

# STEM on the Move

## Examples for bicycle lessons



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# Overview for smaller bicycle topics

## Optimizing Movement

*Use STEM to **cycle more efficient***

Friction (Air, Brakes)

Golden Rule of  
Mechanics

Inclined Plane

## Engineering & Components

*Use the bicycle to **better understand STEM***

Gears & Levers

Spinning Top / Torque

Energy Conversion &  
Momentum

## Biology / Health

*Use STEM to **cycle in a healthy/safe way***

Posture / Safety

Cardiovascular System  
& performance

## Optimizing Movement

## Friction (Air, Brakes)

### GOAL:

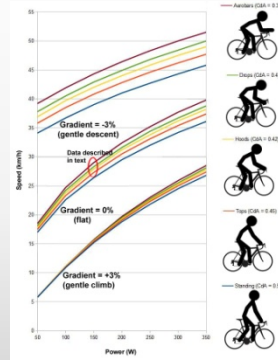
Students describe un-/desired types of friction in cycling and methods of de-/increasing them.

→ **letting the bicycle roll** (after reaching a certain speed or just down a slope) while trying different poses to **reduce air resistance** (attach an umbrella on the rear end?)

→ driving on **different surfaces** (asphalt, soil, sand, ...)

→ After reaching a specific speed, stop the bike by a) **braking** b) just letting it roll c) using oiled brakes

### EXERCISES



## Optimizing Movement

## Golden Rule of Mechanics

GOAL:

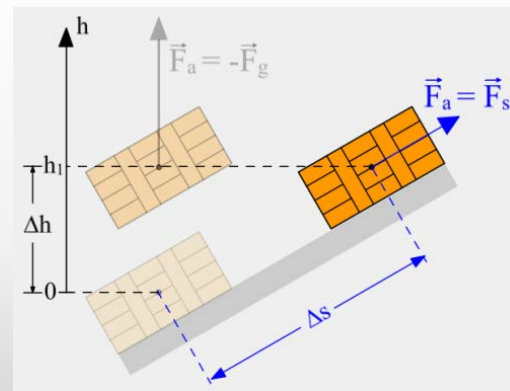
Students describe the rule in words ( $F_1 \cdot s_1 = F_2 \cdot s_2$ ) and use it to evaluate different routes.

→ cycle up hills on different sides with **different steepnesses**

EXERCISES

→ comparing pictures of **different routes** across a mountain path, discussing options

→ use different gears or tires of different sizes



## Optimizing Movement

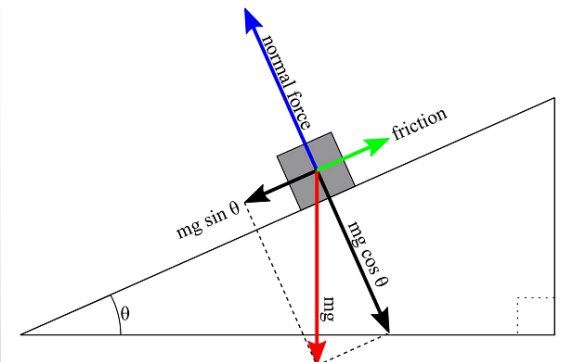
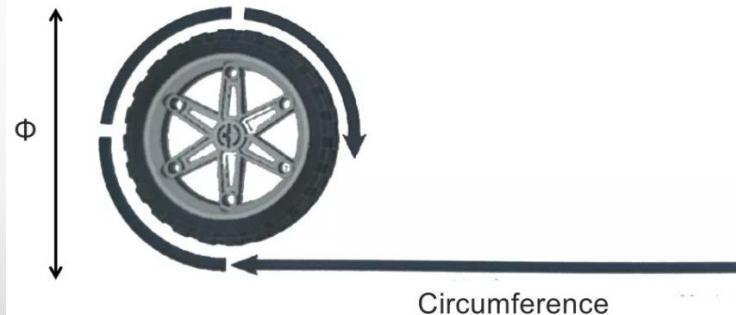
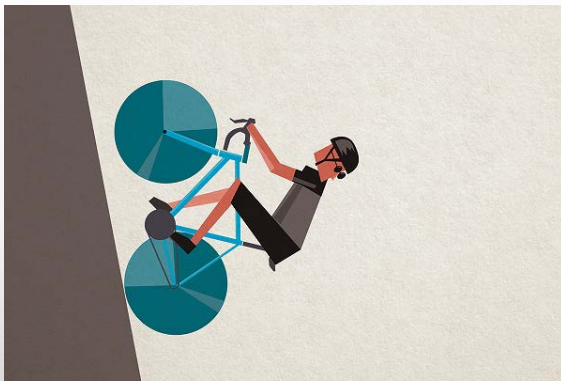
## Inclined Plane

