FUNDAMENTALS OF ENGINEERING EXAM PROBLEMS: Answers

FE-1.1 The absolute viscosity μ of a fluid is primarily a function of

(a) density **(b) temperature** (c) pressure (d) velocity (e) surface tension

FE-1.2 If a uniform solid body weighs 50 N in air and 30 N in water, its specific gravity is

(a) 1.5 (b) 1.67 **(c) 2.5** (d) 3.0 (e) 5.0

FE-1.3 Helium has a molecular weight of 4.003. What is the weight of 2 cubic meters of helium at 1 atmosphere and 20°C?

(a) 3.3 N (b) 6.5 N (c) 11.8 N (d) 23.5 N (e) 94.2 N

FE-1.4 An oil has a kinematic viscosity of 1.25E-4 m^2/s and a specific gravity of 0.80. What is its dynamic (absolute) viscosity in kg/(m·s)?

(a) 0.08 **(b) 0.10** (c) 0.125 (d) 1.0 (e) 1.25

FE-1.5 Consider a soap bubble of diameter 3 mm. If the surface tension coefficient is 0.072 N/m and external pressure is 0 Pa gage, what is the bubble's internal gage pressure?

(a) -24 Pa (b) +48 Pa (c) +96 Pa **(d) +192 Pa** (e) -192 Pa

FE-1.6 The only possible dimensionless group which combines velocity V, body size L, fluid density ρ, and surface tension coefficient σ is:

(a) $L\rho\sigma/V$ (b) $\rho VL^2/\sigma$ (c) $\rho\sigma V^2/L$ (d) $\sigma LV^2/\rho$ **(e) $\rho LV^2/\sigma$**

FE-1.7 Two parallel plates, one moving at 4 m/s and the other fixed, are separated by a 5-mm-thick layer of oil of specific gravity 0.80 and kinematic viscosity 1.25E-4 m^2/s. What is the average shear stress in the oil?

(a) 80 Pa (b) 100 Pa (c) 125 Pa (d) 160 Pa (e) 200 Pa

FE-1.8 Carbon dioxide has a specific heat ratio of 1.30 and a gas constant of 189 J/(kg-°C). If its temperature rises from 20°C to 45°C, what is its internal energy rise?

(a) 12.6 kJ/kg **(b) 15.8 kJ/kg** (c) 17.6 kJ/kg (d) 20.5 kJ/kg (e) 25.1 kJ/kg

FE-1.9 A certain water flow at 20°C has a critical cavitation number, where bubbles form, Ca ≈ 0.25, where $Ca = 2(p_a - p_{vap})/(\rho V^2)$. If pa = 1 atm and the vapor pressure is 0.34 psia, for what water velocity will bubbles form?

(a) 12 mi/hr (b) 28 mi/hr (c) 36 mi/hr (d) 55 mi/hr **(e) 63 mi/hr**

FE-1.10 A steady incompressible flow, moving through a contraction section of length L, has a one-dimensional-average velocity distribution given by $u = U_o(1 + 2x/L)$. What is its convective acceleration at the end of the contraction, x = L?

(a) U_o^2/L (b) $2U_o^2/L$ (c) $3U_o^2/L$ (d) $4U_o^2/L$ **(e) $6U_o^2/L$**
