers select format based on class need: - Annotated flowchart - Comparison table - Card sort - Structured evaluation task Success Criteria - Identify the main fossil fuels. - Explain how electricity is generated. - Describe advantages and disadvantages. - Use scientific evidence in evaluations. - Use scientific vocabulary accurately. Adaptation Prompts If pupils struggle - Provide labelled diagrams. - Use scaffolded explanations. - Highlight key advantages and disadvantages. If secure - Compare different fossil fuels. - Consider long-term sustainability. - Construct balanced evaluations.			
Support / Diamond (challenge)	Support - Electricity generation flowchart. - Fossil fuel fact sheet. - Vocabulary mat. Example sentence starters: “Fossil fuels are non-renewable because _____.” “One advantage of fossil fuels is _____.” Diamond (Challenge) - Evaluate whether reliance on fossil fuels is sustainable. - Compare coal, oil and natural gas. - Consider environmental and economic factors in recommendations.			
Common misconceptions	- Fossil fuels were formed recently. - Electricity exists inside fossil fuels.			

	- Fossil fuels are renewable. - Fossil fuels are always the cheapest option. - Energy is created during electricity generation.			
Assessment (5 mins)	Formative and Summary Quick Check Options - Name three fossil fuels. - Explain how electricity is generated from fuel. - Give one advantage and one disadvantage of fossil fuels. Diagnostic Focus Can pupils: - Identify fossil fuels correctly? - Explain energy transfers involved? - Evaluate advantages and disadvantages? - Use scientific vocabulary accurately?			
Exit ticket (5 mins)	Purpose Inform planning for Lesson 7C.13 Energy from Other Sources Example Questions - Why are fossil fuels non-renewable? - What role does a turbine play in generating electricity? - Give one environmental disadvantage of fossil fuels. Teacher uses responses to assess readiness for learning about renewable energy resources.			
Adaptive teaching	- Retrieval links fossil fuels to earlier energy concepts. - Visual models support understanding of electricity generation. - Hinge questions identify misconceptions about fuels and energy. - Structured evaluation supports scientific reasoning. - Challenge develops balanced judgement using evidence. - Exit ticket informs progression to renewable resources.			
British Vales	⌚ Tolerance – Students consider different viewpoints about fossil fuel use and environmental impact. ⌚ Democracy – Students discuss evidence for and against the continued use of fossil fuels. ⌚ Individual Liberty – Students make informed judgements using scientific evidence.			

Teacher Notes for MTP adaptations

7C.13 Energy from Other Sources		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- Describe how renewable energy resources can be used to generate electricity - Compare the advantages and disadvantages of different renewable energy resources - Explain why different energy resources may be suitable in different locations	Analyse the advantages and disadvantages of different renewable energy resources. Apply knowledge of energy transfers to explain how renewable resources generate electricity. Evaluate the suitability of different renewable resources for particular locations and purposes.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Understand how scientific evidence is used to evaluate different energy resources. WS 3.5 (Interpret Data) Compare information about renewable energy sources. WS 3.6 (Explain using Evidence) Explain how renewable resources transfer energy to generate electricity. WS 3.7 (Evaluation) Evaluate advantages and disadvantages using evidence. WS 4.1 (Scientific Vocabulary) Use terms such as renewable, hydroelectric, geothermal, solar and wind turbine accurately. Maths Skills 1c (Comparisons) Compare different energy resources. 2c (Patterns and Relationships) Identify relationships between geography and energy generation. 4a (Interpretation) Interpret information from tables, diagrams and data.	EEF 4 (Memory): Retrieve prior learning about fossil fuels and electricity generation. EEF 3 (Modelling): Model comparisons between different renewable resources. EEF 6 (Language): Explicit teaching of renewable energy vocabulary. EEF 7 (Feedback): Feedback used to improve comparisons and evaluations.
Do Now (5 mins)	Purpose Retrieve understanding of fossil fuels and prepare pupils to compare renewable alternatives. Suggested Structure (teacher adapts) - Name three fossil fuels. - What does non-renewable mean? - Give one disadvantage of fossil fuels. Diamond (Challenge) - If fossil fuels will eventually run out, where might future electricity come from? Teacher Uses Responses To - Assess understanding of fossil fuels. - Identify misconceptions about renewable resources. - Create a need for alternative methods of electricity generation.			
Hook / Intro (5 mins)	Introduce Key Idea “How can electricity be generated without burning fossil fuels?” Suggested Strategy Display images of: - Wind turbines - Solar panels - Hydroelectric dams - Geothermal power stations Ask: - What do these systems have in common? - Which would work best near school? - Which might work best near the coast? Pedagogical Rationale Encourages pupils to think about energy generation in different geographical contexts and introduces the concept of renewable energy.			

