

MECHANICAL COMPREHENSION:

- Only MOVABLE pulleys provide mechanical advantage.
- Gear revolutions
 - $r = (D \cdot R) / d$; $r \cdot d = R \cdot D$
 - D: # of teeth on gear A
 - R: revolutions of gear A
 - d: number of teeth on gear B
 - r: revolutions of gear B
- Hydrometers use floats to measure specific gravity. Specific gravity is the weight of a liquid compared with the weight of the water. The liquid with the highest specific gravity will cause the float to rise higher in the glass tube.
- Levers
 - First class: Fulcrum is in the middle (scissors, pliers)
 - Second class: Fulcrum is at one end, load is in between (nutcracker, wheelbarrow)
 - Third class: Fulcrum is at one end, effort is in between (tongs, tweezers)
- In pulleys, the smaller pulley will turn faster than those larger than it. It has to “keep up” and therefore turns faster.
- Mechanical advantage in pistons
 - $a_2 \cdot d_2 = a_1 \cdot d_1$
 - a= area, d=displacement
 - smaller D/ bigger D = mechanical advantage
- Axe is classified as a wedge, which is an inclined plane
- The farther away the fulcrum is from the resistance arm, the greater amount of force that is required to lift the weight and the higher the resistance arm will travel.
- No electricity flows through burnt out bulbs, but a voltmeter can bypass it if connected on both sides. It tells you the total voltage in a circuit.
- Current stays the same in series
 - Current is constant in series, voltage is not
 - Voltage is constant in parallel, current is not
 - $V = I \cdot R$ (current*resistance=Voltage)
 - The circuit with the greater resistance is usually in series, because it forces the current through all resistors.
- In a 2 pulley system, the movable pulley will only move up half the distance, and spin half as much as the fixed pulley.
- To find an rpm necessary

- take number of rods on the wheel, divide that from the needed contacts per minute. (ex. twice per second = 120 contacts per minute. 10 projection rods on wheel. $120/10=12$. must rotate at 12 rpm.
- If a driver wheel is present, the adjacent wheels will rotate according to how close to the center the driver wheel makes contact with them. The closer to the center, the faster it will move.
- By increasing the length of the lever arm, the effort is increased enabling a valve to blow off at a higher pressure. Move the weight further away to do this.
 - Think of the picture from the practice exams.. Lever left causes less effort and lets valve blow up at lower pressure. Lots of L's!
- Learn how to read a micrometer...
- Pendulums
 - The one with the longer string takes the longest to complete 1 swing.
 - The weight doesn't matter for swing time. If string length is the same, swing time is the same.
- If a board is placed in the water with 1 weight at each end, the end with the weight closest to the center will tend to float more than the one furthest from the center.
- If weights hang from a string attached to a bar, less pull is exerted by the weight of less weight. The length of the string doesn't matter.
- Buoyancy
 - The deeper you go with an inflated ball, the more difficult it is to hold it under water.
 - The deeper you go with the same ball, the more buoyant the ball is.
- Rate of heat exchange is faster through objects of greater temperature difference.
- Water flows faster through narrow areas than it does through wider. Think of putting your thumb on the end of a hose to make it spray..
 - But.. the same amount of water will flow through the smaller and larger part of the pipe in a given time.
- If you place an object evenly on 2 scales, each scale will read half of the total weight.
- 4-Stroke Engine
 - Intake, Compression, Combustion, Exhaust
- Wheel and axle question, such as bucket being raised from well.
 - Mechanical Advantage = Radius of Axle to handle / radius of drum

- Make sure you're using the RADIUS, not the diameter
- Pressure
 - Pressure = Force / Area
 - Fluid pressure
 - Atmospheric pressure
- Statics and Equilibrium
 - Moment = Force * Distance
- Energy
 - The difference between kinetic and potential (and when one converts to the other)
 - Potential - energy stored in an object
 - Kinetic - energy in motion
- Electrical Theory
 - $V=I*R$; Finds voltage drop across a circuit or single resistor
 - $I=Q/T$; Current = charge / time
 - Current
 - Direct - flows continuously in the same direction
 - Alternating - periodically reverses direction
 - Devices
 - Ammeter - measures current flow in a circuit
 - Voltmeter - measures voltage
 - Multimeter - measures both
 - Units
 - Charge = coulomb, C
 - Current flow = ampere, A
 - Power = volts * amperes
- Vise
 - ideal MA = $(2*\pi*\text{length of handle})/(\text{pitch of thread})$
- Metrology (measuring)
- Newtons Laws
 - First – object in motion will stay in motion, object at rest will stay at rest
 - Second – force = mass * acceleration
 - Third – for every action there is an equal and opposite reaction
- Weight = mass * gravity
- Heat
 - Convection - occurs in liquids and gases by circulating currents caused by a difference in density
 - Conduction - occurs in solids and stationary fluids.

- depends on the temperature difference
 - Placing salt into water increases the specific gravity of the solution and lowers its freezing point.
 - Heating a closed container of boiling water increases the pressure of the water vapor (steam) inside the container and increases the temperature of the water.
 - ALWAYS moves from hot object to cold object.
 - The rate of transfer is greater for the greater temp difference.
- Compressing air in a closed space will decrease the volume and raise the temperature.
- If springs are holding up a box
 - 2 springs holding the box attached as 1 longer spring
 - They are each holding the entire weight of the box
 - 2 springs holding the box at different ends of the box
 - Each spring holds 1/2 the weight of the box
- A square metal plate is hanging by 4 wires (one on each corner). One breaks, and it's hanging by only 3 wires now. Does each wire now carry the same amount of weight, or do the 2 diagonally across from each other hold an equal amount that is more than the lone wire in the other corner?
 - The lone wire does no support. The 2 diagonals carry it alone.
- Aircraft will take off on a treadmill, regardless of treadmill setting.