

Engineering Marvels: Building Stronger Structures

Learning objective: To understand how to strengthen structures by using shapes, materials, and techniques such as triangulation and reinforcement.

Read each question carefully and apply your knowledge of structural design. Use technical terminology where possible to explain your reasoning.

Word bank: triangulation · reinforcement · tensile strength · compressive force · strut · rigid · framework · stability

1. Max is building a bridge out of recycled card. He notices that his square-shaped frame keeps collapsing when he pushes down on it. Explain why adding a diagonal strut to create triangles would make his structure more rigid. (2 marks)

2. Compare and contrast the properties of a cylinder and a cube when used as a supporting pillar. Why might a cylindrical design be more effective at distributing compressive force? (3 marks)

3. Zara is designing a new art studio. She needs the roof to span a wide area without any internal walls. Suggest two structural techniques she could use to ensure the roof remains stable. (2 marks)

4. Kit is designing a tower to hold a heavy weight. He has access to corrugated cardboard and flat card. Justify why the corrugated cardboard might be a superior material for the main load-bearing columns. (2 marks)

5. If a structure is built using thin, flexible materials, what might happen to the structure if it is subjected to high winds? Explain the importance of cross-bracing in this scenario. (3 marks)

Draw: Sketch a design for a tripod base that could support a heavy bird-watching telescope for Nova. Label your diagram to show where the 'struts' are located and indicate where the 'compressive force' will be directed.



Extension challenge: Design a 'Shake Test' experiment to evaluate the stability of a structure. Write a short paragraph explaining how you would ensure your test is a 'fair test', listing the variables you would keep constant and the one variable you would change.