Power (P = W/t = KE/t = PE/t) know this one

1. How much power is done on your car by applying 200 N of force a distance of 12 m in 2 minutes?

20 W 120 seconds

2. How much power is used pushing a 500 N object a distance of 10 m in 3 s?

1666 W

3. A car with occupants has a mass of 1000-kg. If it accelerates from 0 to 70 m/s in 5.7 s, how much power is used?

$W = \Delta KE = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ ($\frac{1}{2}mv_i^2 \approx 0$) $P = \frac{2.45 \times 10^6 J}{5.7s}$ $P = 4.3 \times 10^5$ W

4. A car with occupants has a mass of 1000-kg. If it accelerates from 70 to 100 m/s in 5.9 s, how much power is used?

$W = \Delta KE = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$= \frac{1}{2}(1000)(100^2) - \frac{1}{2}(1000)(70^2) = 2.55 \times 10^6$ J

$P = \frac{2.55 \times 10^6 J}{5.9s} = 4.3 \times 10^5$ W

5. A 15-kg box is carried up a stairs to a floor that is 23-m above the starting location in 43 seconds. A second person carries an identical box the identical distance in 17 seconds. How much more powerful is the second person?

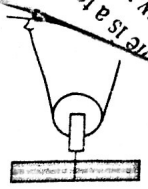
$W = mgh = (15kg)(9.8m/s^2)(23m) = 3381$ J

$P_1 = \frac{3381}{43s} = 79$ W $P_2 = \frac{3381 J}{17s} = 200$ W → about 2.5 times as powerful

Pulley Load = F_{out}, Load distance = d_{out} Effort = F_{in}, Effort distance = d_{in}

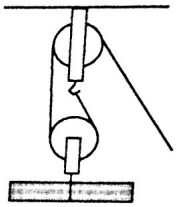
1. Two ropes support the same block (mass of 120-kg). How much is the tension or force is there in the rope?

$F_T = \frac{1176N}{2} = 588N$



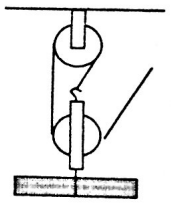
2. How much force must be exerted to lift the 120-kg block using the pulley system to the right?

$MA = 2 = \frac{F_{out}}{F_{in}} = \frac{1176N}{F_{in}}$ $F_{in} = \frac{1176N}{2} = 588N$



3. How much force must be exerted to lift the 120-kg block using the pulley system to the right?

$MA = 3 = \frac{F_{out}}{F_{in}} = \frac{1176N}{F_{in}}$ $F_{in} = 392N$



4. Using the pulley system from #3, you lift a 140-kg sofa 32-meters. Find the a) Load; b) Effort c) Load distance; and d) Effort distance?

a) Load = $F_{out} = 140kg \times 9.8m/s^2 = 1372N$

b) Effort ⇒ $MA = 3 = \frac{F_{out}}{F_{in}}$, $F_{in} = \frac{1372N}{3} = 457N$

c) Load dist. = 32m

d) Effort dist. ⇒ $MA = 3 = \frac{d_{in}}{d_{out}}$ $d_{in} = 32m \times 3 = 96m$

5. Using the pulley system to the right, the load is 480 N and it is lifted 6.0 meters. What is the a) Load; b) Effort; c)Load distance; and d) Effort distance?

a) Load = 480N

b) Effort ⇒ $MA = 3 = \frac{F_{out}}{F_{in}}$, $F_{in} = \frac{480N}{3} = 160N$

c) Load distance: 6.0m d) effort distance ⇒ $MA = 3 = \frac{d_{in}}{d_{out}}$, $d_{in} = 6.0m \times 3 = 18m$

6. The pulley system with 6 strands probably has a lot of friction and additional mass due to the pulleys. If you still want to raise the load 5 meters, how much rope do you have to pull?

$MA = 6 = \frac{d_{in}}{d_{out}}$, $d_{in} = 6 \times 5m = 30m$

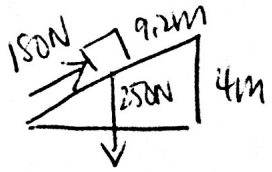
Ramp

1. A ramp that is 9.2m long takes a force of 180-N to push a cart weighing 250-N up to a platform that is 4-m above the beginning level. What is the efficiency of the ramp?

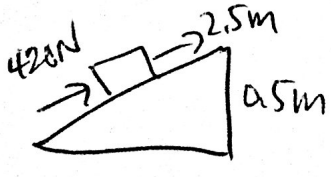
$W_{in} = (180N)(9.2m) = 1656J$

$W_{out} = (250N)(4m) = 1000J$

$Eff = \frac{W_{out}}{W_{in}} = \frac{1000J}{1656J} = 60\%$



2. On a ramp 2.5-m long and 0.5-m high, a force of 420-N is being used to push a loaded cart. How much does the dolly weigh?



$MA = \frac{F_{out}}{F_{in}} = \frac{d_{in}}{d_{out}}$

$\frac{F_{out}}{420N} = \frac{2.5m}{0.5m}$ F_{out} = weight = 2100N

pole is a total of 2-m long and is pivoted 30 cm from a rock that acts as the fulcrum. If the free end is forced down with a force of 220-N, how much force is exerted on the rock?

$MA = \frac{F_{out}}{F_{in}} = \frac{d_{in}}{d_{out}} \rightarrow \frac{F_{out}}{220N} = \frac{1.7m}{0.3m} \rightarrow F_{out} = \boxed{1250N}$

$F_{in} = 220N$, $d_{in} = 1.7m$, $d_{out} = 0.3m$

2. A jack handle 65-cm long is pivoted at one end and pushed down at the other. If it exerts a force of 240-N at a point 12-cm from the pivot, find a) the effort force and b) the mechanical advantage.

a) 44 N

b) 5.4

F_{out} d_{out}

F_{out} ↑ F_{in}

0.12m

PIVOT

Efficiency = Work out/Work in

1. To lift a 540-N load a total of 12.0-m, you turn a crank with a force of 110-N pushing it through a distance of 72-m. What is the efficiency of the machine?

82%

2. Using a machine that is 90% efficient, you have to lift a 1200-N load a total of 3-m. How much work do you have to do?

4000 J

3. In a three strand pulley. A 130-kg load is lifted 25-m, using an effort of 540-N. What is the efficiency of the system?

$Eff = \frac{W_{out}}{W_{in}}$

$W_{out} = (130kg)(9.81m/s^2)(25m) = 31,883J$

$MA = \frac{d_{in}}{d_{out}} = 3 \Rightarrow d_{in} = 25m \times 3 = 75m$

$W_{in} = (540N)(75m) = 40,500J$

$Eff = \frac{31883\ J}{40500\ J} = \boxed{78\%}$