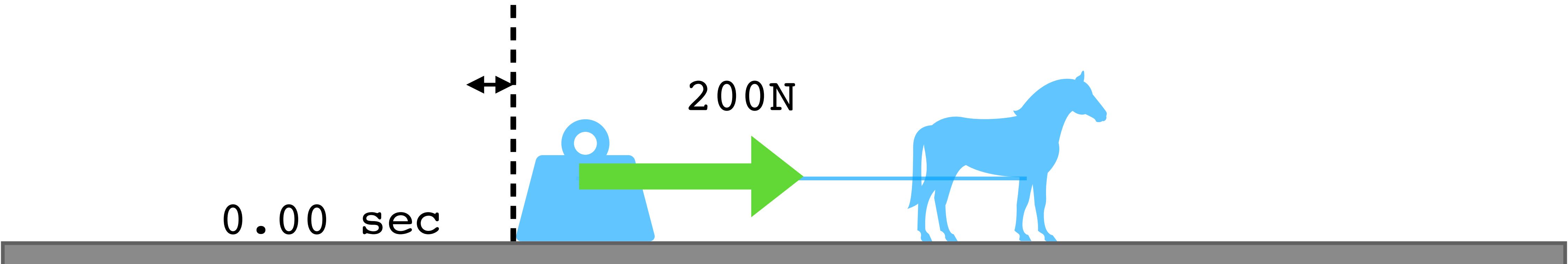
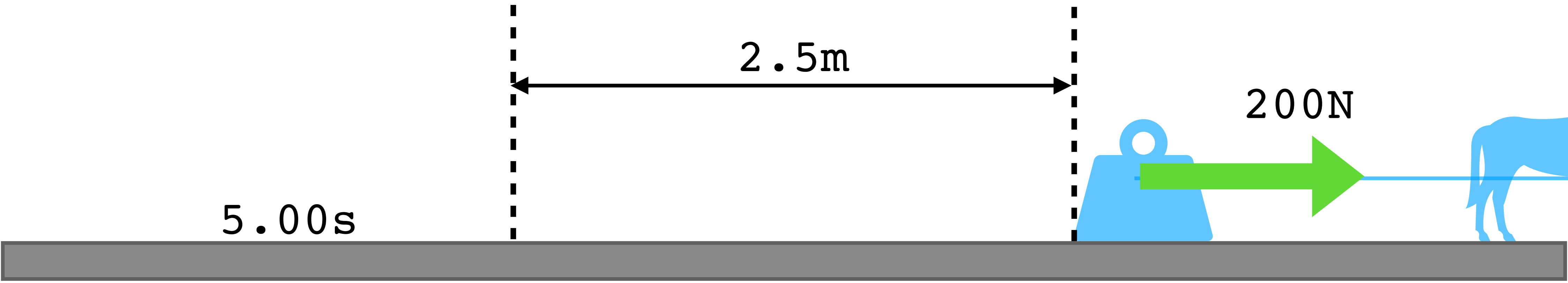
Work

