1) The interval (Δt) used in Eulerian method of time averaging should be
(a) Greater than the time scale of local variation
(b) Greater than the time scale of the process
(c) Neither (a) or (b)
(d) Both (a) & (b)

2) Eularian averaging differs from Lagrangian method since
(a) It considers a fixed point in space
(b) It is more accurate
(c) It involves time averaging
(d) None of the above

3) A mixture of water and its vapor at 1 atm flows in a 0.2 m ID tube with a mass flow rate of 0.1 kg/s. The liquid water is dispersed in the vapor phase in the form of 0.1-mm -diameter droplets and the quality of the mixture is \( x = 0.8 \). While the vapor is saturated, the liquid droplets, are subcooled, both at 95 °C. The volume fraction of the liquid phase is \( \varepsilon = 0.0025 \). Find the interactive force between the liquid and vapor phases.
(a) -22 N/m³
(b) 10200 N/m³
(c) -2400 N/m³
(d) -317.58 N/m³

\[
\begin{align*}
\dot{m}_l &= \rho_l \langle w_l \rangle A_t = \rho_l \langle w_l \rangle \varepsilon \varepsilon A \\
\dot{m}_v &= \rho_v \langle w_v \rangle A_v = \rho_v \langle w_v \rangle (1-\varepsilon) A
\end{align*}
\]

The average velocities of the liquid and vapor phases can be obtained by
\[
\begin{align*}
\langle w_l \rangle &= \frac{\dot{m}_l}{\rho_l \varepsilon \varepsilon A} = \frac{0.02}{965.35 \times 0.0025 \times 31.4 \times 10^3} = 0.264 \text{ m/s} \\
\langle w_v \rangle &= \frac{\dot{m}_v}{\rho_v (1-\varepsilon) A} = \frac{0.08}{0.596 \times 0.9975 \times 31.4 \times 10^3} = 4.29 \text{ m/s}
\end{align*}
\]
4) A heat pipe uses a thermal cycle in which a liquid is evaporated from one end, and the vapor is condensed at the other end. The liquid motion is caused by capillary action through a wick, which is a porous zone (see Fig. 1). The maximum pressure drop that the wick can handle is based on the effective radius, \( r_{eff} \), by \( \Delta p_{max} = \frac{2\sigma}{r_{eff}} \). The effective radius is 5\times10^{-5} \text{ m}. 10 \text{ kW/m}^2 \text{ of heat enters the evaporator and leaves the condenser. The adiabatic section, } L_a, \text{ has a length of 0.5 m, while the evaporator and condenser sections have a length of 0.1 m (}\( L_e=L_c)\). The permeability, \( K \), of the wick is 5\times10^{-9} \text{ m}^2, \text{ while the wick thickness, } wick, \text{ is 0.005 m. The porosity of the wick is 0.3. The working fluid is water, and the only effect the vapor phase has on the wick is that the pressure applied to the interface is 1 atmosphere. Assume that the inertial losses in the wick are negligible, and that the fluid flow in the wick is one-dimensional. Also assume that the wick is thin enough that conduction through the wick can be considered one-dimensional, and that the flow of the liquid has a negligible effect on the temperature distribution in the wick. [Hint: Liquid pressure drop in the wick section plotted in Fig 2].

What is the maximum pressure drop the wick can handle?

(a) 4712.8 Pa
(b) 30 Pa
(c) 30000 Pa
(d) 2356.4 Pa
5) The pressure drop in the wick when compared to the pressure drop in the liquid is
(a) Greater
(b) Lesser
(c) Equal
(d) None of the above