

THE UNIT QUESTION · SCIENCE + MATHEMATICS

“Why do some things float?”

Today: The boat that holds the most coins

LESSON 1 ✓ We predict and we test	LESSON 2 ✓ Material and shape	LESSON 3 · TODAY The boat that holds the most coins	LESSON 4 Presentation and Unit Report
THE BIG IDEA Whether an object floats does not depend only on its weight, but on its material and its shape. A shape that takes up more space in the water can hold more load.		THE MISCONCEPTION WE TARGET “Heavy things sink, light things float.” The lesson puts this belief up against the evidence: a steel ship floats, a steel nut sinks.	

1 First pass · Knowledge

WHAT THEY WILL LEARN

#	LEARNING OBJECTIVE	SUCCESS CRITERION	EVIDENCE	MAX
O1	Explains that the same amount of material holds more load when its shape changes.	Says it in their own words and uses the words “material”, “shape” and “space in the water” correctly.	Spoken explanation · exit ticket, Q1	3
O2	Designs a fair test: changes only one thing at a time.	Names what changes (the shape) and what stays the same (sheet, coins, water).	Hinge question · exit ticket, Q2	3
O3	Records measurements in a table, draws a bar chart and compares by subtraction.	Correct table, correct bar heights, one correct “how many more” comparison.	Group sheet · exit ticket, Q3	4
R	Recall: the same 5 questions as at the start of the unit, for measurable progress (before → today).			5

Target vocabulary: floats · sinks · material · shape · load · prediction · fair test · limit. Mastered: at least 80% correct today; confirmed by recall in lesson 4.

2 Second pass · Growth

WHAT THEY WILL DEVELOP AND THROUGH WHICH ROUTE

GROWTH TARGET	WHY IN THIS LESSON	HOW IT SHOWS TODAY		
EXECUTIVE FUNCTIONS Cognitive flexibility ROUTE · WITHIN THE TASK	The first boat usually sinks; it needs a genuinely different design, not a small fix.	S · WITH SUPPORT Changes the shape after “What else could we try?”	I · INDEPENDENTLY Changes the shape substantially on their own, after the failure.	N · IN A NEW CONTEXT Suggests a second way when comparing the numbers too.
HOLISTIC COMPETENCIES Empathy and respect for diversity ROUTE · BRIDGE	The story of the load line gives faces: sailors who were in danger because others loaded too much.	S · WITH SUPPORT Says how the sailors might have felt, when asked directly.	I · INDEPENDENTLY Talks unprompted about how someone in the story feels and links it to what happened.	N · IN A NEW CONTEXT Recognises how a child in the group feels when their boat sinks, and acts on it.
MENTAL TOUGHNESS Everyday resilience ROUTE · WAY OF WORKING	The first version failing is a natural part of the challenge; it is never created artificially.	S · WITH SUPPORT Returns to the test after encouragement.	I · INDEPENDENTLY Starts the second version on their own.	N · IN A NEW CONTEXT Tries again on a difficult exit-ticket question too.

Also cultivated, without being recorded today: Communication and collaboration (builder, counter and recorder roles) · Ethical thinking and responsibility (in the Bridge).

Three routes of cultivation: within the task (the academic problem itself) · Bridge (a neighbouring social, emotional, ethical or cultural theme) · way of working (roles, climate, natural difficulty). Each lesson records the day's mark (S · I · N); a level is given only in the Developmental Profile.

