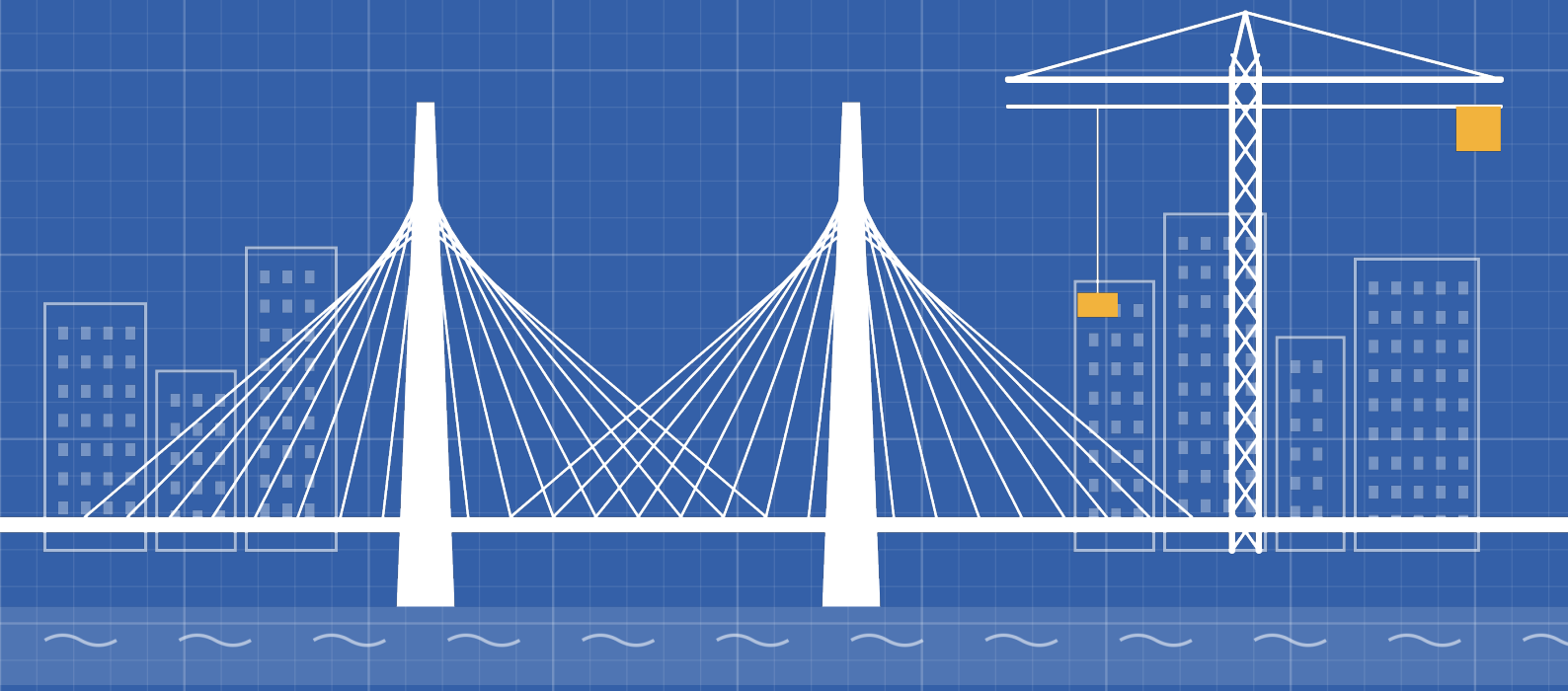


WORKSHEET 1

PEOPLE, NATURE & STRUCTURES

Who designs our structures, what can animals teach us, and how do we sort the things humans build?

Use this worksheet alongside pages 2–5 of your Structural Engineering course notes.

NAME

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WORKSHEET 1

BEFORE YOU START

LEARNING INTENTIONS

We are learning to: **describe** the jobs people do in structural engineering · **explain** what engineers can learn from structures built by animals · **sort** human-made structures into mass, frame and shell.