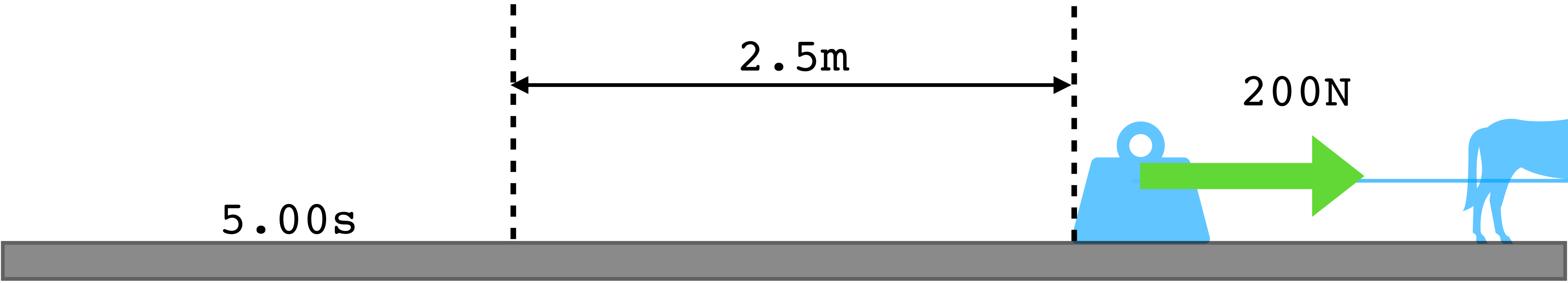
Work

work and power



work and power



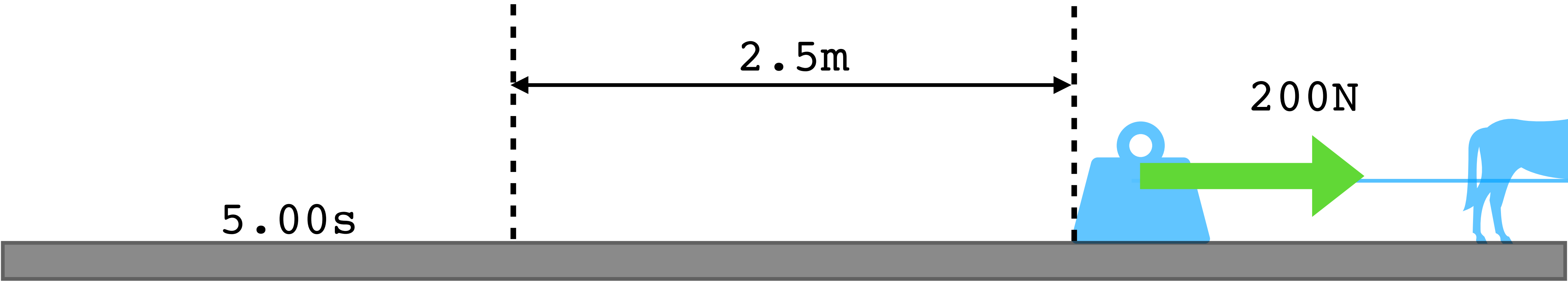


Work done = energy transferred
Work = force x distance

units 1 NM = 1 Joule

Power = rate of energy transfer
Power = rate of working

Joules per second
aka Watts
N (M / sec)



units 1 NM = 1 Joule

Power = rate of energy transfer
Power = rate of working

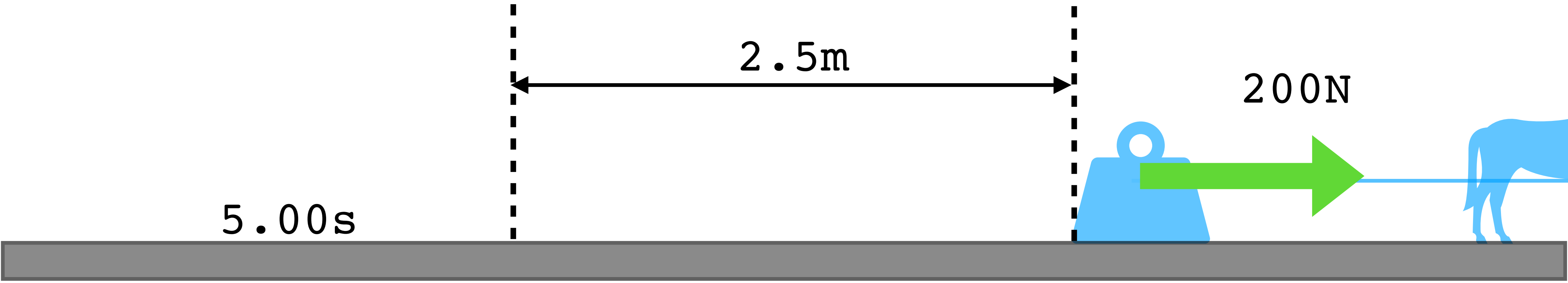
Joules per second
aka Watts
N (M / sec)

Work done = energy transferred
Work = force x distance

Work = 2.5 x 200 = 500 Nm

We say 500Nm of work was done on the object.

In this case the work done by the horse has raised the object's kinetic energy.



