

Review of Physics 2 - Exam, muster

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For every task is for correct general result 1 point, for correct numerical result 1 point and correct way of solution for 3 points, i.e. maximum of possible points is 5 per task and maximum 20 points for the test. Numerical results estimate with the 1-digit of precision.

Task 1 - Water power plant

Calculate the difference in the river levels before and after the hydroelectric power station, where the current flow rate is $I = 400 \text{ m}^3\text{s}^{-1}$, the output power is $P = 2 \text{ MW}$, and efficiency of the power plant is $\eta = 75 \%$. Assume gravitational acceleration as $g = 10 \text{ m s}^{-2}$.

Task 2 - Linear harmonic oscillator

The linear harmonic oscillator with the amplitude of displacement $y_0 = 12 \text{ cm}$ has a period of movement $T = 40 \text{ ms}$. The rigidity of the oscillating system is $k = 6 \text{ Nm}^{-1}$. Calculate the total mass, maximal velocity, maximal acceleration, and total energy of the oscillator.

Task 3 - Capacitors

Three capacitors with capacities $C_1 = 1 \mu\text{F}$, $C_2 = 3 \mu\text{F}$ and $C_3 = 20 \mu\text{F}$ are connected serial. What is the total capacity? What is the total bound electric charge, if the capacities are charged to voltage $U = 200 \text{ V}$? how is the voltage divided into individual capacities?

Task 4 - Water vapor

Inside the closed glass tube with a volume of $V = 3 \text{ cm}^3$ is located pure water vapor with the pressure $p = 2000 \text{ Pa}$ and the temperature $\vartheta = 20 \text{ }^\circ\text{C}$. Calculate their total mass, molar mass, density and number of molecules of the vapor. Relative atomic mass let's assume as 1 for hydrogen and 16 for oxygen; the molar gas constant is $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$, Avogadro constant is $N_A = 6.6 \cdot 10^{23} \text{ mol}^{-1}$, let's assume the behavior of the vapor as an ideal gas.