SUCCESS CRITERIA

I can match six engineering careers to what they do · I can name what an animal builds, what it uses, and one idea engineers could borrow from it · I can sort 12 structures correctly and give a reason.

TASK 1 WHO BUILDS OUR WORLD?

Lots of different people work together to design and build a structure. Match each job to the description that fits it best. Write the **letter** in the box.

JOB		WHAT THEY DO
1. Structural engineer	☐	**A.** Plans and controls the **costs** of a building project, from materials to wages.
2. Architect	☐	**B.** Designs how a building **looks and feels**, and how people will use the spaces inside.
3. Civil engineer	☐	**C.** Runs the **construction site** day to day: safety, teams, deliveries and the timetable.
4. Quantity surveyor	☐	**D.** Calculates the **forces** in beams, columns and frames so the structure is strong and stable.
5. CAD technician	☐	**E.** Plans and builds big **public projects** such as roads, railways, bridges, dams and water supply.
6. Site manager	☐	**F.** Turns sketches into accurate **2D drawings and 3D computer models**.

b There is more than one way into these careers. Tick **every** route that can lead to a job in structural or civil engineering.

- ☐ University degree
- ☐ College course
- ☐ Apprenticeship
- ☐ There is only one way in

c Name **three school subjects** that would help you become an engineer.

TASK 2 ANIMAL ARCHITECTS

Humans are not the only builders. Animals have been building homes for millions of years — using no machines at all. Complete the blank boxes in the table.


Honeybee


Spider


Termite


Beaver


Weaver bird

Animal	What it builds	Material it uses	One idea engineers could borrow
Honeybee	Honeycomb made of six-sided (hexagon) cells	Beeswax	
Spider	Web		
Termite		Soil mixed with saliva	
Beaver		Branches, logs, mud and stones	
Weaver bird	Hanging nest		

BIOMIMICRY

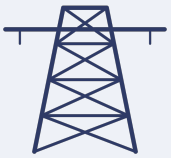
Copying nature to solve human problems is called **biomimicry**. The Eastgate Centre in Harare, Zimbabwe, was designed to cool itself like a termite mound — air flows through chimneys and vents, so it uses far less energy than a normal air-conditioned building.

b Human construction often harms the environment. Give **one** way our buildings could be more like animal structures.

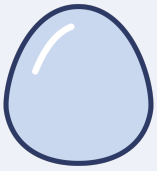
TASK 3 MASS, FRAME OR SHELL?



MASS — strong because it is heavy. Blocks of stone, brick or concrete hold it up.



FRAME — a skeleton of members carries the weight. Walls are only a covering.



SHELL — a thin outer skin holds everything together and carries the load.

Write **mass**, **frame** or **shell** beside each structure.

Structure	Type	Structure	Type
Egyptian pyramid		Electricity pylon	
Egg		Drystone dyke (wall)	
Bicycle		Drinks can	
Concrete dam		Steel skeleton of a skyscraper	
Cycle helmet		Stone lighthouse	
Climbing frame		Car body	

b An empty drinks can weighs only about 13 g, yet standing upright it can hold up a tall pile of heavy books. Explain why a **shell** can be so strong for its weight.

c **Challenge:** Many buildings mix structure types. A new house in Scotland often has a timber frame inside and brick walls outside. Which **two** types does it combine?

TASK 4 STRUCTURE SPOTTER

Look around your classroom, school or the view from the window. Find one real example of each type.

Mass: _____

Frame: _____

Shell: _____

REFLECT

HOW CONFIDENT AM I?

	Not yet	Getting there	Got it!
I can match engineering careers to what they do, and name routes into them.	○	○	○
I can explain what engineers can learn from animal structures (biomimicry).	○	○	○
I can sort structures into mass, frame and shell, and explain my choice.	○	○	○

NICE WORK.

Next up: **Worksheet 2 — Bridges & Forces.**

Stuck? The course notes and video tutorials are free at **detscotland.co.uk**.

"Engineering is the art of directing the great sources of power in nature for the use and convenience of man."

Thomas Tredgold, civil engineer (1788–1829)

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