

Skill and Practice Sheet Answers

7A Work Done against Gravity

- 1,323 joules
- 207,000 joules
- 20 joules
- 3 meters
- 3,375 joules
- 80 kilograms

7B Power

- 250 watts
- 50 watts
- 1,200 watts
- 1,500 watts
- 741 watts
- 720 watts
- work = 500 joules; power = 33 watts
- 1,800 seconds or 30 minutes
- 2,160,000 joules
- 2,500 watts
- 90,000 joules
- work = 1,500 joules; time = 60 seconds
- force = 25 newtons; power = 250 watts
- distance = 100 meters; power = 1,000 watts
- force = 333 newtons, work = 5,000 joules

7C Mechanical Advantage

- 4
- 0.4
- 100 newtons
- 25 newtons
- 300 newtons
- 26 newtons
- 3
- 150 newtons
- 1.5
- Answers are:
 - 1,500 newtons
 - 2 meters

7D Mechanical Advantage of Simple Machines

- 5
- 1.5
- 0.5 meters
- 4.8 meters
- 0.4
- 0.8 meters
- 0.25 meters
- 6.7
- 2 meters
- 12 meters
- 2.4
- 6 newtons
- 560 newtons
- 4 meters

7E Gear Ratios

1. 9 turns
2. 1 turn
3. 4 turns
4. 10 turns
5. 6 turns
6. Answers for the table are:

Input Gear (# of teeth)	Output Gear (# of teeth)	Gear ratio (Input Gear: Output Gear)	How many turns does the output gear make if the input gear turns 3 times?	How many turns does the input gear make if the output gear turns 2 times?
24	24	1	3	2
36	12	3	9	0.67, or 2/3 of a turn
24	36	0.67, or 2/3	2	3
48	36	1.33, or 4/3	4	1.5
24	48	0.5, or 1/2	1.5	4

7. Answers for the table are:

Set up	Gears	Number of teeth	Ratio 1 (top gear: middle gear)	Ratio 2 (middle gear: bottom gear)	Total gear ratio (Ratio 1 x Ratio 2)
1	Top gear	12	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{1}{3}$
	Middle gear	24			
	Bottom gear	36			
2	Top gear	24	$\frac{2}{3}$	$\frac{3}{1}$	$\frac{2}{1}$
	Middle gear	36			
	Bottom gear	12			

Set up	Gears	Number of teeth	Ratio 1 (top gear: middle gear)	Ratio 2 (middle gear: bottom gear)	Total gear ratio (Ratio 1 x Ratio 2)
3	Top gear	12	$\frac{1}{4}$	$\frac{4}{2}$	$\frac{1}{2}$
	Middle gear	48			
	Bottom gear	24			
4	Top gear	24	$\frac{1}{2}$	$\frac{4}{3}$	$\frac{2}{3}$
	Middle gear	48			
	Bottom gear	36			

