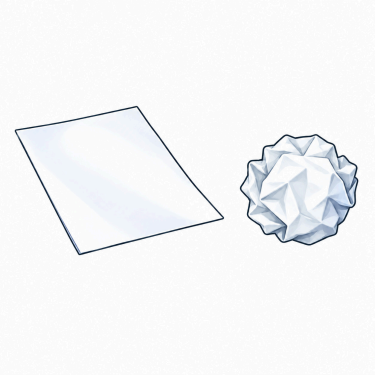
01. Paper race

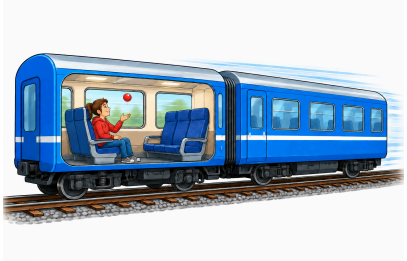
Two identical sheets of paper: one is left flat, the other crumpled into a tight ball. They are released together from the same height in still air. Which usually lands first? What if there is no air?



My prediction and explanation:

02. A ball on a train

A train travels straight at constant speed. A passenger tosses a ball straight up inside the carriage. Will it return to the hand or fall behind it?



My prediction and explanation:

03. Coin and card

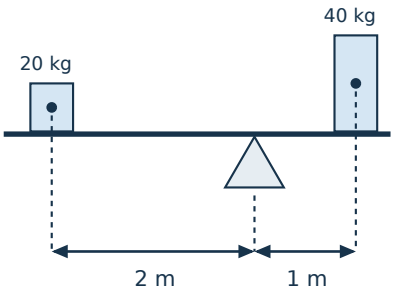
A smooth bank card lies across a drinking glass, with a coin on top. The card is pulled sharply sideways. Where does the coin go? What changes if the card is pulled slowly?



My prediction and explanation:

04. Two weights on a lever

Two weights rest on a weightless lever. The 20 kg weight is 2 m from the pivot; the 40 kg weight is 1 m away. Distances are measured horizontally to the centres of the weights. Which side goes down, or will the lever balance?



My prediction and explanation:

05. Two ramps

The same load is slowly pulled to the same height on two smooth ramps: one short and steep, the other long and gentle. The pull is along the ramp. Which needs less force? Which needs less work? There is no friction.

My prediction and explanation:



Short Long

06. Melting ice

A piece of pure ice floats in a glass of fresh water. It melts completely. Will the water level rise, fall or stay the same? Ignore evaporation and expansion of the warming water.

My prediction and explanation:



Answers and explanations

Try the puzzles first, then compare your reasoning with the explanations.

1 Paper race

In air, the crumpled sheet usually lands first. In a vacuum, they land together.
The sheets have the same mass. Air slows the flat sheet more. With no air, this difference disappears: released together from the same height, both sheets fall together.

2 A ball on a train

The ball returns to the hand.
Before the throw, the ball is already moving forwards with the train. It keeps this horizontal velocity after the throw. If the train moves straight at constant speed, the ball does not fall behind.

3 A coin and a card

A quick pull makes the coin fall into the glass.
The card slips away before friction can move the coin very far. Gravity pulls the coin down. With a slow pull, friction carries the coin along with the card, so it may miss the glass.

Answers and explanations

Continued: puzzles 4-6

4 A lever with two loads

The lever stays balanced.
Compare mass × distance from the pivot: 20 × 2 = 40 and 40 × 1 = 40. The two loads produce equal turning effects. The lever itself is weightless in this problem.

5 Two tracks

The longer, gentler track needs less force. The work is the same.
A smaller force acts over a greater distance. Without friction, the work needed to lift the load is mgh. The mass and height are unchanged: saving force does not save work.

6 A melting iceberg

The water level stays the same.
Floating ice displaces water equal to its own mass. When it melts, it becomes exactly that volume of fresh water. Under the conditions in the question, the water level therefore stays unchanged.

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