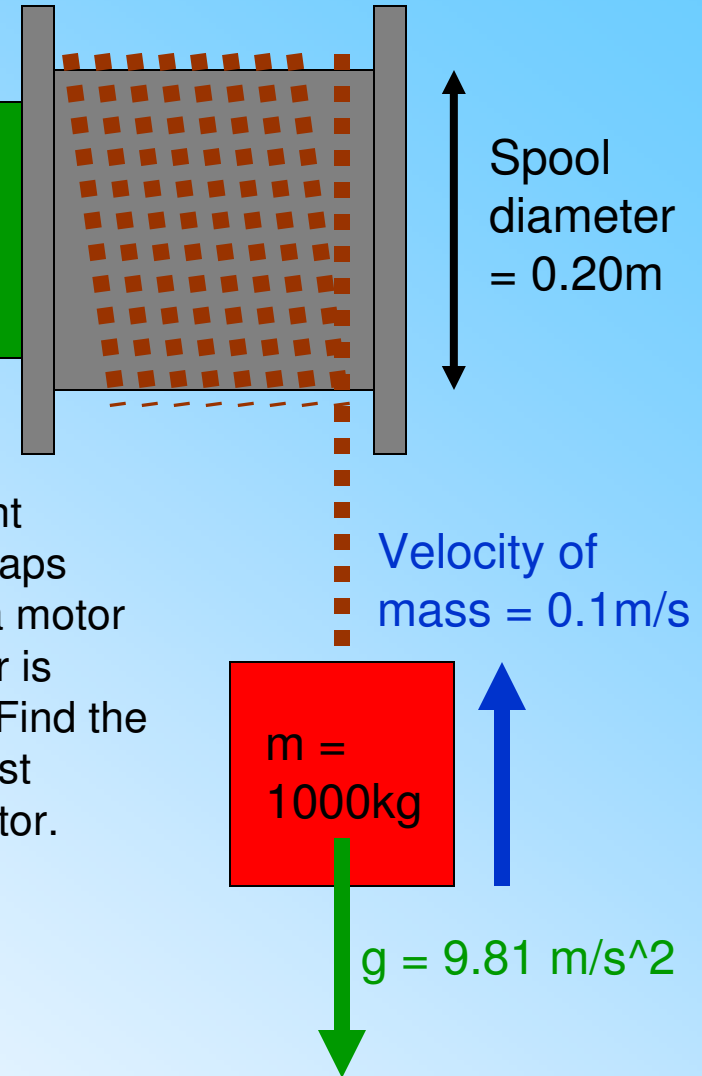# Power Conservation: Winches

Winches are sometimes put onto the bumpers of trucks. They can be used to pull the truck when it gets stuck, or drag things like trees off a trail. A winch is composed of a motor, gearbox, and a spool of cable. The motor supplies power (torque and angular velocity) which is converted in the gearbox and is then used to turn the spool and pull things with the cable.

Motor   Gearbox   Spool

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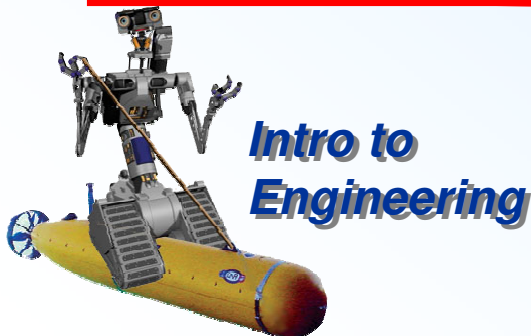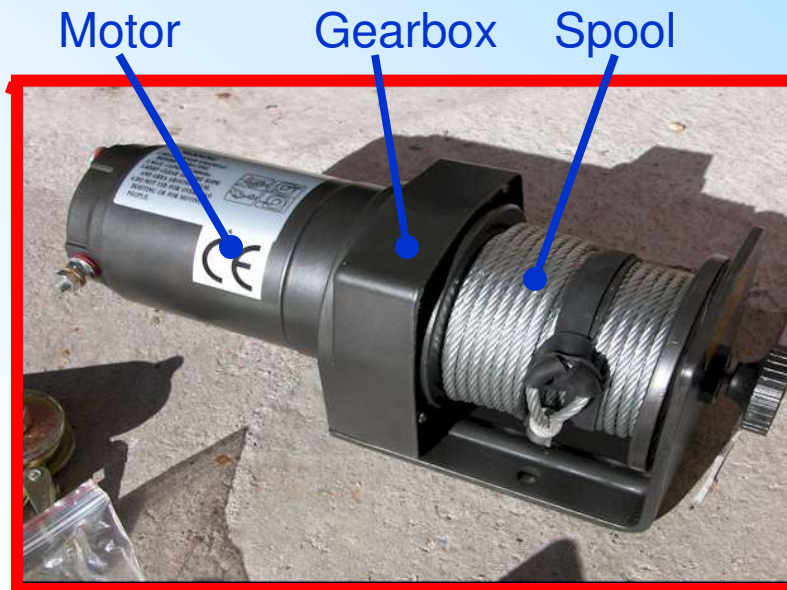
Winch problem

Motor
$\omega = 100$ radian/sec
T = ? Nm, P = ? Watt

Gear Box
$\eta = 75\%$
GR = ?

Spool
diameter
= 0.20m

Problem Statement:

A winch is pulling a mass vertically against gravity at a constant velocity V = 0.1m/s. The mass is connected to cable, which wraps around a pulley of diameter 0.2m. The pulley is connected to a motor through a gear box, which has an efficiency of 75%. The motor is spinning at 100 radians/second while the mass is being lifted. Find the Gear Ratio (GR) of the gear box and the Torque the motor must produce. Also calculate the amount of power output by the motor.

Velocity of
mass = 0.1m/s

m =
1000kg

g = 9.81 m/s^2

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