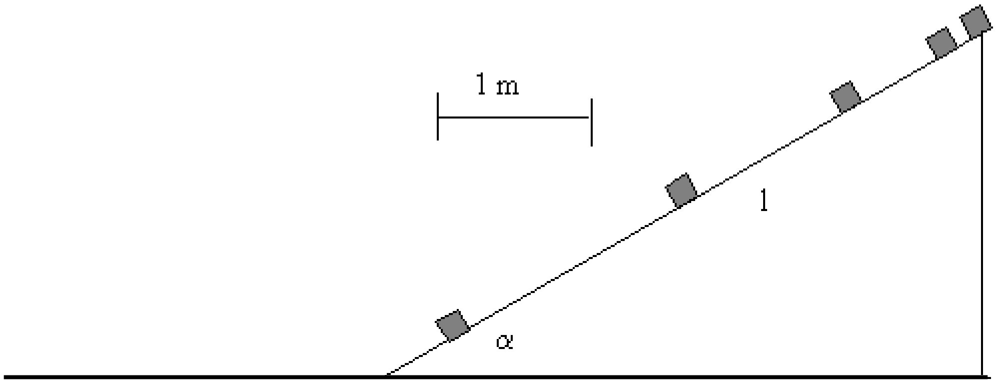
Form 10

1. Problem

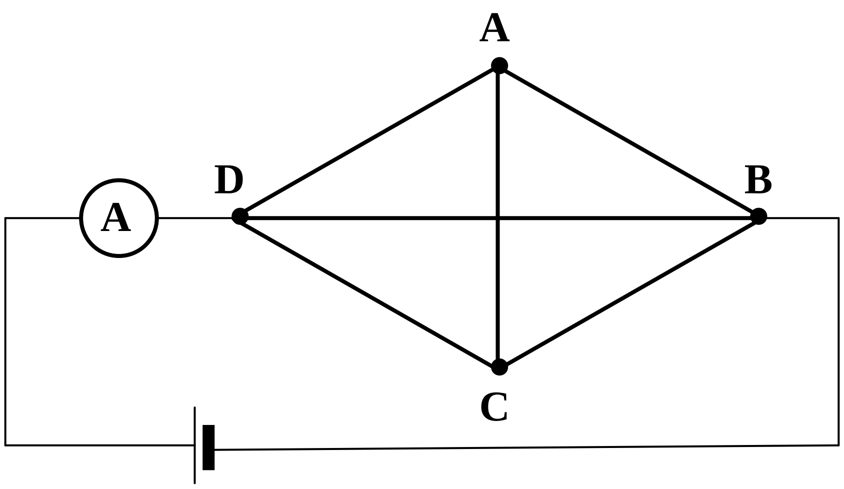
At the top of inclined plane small box is released. Mass of the box is 2kg. Positions of the box after each $t_0 = 0{,}5$ s since release are shown in the picture. g can be assumed equal to 10 m/s^2



A. By doing measurements in the picture, determine the length of the plane and angle α.
B. Determine acceleration of the box.
C. What is the time in which the box reaches the end of the plane and what is final speed?
D. What is the ratio of mechanical energies at the beginning of the motion and at the end of the inclined plane (use the lower end of the plane as the reference point)?
E. What is the distance the box makes on the horizontal surface if it decelerates by 4 m/s^2.

2. Problem

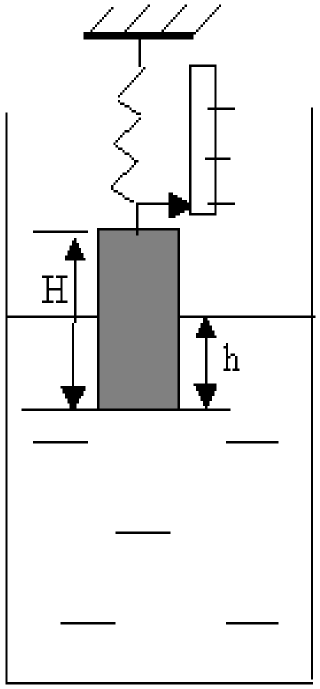
Sides of the rhomb AB = BC = CD = DA = 100 cm, but diagonals AC = 120 cm and BD = 160 cm. Rhomb is made of nichrome wire with cross section area of 1,1 mm^2. Diagonal wires AC and BD are not connected at the centre of the rhomb. Voltage applied to the rhomb U = 3,2 V. $\rho = 1{,}1 \cdot 10^{-6}\ \Omega \cdot$m.

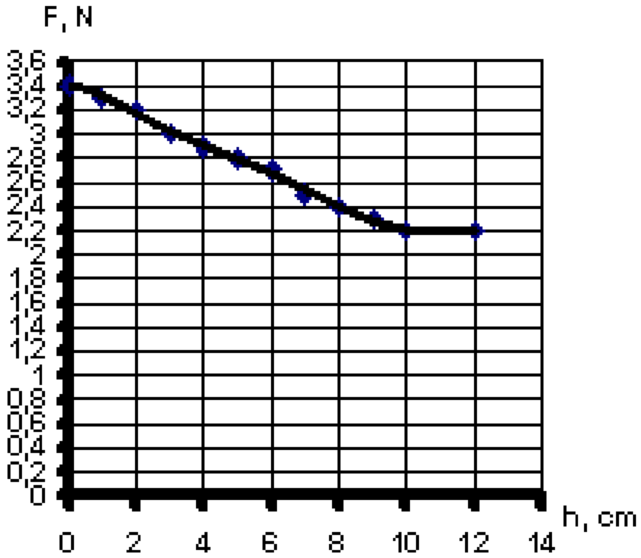


A. Calculate total resistance of the rhomb (between points D and B), and current measured by ammeter A.
B. Calculate current in each side and diagonal of the rhomb.
C. Which section of the rhomb warms up the most? Why?

3. Problem

Cylindrical body is attached to dynamometer. Radius of the cylinder is R, and height H = (10,0 ±0,1) cm. Cylinder is partly immersed in the water. h-distance from the bottom of the cylinder to the water surface. Force measured by dynamometer versus immersion depth is shown in the plot. It can be assumed g = 10 m/s^2.





A. Draw the forces acting on the cylinder when it is immersed in the water.
B. Determine the mass of the cylinder?
C. Draw plot Archimedes force F_A versus immersion depth *h*.
D. Determine the volume of the cylinder and its density if density of water is 1000 kg/m^3.
E. Cylinder immersed in depth h=10 cm is slowly pulled out of the water. What is the work required to do it?

4. Problem

Cylindrical container with base area 150 cm^2 is filled with 2,0 litters of water at $T_1 = 50{,}0\ ^0$C. Piece of ice with a small lead bullet frozen in it is thrown in the water. Combined mass of ice and bullet equal to 1,0 kg and their temperature $T_2 = 0\ ^0$C. Calculate the water level in container just after piece of ice is thrown in (ice is floating). After the ice is molten and the bullet is sunken, water temperature in the container became $T_3 = 9{,}8\ ^0$C. Calculate the change of the water level compared to that just after the addition of ice.

Density of water ρ =1000 kg/m^3; specific heat capacity of water c = 4200 J/(kg·^{0}C), heat of fusion of ice λ = 334 kJ/kg, density of lead ρ_{sv} = 11350 kg/m^3, specific heat capacity of lead c_{sv} = 130 J/(kg·^{0}C).