Direct Teaching: Cell Structure (10 – 15 mins)	Content: Renewable Energy Resources Introduce: Renewable resources are energy resources that are naturally replenished and can be used repeatedly. Examples: • Solar energy • Wind energy • Hydroelectric power • Wave power • Tidal power • Geothermal energy • Biogas Key Idea Renewable resources transfer energy from natural energy stores into useful electrical energy. Unlike fossil fuels, they are not dependent on fuels that take millions of years to form. Electricity Generation Wind Turbine Kinetic store (Moving air) → Kinetic store (turbine) → Electrical transfer Hydroelectric Power Gravitational store (water at height) → Kinetic store (moving water) → Kinetic store (turbine) → Electrical transfer Solar Panels Energy from sunlight → Electrical transfer <i>Keep this simple at KS3 without introducing the photovoltaic effect.</i> Advantages of Renewable Resources • Will not run out in the short term. • Reduce reliance on fossil fuels. • Can reduce environmental impacts from burning fuels. Disadvantages of Renewable Resources • Some depend on weather conditions. • Some require specific geographical locations.			
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	- Electricity generation may be less predictable. Teacher Modelling (EEF 3) Model a comparison: <table><tr><th>Resource</th><th>Advantage</th><th>Disadvantage</th></tr><tr><td>Wind</td><td>Renewable</td><td>Depends on wind</td></tr><tr><td>Solar</td><td>Renewable</td><td>Depends on sunlight</td></tr><tr><td>Hydroelectric</td><td>Reliable in suitable locations</td><td>Requires appropriate landscape</td></tr></table> Model explanation: “Wind energy is renewable, but electricity generation depends on whether sufficient wind is available.” Check for Understanding (Hinge Point) - What does renewable mean? - Which resource depends on sunlight? - Why might hydroelectric power not work everywhere? - Give one advantage of renewable energy. Mini whiteboards / cold calling	Resource	Advantage	Disadvantage	Wind	Renewable	Depends on wind	Solar	Renewable	Depends on sunlight	Hydroelectric	Reliable in suitable locations	Requires appropriate landscape			
Resource	Advantage	Disadvantage														
Wind	Renewable	Depends on wind														
Solar	Renewable	Depends on sunlight														
Hydroelectric	Reliable in suitable locations	Requires appropriate landscape														
Guided Practice (10 mins)	Task Type Supported comparison and classification. Pupils - Match energy resources to descriptions. - Compare advantages and disadvantages. - Categorise resources according to suitability. Teacher Role - Model first examples. - Reinforce scientific vocabulary. - Address misconceptions about renewability.															
Main Task (20 mins)	Core Task Pupils: - Compare renewable energy resources. - Explain how they generate electricity. - Identify advantages and disadvantages. - Recommend suitable resources for different situations. Suggested Contexts - Coastal town															

	- Mountain valley - Desert environment - Urban city - Rural community Teacher Flexibility Teachers select format based on class need: - Comparison table - Information carousel - Card sort - Structured written comparison Success Criteria - Identify renewable resources. - Explain how electricity is generated. - Compare advantages and disadvantages. - Explain why different resources suit different locations. - Use scientific vocabulary accurately. Adaptation Prompts If pupils struggle - Provide fact cards. - Use scaffolded comparison tables. - Highlight key advantages and disadvantages. If secure - Compare multiple resources simultaneously. - Consider reliability and environmental impact. - Justify recommendations using evidence.			
Support / Diamond (challenge)	Support - Renewable energy fact sheets. - Comparison scaffold. - Vocabulary mat. Example sentence starters: “An advantage of _____ is _____.” “A disadvantage of _____ is _____.” Diamond (Challenge) - Evaluate which renewable resource is most important for the future. - Compare renewable resources with fossil fuels. - Consider environmental, economic and geographical factors.			

