ANSWER SHEET

Problem 2

IPhO Estonia 2012

Problem T2. Kelvin water dropper *(8 points)*

Part A. Single pipe *(4 points)*

i. (1.2 pts)

$$r_{\max} = \sqrt[3]{\frac{3\sigma d}{4\rho g}}$$

ii. (1.2 pts)

$$Q = 4\pi\varepsilon_0\varphi r$$

iii. (1.6 pts)

$$\varphi_{\max} = 2\sqrt{\sigma r/\varepsilon_0}$$

Part B. Two pipes *(4 points)*

i. (1.2 pts)

$$Q_0 = 2\pi\varepsilon_0 q r_{\max}/C$$

ii. (1.5 pts)

$$q(t) = q_0 e^{\gamma t}, \quad \gamma = \frac{\pi\varepsilon_0 n}{C}\sqrt[3]{\frac{6\sigma d}{\rho g}}.$$

iii. (1.3 pts)

$$U_{\max} = \sqrt[6]{\frac{H^3 g\sigma^2\rho d^2}{6\varepsilon_0^3}}$$