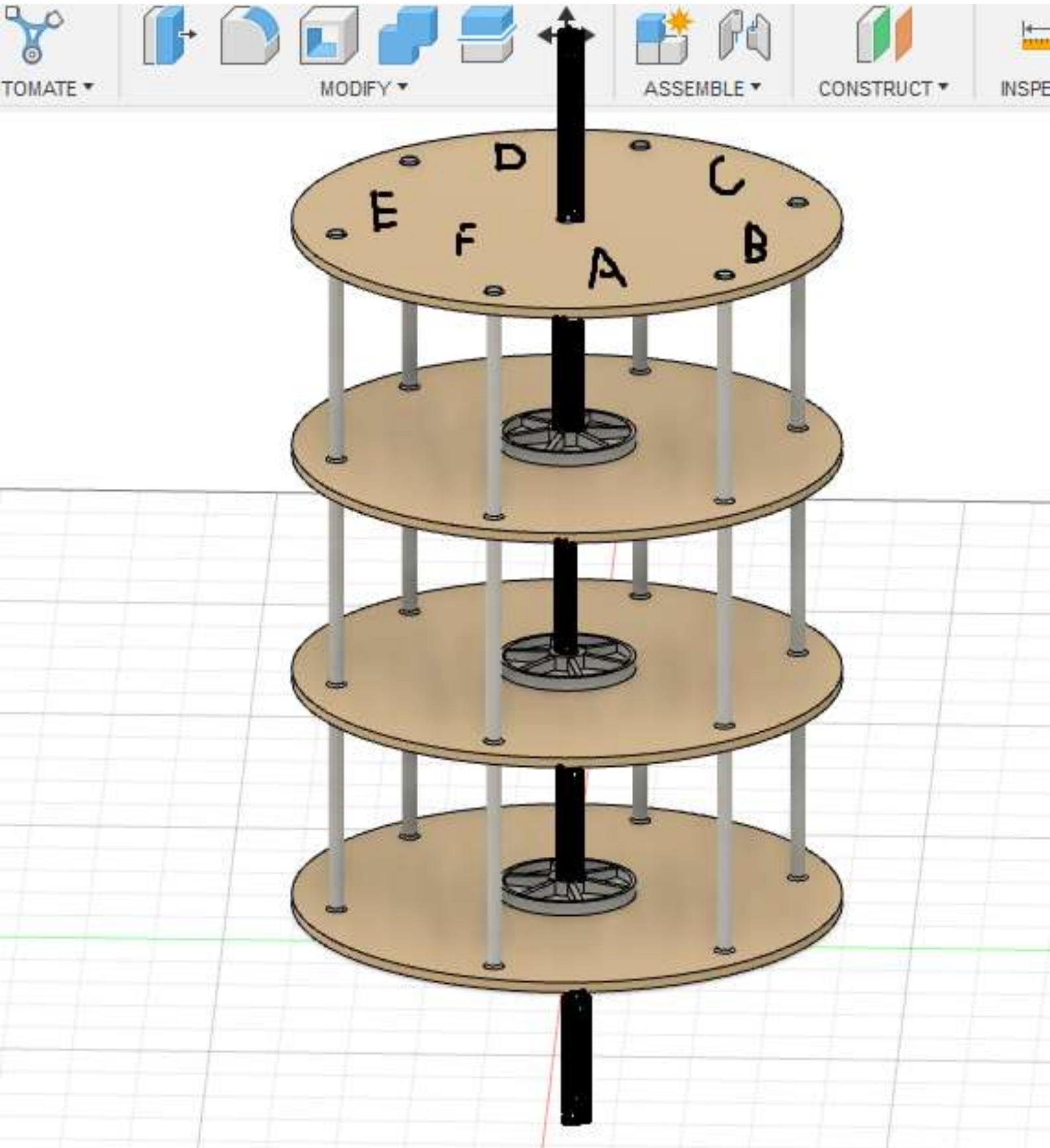
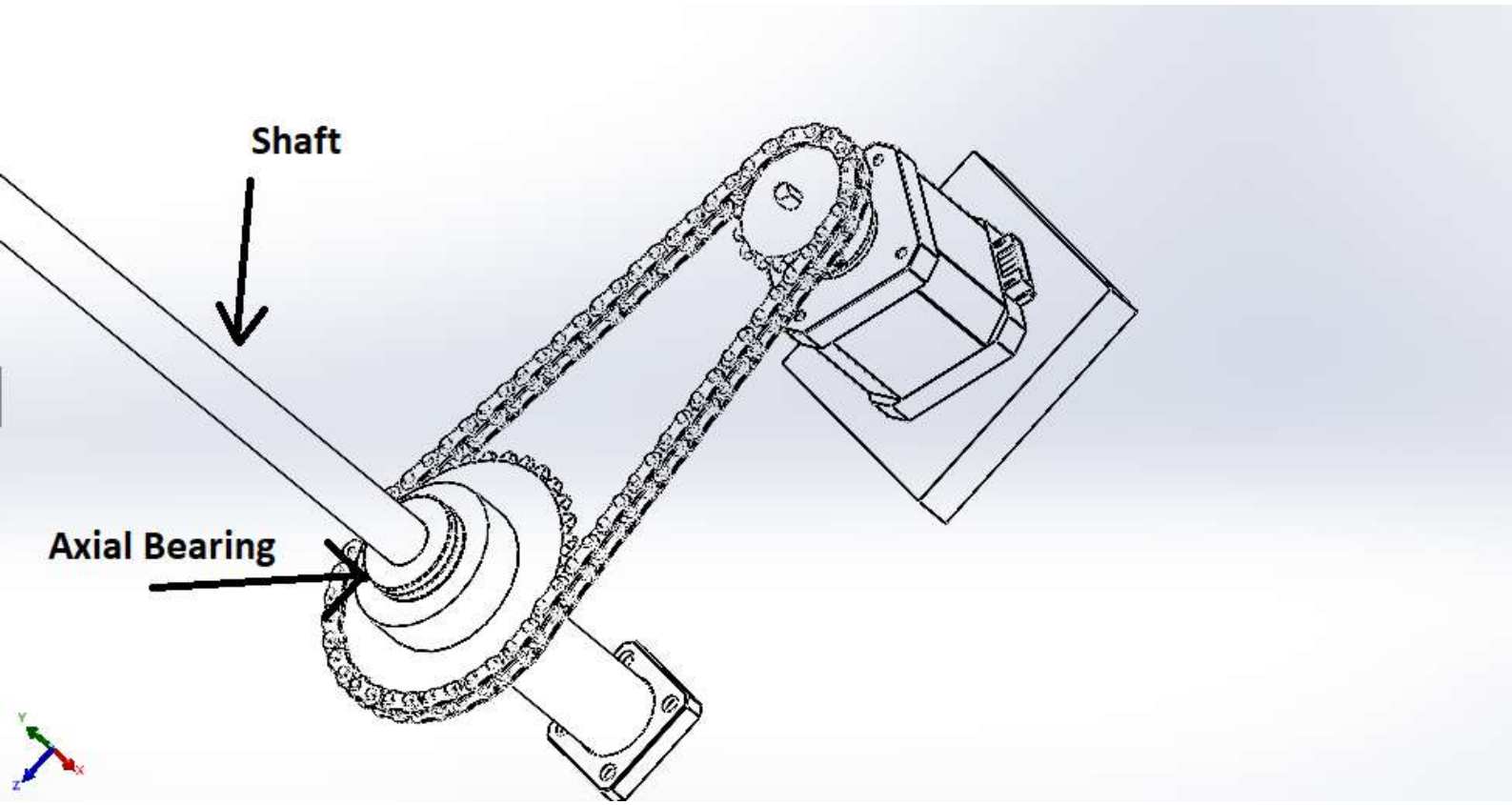
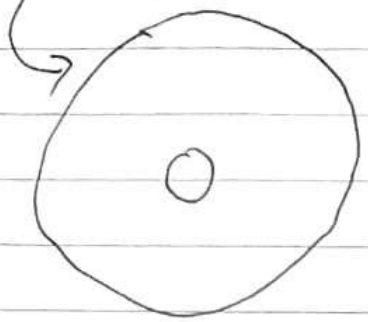