### GOAL:

- Students discuss how steepness affects the efficiency of cycling <OR>
- Students explain and apply different gear settings depending on the steepness of the slope

### EXERCISES

- trying out different gear combinations while cycling
  - a) ... on a horizontal plane
  - b) ... up a hill (at different angles)
- comparing travel distance per pedal cycle for different settings
- runners vs. cyclists on a steep slope → who is faster – and why? (Extra: Looking at the forces applying to the bicycle)

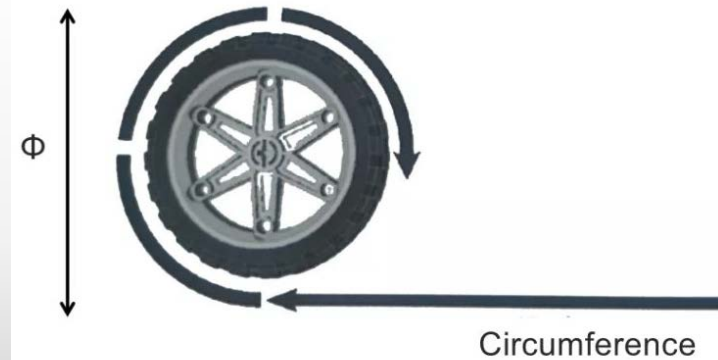
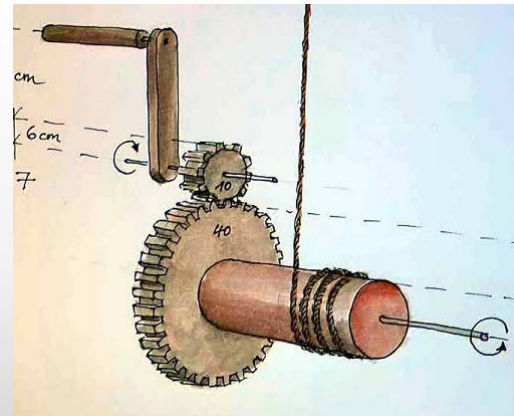
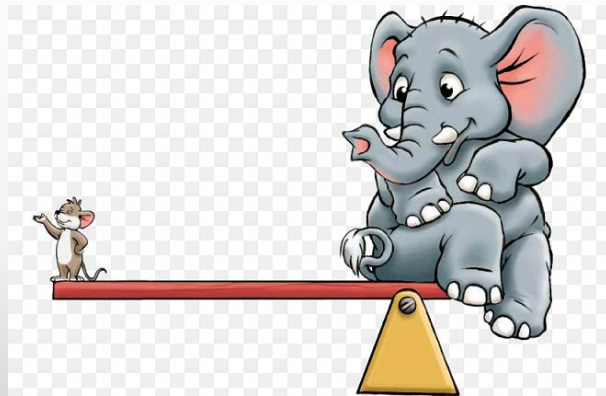


GOAL:

Students compare bicycles to simple levers and explain the applications of the gears.

- Cycling with **different gear settings** or bicycles with differently sized tires
- Using simple **levers to lift objects** vs. lifting them directly
- Use detached cycling components to create **winches** for a better comparison
- comparing travel distance per pedal cycle for different settings

EXERCISES

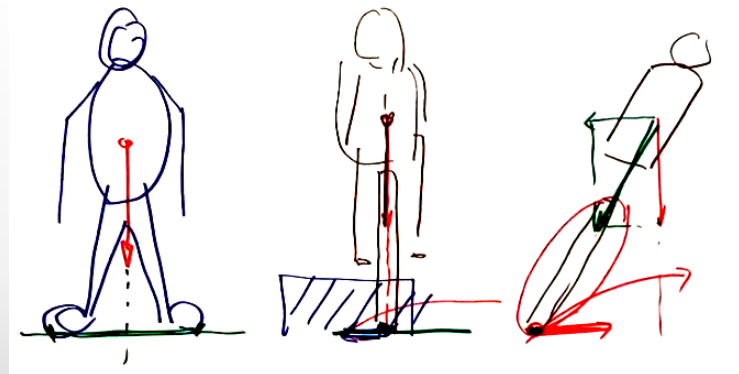
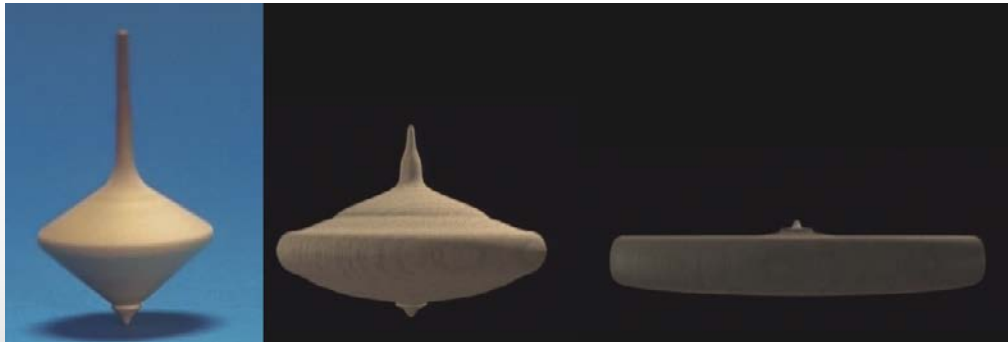