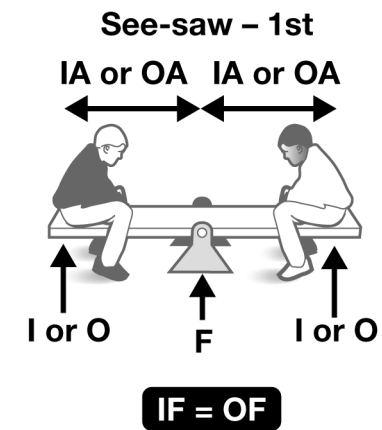
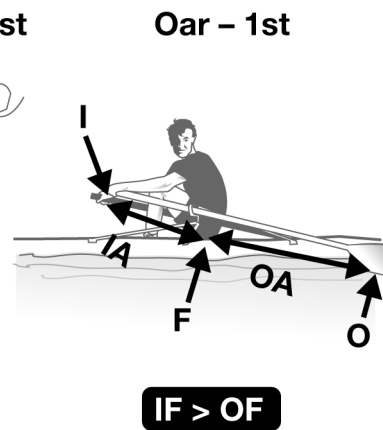
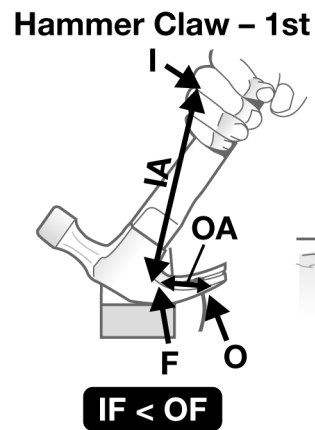
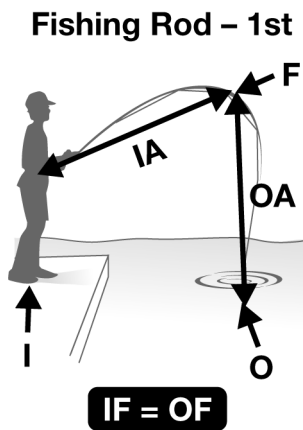
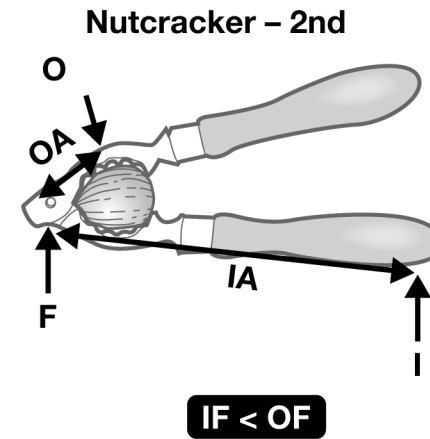
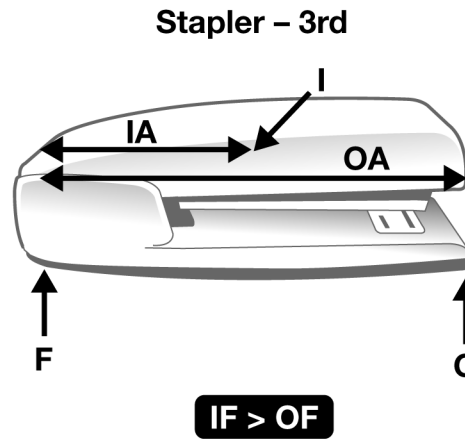
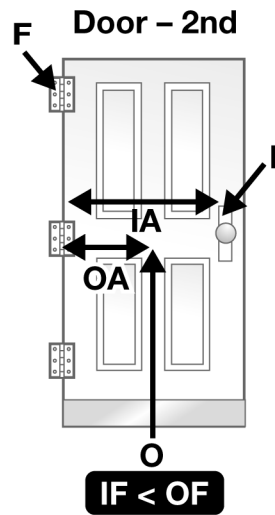
8. The middle gear turns left. The bottom gear turns right.
9. 3 times
10. 4 times
11. 1/2 time
12. 6 times

7F Types of Levers

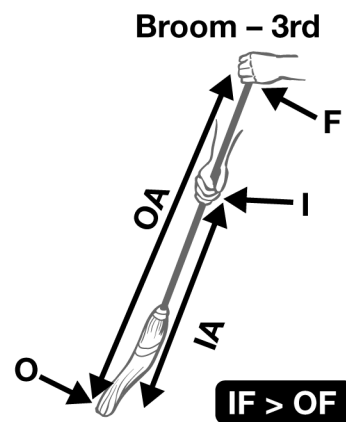
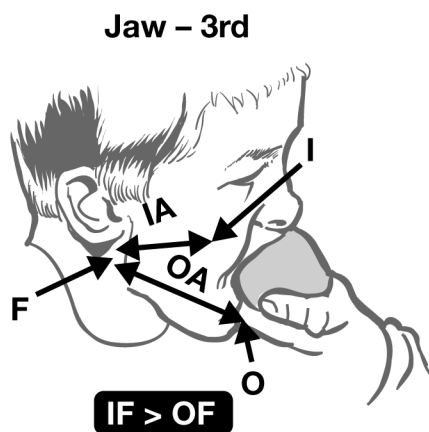
Part 1 and 2 answers:

