

Max's Structural Engineering Challenge

Learning objective: To understand how structural integrity is affected by shapes and materials, and to identify how to strengthen structures against compression and tension.

Max the monkey has been tasked with building a bridge to cross the jungle river. He needs your help to select the most stable design features. Read the design scenarios below and justify your choices using your knowledge of structural reinforcement. Ensure you explain the 'why' behind your engineering decisions.

Word bank: compression · tension · triangulation · struts · reinforcement · stability · load-bearing · span

1. Max is deciding between a square frame and a triangular frame for his bridge supports. Explain why the triangular frame is more resistant to deformation when a heavy load is applied. (2 marks)

2. When building a long bridge, the middle section often sags. Suggest one modification Max could make to the structure to improve its load-bearing capacity and justify your choice. (2 marks)

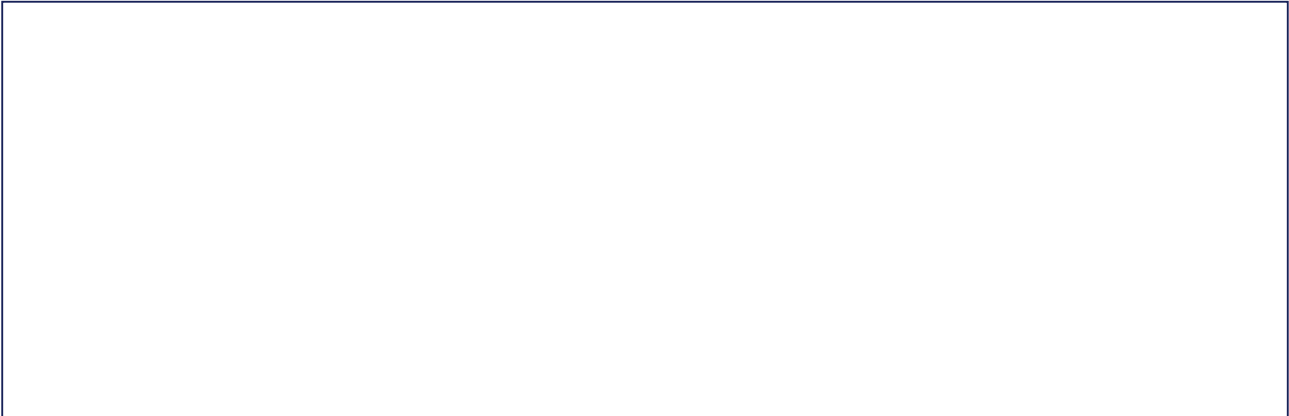
3. Compare and contrast how 'compression' and 'tension' act upon a suspension bridge. Which parts of the bridge are most likely to experience these forces? (2 marks)

4. Max has a budget of £50.00 for materials. If wooden struts cost £4.50 each and metal connectors cost £2.25 each, calculate the maximum number of struts he can buy if he must purchase 8 connectors. Show your working out. (2 marks)

5. What might happen to the stability of the bridge if Max chooses materials that are too flexible? Explain the relationship between rigidity and structural integrity. (2 marks)

6. Justify why engineers use cross-bracing in the design of tall towers or bridges. How does this prevent the structure from collapsing under sideways force? (2 marks)

Draw: Sketch a bridge design for Max that incorporates at least three examples of triangulation. Label your struts, your joint connectors, and indicate where the primary load-bearing points are located.



Extension challenge: Design a 'Bridge Stress Test' report. If Max's bridge is intended to hold a load of 10kg, write a brief set of instructions for how he could safely test the bridge's strength, including how he should measure the point of structural failure.