Activity 1.1.1 Simple Machine Investigation

Warmup

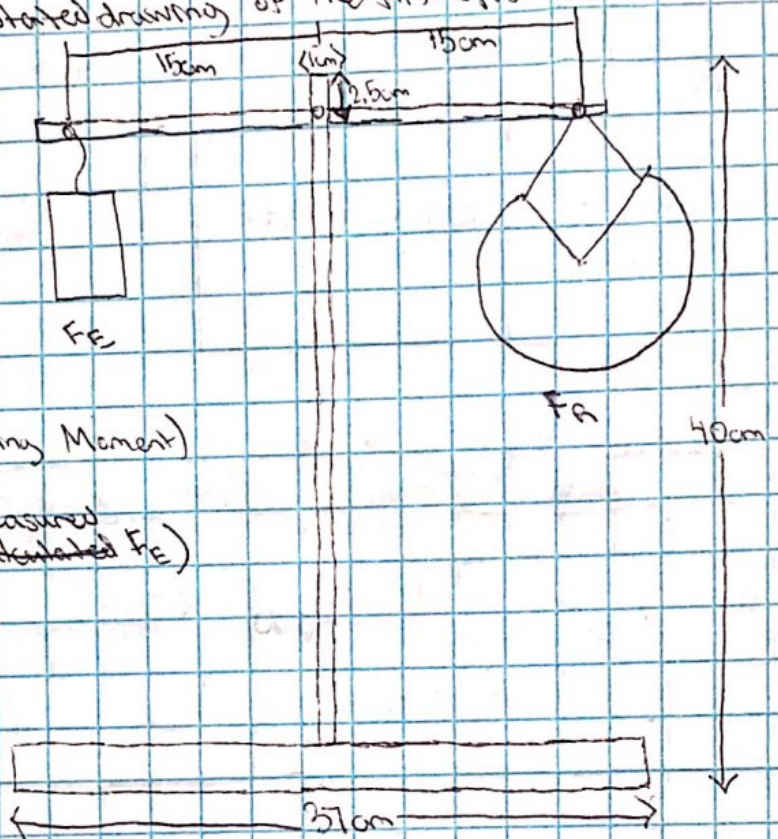
Lesson 1.1.6 the Amazing Do Nothing Machine

Vernier Logger Pro

- Attach force sensor
- Click collect button
- Click button for specific points [x=]

* Find force using total force minus starting force

1. Create a scaled annotated drawing of the first class lever.



$D_E = 15\,cm$
$D_R = 15\,cm$
$F_E = 2.891\,N$ (using Moment)
$F_R = 2.891\,N$
$F_E = 2.982\,N$ (measured ~~calculated~~ F_E)

2. Calculate the ideal mechanical advantage of the lever system.

Formula	Substitute / Solve	Final Answer
$IMA = \frac{D_E}{D_R}$	$IMA = \frac{15\,cm}{15\,cm} = 1$ $IMA = \frac{0.4926}{0.4926} = 1$	$IMA = 1$

$15\,cm \frac{1\,m}{100\,cm} = 0.15\,m \frac{3.28\,ft}{1\,m} = 0.492\,ft$

$2.891\,N \frac{0.224816}{1\,N} = 0.65016$

$2.982\,N \frac{0.224816}{1\,N} = 0.6716$

Signature: Breeyanna Williams Witness: Date: 1/29/2014

21 Activity 1.1.1 Simple Machine Investigation Pt. 2

3. Calculate the ideal effort force needed to overcome the known resistance force.

Formula	Substitute	Solve	Final Answer
$M_E = M_R$ $F_E d_E = F_R d_R$	$(F_E)(0.492ft) = (0.6516)(0.492ft)$ $(F_E)(0.492ft) = 0.33\ ft \cdot lb$	$F_E = 0.65016$	$F_E = 0.6516$

4. Calculate the actual mechanical advantage of the lever system.

Formula	Substitute / Solve	Final Answer
$AMA = \frac{F_R}{F_E}$	$AMA = \frac{(0.6516)}{(0.6716)} = 0.97$	$AMA = 0.97$

