Static response of a magnetically active fluid (10 points)

Part A: Static Testing (1.6 points)

Magnetic interaction: force on a ferrofluid

A.1 (0.8 pt)
Diagram:

$z =$

A.2 (0.8 pt)

Density difference $\Delta\rho =$

Part B: Magnetic interaction: surface tension of a ferrofluid (1.2 points)

B.1 (0.6 pt)
$z_{\text{crit}} =$

$\lambda =$

B.2 (0.6 pt)
$\sigma =$

Part C: Optical surface characterisation: non-spiking regime (4.1 points)

Optical surface characterisation: non-spiking regime

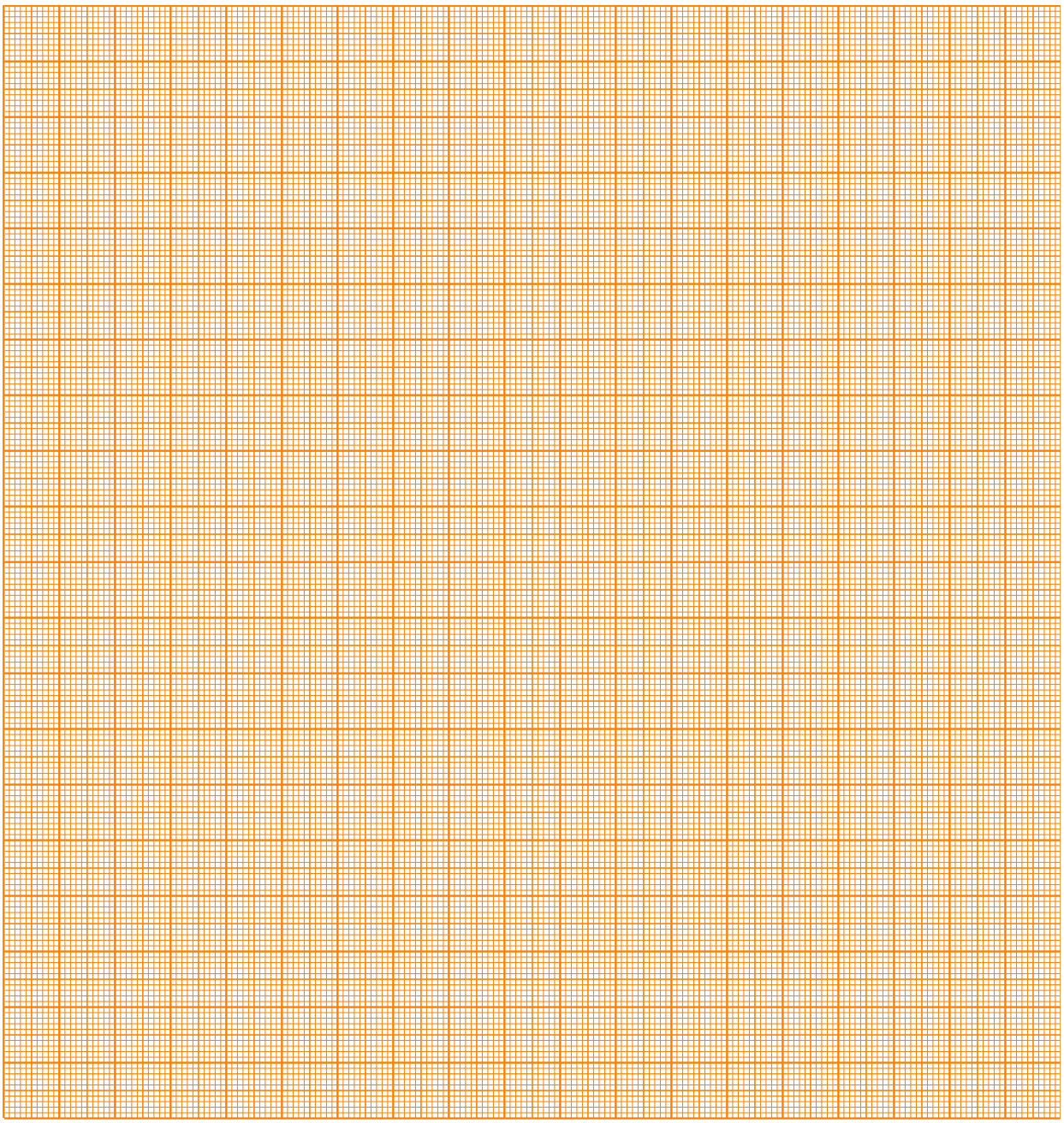
C.1 (0.6 pt)
Diagram

Measurements:

$\Delta z =$

C.2 (3.5 pt)
Measurements:

C.2 (cont.)
Graph:



C.2 (cont.)
Relationship plotted on graph:

Space to work

$n =$

Part D: Spiked surface characterisation: spike formation and disappearance (3.1 points)

Spiked surface characterisation: spike formation and disappearance

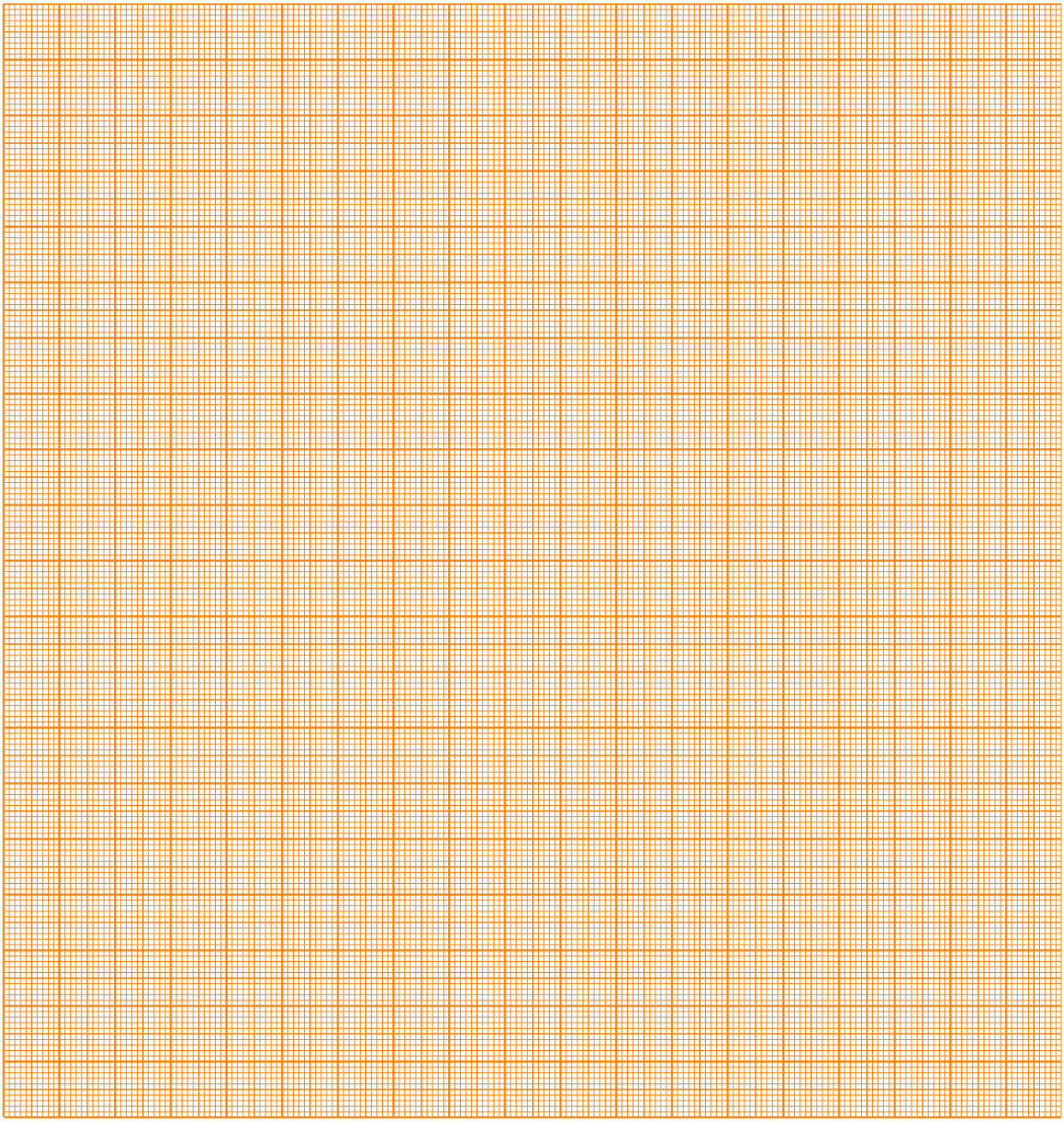
D.1 (0.5 pt)

