

Max's Mechanical Masterpiece: Designing Linkages

Learning objective: To understand and apply the principles of mechanical systems, specifically focusing on how linkages and pivots create movement.

Max the monkey is building a new mechanical puppet for the jungle theatre, but he needs your expertise! Use your knowledge of mechanisms to solve these design challenges. You must identify the correct components and explain how the movement is transferred from one point to another. Refer to the word bank to ensure you are using technical vocabulary accurately.

Word bank: pivot · lever · linkage · input · output · force · stiffness · friction

1. Max wants his puppet to wave its arm. If he pushes the bottom of a lever (the input), explain why the top of the lever (the output) moves in the opposite direction, assuming the pivot is in the centre. Justify your answer using the term 'pivot'. (2 marks)

2. What might happen to the movement of a mechanism if the pivot point is made from a material with high friction? Explain the impact on the efficiency of the machine. (2 marks)

3. Compare and contrast a simple lever with a complex linkage system. In what scenario would a linkage system be more beneficial than a single lever? (3 marks)

4. Max is buying materials for his puppet. He has £5.00. Cardboard strips cost £0.45 each and split pins (pivots) cost £0.15 each. If he buys 6 strips and 4 pins, how much change will he receive? Show your working out. (3 marks)

5. If you were designing a mechanism to open a trapdoor using a foot pedal, where would you place the pivot to ensure the least amount of force is required to lift the door? Explain your reasoning. (3 marks)

6. Design a 'creature feature'. Describe a mechanism you could add to a puppet that allows its jaw to open and close using a single sliding motion. (4 marks)

Draw: Sketch a labelled diagram of a simple linkage system that uses two levers and one central pivot. Label the 'input force' and the 'output movement'.



Extension challenge: Design a 'Mechanical Menagerie' device! Write a short proposal for a puppet that uses at least two different types of linkages to create a complex movement, such as a bird flapping its wings or a frog jumping. Explain why your chosen materials (e.g., card, wood, plastic) are suitable for the mechanism's durability.