TOMATE
MODIFY
ASSEMBLE
CONSTRUCT
INSPE
D
C
E
F
A
B

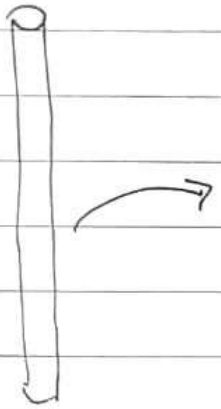

Shaft
Axial Bearing

1 plate 30 mm diameter = 0.7 kg , ∴ 4 plates = 2.8 kg



Mass of 1 item = 0.10 kg
Mass of 10 items = 1 kg

Total mass of rack unloaded = 2.8 kg
Total mass of rack loaded = 3.8 kg



Shaft = 12 mm diameter steel
Mass of shaft = 0.7 kg

- Sprocket attached to Motor : 15 Teeth & 6.350 mm pitch → pitch circle diameter = 34 mm
- Sprocket attached to shaft of rack : 30 Teeth & 6.350mm pitch → pitch circle diameter = 71 mm
- Roller chain 6.350 mm pitch
  - weight of chain = 1 kg.

- Rotation of rack 12 rpm

Chain Velocity, $V = \frac{Z \times t \times n}{60}$ (Z: teeth, t: pitch, n: rpm)

$$= \frac{(30 \times 6.350 \times 10^{-3} \times 12)}{60}$$

$$= 0.0381 \text{ m/s}$$

Where, M_t = Shaft torque

N = Shaft power

T = Traction force

D_p = Pitch Diameter of sprocket

v = Chain velocity

$$\therefore \quad M_t = \frac{14.22 \times (71 \times 10^{-3})}{2}$$

$$= 0.505 \text{ Nm}$$

$$N = T \times v$$

$$= 14.22 \times 0.0381$$

$$= 0.542 \text{ W}$$

Chain Traction Force, $T = \dfrac{\left(P/2 + P_1\right) \cdot F_s \cdot F_v}{N_1} \times 9.81 N$

Where; P = Transported weight
T = Traction force
P_1 = Weight of chain
F_s = coefficient for type of operation
F_v = velocity coefficient
N_1 = Number of chains
F_r = coefficient of friction between chain & sprocket

F_s is assumed to be $\boxed{1.0}$ since it is assumed that the load is evenly distributed of the rack.

$F_r = 0.2$

$F_v = 0.5 \Rightarrow 30/15$

$$T = \frac{\left(\frac{3.8}{2} + 1\right) \times 1 \times 0.5}{1}$$

$= 14.22 \ N$

Calculation for shaft power

$$M_t = \frac{T \cdot D_p}{2} \ Nm$$

$N = T \cdot v$