

TUT. # 3 (HW No. 1)

Solve the following Problems

- 1- A perfect gas undergoes a process whereby its pressure is doubled and its density is decreased to three-quarters of its original value. If the initial temperature is 200°F, what is the final temperature in °F and in °C?
- 2- A block weighing 500 N slides down on inclined surface on which there is a thin film of SAE30 oil at room temperature. As shown in Fig.(1), the inclination angle is 20°. The block is a cube 0.2 m on a side. What is the terminal speed of the block as it slides down the incline? The oil thickness is 0.003 cm. Assume a linear variation of the velocity across the oil film.
- 3- Consider two infinite parallel plates, a distance h apart (Fig.2). The velocity distribution between the plates is:

$$u = \frac{1}{2\mu} \frac{dp}{dx} y^2 + C_1 y + C_2$$

Use the boundary conditions for a viscous flow to evaluate the constants C_1 and C_2 .

- 4- Calculate the capillary rise (h) of water in a clean glass tube, if the inside diameter of the glass tube is 1/8 inch. The surface tension of water in English units is approximately 0.005 lb/ft. The density of water is 1.9404 Slug/ft³.
- 5- What diameter of glass tube is required if the capillary effect on the water within the tube are not to exceed 0.5 mm.
- 6- The output from a differential transducer used in a laboratory experiment indicates that the local pressure (at a specific location on the model) is 4.5×10^3 N/m² below the atmospheric value. The atmospheric pressure in the laboratory is determined using a mercury barometer. The column of mercury in the barometer is 75.2 cm in length. Calculate the absolute pressure and the gauge pressure in the following units (a) N/m² (b) lb/in² and (c) lb/ft².
- 7- If 200 ft³ of oil weighs 10520 lb, calculate its specific weight, G , density, ρ , and specific gravity, S , in SI units.
- 8- (a) Convert a pressure head of 5 m of water to meters of oil of Sp. Gr. =0.75.
(b) Convert a pressure head of 60 cm of mercury to meters of oil of Sp. Gr. =0.75.