Work done = energy transferred
Work = force x distance

units 1 NM = 1 Joule

Joules per second
aka Watts
N (M / sec)

Work = 2.5 x 200 = 500 Nm

Power = rate of energy transfer
Power = rate of working

Power = work done / time taken

Power = 500 / 5.00 = 100 Watts

the horse has a power output of 100W

Power

Power has units of Watts, 1 Watt = 1 Joule per second.

there's another useful way to find the power:

$$W = Fd$$

divide by the time taken

$$\boxed{\frac{W}{\Delta t}} = F\frac{d}{\Delta t}$$

the definition of power

$$\boxed{P = Fv}$$

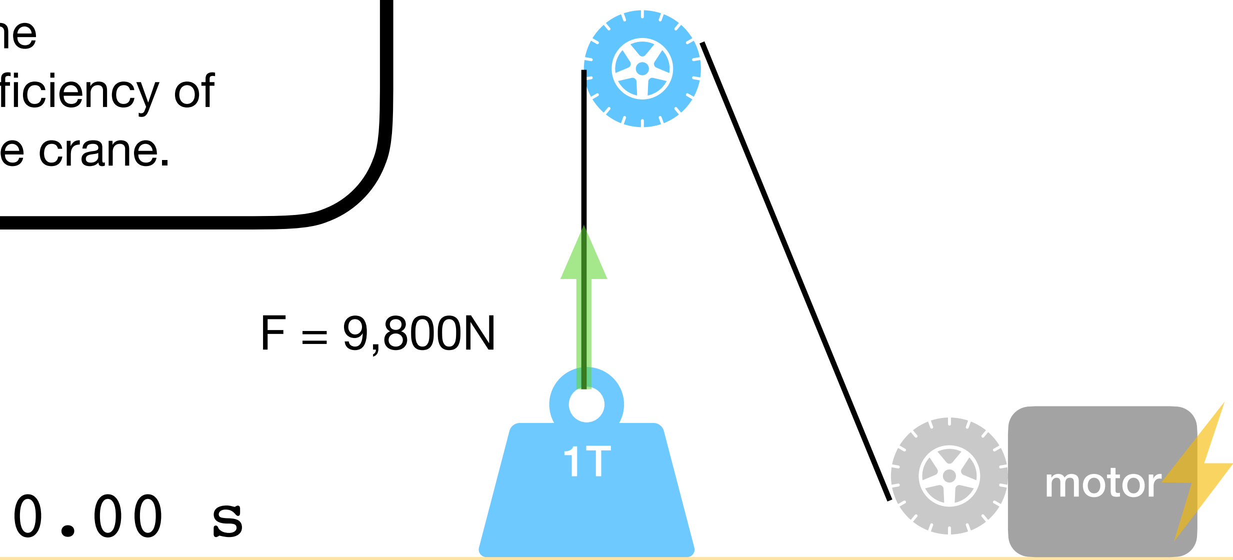
- $g = 9.8$ N / Kg
- Weight = m x g

  W = 9.8 x 1000

  W = 9800N

find:

1. The increase in gpe of the mass.
2. The power of the motor.
3. The efficiency of the crane.

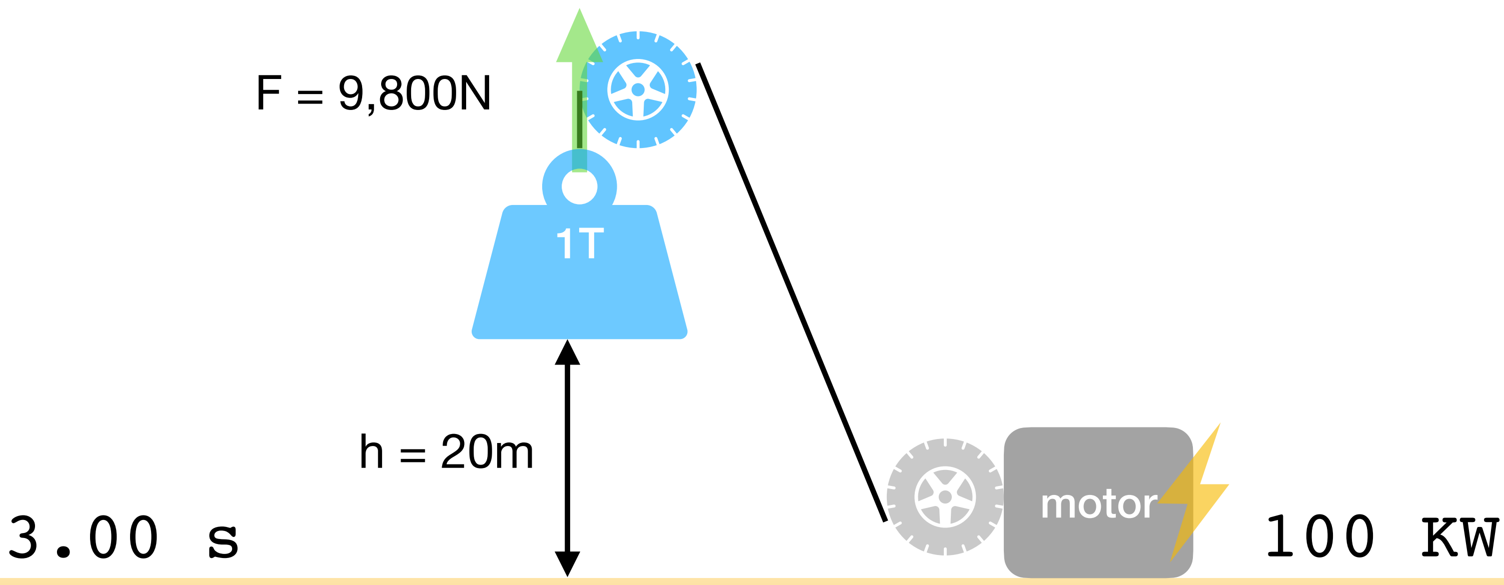


Work done = energy transferred
Work = force x distance

units 1 NM = 1 Joule

Power = rate of energy transfer
Power = rate of working

Joules per second
aka Watts
N (M / sec)



units 1 NM = 1 Joule

Power = rate of energy transfer
Power = rate of working

Joules per second
aka Watts
N (M / sec)

1. The increase in gpe of the mass.

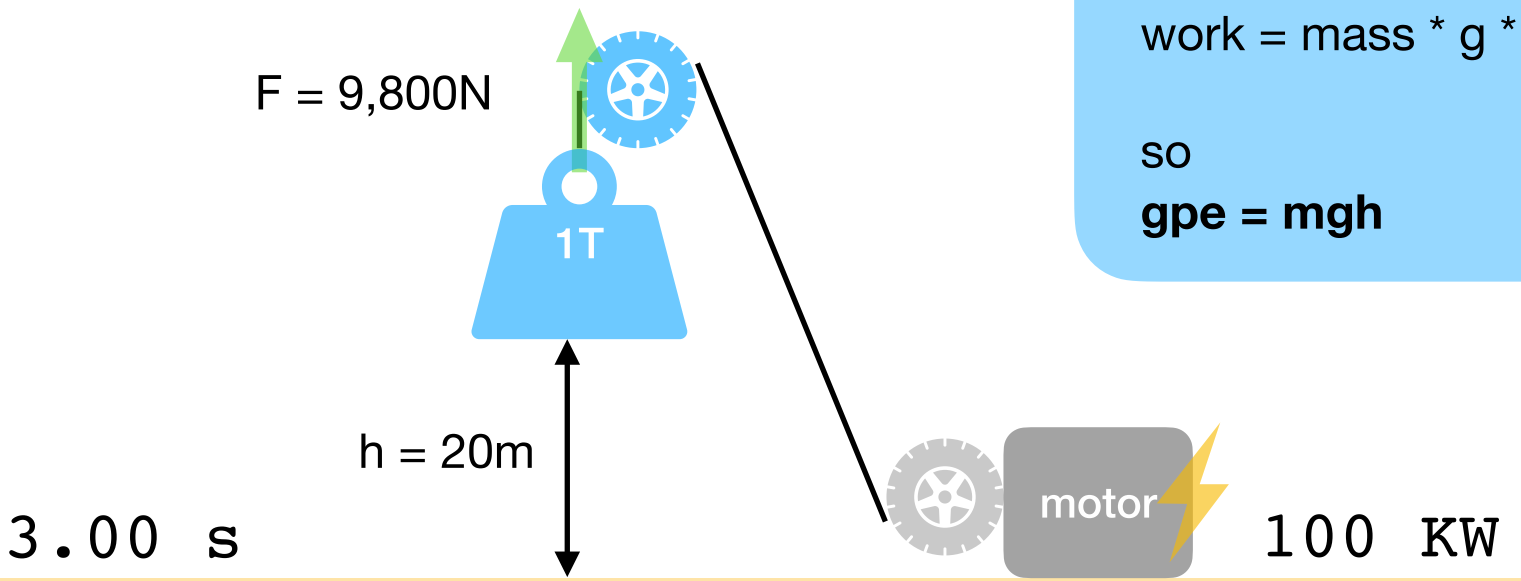
Work done = energy transferred
Work = force x distance

change in GPE = work done on the mass
w = 9800 x 20

w = 196,000 J

since
work = force * distance
work = mass * g * distance

so
gpe = mgh



Work done = energy transferred
Work = force x distance

units 1 NM = 1 Joule

Joules per second
aka Watts
N (M / sec)

