

Design Technology: Mechanical Systems Assessment

Learning objective: To evaluate understanding of levers and pulleys in mechanical systems, including the identification of fulcrums, loads, and effort, and the application of mechanical advantage.

Read each question carefully. Use your knowledge of mechanisms to provide detailed, scientific answers. Ensure you use technical vocabulary where appropriate.

Max the monkey is helping build a new playground. He is using a seesaw to lift heavy crates of equipment and a pulley system to hoist baskets of fruit to the top of the climbing frame. Max knows that by changing the position of the pivot or adding more wheels to a system, he can make his work much easier.

Word bank: fulcrum · load · effort · mechanical advantage · pivot · pulley · gear · resistance · system

1. Identify the three main components of a lever. Explain the function of the fulcrum. (3 marks)

2. If Max is using a lever to lift a heavy crate, where should he place the fulcrum to make the crate feel lighter? Justify your answer. (3 marks)

3. Compare and contrast a fixed pulley and a movable pulley. How do they differ in terms of the effort required to lift a load? (4 marks)

4. Max wants to lift a load of £50 worth of fruit. If he uses a pulley system that requires only half the effort, what is the 'mechanical advantage' of his system? Explain your reasoning. (3 marks)

5. Explain why increasing the distance between the effort and the fulcrum makes it easier to lift a heavy object. Use the term 'lever arm' in your explanation. (4 marks)

6. Design Challenge: Max needs to design a mechanism to open a heavy wooden gate. Describe the system you would design (lever or pulley) and explain why it is the most efficient choice. Use technical vocabulary to describe the movement. (8 marks)

Draw: Draw a diagram of a first-class lever in balance. Clearly label the 'Fulcrum', 'Load', and 'Effort'. Add an arrow to show the direction of force.



Extension challenge: Greater Depth Challenge: What might happen if the rope in a pulley system stretches under the weight of the load? How would this affect the efficiency of the mechanism? Justify your answer.

Total: /25