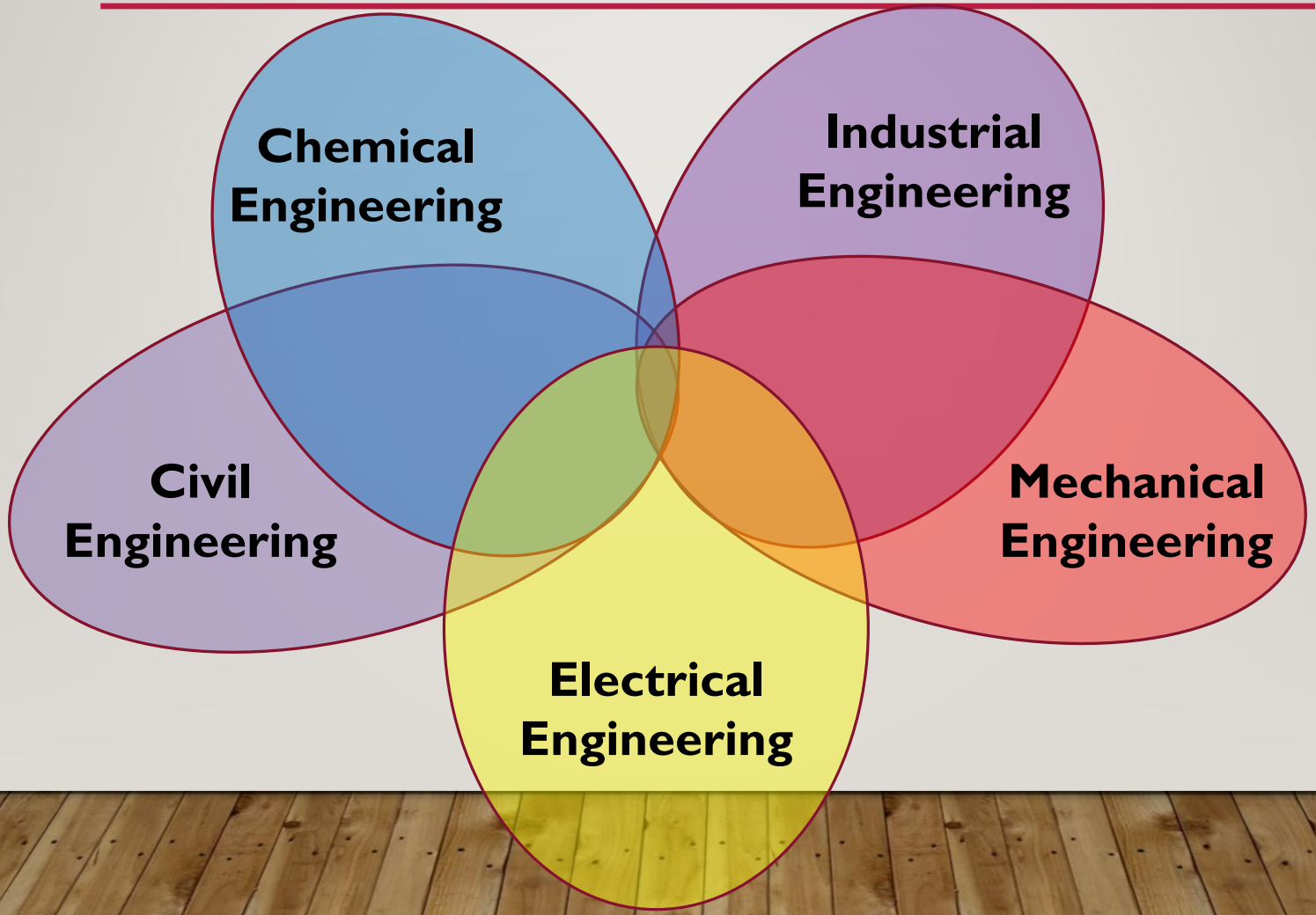
MECHANICAL ENGINEERING



MECHANICAL ENGINEERING – INTRO VIDEO

- Video: https://www.youtube.com/watch?v=A1V-QQ5wFU4

MECHANICAL ENGINEERING

Design, produce, operate, and service machines and mechanical devices

- Mechanical Engineer
- Acoustic Engineer
- Automotive Engineer
- Aerospace Engineer

MECHANICAL ENGINEERING
DESIGN, PRODUCE, OPERATE, AND SERVICE MACHINES AND MECHANICAL DEVICES

- Second largest engineering discipline after electrical engineering
- Often involved in automating time-consuming or expensive procedures
- Composed of 2 main divisions:

1) Design and controls is concerned with:
   - The strength of machine parts and the stress that each part will be subjected to
   - Developing tools that help the design engineer design a machine
   - Controlling machines through mechanical, hydraulic, and digital controls
   - Minimizing the unwanted noise of a machine

2) Thermal science is concerned with:
   - The flow of fluids and energy between systems
   - Study and predict the temperature of machines parts, and design cooling devices for them
   - Heating, ventilating, and air conditioning of buildings
   - Performance and efficiency of large power generation plants, and developing alternative energy sources

ACOUSTICAL ENGINEERING

PLAN, PERFECT, OR IMPROVE THE SOUND OF AN ARCHITECTURAL SPACE

- Investigate how different noises and background sounds affect productivity in a building
- Work on an architectural space can range anywhere from examining the innumerable surfaces in a church to drawing CAD plans for a subwoofer enclosure

AUTOMOTIVE ENGINEERING

PLAN, COORDINATE, AND IMPLEMENT THE SPECIFICATIONS FOR A NEW CAR, ENGINEERING EVERY PART

- Design and draw automotive parts
- Combine the automotive parts into components
- Integrate the components into the car's systems
- Make the mechanical aspects of the car fit into the aesthetic design

AEROSPACE ENGINEERING

DESIGN, DEVELOP, TEST, AND HELP MANUFACTURE AIRCRAFT, MISSILES, AND SPACECRAFT

- Develop new technologies for military and commercial use
- Can be divided into 2 fields:
  - Aeronautical engineering: works will aircrafts
  - Astronautical engineering: works with spacecrafts
- Can specialize in many fields, ranging from propulsion to thermodynamics

WHAT WE'RE DOING

- Simple Machines
- Material Sciences
- Tools & more safety
- CAD
- Mousetrap cars

- Alternative projects

Introduction to

SIMPLE MACHINES

WHAT ARE THEY?

Simple machines are machines
with few or no moving parts
that are used to make work easier

TYPES OF SIMPLE MACHINES

Wedge

Wheel and Axle

Lever

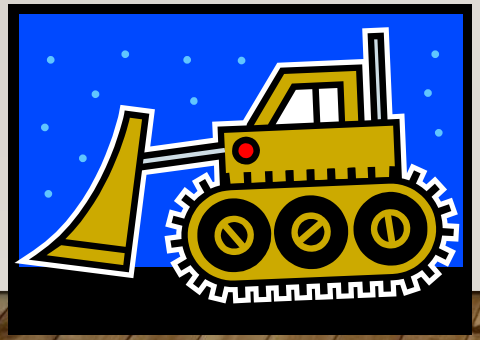
Inclined Plane

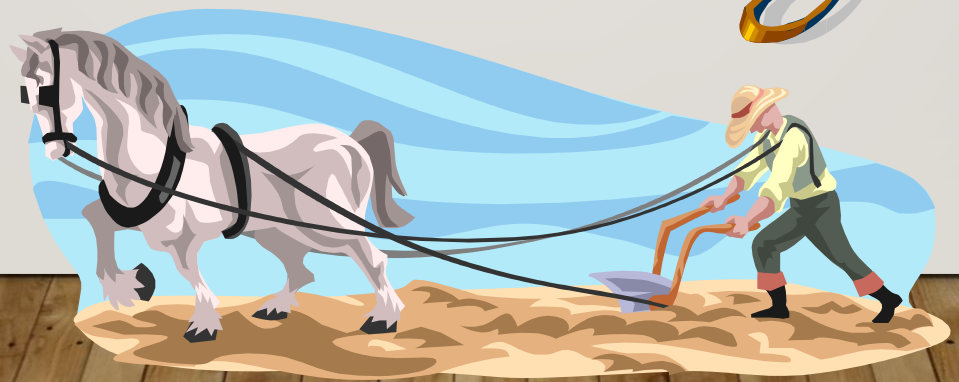
Screw

Pulley

WEDGE

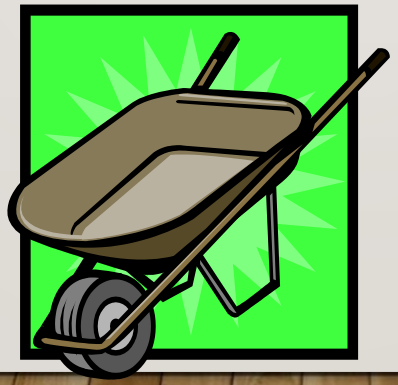
- Pushes materials apart, cuts things
- Examples: axe, doorstop, chisel, nail, saw, jackhammer, bulldozer, snow plow, horse plow, zipper, scissors, airplane wing, knife, fork, bow of a boat or ship