5. Calculate the efficiency of the lever system.

Formula	Substitute / Solve	Final Answer
$\%\ Efficiency = \frac{AMA}{IMA} 100$	$\%\ Efficiency = \frac{(0.97)}{(1.00)} 100$ $= 97$	$\%\ Efficiency = 97$

6. List and describe two examples of a first class lever.

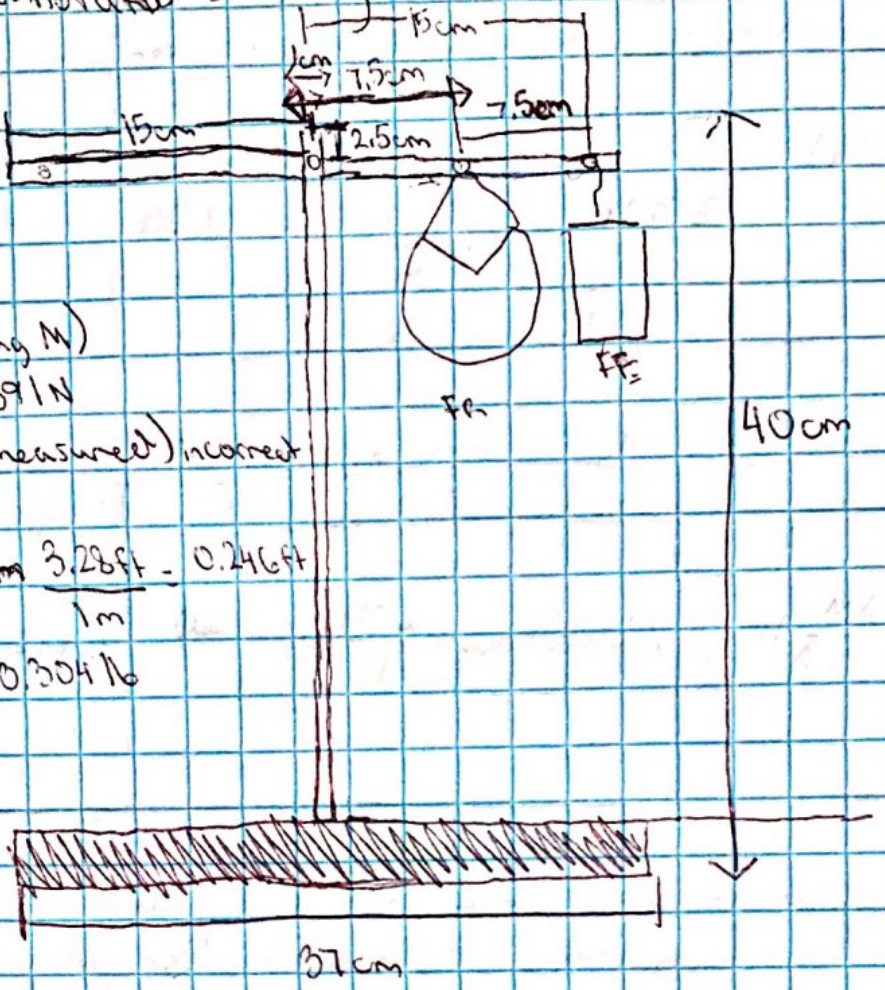
One example of a first class lever is a seesaw. A seesaw works with one person on one end of the lever, another person on the other end, and the fulcrum in the center. If one person is heavier than the other then the heavier person's side would sink. To have a MA of 1 they would have the same weight or approximately the same weights. Person 1 is the effort and person 2 is the resistance. Another example of a first class lever is a pair of scissors. A pair of scissors works with the turning point in the center being the fulcrum, the blade and what it's cutting being the resistance, and the handles being the effort.