3 The flow of the lesson

75 MINUTES · SIX STAGES

5' Welcome	10' Warm-up	22' Academic core	18' Application & creation	12' Bridge	8' Reflection
5' 0:00–0:05 Welcome	Circle. Each child shows their drawing from the home Challenge and says one sentence: “Our boat held ... coins”. The day’s goal goes on the board: <i>Which boat holds the most coins, and why?</i> LINK TO LESSON 2 COMMUNICATION			A Leads the circle and writes the children’s numbers on the board. B Notes who brings the Challenge and who speaks on their own initiative.	
10' 0:05–0:15 Warm-up	Recall (4'): the 5 questions from the start of the unit, with pictures and “floats / sinks / it depends” cards. Rule game (6'): they stand up when they hear “heavy”. Halfway through the rule changes: they stand only for “heavy that floats”. RECALL · R/5 INHIBITORY CONTROL			A Reads the questions and changes the rule without warning. B Records each child’s recall score.	
22' 0:15–0:37 Academic core	Phenomenon (4'): a steel ship in a photograph and a steel nut in a basin. “Why does one float and the other sink?” Two predictions per pair. Worked example (7'): 50 g of modelling clay in three shapes. Table: What do I change? What do I keep the same? What do I measure? Hinge question (2'): “Which test is fair?” A/B cards (p. 4). Guided practice (9'): pairs repeat the test and count coins. The explanation is built together: <i>the wide boat takes up more space in the water.</i> O1 · O2 COGNITIVE FLEXIBILITY			A Models the fair test; asks “Why do you say that?” and “What else could we try?”. B Counts the answers to the hinge question; notes who changes their prediction because of the result.	
18' 0:37–0:55 Application & creation	Challenge: “With one 15 × 15 cm sheet of kitchen foil, build the boat that holds the most coins.” - Groups of three with roles: builder, counter, recorder. They swap for the second version. - Plan → build → test → redesign → second test. - Shared bar chart: “Our second boat held ... more coins”. O2 · O3 RESILIENCE FLEXIBILITY			A Manages time; asks guiding questions and does not give the solution. B Records flexibility and resilience after the first failure; notes how children react when someone else’s boat sinks.	
12' 0:55–1:07 Bridge	“The line on the ship”. A story in pictures about the load line; each pair marks the “safety line” on their own boat; a circle with three questions; one sentence: “If I see something that could hurt someone, I can...” (p. 3). APPLYING O3 EMPATHY ETHICAL THINKING			A Tells the story; asks the questions and leaves time for silence. B Records empathy; who talks unprompted about how others feel; keeps the children’s sentences.	
8' 1:07–1:15 Reflection	Exit ticket (4'): three questions with “how sure am I?” on each (p. 4). Circle (2'): “What did you change when your boat sank?” Challenge (2'): the challenge for home. O1–O3 SELF-REGULATED LEARNING			A Hands out and collects the exit ticket; leads the circle. B Records one phrase “in the child’s words”.	

4 Bridge · from knowledge to life

12 MINUTES · A ROUTE OF CULTIVATION

BRIDGE · SAFETY AND RESPONSIBILITY FOR OTHERS

“The line on the ship”

The children have just measured how many coins their boat holds before it sinks. Real ships have a limit too; once, some people ignored it, and sailors were put in danger.

HOW IT UNFOLDS

1. **A story in pictures (4')**. Ships loaded with too much so that their owners could earn more; Samuel Plimsoll, who asked for a limit line to be painted on the side of every ship. A photograph of the line on a ship in harbour.
2. **Our own line (3')**. Each pair marks with a pen where they would draw the “safety line” on their boat, based on the coins they counted.
3. **Circle (4')** with the three questions.
4. **One sentence (1')**. “If I see something that could hurt someone, I can...”

Cultivates: Empathy · Ethical thinking and responsibility.

QUESTIONS FOR DISCUSSION

- Why would someone load more than the boat can hold?
- How would you feel if you were a sailor on that ship?
- Mr Plimsoll was not a sailor. Why did he care?

CARE

No pictures of shipwrecks or of people in danger. If a child brings a personal experience or a fear of the sea, teacher B welcomes it calmly and does not explore it in front of the group.

The Bridge is not a moral lesson. We ask, we listen, and the children take a position; the day’s learning gives them the tools to think it through.

5 How · Methods, strategies, practices

MODEL 2 IN PRACTICE

METHODS

Phenomenon-based learning. The steel ship opens the question. **Challenge-based learning.** One measurable goal: the most coins.

STRATEGIES

Retrieval practice at the start · **Worked example** for the fair test · **Hinge question** before the challenge · **Explicit teaching of metacognition** at the close.

CLASSROOM PRACTICES

Experiment with measurements · **Think-Pair-Share** for predictions · **Story and circle** in the Bridge · three-question **exit ticket**.

6 Differentiation

SAME OBJECTIVES, DIFFERENT SUPPORT

MORE SUPPORT

- A ready-made table outline with pictures.
- Vocabulary cards on the table.
- Counting coins in fives.

