1.

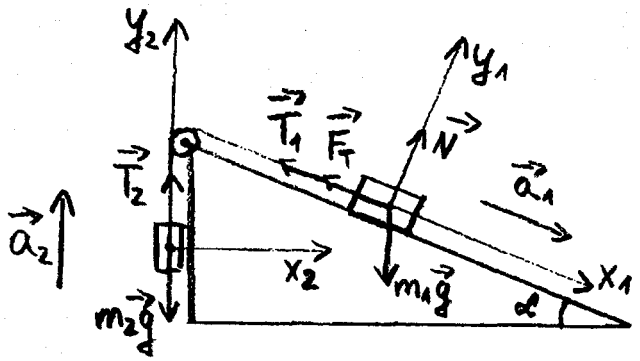
$m_1 = 5\ kg$

$m_2 = 2\ kg$

$\mu = 0,1$

$\alpha = 36°$

$T,\ a\ -?$



1- $m_1\vec{g} + \vec{N} + \vec{T}_1 + \vec{F}_T = m_1\vec{a}_1$

x: $m_1 g \sin\alpha - T_1 - F_T = m_1 a_1$

y: $-m_1 g \cos\alpha + N = 0$, $N = m_1 g \cos\alpha$

$F_T = \mu N = \mu m_1 g \cos\alpha$

$m_1 g \sin\alpha - T_1 - \mu m_1 g \cos\alpha = m_1 a_1$

2- $m_2\vec{g} + \vec{T} = m_2\vec{a}$

y: $-m_2 g + T_2 = m_2 a_2$

$m_1 g \sin\alpha - T_1 - \mu m_1 g \cos\alpha + T_2 - m_2 g = m_1 a_1 + m_2 a_2$

$T_1 = T_2 = T$, $a_1 = a_2 = a$

$$a = \frac{m_1 g(\sin\alpha - \mu\cos\alpha) - m_2 g}{m_1 + m_2}$$, $a = 0,77\ \frac{m}{s^2}$

$a = +0,77\ \frac{m}{s^2}$

$T = m_2 g + m_2 a = m_2(g + a)$

$a = -0,77\ \frac{m}{s^2}$

$T \approx 21\ N$

2.

$p_0 = 1{,}01 \cdot 10^5$ Pa

$T_0 = 300$ K

$V_{01} = 1 \cdot 10^{-4}$ m^3

$V_{02} = 2 \cdot 10^{-4}$ m^3

$T_1 = 273$ K

$T_2 = 373$ K

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p - ?

1)

p_0, T_0, V_{01}	p_0, T_0, V_{02}

2)

p, T_1, V_1	p, T_2, V_2

$$V_{01} + V_{02} = V_1 + V_2$$

1) $$p_0 V_{01} = \frac{m_{01}}{M_{01}} R T_0$$

$$p_0 V_{02} = \frac{m_{02}}{M_{02}} R T_0$$

2) $$p V_1 = \frac{m_{01}}{M_{01}} R T_1$$

$$p V_2 = \frac{m_{02}}{M_{02}} R T_2$$

$$\frac{p_0 V_{01}}{T_0} = \frac{p V_1}{T_1}, \quad V_1 = \frac{p_0 V_{01} T_1}{T_0 p}$$

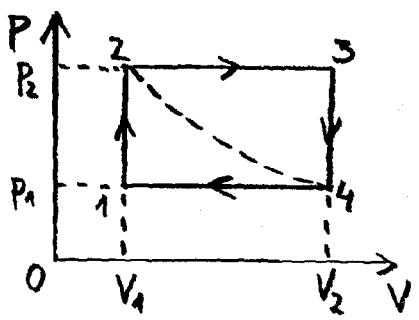
$$\frac{p V_{02}}{T_0} = \frac{p V_2}{T_2}, \quad V_2 = \frac{p_0 V_{02} T_2}{T_0 p}$$

$$V_{01} + V_{02} = \frac{p_0 V_{01} T_1}{T_0 p} + \frac{p_0 V_{02} T_2}{T_0 p}$$

$$p = \frac{p_0 (V_{01} T_1 + V_{02} T_2)}{T_0 (V_{01} + V_{02})}$$

$$p = 1{,}14 \cdot 10^5 \text{ Pa}$$

3.