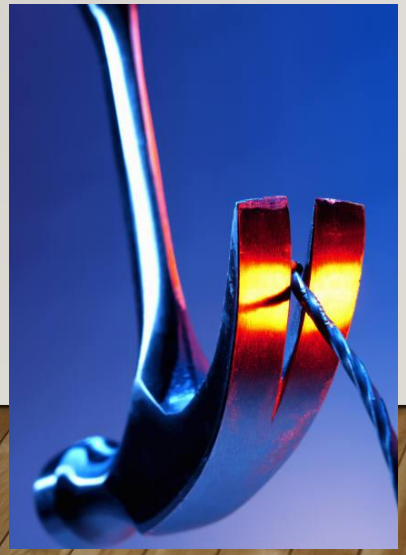
WHEEL AND AXLE

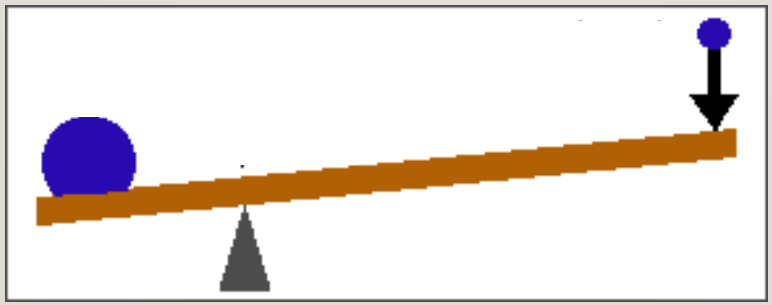
- Makes it easy to move things by rolling them, and reducing friction
- Examples: car, bicycle, office chair, wheel barrow, shopping cart, hand truck, roller skates

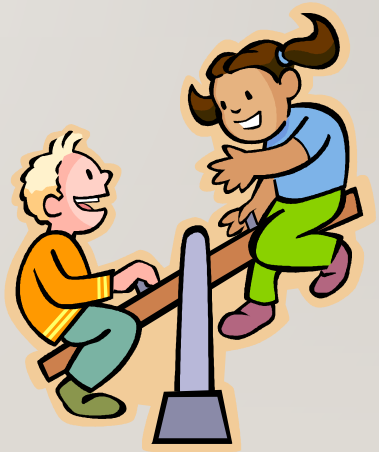


LEVER

- Makes lifting weight easier by using a fulcrum to redirect force over a longer distance
- Examples: see-saw, dump truck, broom, crane arm, hammer claw, crow bar, fishing pole, screwdriver, bottle opener





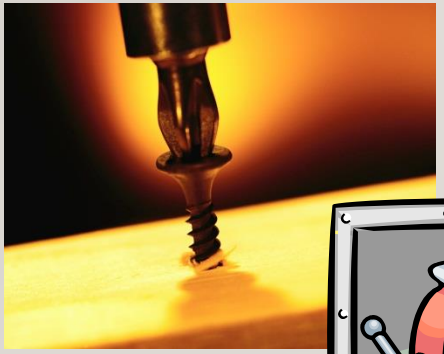


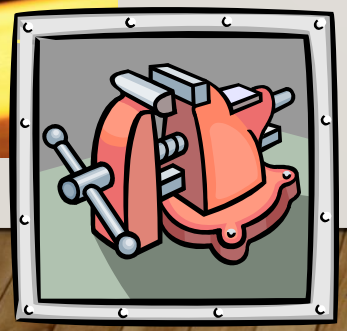
INCLINED PLANE

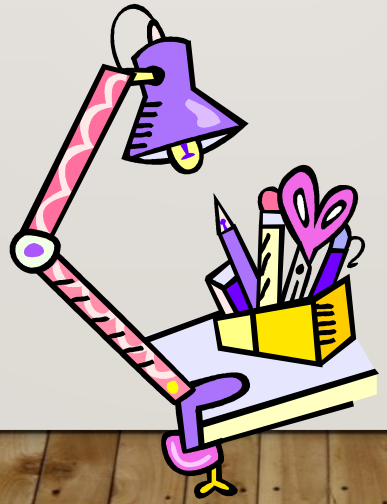
- Makes it easier to move objects upward, but you have to go further horizontally
- Examples: highway or sidewalk ramp, stairs, inclined conveyor belts, switchback roads or trails

