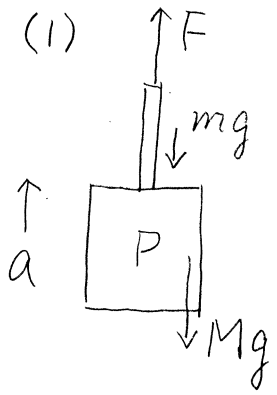
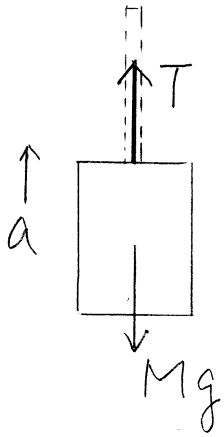
7 (1)



$$(M+m)a = F-(M+m)g$$

$$a = \frac{F}{M+m} - g \ [m/s]$$

(2)

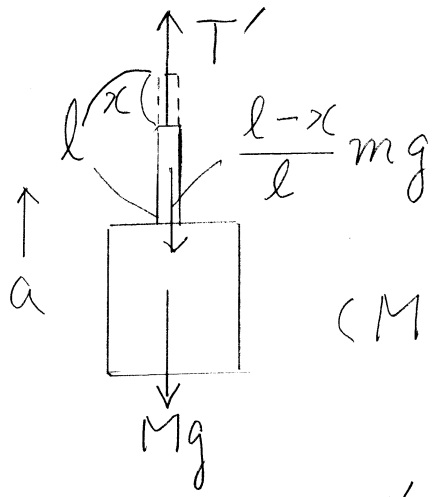


$$Ma = T - Mg$$

$$M\left(\frac{F}{M+m} - g\right) = T - Mg$$

$$T = \frac{M}{M+m} F \ [N]$$

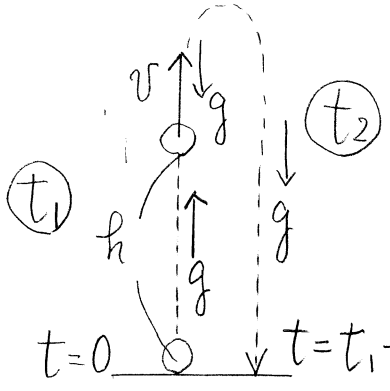
(3)



$$\left(M+\frac{\ell-x}{\ell}m\right)\left(\frac{F}{M+m}-g\right) = T' - \left(M+\frac{\ell-x}{\ell}m\right)g$$

$$T' = \left(M+\frac{\ell-x}{\ell}m\right)\cdot\frac{F}{M+m} \ [N]$$

(4) (1)より $a = \dfrac{2(M+m)g}{M+m} - g = g \ [m/s^2]$



$$h = \frac{1}{2}gt_1^2 \quad t_1 = \sqrt{\frac{2h}{g}}$$

$$v = gt_1 = \sqrt{2gh}$$

$$-h = vt_2 - \frac{1}{2}gt_2^2$$

(7-2) $-h = vt_2 - \frac{1}{2}gt_2^2$

$$gt_2^2 - 2vt_2 - 2h = 0$$

解の公式より

$$t_2 = \frac{v \pm \sqrt{v^2 + 2gh}}{g}$$ ($t_2 > 0$ なので、+をとる)

$$t_2 = \frac{\sqrt{2gh} + 2\sqrt{gh}}{g}$$

$$= (\sqrt{2} + 2)\sqrt{\frac{h}{g}}$$

$$t = t_1 + t_2 = \sqrt{\frac{2h}{g}} + (\sqrt{2} + 2)\sqrt{\frac{h}{g}}$$

$$= (2\sqrt{2} + 2)\sqrt{\frac{h}{g}}$$

$$= \underline{2(\sqrt{2} + 1)\sqrt{\frac{h}{g}}\ [s]}$$