Signature Investigator Witness: Date: 1/29/2014

Activity 1.1.1 Simple Machine Investigation Pt. 3

Second Class Lever

7. Create a scaled annotated drawing of the second class lever.



$D_E = 7.5cm$

$D_R = 7.5cm$

$F_E = 2.89lN$ (using N)

$F_R =$ 2.89lN

$F_E = 1.352N$ (measured) incorrect

$7.5cm \frac{1m}{100cm} = 0.075m \frac{3.28ft}{1m} = 0.246ft$

$1.352N \frac{0.2248lb}{1N} = 0.304lb$

8. Calculate the ideal mechanical advantage of the lever.

Formula	Substitute / Solve	Final Answer
$IMA = \frac{D_E}{D_R}$	$IMA = \frac{7.5cm}{7.5cm} = 1$	$IMA = 1$
	$IMA = \frac{0.246ft}{0.246ft} = 1$	

9. Calculate the ideal effort force needed to overcome the known resistance force.

Formula	Substitute / Solve	Final Answer
$M = M$ $F_d = F_d$ $F_E D_E = F_R D_R$	$(0.246ft)(F_E) = (0.246ft)(0.6516)$ $(0.246ft)F_E = 0.1599ft \cdot lb$ $F_E = 0.6501b$	$F_E = 0.6501b$

Signature Breeanna D Williams Witness

Date 1/29/2018

23 Activity 1.1.1 Simple Machine Investigation Pt. 4

10. Calculate the actual mechanical advantage of the lever system.

Formula	Substitute/Solve	Final Answer
$AMA = \frac{F_R}{F_E}$	$AMA = \frac{2.891N}{2.891N} = 1.000$ $= 0.6516 = 1.000$ 0.6516	$AMA = \frac{1.000}{1.00}$

11. Calculate the efficiency of the lever system.

Formula	Substitute/Solve	Final Answer
$\%\ Efficiency = \frac{AMA}{IMA} 100$	$\%\ Efficiency = \frac{1.00}{1} 100 = 100$	$\%\ Efficiency = 100$

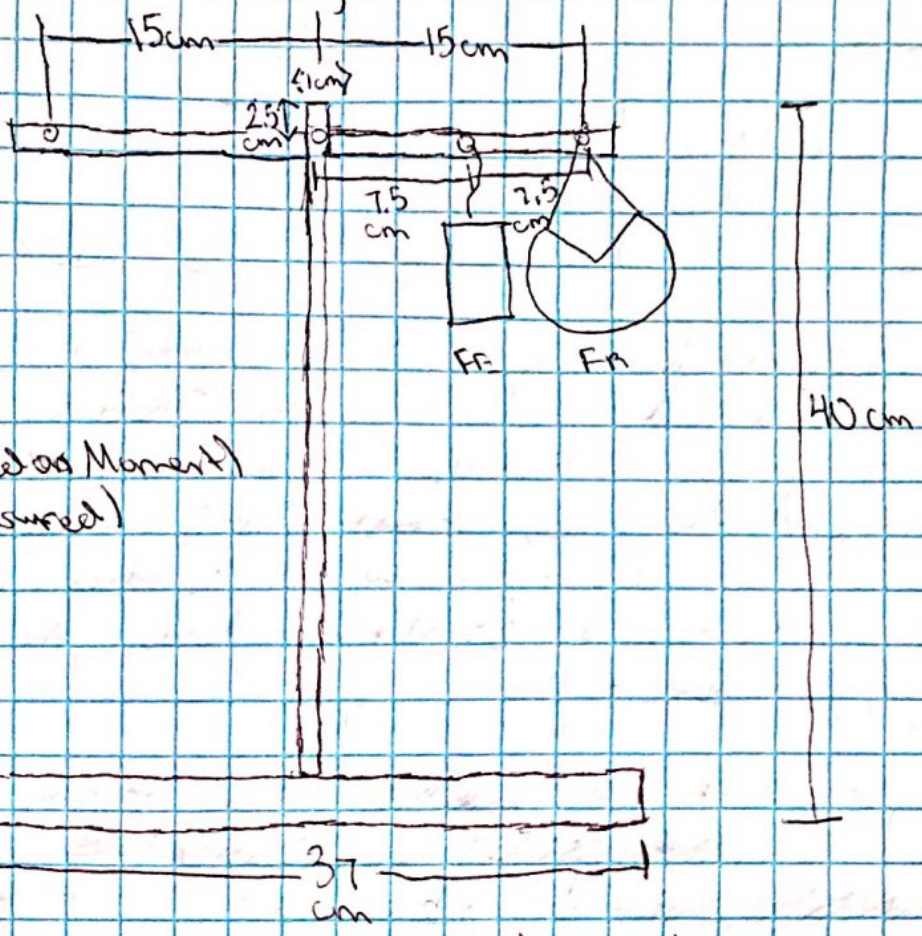
12. List and describe two examples of a second class lever