## GOAL:

Students explain why bicycles stay stable during cycling (even during tight turns)

## EXERCISES

- Trying to **balance yourself** while sitting on a standing bike vs. cycling on it
- „**Slow race**“ (driving on a line/course as slow as possible)
- Spinning a wheel while sitting on a rotatable chair



## GOAL:

- Students describe energy conversions at the example of a bicycle <OR>
- Students explain the efficiency of a bike compared to running by using momentum

## EXERCISES

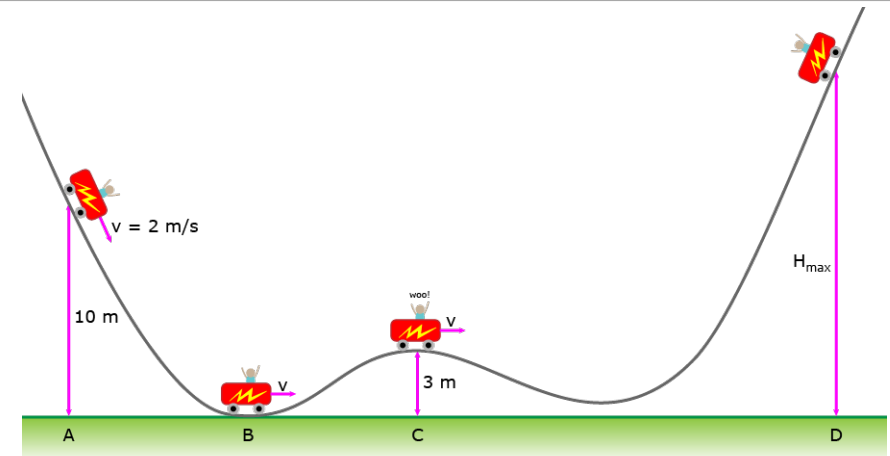
- Rolling down from a slope/hill from **different heights**
- **Stopping movement** while on a bike vs. while walking (with a mattress)
- Describing what happens in different top/valley configurations



all potential energy  
no kinetic energy



no potential energy  
all kinetic energy





## Biology / Health

## Posture / Safety

### GOAL:

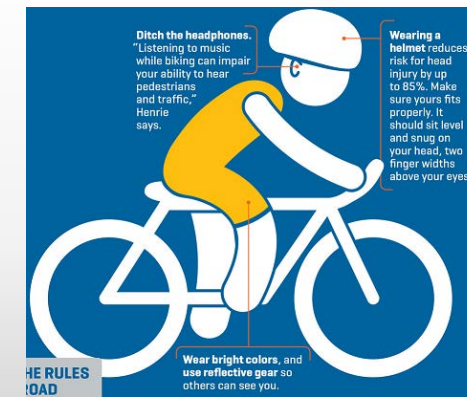
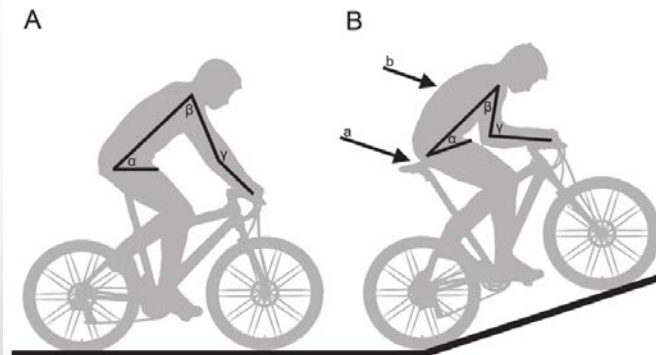
Students list a few measures for safe cycling and perform a healthy posture on bicycles.

→ cycling with different postures (esp. The back) or with various heights of saddle/handlebars and comparing the feeling

### EXERCISES

→ watching the performance of other students (e.g. via video and slow-motion) and evaluate their form

→ comparing the impact (e.g. on watermelons) with and without safety gear



GOAL:

Students explain stress factors on the cardiovascular system and describe/perform efficient/healthy ways of cycling

EXERCISES

- comparing (practically/theoretically) sprint cycling with moderate cycling – pro and contra, including dangers for the body
- discussing key factors for a healthy/safe performance (heat, water, muscle stress, ...)

