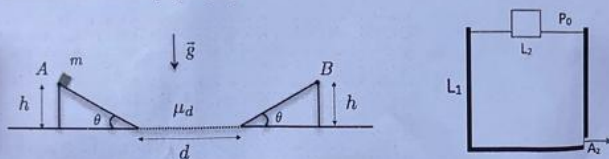


Exam ACSAI_February 2024

1 Mechanics and fluids

A body of mass m starts from rest from point A, placed at an unknown initial height h from the ground, and slides along a smooth plane inclined at an angle θ with respect to the horizontal. Having reached the ground, the body travels a distance d along a horizontal plane where friction is present, with a dynamic friction coefficient μ_d . Once the horizontal section is completed, the body rises on a second inclined plane, identical to the previous one, until it reaches the maximum height from the ground h_f .

- Determine the initial height from the ground (2)
- Explain how you would measure the height h of point A using a barometer (2)
- A cubic container of side L_1 is completely filled with water of density ρ_w . A cube of mass m and side L_2 floats in the water. Determine the immersed length of the floating cube (2)
- A hole of area A_2 is made at the base of the container. How long does it till the container is empty? (3)



2 Thermodynamics

A mass m_1 of a drink at temperature T_1 is mixed with a mass m_2 of a second drink at temperature T_2 in a container with adiabatic walls. Calculate:

- the equilibrium temperature (3)
 - the mass of ice, initially at a temperature of 0°C , which must be added to the container after the equilibrium referred to in point a) has been reached, to bring the cocktail to the temperature T_f (3)
- Note: assume that the masses of the two initial drinks maintain their specific heats unchanged even when mixed
- calculate the change in entropy of the ice in the process (3)

3 Electromagnetism

A flat capacitor is subjected to a potential difference $\Delta V = V_+ - V_-$. An electron starts from rest from the negative plate of the capacitor and reaches the positive plate after a time t . Calculate:

- The work done by the electric field. What is its sign? (3)
- The speed at which the electron hits the positive plate (3)
- The potential difference needed so that the electron reaches the positive plate twice as fast (3)

4. Describe the photoelectric effect (3)