An example of a second class lever is a wheelbarrow. The fulcrum is the wheel, the resistance is what is inside the wheelbarrow, and the effort is the force that applies on the handles. Another example of a second class lever is a nutcracker. The end is the fulcrum, the nut in the middle is the resistance, and your hand applying pressure on the other end is the effort.

Signature: Breelyanna Williams Witness: Date: 1/29/2018

Activity 1.1.1 Simple Machine Investigation Pt.5

13 Create a scaled annotated drawing of the third class lever



$D_E = 7.5$ cm
$D_R = 7.5$ cm
$F_R = 2.891$ N
$F_E = 2.891$ N (based on Moment)
$F_E = 6.933$ N (measured)

14. Calculate the ideal mechanical advantage of the lever system.

Formula	Substitute / Solve	Final Solution
$IMA = \frac{D_E}{D_R}$	$IMA = \frac{0.246\,ft}{0.246\,ft} = 1$ $\quad IMA = \frac{7.5cm}{7.5cm} = 1$	$IMA = 1$

15. Calculate the ideal effort force needed to overcome the known resistance force.

Formula	Substitute / Solve	Final Solution
$M = M$ $F_d = F_d$ $F_E D_E = F_R D_R$	$(F_E)0.246ft = (0.6516)(0.246ft)$ $(F_E)0.246ft = 0.1599ft \cdot lb$ $F_E = 0.6516$	$F_E = 0.6516$

16. Calculate the actual mechanical advantage of the lever system.

Formula	Substitute / Solve	Final Solution
$AMA = \frac{F_R}{F_E}$	$AMA = \frac{2.891\,N}{6.933\,N} = 0.417$	$AMA = 0.417$

Signature: Breeyanna R Williams Witness. Date: 11/29/2018

25 Activity 1.1.1 Simple Machine Investigation Pt. 8

17. Calculate the efficiency of the lever system.

Formula	Substitute / Solve	Final Solution
$\%\ Efficiency = \frac{AMA}{IMA} 100$	$\%\ Efficiency = \frac{0.417}{1}(100) = 41.7$	$\%\ Efficiency = 41.7$

18. List and describe two examples of third class lever.

An example of a third class lever is tweezers. The fulcrum is at one end of the tweezers, the resistance is at the other end, and you apply pressure near the middle. Another example of a third class lever is a fishing rod. The fulcrum is at one end of the rod, at the other end is the resistance, or the fish and the body, and around the middle is the handle with a person's hand applying force to it.

19. It is possible for a first class lever to have a mechanical advantage less than one. This can happen with the first class lever if the fulcrum is closer to the effort than the resistance because it'll take more force to lift the resistance force since it's so far from the fulcrum. A second class lever can't have a mechanical advantage of less than 1 because with a second class lever, you're basically lifting it which creates a high mechanical advantage. A third class lever can't have a mechanical advantage of greater than one because the only way to move the resistance force will it's on the lever is to lift it which is hard when you farther away from and therefore have less a direct grip.

20. When I was solving for mechanical advantage, the final answer didn't require units because they were canceled out.

Signature: Breeyanna R Williams Witness Date: 1/29/2021