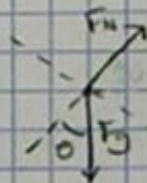


Blocks on ramps

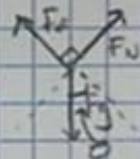
a)



$$F_N - F_g \cos \theta = 0$$

$$F_g \sin \theta = ma$$

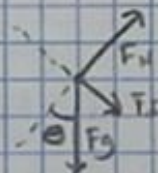
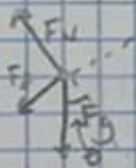
b)



$$F_N - F_g \cos \theta = 0$$

$$F_f - F_g \sin \theta = 0$$

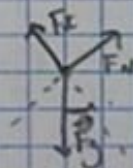
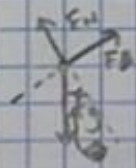
c)



$$F_f + F_g \sin \theta = ma$$

$$F_N - F_g \cos \theta = 0$$

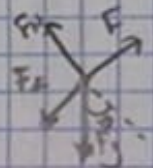
d)



$$F_N - F_g \cos \theta = 0$$

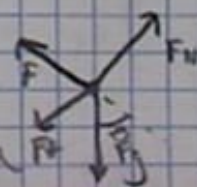
$$F_f - F_g \sin \theta = ma$$

e)

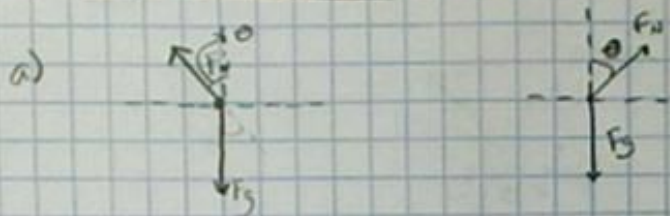


$$F_N - F_g \cos \theta = 0$$

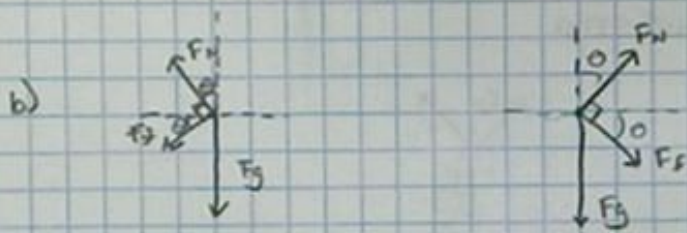
$$F - F_f - F_g \sin \theta = ma$$



Cars on Curve



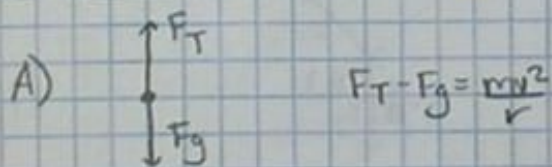
$$F_N \cos \theta - F_g = 0$$
$$F_N \sin \theta = \frac{mv^2}{r}$$



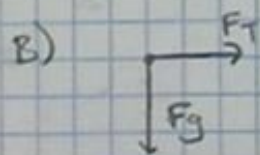
$$F_N \cos \theta - F_g - F_f \sin \theta = 0$$
$$F_N \sin \theta + F_f \cos \theta = \frac{mv^2}{r}$$

$$F_f = \mu F_N$$

Circular Track

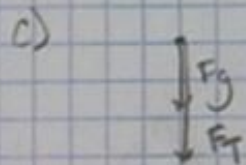


$$F_T - F_g = \frac{mv^2}{r}$$

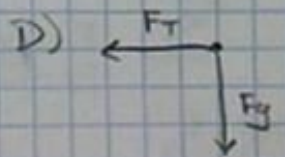


$$F_T = \frac{mv^2}{r}$$

$$F_g = mg$$



$$F_g + F_T = \frac{mv^2}{r}$$

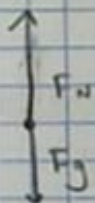


$$F_T = \frac{mv^2}{r}$$

$$F_g = mg$$

Elektor

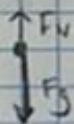
a)



$$F_N - F_g = ma$$

$$F_N = ma + F_g$$

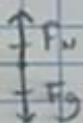
b)



$$F_g - F_N = ma$$

$$F_g - ma = F_N$$

c)



$$F_N - F_g = 0$$

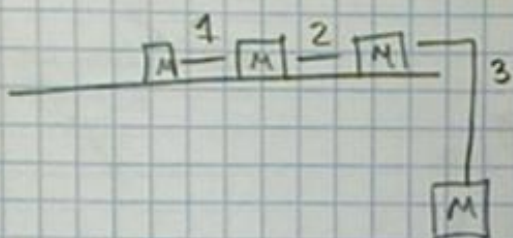
$$F_N = F_g$$

d) Same as c

e)



$$F_g = ma = mg$$



No Friction:

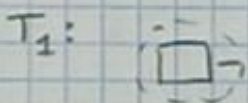
all blocks have the same acceleration.

Choose all blocks as the system

Acceleration

$$Mg = (M+M+M+M)a$$

$$\frac{Mg}{4M} = a = \frac{g}{4}$$

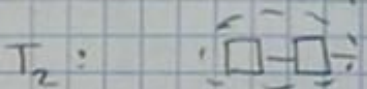


Choose for left block as system

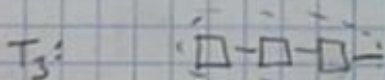
$$F_T = Ma$$

plug in a

$$F_T = \frac{Mg}{4}$$



$$F_T = (M+M)a = 2M \frac{g}{4} = \frac{Mg}{2}$$



$$F_T = (M+M+M)a = \frac{3Mg}{4}$$

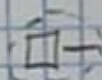
With Friction

$$F_f = \mu F_N \quad F_N = 3Mg$$

acceleration: $Mg - \mu 3Mg = 4Ma$

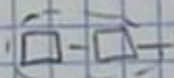
$$Mg(1 - 3\mu) = 4Ma$$

$$a = \frac{g(1 - 3\mu)}{4}$$

T_1 : 

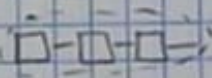
$$F_T - \mu Mg = Mg \frac{(1 - 3\mu)}{4}$$

$$F_T = \frac{Mg(1 - 3\mu)}{4} + \mu Mg$$

T_2 : 

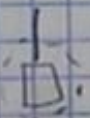
$$F_T - 2\mu Mg = \frac{2Mg(1 - 3\mu)}{4}$$

$$F_T = \frac{2Mg(1 - 3\mu)}{4} + 2\mu Mg$$

T_3 : 

$$F_T - 3\mu Mg = \frac{3Mg(1 - 3\mu)}{4} + 2\mu Mg$$

or



$$F_g - F_T = \frac{Mg(1 - 3\mu)}{4}$$