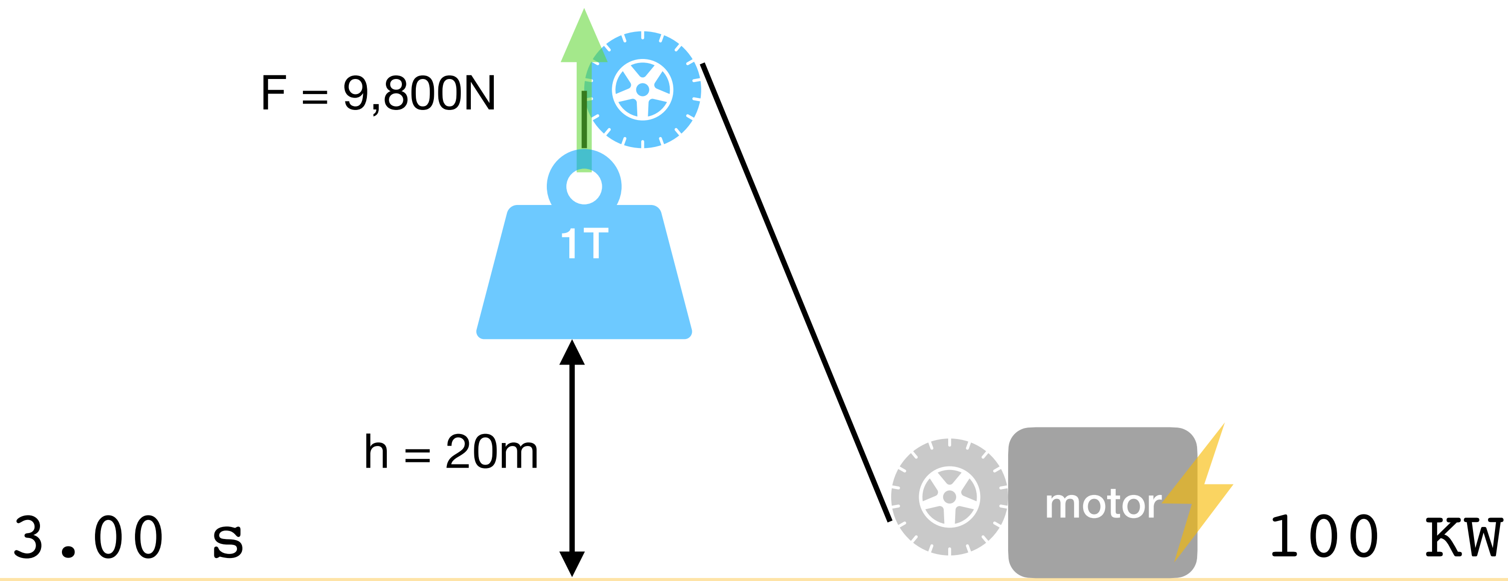
2. The power of the motor

w = 196,000 J

Power = rate of energy transfer
Power = rate of working

power = work / time taken

power = 196,000 / 3
power = **65,333 J/s (Watts)**



Work done = energy transferred
Work = force x distance

units 1 NM = 1 Joule

Power = rate of energy transfer
Power = rate of working

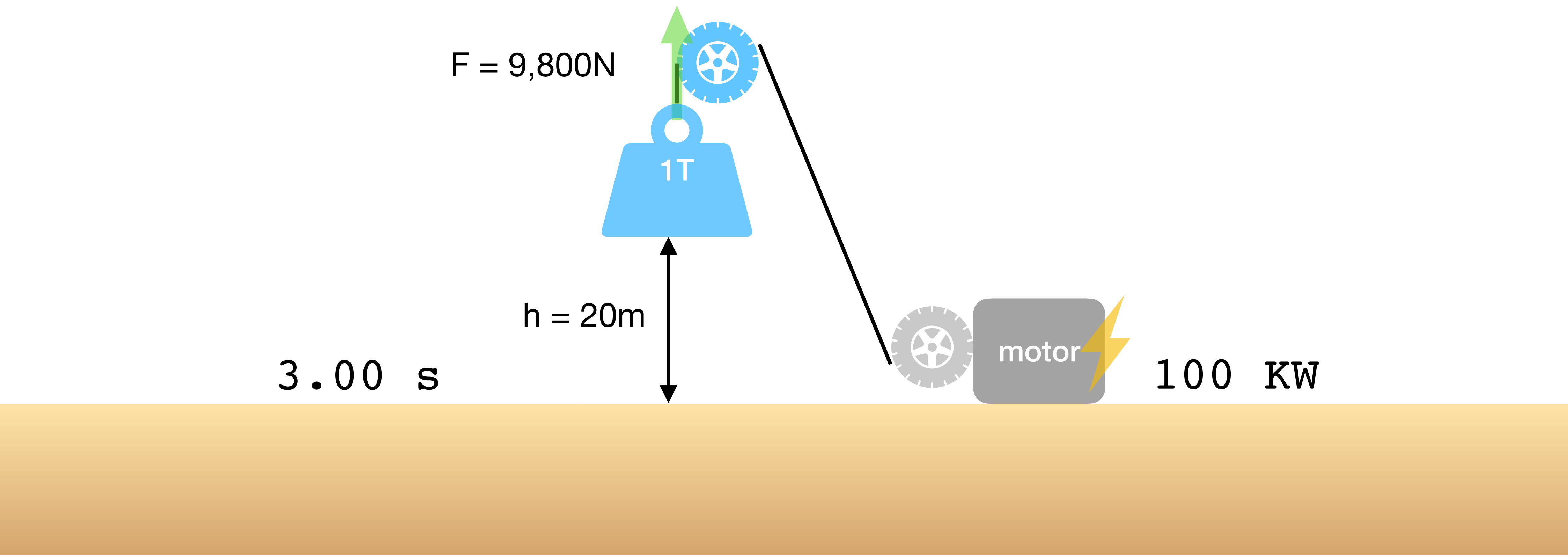
Joules per second
aka Watts
N (M / sec)

3. The efficiency of the crane

w = 196,000 J

power = 196,000 / 3
power = 65,333 J/s (Watts)

efficiency = useful power out / total power in
e = 65,333 / 100,000
e = 65.3 %

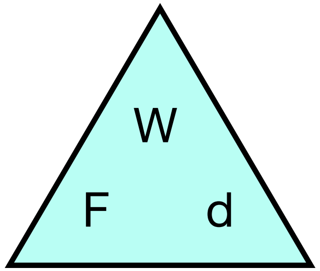


