

# Max and Kit's Mechanical Marvels: Levers and Pulleys

*Learning objective: To understand the purpose and mechanisms of levers and pulleys, and how they assist in lifting and moving loads.*

Read each card carefully. The front of the card presents a key term or challenge, and the back provides the definition or explanation. Use these to test your knowledge of mechanical systems.

**What is a lever?**

A simple machine consisting of a beam or rigid rod pivoted at a fixed hinge, used to help lift a heavy load with less effort.

**Define the 'fulcrum'.**

The fulcrum is the fixed point or pivot upon which a lever rests or rotates.

**What is the 'load' in a mechanical system?**

The load is the object or weight that you are trying to move or lift using the machine.

**What is 'effort'?**

Effort is the amount of force applied to the lever or pulley system to move the load.

**Explain the function of a pulley.**

A pulley is a wheel with a grooved rim around which a rope or cable passes; it is used to change the direction of a force or to make lifting heavy objects easier.

**How does moving the fulcrum closer to the load change the effort needed?**

Moving the fulcrum closer to the load decreases the amount of effort required to lift it, because it increases the mechanical advantage.

**Compare and contrast a single fixed pulley and a movable pulley.**

A fixed pulley changes the direction of the force (making it easier to pull down to lift up), while a movable pulley reduces the amount of force needed to lift the load.

**Max is trying to lift a heavy box. Why might he choose to use a long lever instead of lifting it by hand?**

A long lever allows Max to apply force over a greater distance, which makes the load feel lighter and requires less effort than lifting the object directly.

**Justify why engineers use pulleys on construction sites.**

Engineers use pulleys because they allow heavy materials to be lifted vertically with less physical exertion and provide better control over the placement of the load.

**What might happen if the fulcrum of a lever were made of a soft, squishy material instead of a hard, solid one?**

If the fulcrum were soft, it would compress under pressure, causing the lever to lose stability and making it much harder to transfer the force effectively to the load.

**Explain why a system with more pulleys often makes a heavy load feel 'lighter'.**

The weight of the load is distributed across multiple sections of the rope, meaning the person pulling only needs to provide a fraction of the total force required.

**Design Challenge: If you were building a crane using pulleys, why is the strength of the rope just as important as the pulleys themselves?**

The rope must be strong enough to withstand the tension of the load; if the rope snaps, the mechanical advantage of the pulley system becomes useless as the connection to the load is broken.