Water-Hammer Effect

Part A. Excess Pressure and Propagation of Pressure Wave

A.1 (1.6 pt)

$\alpha =$

$\beta =$

$\gamma =$

A.2 (0.6 pt)

$c =$

$\Delta P_{\mathrm{s}} =$

Part B. A Model for the Flow-control Valve

B.1 (1.0 pt)
(Give answer in terms of ρ_0, v_{in}, r, R, and C_{c}.)

$\Delta P_{\mathrm{in}} = P_{\mathrm{in}} - P_{\mathrm{a}} =$

Part C. Water-Hammer Effect due to Fast Closure of Flow Control Valve

C.1 (0.6 pt)
(Give answers in terms of ρ_0, g, h, and P_{a}.)

$P_0 =$

$v_0 =$

C.2 (1.2 pt)

$P(t \to \tau/2) =$

$v(t \to \tau/2) =$

$P(t \to \tau) =$

$v(t \to \tau) =$

Part D. Water-Hammer Effect due to Slow Closure of Flow Control Valve

D.1 (3.0 pt)

Formula of $\Delta P_n/(\rho_0 c)$ in terms of $\Delta P_{n-1}/(\rho_0 c)$, v_{n-1}, and v_n, valid for $n = 1, 2, 3, 4.$.

$\Delta P_n/(\rho_0 c) =$

Formula of v_n in terms of $\Delta P_{n-1}/(\rho_0 c)$ and v_{n-1}, valid for $n = 1, 2, 3.$

$v_n =$

D.2 (2.0 pt)

On the first sheet of graph paper after this answer sheet, make all requested plots of ΔP versus $\rho_0 c v$ and draw lines and curves intersecting at ($\rho_0 c v_n$,ΔP_n) and label each with its closing-step number n ($n = 1, 2, 3, 4$).

The other two sheets of graph paper are meant to be used for making preliminary plots only.

----------**Graph paper on next sheet** ----------

For $n = 1, 2, 3, 4$, enter values of $\rho_0 c v_n$ and ΔP_n (both in units of MPa) estimated from your plot into the following table:

	$\rho_0 c v_n$/MPa	ΔP_n/MPa
$n = 1$		
$n = 2$		
$n = 3$		
$n = 4$		

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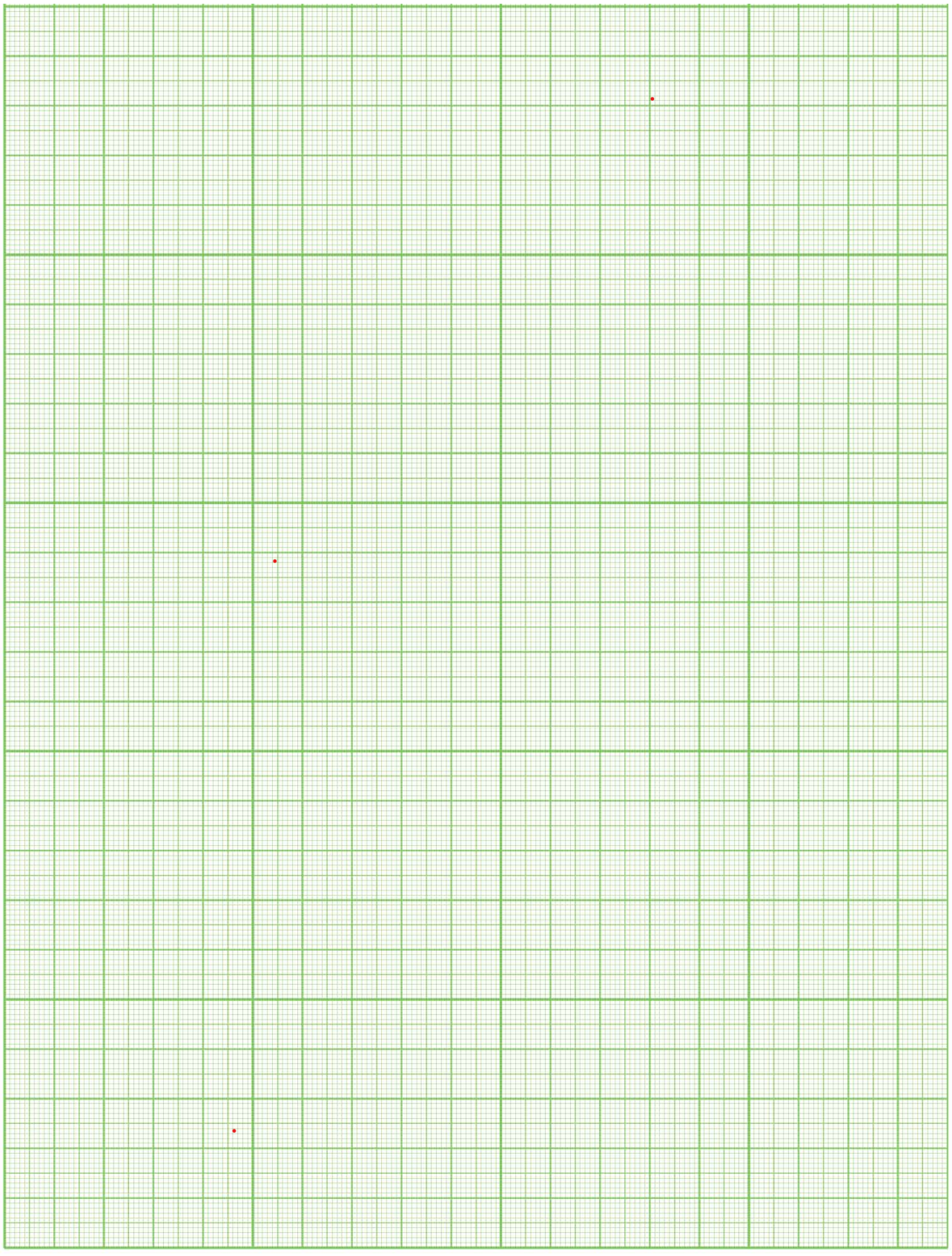
A1-4