MORE CHALLENGE

- Predicting the number of coins before each test: “how far off were you?”.
- Comparing three groups on the bar chart: “how many more, how many fewer”.

FADING THE SUPPORT

In lesson 4 the fair-test table is given blank. The children set it up on their own, with one guiding question if needed.

WHERE THEY WILL MEET IT AT SCHOOL

National Curriculum, Science Year 2 · Uses of everyday materials; working scientifically: simple tests and recording in tables. Mathematics Year 2 · Statistics: tally charts, tables and block diagrams; comparing numbers.

HOW IT BUILDS ON THE PREVIOUS LESSON

In lesson 2 the children saw that the same material can float or sink. Today they move from observing to measuring: how much load each shape holds.

7 Assessment

EVERY ASSESSMENT LEADS TO A DECISION

HINGE QUESTION · MIDWAY THROUGH THE CORE

“Which test is fair?” A: two different amounts of modelling clay in two shapes.
B: the same amount in two shapes.

CORRECT: B

DECISION RULE

If at least 6 of the 8 children hold up B, we carry on.
Otherwise teacher A shows a second worked example (2') and teacher B sits with the children who chose A at the start of the challenge.

WHEN	TYPE	TOOL	WHAT WE DECIDE	WHERE IT IS RECORDED
Warm-up	Diagnostic	Recall: the same 5 questions as at the start of the unit	Which idea needs a reminder in the core	Progress: before → today
Core	Formative	Hinge question with A/B cards	Carry on, or a second worked example	Not scored
Application	Developmental	Observation: flexibility, resilience	Which guiding question each group needs	Mark S / I / N
Application	Authentic	Coins, 1st → 2nd version · bar chart	What the group presents in lesson 4	The day's work
Bridge	Developmental	Observation in the circle · each child's sentence	What we return to in lesson 4	Mark S / I / N · empathy
Close	Summative	Exit ticket · 10 marks	Mastered (≥80%) or revisited in lesson 4	Score per objective O1–O3
Close	Self-assessment	“How sure am I?” on each question	A conversation when confidence does not match the result	Self-regulated learning

In the Bridge we do not assess what the child believes, but how they think, and only when that is a target for the day.

8 Exit ticket

10 MARKS · ONE QUESTION PER OBJECTIVE · “HOW SURE AM I?” ON EACH QUESTION

QUESTION 1 · O1

HOW SURE AM I? 😊 😐 😞 3 MARKS

Anna and Nick have the same amount of modelling clay. Anna's ball sinks, Nick's boat floats. Why?

One mark each: mentions the shape · explains the space in the water · uses the word “material” or “shape” correctly.

QUESTION 2 · O2

HOW SURE AM I? 😊 😐 😞 3 MARKS

We want to see which shape holds the most coins. Circle what must stay the same: the sheet · the shape · the coins · the water.

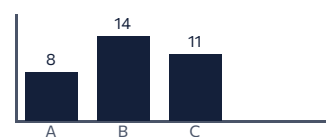
One mark each for the sheet, the coins and the water; no marks if the shape is also circled.

QUESTION 3 · O3

HOW SURE AM I? 😊 😐 😞 4 MARKS

Look at the bar chart. Which boat held the most coins? How many more than boat A?

Reads the tallest bar (1) · reads A correctly (1) · correct subtraction $14 - 8 = 6$ (2).



CHALLENGE · ~10' WITH THE FAMILY

One tangerine with its peel and one without. Predict which will float, test it in the sink and draw what happened. Why do you think it happened?

Bring back: the drawing. It opens lesson 4.

MATERIALS

Modelling clay 50 g × 8 · kitchen foil 15 × 15 cm × 16 · 200 coins · 4 basins of water · towels · photographs of a steel ship and a load line · a nut · A/B cards · fair-test tables · bar-chart sheets · markers · exit tickets.

WHAT GOES INTO THE LESSON REPORT

Score and level on each knowledge objective · measurable progress in recall · S / I / N mark for flexibility, empathy and resilience · the child's phrase · the day's Bridge with one question to talk about at home · the Challenge. The family receives the report after the lesson.