Surface tension of ferrofluid in air: $\sigma_{\text{fa}} =$

D.2 (1.0 pt)

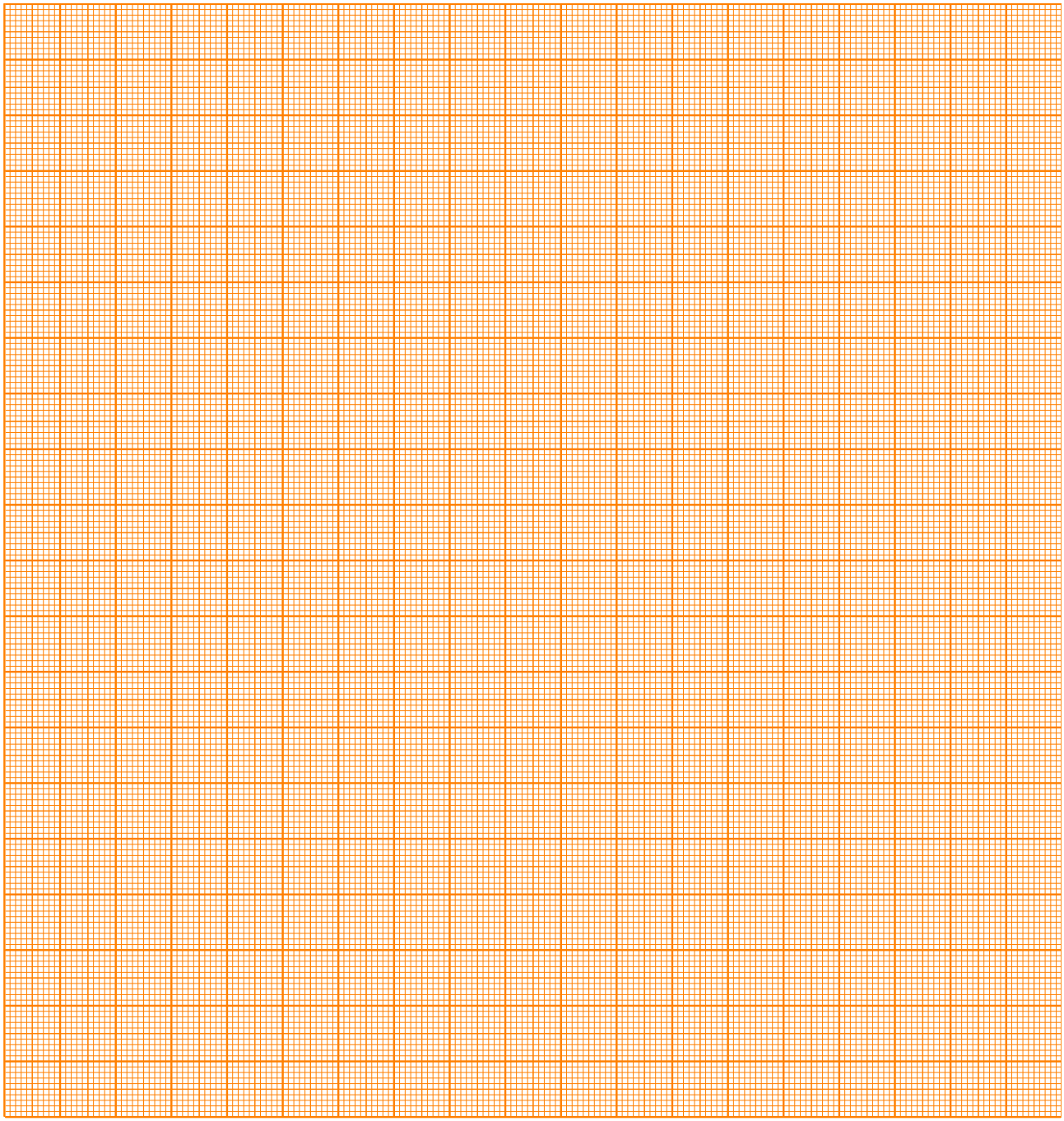
Number of spikes	Magnet distance z	Δz

D.3 (1 pt)