English (Official)



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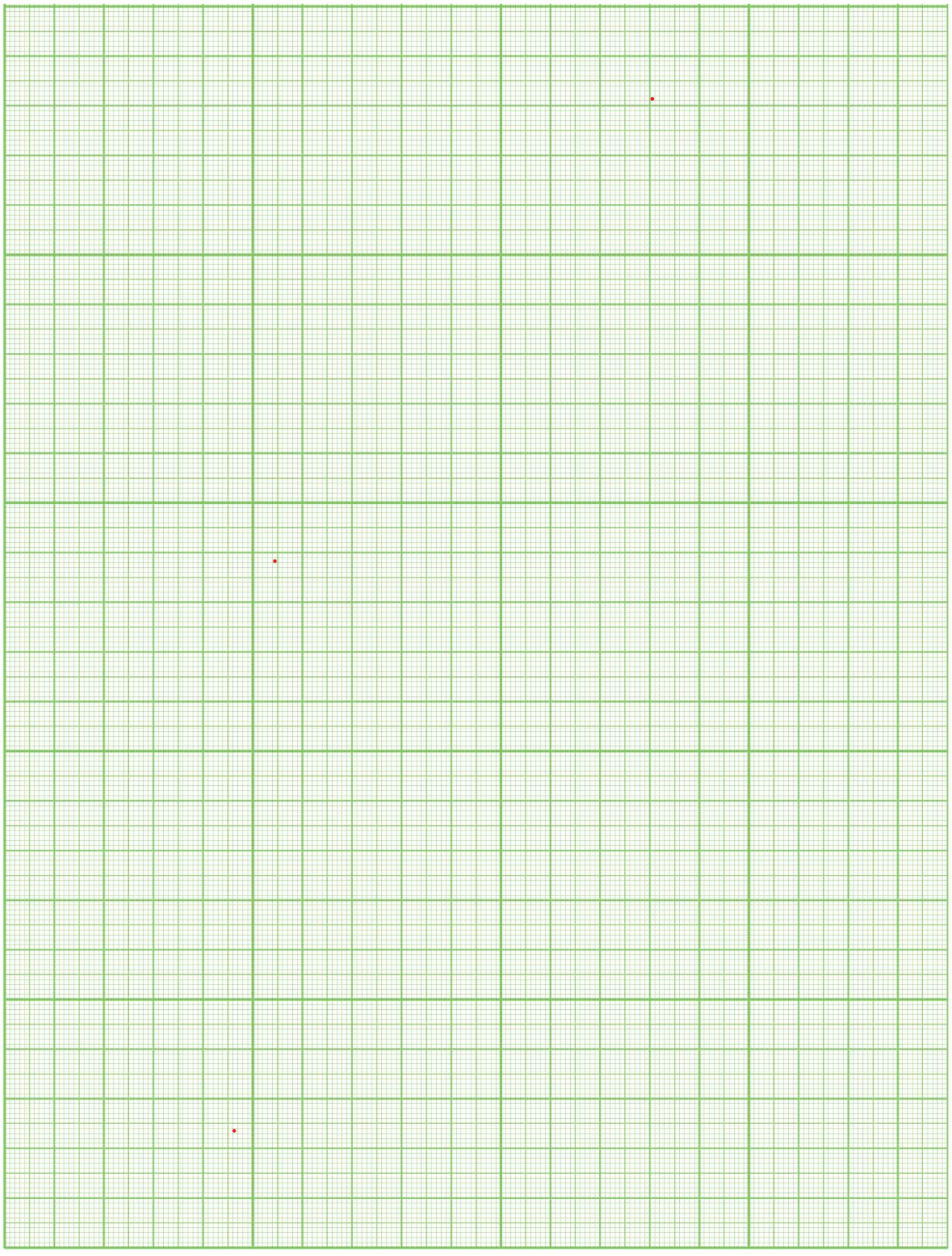
A1-5

English (Official)



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A1-6

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