Common misconceptions	- Renewable resources never have disadvantages. - Renewable electricity generation works equally well everywhere. - Wind turbines generate electricity all the time. - Solar panels work only in very hot countries. - Renewable resources have no environmental impact.			
Assessment (5 mins)	Formative and Summary Quick Check Options - Define renewable resource. - Explain how one renewable resource generates electricity. - Give one advantage and one disadvantage of a renewable resource. Diagnostic Focus Can pupils: - Distinguish renewable from non-renewable resources? - Compare different renewable resources? - Explain electricity generation? - Use scientific vocabulary correctly?			
Exit ticket (5 mins)	Purpose Inform planning for Lesson 7C.14 Choosing Resources Example Questions - What is a renewable resource? - Which renewable resource would work best in a very windy location? - Give one reason why different locations use different energy resources. Teacher uses responses to identify misconceptions before pupils evaluate and recommend resources in the final lesson.			
Adaptive teaching	- Retrieval links fossil fuels and electricity generation. - Hinge questions identify misconceptions about renewable resources. - Structured comparisons reduce cognitive load. - Teacher modelling develops evaluative thinking. - Challenge develops evidence-based decision			

	- making. - Exit ticket informs planning for resource selection and evaluation.			
British Vales	⌵ Tolerance – Students consider different approaches to energy generation and recognise that different regions may make different energy choices. ⌵ Democracy – Students evaluate evidence and discuss the advantages and disadvantages of renewable resources. ⌵ Individual Liberty – Students make informed decisions about energy resources using scientific evidence.			
Teacher Notes for MTP adaptations				

7C.14 Choosing Resources		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- Compare different energy resources for a range of locations - Evaluate the advantages and limitations of different energy resources - Justify recommendations using scientific evidence	Analyse geographical, environmental and economic information to determine the most suitable energy resource for a location.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Understand how scientific evidence informs decision-making. WS 3.5 (Interpret Data) Analyse information about locations and energy resources. WS 3.6 (Explain using Evidence) Justify recommendations using scientific evidence. WS 3.7 (Evaluation) Evaluate advantages and limitations of different solutions. WS 4.1 (Scientific Vocabulary) Use terms such as renewable, sustainable, resource, environmental impact and suitable accurately. Maths Skills 1c (Comparisons) Compare	EEF 4 (Memory): Retrieve understanding of fossil fuels and renewable resources from previous lessons. EEF 3 (Modelling): Model how to evaluate options and justify recommendations using evidence. EEF 6 (Language): Explicit teaching of evaluative vocabulary including suitable, sustainable, advantage and limitation. EEF 7 (Feedback): Feedback used to improve scientific argument and justification.
Do Now (5 mins)	Purpose Retrieve learning from Lessons 7C.12 and 7C.13 and prepare pupils to evaluate energy resources. Suggested Structure (teacher adapts) - Name one fossil fuel. - Name two renewable energy resources. - Give one advantage of renewable energy. Diamond (Challenge) - Would the best energy resource be the same in every location? Explain your thinking. Teacher Uses Responses To - Assess understanding of energy resources. - Identify misconceptions about renewable energy. - Prepare pupils for evidence-based decision making.	Apply knowledge of renewable and non-renewable resources to unfamiliar scenarios. Evaluate competing energy strategies and justify recommendations using evidence.		
Hook / Intro (5 mins)	Introduce Key Idea “If you were responsible for providing electricity to a town, which energy resource would you choose?” Suggested Strategy Present three locations: - A windy coastal town - A sunny desert region - A mountainous river valley Ask: - Would the same energy resource be suitable for all three? - What factors would you need to consider? - How should evidence influence the decision? Pedagogical Rationale Provides an authentic context for evaluation and highlights that scientific decisions often involve comparing multiple options.			