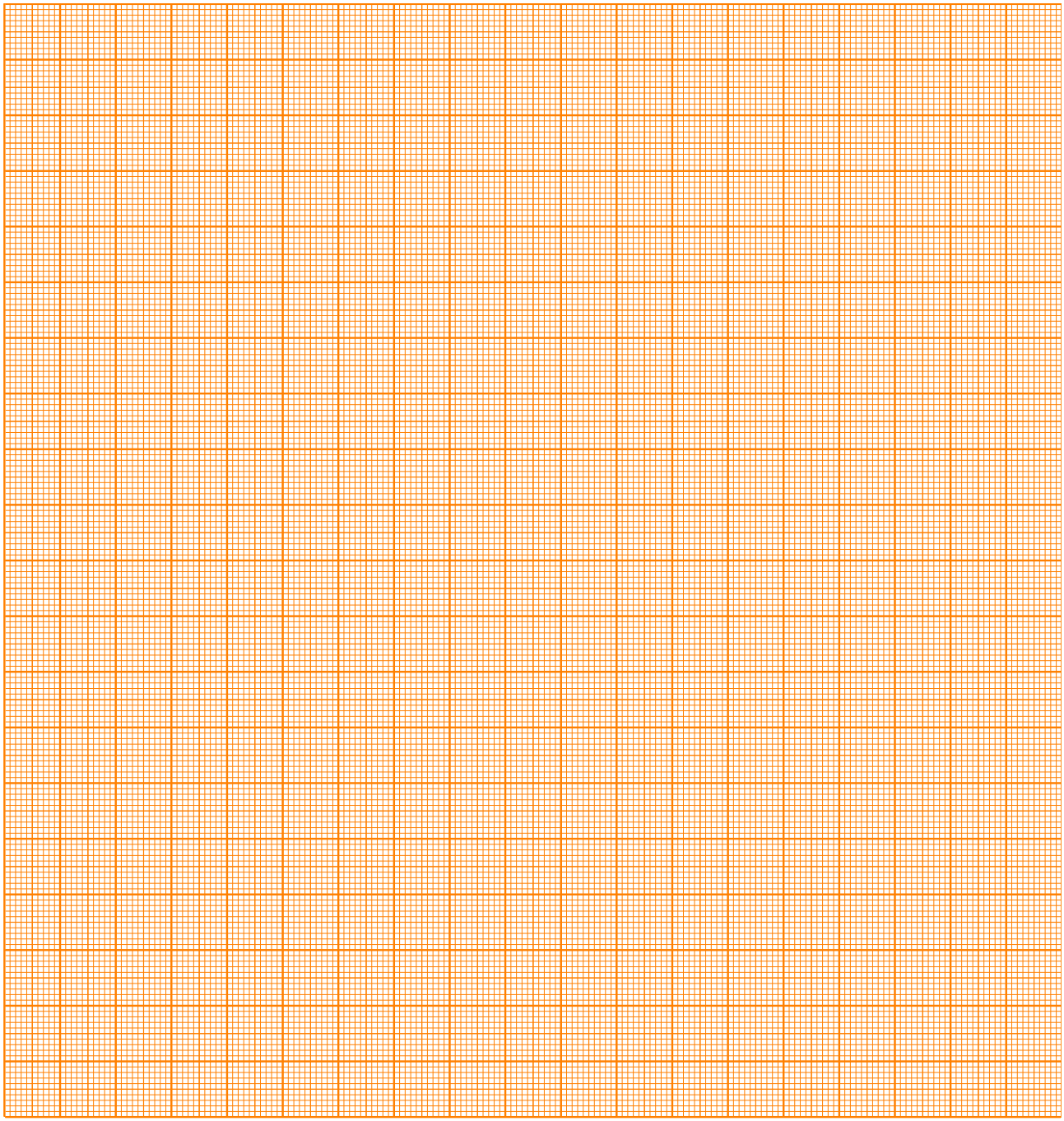


D.4 (0.6 pt)
Sketch:

Additional graph paper



Additional graph paper



Wave pulses in a magnetically active fluid (10 points)

Part A: Plane pulses (1.3 points)

A.1 (0.3 pt)
Diagram of setup:

A.2 (0.8 pt)

A.2 (cont.)

A.3 (0.2 pt)

Part B: Waves pulses in fluid of varying depth (3.4 points)

Waves pulses in fluid of varying depth

B.1 (0.3 pt)
Diagram:

$d(y) =$

B.2 (0.3 pt)

B.3 (0.3 pt)

(i)

(ii)

B.4 (1.2 pt)

B.4 (cont.)