1 : P_1, V_1, T_1

2 : P_2, V_1, T_2

3 : P_2, V_2, T_3

4 : P_1, V_2, T_4 ($T_4 = T_2$)

$$A = (P_2 - P_1)(V_2 - V_1)$$

$T_4 = T_2$, $P_2 V_1 = P_1 V_2$, $\frac{P_1}{P_2} = \frac{V_1}{V_2}$

$P_1 \cdot V_1 = R \cdot T_1$ $\quad \vartheta = 1\ mol$

$P_2 \cdot V_2 = R \cdot T_3$

$$\left(\frac{P_1}{P_2}\right)\left(\frac{V_1}{V_2}\right) = \frac{T_1}{T_3}$$

$$\frac{P_1}{P_2} = \frac{V_1}{V_2} = \sqrt{\frac{T_1}{T_3}}$$

$$A = P_2 \cdot V_2 \left(1 - \frac{P_1}{P_2}\right)\left(1 - \frac{V_1}{V_2}\right) = R T_3 \left(1 - \sqrt{\frac{T_1}{T_3}}\right)^2$$

$$\underline{A = R T_3 \left(1 - \sqrt{\frac{T_1}{T_3}}\right)^2}$$

4.

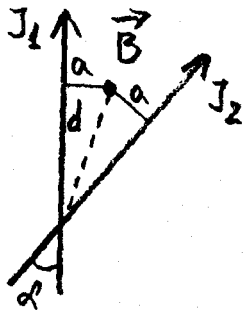
$J_1 = 1\ A$

$J_2 = 2\ A$

$\alpha = 60°$

$\mu = 1$

$d = 0{,}1\ m$



$$B = \frac{\mu \mu_0 J}{2\pi a}$$

$$B_1 = \frac{\mu \mu_0 J_1}{2\pi a}$$

$$B_2 = \frac{\mu \mu_0 J_2}{2\pi a}$$

$$a = d \sin \frac{\alpha}{2}$$

$$B = B_1 - B_2 = \frac{\mu \mu_0 (J_1 - J_2)}{2\pi d \sin \frac{\alpha}{2}}$$

$$B = 4 \cdot 10^{-6}\ T$$

5.

$m = 0{,}02\ kg$

$T = 2\ s$

$E = 0{,}01\ J$

$X_1 = 0{,}025\ m$

$X(t)$

$F_x(t)$

$$\omega = \frac{2\pi}{T}\ ,\quad \omega = \pi$$

$$E = \frac{k X_{max}^2}{2}$$

$$\omega = \sqrt{\frac{k}{m}}\ ,\quad \omega^2 = \frac{k}{m}$$

$$k = m\omega^2$$

$$E = \frac{m\omega^2 X_{max}^2}{2}$$

$$X_{max} = \frac{1}{\omega}\sqrt{\frac{2\cdot E}{m}}$$

$$X_{max} = 0{,}32\ m$$

$t = 0\ ,\quad X_1 = X_{max}\cdot\cos\varphi_0$

$$\cos\varphi_0 = \frac{X_1}{X_{max}} = 0{,}078$$

$$\varphi_0 \approx 85^\circ$$

$$X(t) = X_{max}\cdot\cos(\omega t + \varphi_0)$$

$$X(t) = 0{,}32\cdot\cos\left(\pi\cdot t + \frac{17}{36}\pi\right)$$

$$F_x(t) = m\,a_x$$

$$a_x = x'' = -X_{max}\cdot\omega^2\cdot\cos(\omega t + \varphi_0)$$

$$F_x(t) = -m\cdot X_{max}\cdot\omega^2\cdot\cos(\omega t + \varphi_0)$$

$$F_x(t) = -0{,}02\cdot 0{,}32\cdot\pi^2\cdot\cos\left(\pi t + \frac{17}{36}\pi\right)$$
