UNIVERSITY OF BIRMINGHAM | SCHOOL OF PHYSICS AND ASTRONOMY

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making physics matter

CLOCKS AND GEARS

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CREATIONS
Developing an Engaging Science Classroom

WHY DID WE INVENT CLOCKS?

hourglass

obelisk

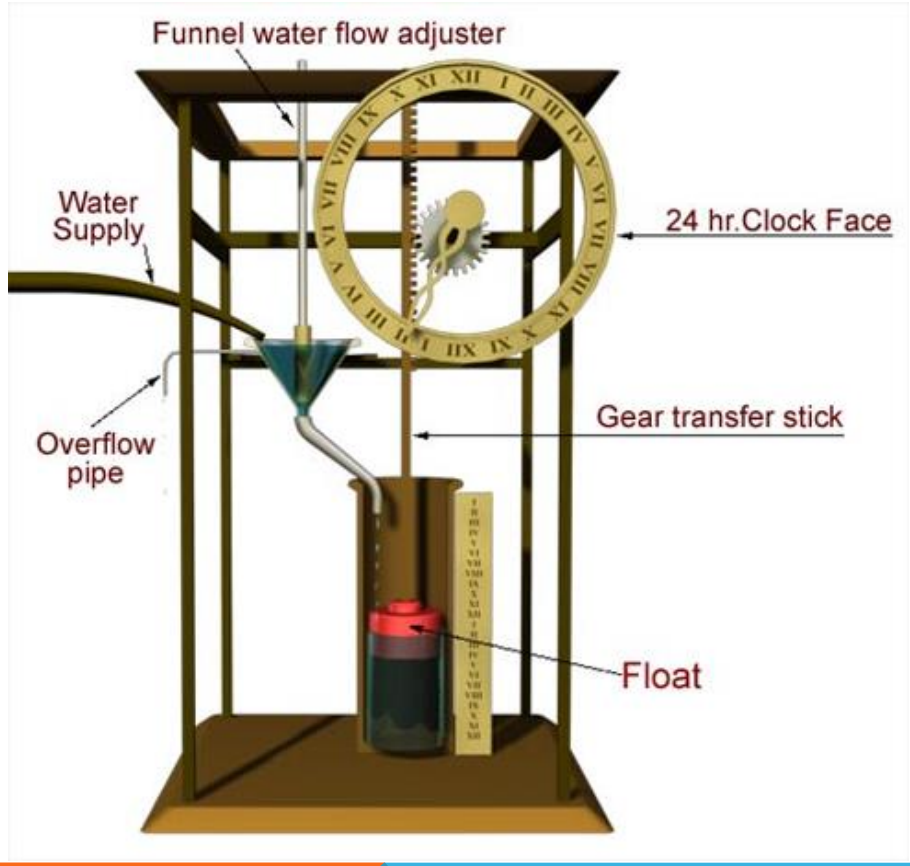
water-clock

oil- lamp clock

candle-clock

sundial

CLOCKS BECOME MORE ACCURATE…

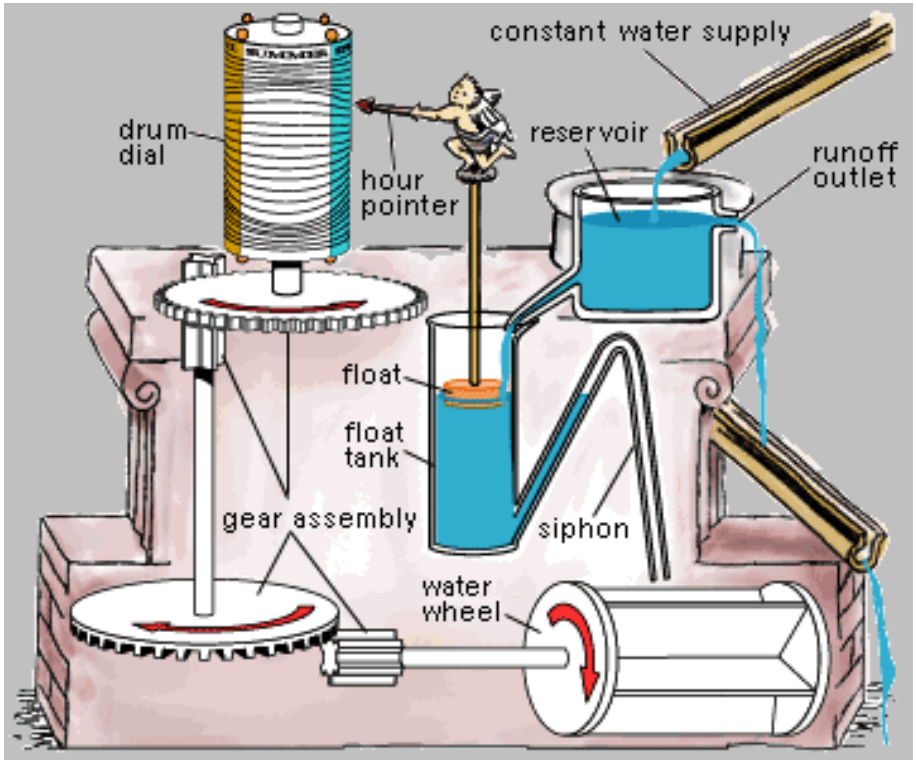


Ancient Greek water-clock that uses gears.