efficiency

$$\text{efficiency} = \frac{\text{useful power out}}{\text{total power in}} \times 100$$

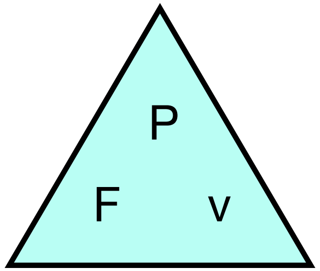
$$\text{efficiency} = \frac{\text{useful energy out}}{\text{total energy in}} \times 100$$

useful equations



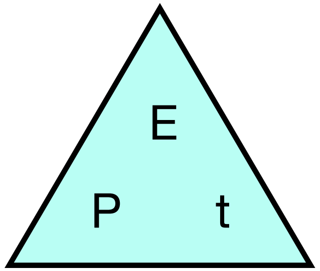
work = force * distance

Nm N m



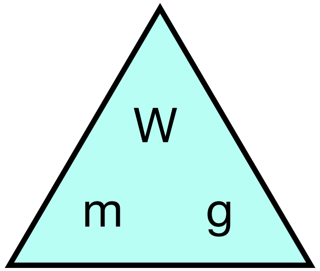
power = force * velocity

W N m/s



energy transferred = power * time

J W s



weight = mass * gravitational field strength

N Kg N/Kg ~ m/s^2

gpe = mgh

gravitational potential energy = mass * gravitational field strength * height

J Kg N/Kg ~ m/s^2 m