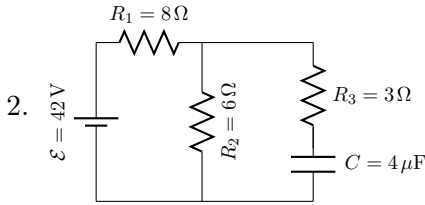
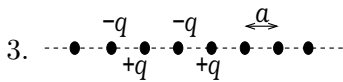


Determine the period of oscillations of a liquid (density = ρ) of mass m poured into a bent tube whose right arm forms an angle θ with the vertical. Cross-sectional area of the tube is S . Neglect viscosity of the liquid.



The capacitor in the figure is initially uncharged. The switch is closed at $t = 0$.

(a) Immediately after the switch is closed, what is the current through each resistor? (b) What is the current through each resistor after a long time? (c) What is the final charge on the capacitor?



Evaluate total electrostatic energy of an infinite linear array of point charges $+q$ and $-q$ in vacuum where two nearest neighbors of each positive charge are negatively charged and vice versa. The distance between two nearest point charges is a .

4. A nucleus of mass M_1 at rest emits a γ -ray photon and the rest mass of the resulting nucleus is M_2 . Express the energy of the γ -ray in terms of M_1 and M_2 .

5. A and B are independent witnesses in a case. The probability that A speaks the truth is " x " and that of B is " y ". If A and B agree on a certain statement, what is the probability that the statement is true?

6. Find the entropy change of n moles of an ideal gas with adiabatic exponent γ if, as a result of a certain process, the gas volume increased α times while the pressure dropped β times.

7. Compute the Wronskian of the differential equation $\frac{d^2y}{dx^2} - 2 \tan x \frac{dy}{dx} + (\sec x)y = 0$

8. The electrostatic potential is given by $V = V_0(x^2 + y^2 + z^2)$ where V_0 is a constant. Find the charge density.

9. A particle is moving under gravity along the inner surface of a hollow sphere of radius R . How many degrees of freedom does it have? Write down its Lagrangian.

10. Evaluate $\int_0^\infty e^{-\sqrt{x}} dx$