How does it work?

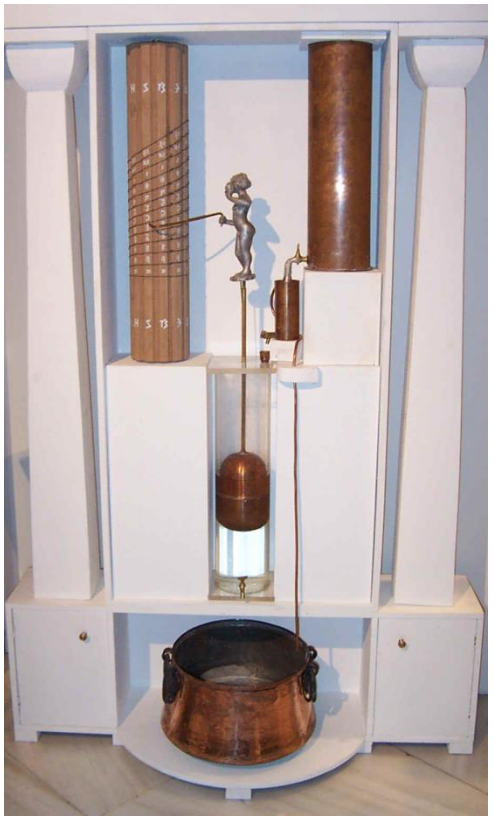
An ancient Greek water clock or ***clepsydra*** is a device where time is measured by the flow of water *into* or *out from* a vessel where the amount is then measured.

...AND MORE COMPLICATED !



The clock of Ctesibius.

It uses a combination of gears to control the speed of motion.



Ctesibius (285–222 BC) was a Greek inventor and mathematician in Alexandria, Egypt. None of his written work has survived.

CLOCKS WITH EXTRA FEATURES

The alarm clock of Archimedes.

How does it work?

Archimedes of Syracuse (287 BC – 212 BC) was an Ancient Greek mathematician, physicist, engineer, inventor, and astronomer. His last words were *"Do not disturb my circles",* for the circles he was drawing in the sand when a Roman soldier walked on them.

CLOCKS WITH EXTRA FEATURES

The hydraulic clock of
Archimedes,
the first ticking-clock in human
history.

ASTRONOMICAL CLOCKS

An astronomical clock is a clock with special mechanisms and dials to display astronomical information, such as:

- the relative position of the Sun
- the relative position of the moon
- zodiac constellations
- major planets

Face of the Astronomical Clock, in Old Town Square, Prague, Czech Republic.

THE OLDEST ASTRONOMICAL CLOCK

The **Antikythera Mechanism** is an ancient Greek astronomical clock, used to predict astronomical positions and eclipses as well as the cycles of the ancient Olympic Games.

GEARS AND MATHS

Which horse on a Merry-Go-Round moves faster?

