

Machines (p. 266 – 273)**I. Machines**

1. Define the term machine.

Machine – device that makes doing work easier

2. Differentiate between the following terms.

W_{in}

Input Work = Work that you do (Input force \times Input distance)

W_{out}

Output Work = Work the machine does (Output force \times Output distance)

3. ^{output}Input work can never be greater than ^{input}output work.

Circle One :

True

False

4. Differentiate between the following terms.

(Input Force) Effort Force = force exerted by a person on a machine

(Output Force) Resistance Force = force exerted by the machine

5. Define the term mechanical advantage.

Mechanical Advantage – ratio of resistance (output) force to effort (input) force

6. Write the formula used to determine mechanical advantage.

$$MA = \frac{F_r}{F_e} \quad \text{or} \quad MA = \frac{F_{out} (N)}{F_{in} (N)}$$

7. What are three ways that machines make work easier?

1. Increase the applied force.

2. Increase distance over which force is applied.

3. Change direction of an applied force.

8. In ideal machines, the output work equals input work.

Circle One :

True

False

9. Define the term ideal mechanical advantage.

Ideal Mechanical Advantage – ratio of displacement of effort (input) divided by the displacement of resistance (output)

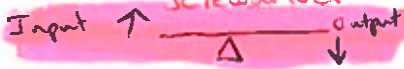
10. Write the formula used to determine ideal mechanical advantage.

$$IMA = \frac{d_e}{d_r} \quad \text{or} \quad IMA = \frac{d_{in} (m)}{d_{out} (m)}$$

1. Lever

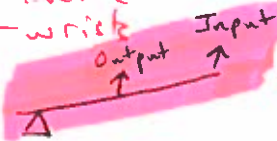
1st Class

- Seesaw
- scissors
- crowbar
- tongs
- neck
- screwdriver



2nd Class

- wheelbarrow
- ankle
- wrist



3rd Class

- baseball bats
- brooms
- golf clubs
- fishing pole
- knees + elbows
- door hinges



2. Pulley

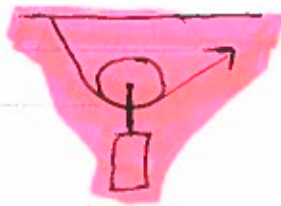
Fixed

- Fly pole
- Blinds
- Elevator



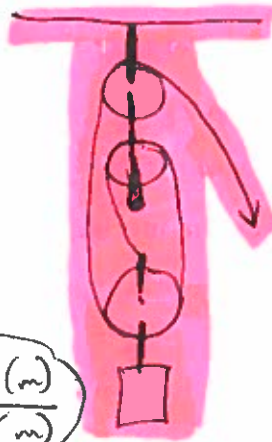
Movable

- Pull sails on boats
- window washers
- Zip Cords (Wacky Waters)



Block + Tackle

- Cranes
- weight systems
- Chair Lift



3. Wheel + Axle

- Car wheel
- Screwdriver
- Pencil Sharpener
- Door knobs

4. Inclined Planes

- Switchbacks
- Ramps
- Ladders
- slides

$$IMA = \frac{\text{wheel (m)}}{\text{axle (m)}}$$

$$IMA = \frac{\text{length}}{\text{height}}$$

Closer Threads = \uparrow IMA

5. Screws

- Augers
- Screws (nuts, bolts)
- Jar Lids

6. Wedge

- Knife Blade
- Log Splitter
- Zipper
- Can Opener

Thinner = longer = \uparrow IMA

11. In real machines, output work never exceeds in input work.

Circle One : True False

12. Define the term efficiency.

Efficiency - ratio of output work to input work

13. Write the formula used to determine efficiency.

$$e = \frac{W_{out}}{W_{in}} \times 100\% = \left(\frac{F_r d_r}{F_e d_e} \times 100\% \right)$$

14. Write the formula used to determine efficiency with regards to mechanical advantage.

$$e = \frac{MA}{IMA} \times 100\%$$

II. Compound Machines

1. List the six types of simple machines.

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1. Lever 3. Pulley 5. Wheel + Axle
 2. Inclined Plane 4. Wedge 6. Screw

2. The IMA of all simple machines is the ratio of distances moved.

3. Define the term compound machine.

Compound Machine - machine consisting of two or more simple machines linked in such a way that the resistance force of one machine becomes the effort force of the second

4. How are the following calculated on compound machines?

MA = product (x) of the MA's of simple machines from which it is made

Example → p. 270 → IMA = ratio of distances moved; multiplied (x)

5. How would a bicyclist change the following gears when : (Circle one for each gear.)

(~~Force~~)



Rear Gear Radius

Front Gear Radius

Result:

↑ IMA Climbing A Hill : Small Large Small Large - More turns

↓ IMA Going High Speeds : Small Large Small Large - Less force

III. The Human Walking Machine



1. What form of simple machine is found in humans that allow for walking and running?

levers

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2. What are the four basic parts of each lever system in humans?

1. Rigid Bar (Bone)
2. Source Of Force (Muscle Contraction)
3. Fulcrum (Movable Joints Between Bones)
4. Resistance (Weight of Body or Object Lifted or Moved)