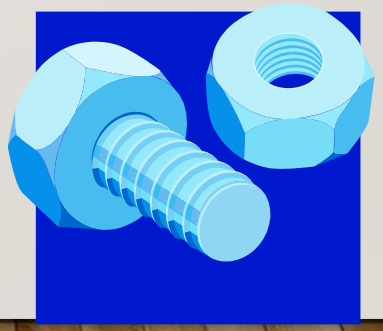
SCREW

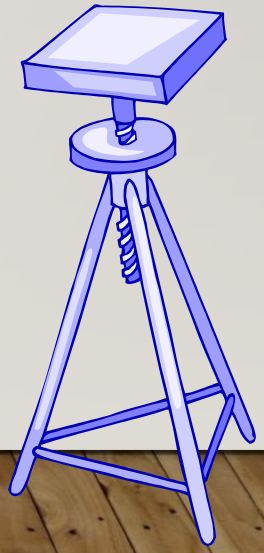
- Turns rotation into lengthwise movement
- Takes many twists to go a short distance
- Holds things together
- Examples: screws, bolts, clamps, jar lids, car jack, spinning stools, spiral staircases



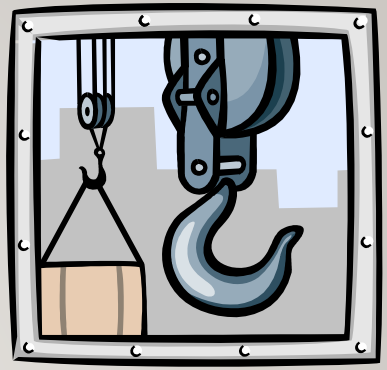




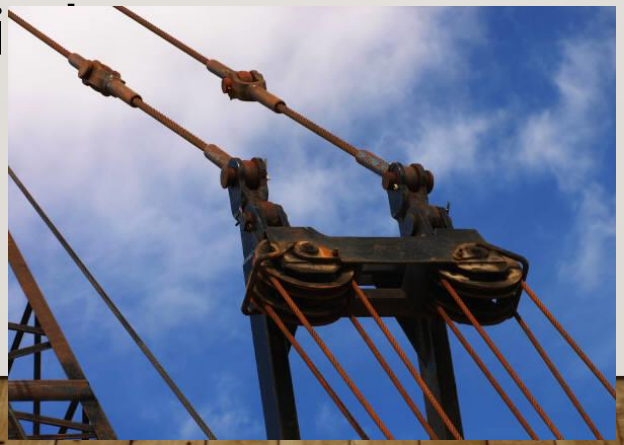




PULLEY



- Makes lifting things with a rope easier by redirecting force and the addition of additional pulleys
- Examples: flag pole, elevator, sails, fishing nets, clothes lines, cranes, window shades and blinds, rock cli



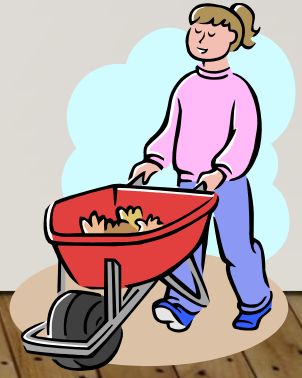
WHY USE SIMPLE MACHINES?

For the mechanical advantage…

- Making something easier to do, but it takes a little longer to do it
- For example, going up a longer flight of stairs instead of going straight up a ladder

COMPLEX MACHINES

- Combining two or more simple machines to work together
- Examples:
  - Car jack **combines** wedge and screw
  - Crane or tow truck **combines** lever and pulley
  - Wheel barrow **combines** wheel and axle with a lever



SUMMARY

Wedge	Pushes material apart, cuts
Wheel and Axle	Makes it easy to move things by rolling them, and reducing friction
Lever	Helps lift heavy weights using longer distances
Inclined Plane	Makes it easier to move objects upward; a longer path, but easier lifting
Screw	Turns rotation into lengthwise movement
Pulley	Makes lifting heavy weights easier by redirecting force

MECHANICAL ADVANTAGE

MECHANICAL ADVANTAGES & EFFICIENCY

- Ideal Mechanical Advantage
  - Theoretically what MA a machine has (no friction, heat, etc.)
- Actual Mechanical Advantage
  - The actual measured MA (takes into consideration losses from friction, heat, etc.)
- Efficiency
  - How close a machines actual MA is to its theoretical MA
  - $efficiency = \frac{AMA}{IMA}$

TO DO:

- You will be assigned a number to become a specialist in one simple machine
- You and your simple friends will be tasked with creating a PowerPoint explaining this simple machine
- For your presentation, you must:
  - Explain your simple machine, its basic principles, and how/where it is used
  - Find or create a real-world example of this machine. You will demonstrate this simple machine and also explain:
    - How is this an example of a _____ simple machine?
    - What factors will increase this machine's Ideal Mechanical Advantage? Decrease?
    - What factors will increase this machine's efficiency? Decrease?
    - Where might this example be used in the real world and how might it be applied?