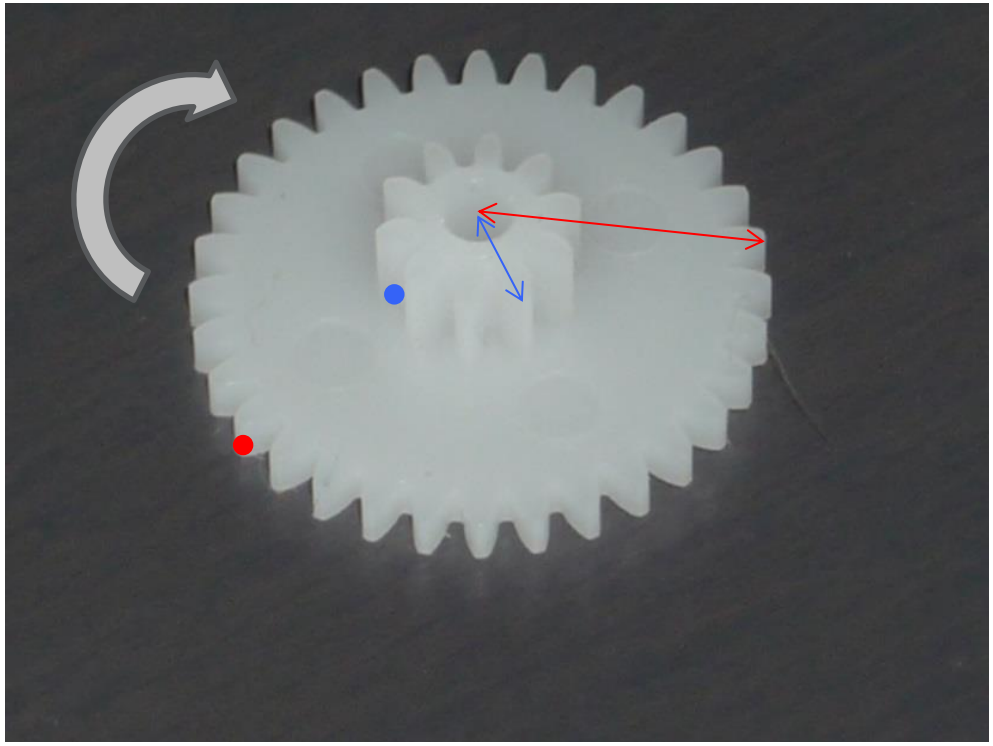
The one on the inside or the one on the outside?

Why?

When objects move in a circle, there are two types of speed:

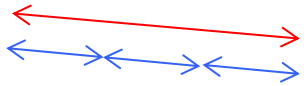
- Linear speed is equal to the ***distance*** covered divided by the time taken
- Angular speed is equal to the ***angle*** covered divided by the time taken

GEARS IN SAME AXLE



Which dot moves faster?
The red or the blue?

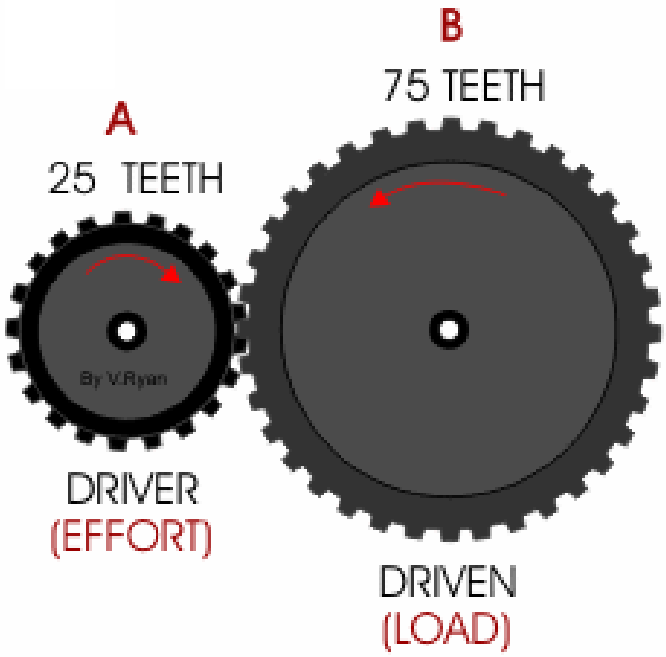
Why?



How much faster does it move?

$$\frac{speed\ of\ \mathbf{red}\ dot}{speed\ of\ \mathbf{blue}\ dot} = \frac{radius\ of\ \mathbf{large}\ gear}{radius\ of\ \mathbf{small}\ gear}$$

WHEN ONE GEAR DRIVES ANOTHER



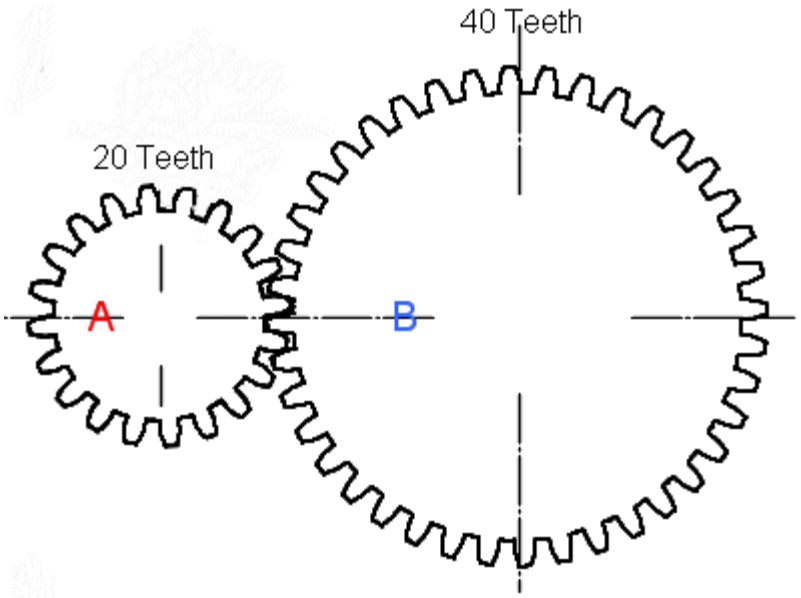
Which gear ***rotates*** faster? A or B?