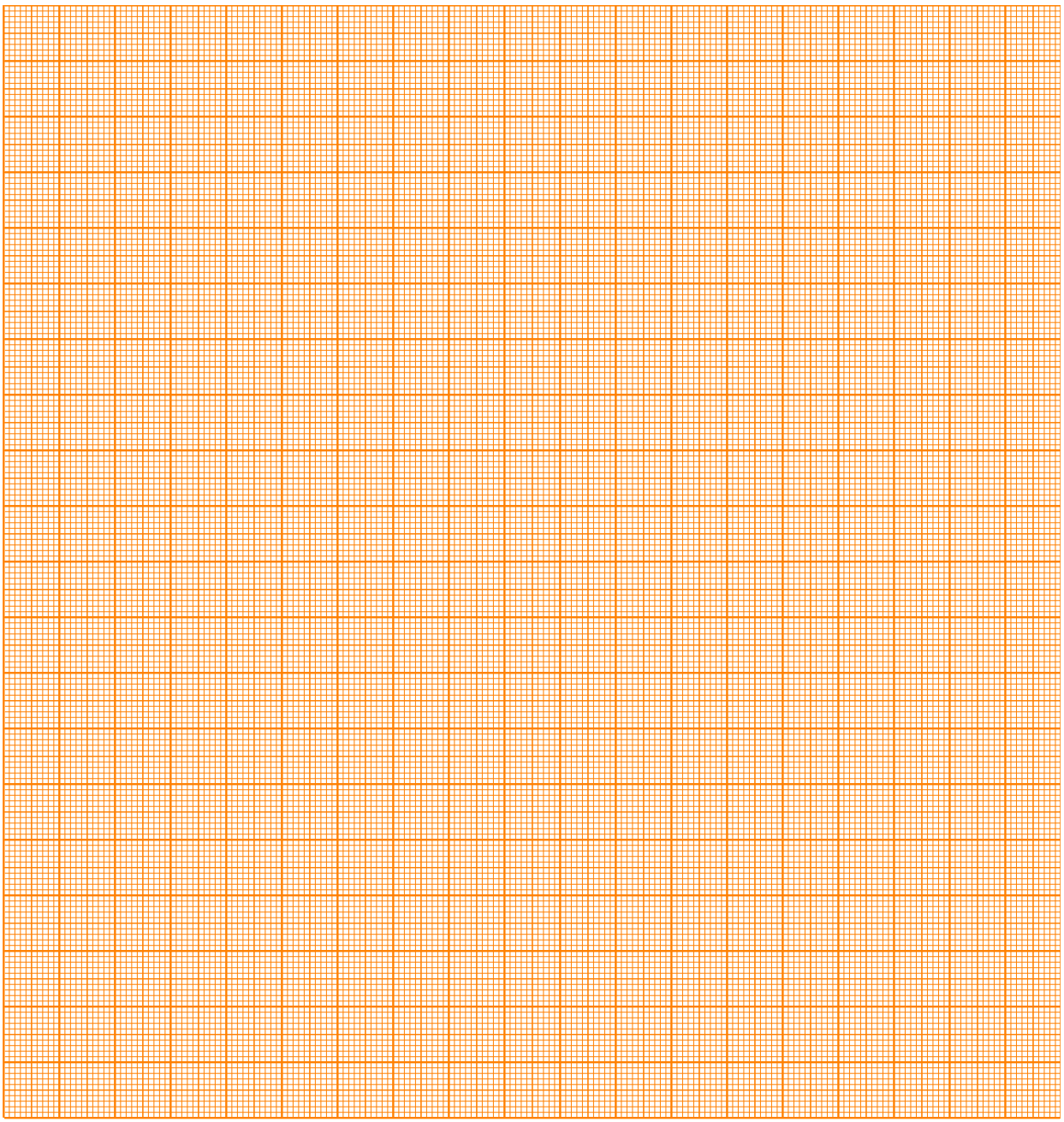
B.4 (cont.)

B.5 (1.3 pt)

$\kappa =$

$\Delta\kappa =$

B.5 (cont.)



Part C: Wave and magnetic effects (1.8 points)

C.1 (1.8 pt)

mechanically by sliding the container on the wooden base

mechanically by sliding the wooden base with the container fixed in place on top

pulses magnetically by rapidly withdrawing a magnet from near to the ferrofluid

Part D: Internal properties of ferrofluid within a strong magnetic field (3.5 points)

D.1 (0.2 pt)

D.2 (0.8 pt)

D.2 (cont.)

D.3 (0.4 pt)

D.4 (0.3 pt)

D.5 (1 pt)

D.6 (0.8 pt)

Additional graph paper