Direct Teaching: Cell Structure (10 – 15 mins)	Content: Choosing Energy Resources Recap: Different resources have different: • Advantages • Disadvantages • Environmental impacts • Levels of reliability Factors Affecting Suitability Introduce: When selecting an energy resource, scientists and engineers consider: • Location • Climate • Geography • Reliability • Environmental impact • Availability of resources Examples Wind Energy Suitable where: • Wind speeds are high. • Open space is available. Less suitable where: • Wind is unreliable. Solar Energy Suitable where: • Sunlight is available for long periods. Less suitable where: • Cloud cover is frequent. Hydroelectric Power Suitable where: • Large rivers and valleys exist. Less suitable where: • Water supply is limited. Fossil Fuels Suitable where: • Reliable electricity is required.		the suitability of energy resources. 2c (Patterns and Relationships) Identify links between geography and energy generation. 4a (Interpretation) Interpret information from maps, tables and case studies.	
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	Less suitable where: - Environmental concerns are a priority. Key Idea There is rarely one perfect energy resource. Scientists evaluate evidence and make informed decisions based on the situation. Teacher Modelling (EEF 3) Scenario: Remote Coastal Community Evidence: - Strong winds - Small population - Limited access to fossil fuels Teacher models: - Identify relevant information. - Compare possible resources. - Justify a recommendation. Example: “Wind energy would be suitable because strong winds are available. It is renewable and does not rely on transported fuel supplies.” Check for Understanding (Hinge Point) - Which renewable resource would be suitable for a windy coastline? - Why might hydroelectric power not work everywhere? - What factors should be considered when choosing an energy resource? - Why is evidence important when making recommendations? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported evaluation and recommendation. Pupils - Match locations to suitable energy resources. - Explain choices using evidence. - Compare advantages and limitations. Teacher Role			

	• Model the first scenario. • Reinforce evaluative language. • Support evidence-based reasoning.			
Main Task (20 mins)	Core Task Pupils: • Analyse information about different locations. • Compare appropriate energy resources. • Evaluate options. • Justify recommendations using scientific evidence. Suggested Contexts • Coastal village • Busy city • Mountain valley • Sunny desert community • Island community Teacher Flexibility Teachers select format based on class need: • Scenario cards • Decision-making exercise • Structured evaluation table • Extended written recommendation Success Criteria • Compare different energy resources. • Consider advantages and limitations. • Use evidence when making decisions. • Justify recommendations logically. • Use scientific vocabulary accurately. Adaptation Prompts If pupils struggle • Provide structured comparison tables. • Highlight key information. • Use sentence starters. If secure • Consider multiple factors simultaneously. • Evaluate trade-offs. • Produce balanced recommendations. •			
Support / Diamond (challenge)	Support • Energy resource fact sheets. • Evaluation framework.			

	• Sentence starters. Example: “This resource is suitable because _____.” “An advantage is _____, however a limitation is _____.” Diamond (Challenge) • Evaluate whether a location should rely on one resource or several. • Consider environmental, economic and social factors. • Justify recommendations in unfamiliar scenarios.			
Common misconceptions	• There is one best energy resource for all locations. • Renewable resources have no disadvantages. • Fossil fuels should never be used. • Wind and solar power generate electricity continuously. • Environmental impact is the only factor that matters.			
Assessment (5 mins)	Formative and Summary Quick Check Options • Recommend an energy resource for a given location. • Explain one advantage and one limitation. • Justify a decision using evidence. Diagnostic Focus Can pupils: • Compare resources effectively? • Use evidence to support recommendations? • Evaluate advantages and limitations? • Apply learning to unfamiliar situations?			
Exit ticket (5 mins)	Purpose Review and consolidate the entire Energy, Fuels and Efficiency topic. Example Questions • Which renewable resource would be most suitable for a windy location? • Why are fossil fuels considered non-renewable? • What evidence should be considered when choosing an energy resource?			

	Teacher uses responses to identify areas for retrieval and end-of-unit review.			
Adaptive teaching	• Retrieval links together learning from the entire unit. • Hinge questions identify misconceptions about energy resources. • Structured evaluation scaffolds complex decision making. • Challenge develops balanced scientific judgement. • Evidence-based reasoning is modelled explicitly. • Exit ticket informs future retrieval and assessment.			
British Vales	⌵ Democracy – Students use evidence to discuss and justify recommendations about energy resources. ⌵ Tolerance – Students evaluate different viewpoints and recognise that different regions may make different energy choices. ⌵ Individual Liberty – Students make informed decisions using scientific evidence and reasoning.			
Teacher Notes for MTP adaptations				