1. First class lever in static equilibrium has 50-lb res. force and 15-lb eff. force. The lever's effort force is located 4 ft from the fulcrum.

\[ R = 50 \text{ lb} \quad E = 15 \text{ lb} \]

\[ E - 4 \text{ ft} \quad \frac{15 \text{ lb}}{50 \text{ lb}} \]

2. AMA of system

\[ \text{AMA} = \frac{50}{15} = 3.33 : 1 \]

3. 15 lb x (4 ft) = 50 lb x DR

\[ 60 \text{ lb-ft} = 50 \text{ lb x DR} \]

\[ \frac{60}{50} = \text{DR} \]

\[ \text{DR} = 1.2 \text{ ft} \]

4. A wheel barrow is used to lift a 200-lb load. The length from the center of the wheel to the center of the load is 2 ft. The length from the wheel to the effort is 5 ft.

\[ 200 \text{ lb} \]

\[ 2 \text{ ft} \quad \text{R} \quad E \]

\[ 5 \text{ ft} \]

\[ \text{Wheel} \quad \text{Effort} \]

\[ \text{Load} \]
7. A medical technician uses a pair of four-inch-long tweezers to remove a wad of silver from a patient. The technician is applying one-fourth of the squeezing force to the tweezers. It is more than \( \frac{1}{4} \) lb of force is applied to the tweezers. It will break and become difficult to remove.

\[
\frac{F}{lb} = \frac{1}{4} \text{ lb}
\]

8. \( \frac{11}{6} \text{ ft} \times \frac{1}{5} \text{ lb} \) \( \text{AMA} = 0.2 \)

9. \( 4 \text{ ft} \times \frac{1}{5} \text{ lb} + \frac{1}{5} \text{ lb} \text{ (DE)} = 0 \)

\[
2 \text{ lb} \text{ (DE)} = \frac{1}{5} \text{ lb}
\]

\[
DE = 0.8 \text{ in}
\]

10. The linear distance traveled in one revolution of a 36-inch-diameter wheel would be equivalent to its circumference. Thus, would be \( 36 \times \pi = 113.1 \text{ in} \).

11. An industrial water shut-off valve is designed to operate with 30 lb of effort force. The valve will encounter 200 lb of resistance force applied to a 1.5-in.-diameter axe.

12. \( \frac{200}{30} = 6.667 \)

13. \( 30 = 200 \text{ lb} + 15 \text{ lb} \) input wheel = 10 in in dia.

14. \( \frac{560}{50} \text{ AMa} = 11.2 \)

15. \( 2 \times (\text{st of power of pulleys}) + 7 \text{ (ft of change direction)} \times 9 \text{ (st of strands)} \times 2 \times 9 + 7 = 9 \text{ st of strands} \)

16. Max weight = 900 lbs

17. Max weight = 900 lbs
Activity:

18. A civil engineer must design a wheelchair-accessible ramp next to a set of steps leading up to a building. The height from the ground to the top of the stairs is 2ft. Based on ADA standards, the slope must be 1:12 or less. Slope is equal to the rise of the ramp divided by the run of the ramp.

19. \[ \text{slope} = \frac{\text{rise}}{\text{run}} \]
   \[ \frac{1}{2} = \frac{1}{\text{run}} \]
   \[ \text{run} = 24 \text{ ft} \]

20. \[ a^2 + b^2 = c^2 \]
   \[ (24^2) + (12^2) = DE^2 \]
   \[ 576 + 144 = DE^2 \]
   \[ \sqrt{580} = DE = 24.08 \]
21. Temp = 24.05 - 12.04 = 12.01

22. If a person and wheelchair have a combined weight of 156 lb, how much ideal effort force is required to travel up the ramp?

\[
F_E = \frac{W}{12.042} \quad F_E = 15.363 \text{ lb}
\]

23. A hydraulic shear applies a 2000 lb force to a wedge. It is used to shear plate steel to rough size. The shear has a 1/4 inch thick cutting blade with a 45° slope.

\[
a^2 + b^2 = c^2 \\
L = \sqrt{0.25 in^2 + 0.25 in^2} \quad L = 0.35355 \text{ in}
\]

25. \( \frac{0.250 \text{ in}}{0.75 \text{ in}} = 1.00 = I_M \),

26. A 7/16 nut driver with a 1 1/2 inch diameter handle is used to install a 1/4-20 UNC bolt into a robotic arm.

27. \( C = \pi (1.5 \text{ in}) = 4.7124 \text{ in} \)

28. \( P = \frac{1}{20 \text{ threads/in}} = 0.05 \text{ in} \)

29. \( I_M = \frac{4.7124 \text{ in}}{0.0560 \text{ in}} = 99.248 \)

30. Ideally, how much force can be overcome if 5 lb of force is exerted?

\[ P = 99.248 (5.0016) = 471.241 \text{ lb} \]

\[ P = 471.1 \text{ lb} \]