

Mechanical Marvels: Levers and Pulleys

Learning objective: To understand how levers and pulleys function as simple machines to increase force or change the direction of a pull, and to apply this knowledge to design solutions.

Read each question carefully. Use your understanding of mechanical advantage, pivots, and force to provide detailed, scientific explanations. Refer to the word bank if you need help with technical vocabulary.

Max the monkey is helping his friends in the jungle by designing machines to lift heavy fruit baskets. Meanwhile, Kit the fox is experimenting with pulleys to hoist supplies up to a high treehouse. Remember that a lever requires a fulcrum (pivot point), and a pulley uses a wheel and rope to redirect force.

Word bank: fulcrum · load · effort · mechanical advantage · pivot · fixed pulley · tension · force

1. Max is using a long wooden pole as a lever to lift a heavy crate of mangoes. If he moves the fulcrum closer to the crate, explain how this changes the amount of effort Max needs to apply. Justify your answer using the term 'mechanical advantage'. (3 marks)

2. Compare and contrast a fixed pulley and a lever. In what way are they both considered 'simple machines'? (2 marks)

3. Kit needs to lift a 10kg basket of supplies 5 metres into the air using a single fixed pulley. Does the pulley reduce the weight of the basket? Explain why he might choose to use a pulley even if the effort required remains the same. (2 marks)

4. If Max wants to lift a very heavy load with minimal effort, should he place the fulcrum closer to the load or closer to his hands? Explain your reasoning. (2 marks)

5. Design a scenario where a system of two pulleys would be more efficient than a single fixed pulley. Describe the setup and what happens to the force required. (3 marks)

6. What might happen if the rope used in a pulley system was made of a material that stretched significantly under pressure? How would this affect the efficiency of the lift? (2 marks)

Draw: Draw a diagram of a Class 1 lever. Clearly label the fulcrum, the load, and the position where the effort is applied. Add an arrow to show the direction of the force.



Extension challenge: Imagine you are building a bridge for a local stream. Design a pulley-based mechanism that would allow a small child to lift a 'drawbridge' section weighing £50 worth of heavy timber. Write a short paragraph justifying your choice of pulley placement and how you would ensure the structure is safe.