10.2 Machines

Simple Machines: (pg. 269) (A machine transfer energy!!)
Lever, Screws, Wedges, Pulley, Wheel & Axle, & Inclined Plane

Output work can never be greater then the input work.

F_e = effort force ** person
F_r = resistance force ** machine

Mechanical Advantage: $MA = \frac{F_r}{F_e}$

*fixed pulley: $F_e = F_r$ = 1 Direction of F_e that changes
bottle opener:
MA > 1 Machine (lever) increase force

May 5-9:21 AM

$W_o = W_i$

$F_r d_r = F_e d_e$

$MA = \frac{F_r}{F_e}$ (Force)

$\frac{d_e}{d_r} = IMA$ (Distance)

Ideal Mechanical Advantage:

Efficiency: $e = \frac{W_o}{W_i} \times 100$

$e = \frac{MA}{IMA}$

$e = \frac{F_r d_r}{F_e d_e}$ *meters

pg. 268 E.C. Challenge problem: due Tues. May 9th

*work on your OWN

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Compound Machines:

IMA: distance moved or the ratio of the distance between where where the force is applied & the pivot point. (fraction)

Steering wheel: pg. 269

Bicycle:
* MA: $\frac{\text{force gear on chain}}{\text{force rider on pedal}} \times \frac{\text{F wheel around}}{\text{F chain on gear}}$

* Number of turns: $\frac{\text{front gear radius}}{\text{rear gear radius}}$

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IMA: $\frac{\text{pedal radius}}{\text{front gear radius}} \times \frac{\text{rear gear radius}}{\text{wheel radius}}$ (Distance)

$\frac{\text{rear gear radius}}{\text{front gear radius}} \times \frac{\text{pedal radius}}{\text{wheel radius}}$

$IMA = \frac{\text{teeth on rear gear}}{\text{teeth on front gear}} \cdot \frac{\text{pedal arm length}}{\text{wheel radius}}$

Count # teeth on gears = same chain & have teeth same size

Force is applied to a pedal, assume that it is applied perpendicular to the arm. (why?) TORQUE

May 5-9:32 AM

Ex. 1: You examine the rear wheel on your bicycle. It has a radius of 35.6 cm and has a gear with a radium of 4.00 cm. When the chain is pulled with a force of 155 N, the wheel rim moves 14.0 cm. The efficiency of this part of the bicycle is 95.0%.

~~What~~ is the IMA of the wheel and gear?

~~What~~ is the MA of the wheel and gear?

What is the resistance force?

How far was the chain pulled to move the rim 14.0 cm?

rear wheel = 35.6

rear gear rad = 4.00cm

$IMA = \frac{4.00}{35.6} = 0.112$ $\quad \mathcal{E} = \frac{MA}{IMA} \cdot 100$

$MA = \frac{f_r}{f_e}$ $\quad MA = IMA \cdot \mathcal{E}$

$0.106 = (0.112) \cdot .95$

$f_r = MA \cdot f_e$

$(0.106)(155N) = 16.43N$

$IMA = \frac{d_e}{d_r}$ $\quad d_e = IMA \cdot d_r$

$(0.112)(14) = 1.57cm$

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Ex. 2: A bicycle has a pedal radius of 15.0cm, a front gear radius of 5.57 cm, a rear gear radius of 4.00 cm and a rear wheel radius of 35.6 cm.

What is the IMA of the bicycle?

How many times will the rear wheel turn for one complete turn of the pedal?

$\frac{\text{rear gear rad}}{\text{front gear rad}} \times \frac{\text{ped rad}}{\text{wheel rad}}$

$\frac{4.00}{5.57} \times \frac{15.0cm}{35.6cm} = 0.303$

$\#\text{of Turns} = \frac{\text{front gear rad}}{\text{rear gear rad}} = \frac{5.57}{4.00}$

$1.39cm$

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Example 3: Hayden exerts a force of 215 N on a lever to raise a 1350 N rock a distance of 15 cm. If the efficiency of the lever is 86.5%, how far did Hayden have to move the end of the lever?

$d_e \cdot Eff = \frac{f_r d_r}{f_e d_e} \cdot d_e$

$d_e \mathcal{E}ff = \frac{f_r \cdot d_r}{f_e \cdot \mathcal{E}}$ $\quad \frac{1350 \cdot .15}{215 \cdot .865}$

$d_e =$ $\quad 1.09M$

May 5-9:41 AM

Assignment:

Page 272 problems 24 - 27 28 is E.C.

Monday:
- Complete notes on pages 272 - 273 (see website)
- Examples of machines
- Chapter 10 review part 1

Tuesday:
- Chapter 10 review part 2
- Create equipment to use for cedar point

Wednesday:
- Field trip - (van) practice for cedar point
- Work on both reviews

Thursday:
- Correct both reviews
- Field trips - (van) or school practice for cedar point

Friday:
- Field trips
- Review for Chapter 10 test on Monday, May 15th

May 5-9:43 AM