Why?

How much faster does it rotate?

$$\frac{\textbf{rotating}\ speed\ of\ gear\ A}{\textbf{rotating}\ speed\ of\ gear\ B} = \frac{number\ of\ teeth\ in\ gear\ B}{number\ of\ teeth\ of\ gear\ A}$$

TESTING WHAT WE'VE LEARNED…

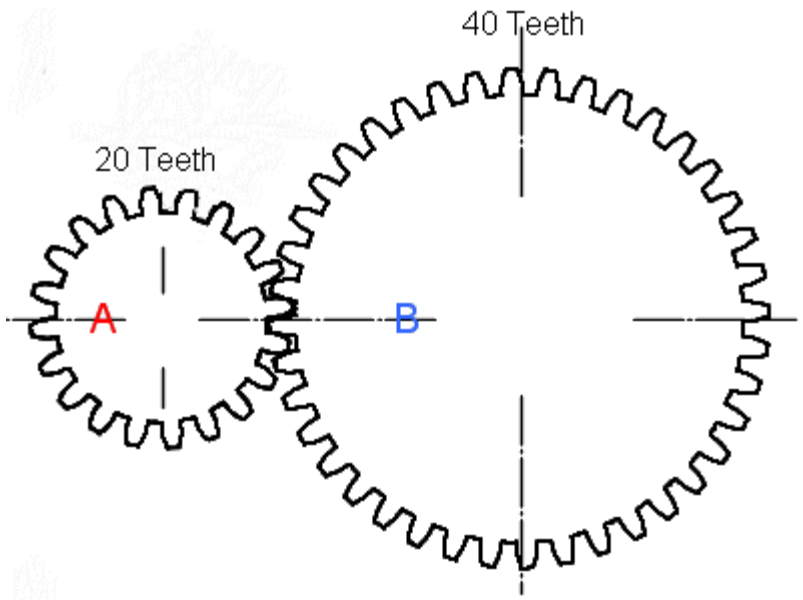


Which gear ***rotates*** faster? A or B?

How much faster does it rotate?

Answer:

TESTING WHAT WE'VE LEARNED…



Which gear ***rotates*** faster? A or B?

How much faster does it rotate?

Answer: gear A rotates twice as fast as gear B

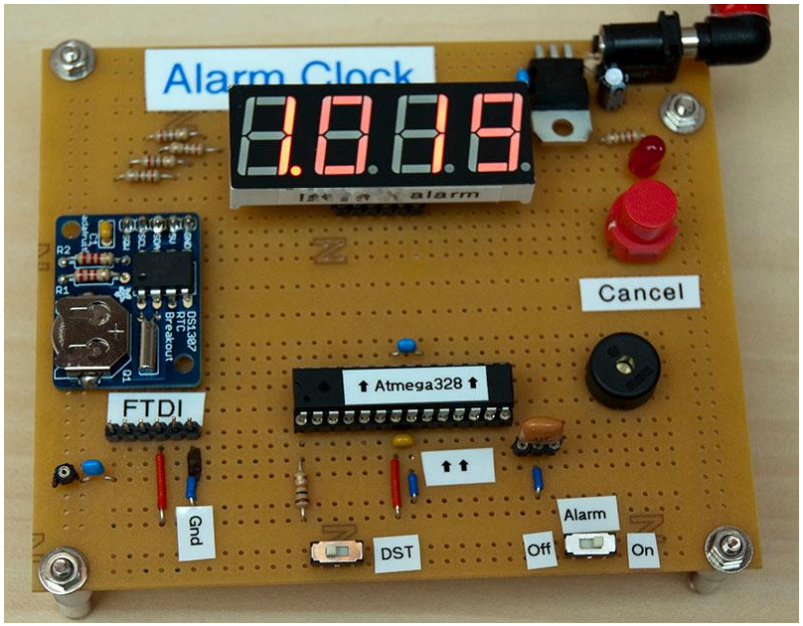
HUMAN GEARS !

Show us what you have learned by making human gears with your class mates!

CLOCKS TODAY

MECHANICAL CLOCKS

DIGITAL CLOCKS



It is now time to make your own clock !

CLOCKS WITH PENDULUMS

The pendulum controls how fast the dials move.

Question: how does the length of the pendulum affect the speed of the tick-tock swing?