1. 2nd class lever
2. 1st class lever
3. 3rd class lever

4. Answers for (4) include answers for (1) - (4) in Part 2:

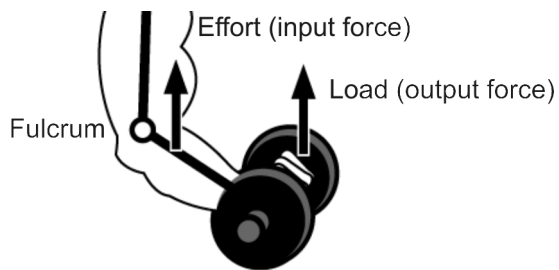


5. Two examples:



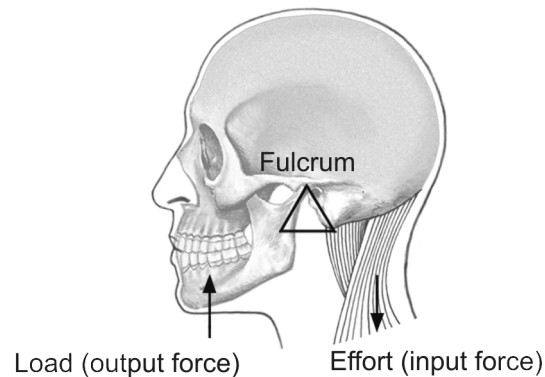
7G Levers in the Human Body

Lever A:



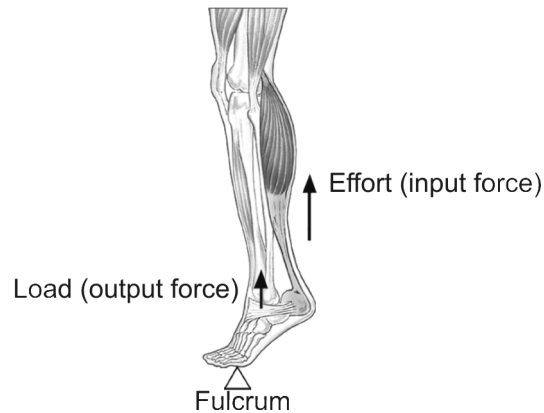
1. Type of lever: Third-class lever.
2. This lever is used to lift objects.

Lever B:



3. Type of lever: First-class lever.
4. This lever is used to chew food.

Lever C:



5. Type of lever: Second-class lever.
6. This lever is used to raise and lower the heel of the foot while standing.

7H Efficiency

1. 27.1 percent
2. 92 joules
3. 100,000 joules
4. 94.2 kilojoules
5. Answers are:
 - a. 2,025 million watts
 - b. 39.5 percent
6. 59 percent

7I Bicycle Gear Ratios Project

1. Schematic diagrams will vary according to individual bicycle designs.
2. See Table 1 for sample answer.

3. See column six, Table 1, for sample answer. This bicycle has 16 different gear ratios. Several gear ratios occur twice, and one gear ratio (1.8) is repeated three times. This bicycle should be known as a 16-speed rather than a 21-speed bike.

Front Gear #	Number of teeth	Rear Gear #	Number of teeth	Gear combo number	Gear Ratio
1	22	1	23	1	1.0
		2	20	2	1.1
		3	18	3	1.2
		4	16	4	1.4
		5	14	5	1.6
		6	12	6	1.8
		7	11	7	2.0
2	32	1	23	8	1.4
		2	20	9	1.6
		3	18	10	1.8
		4	16	11	2.0
		5	14	12	2.3
		6	12	13	2.7
		7	11	14	2.9
3	42	1	23	15	1.8
		2	20	16	2.1
		3	18	17	2.3
		4	16	18	2.6
		5	14	19	3.0
		6	12	20	3.5
		7	11	21	3.8

4. Answers are:
- a. The lowest gear ratio on this bike is 1.0 (first gear). For every complete turn of the front gear, the rear gear (and therefore the back wheel) makes one turn also. It doesn't take a lot of force to turn the pedals in first gear but you don't get a lot of distance from each revolution of the front gear. The low gear ratios are useful for hill climbing.
 - b. The highest gear ratio on the bike is 3.8 (twenty first gear). For every complete turn of the front gear, the rear gear makes 3.8 turns. You get quite a bit more distance from each revolution of the front gear in twenty first gear, but it takes a lot more force to move the pedals. The higher gear ratios are useful when going downhill. Twenty-first gear is a "crossover" gear combination, which means it uses the biggest gear in the front and the smallest in the back. Using this gear is hard on the chain and hard on the rider's ears, as it tends to be noisy due to extra friction between the moving parts of the gear system.