Review

Chapter 1:

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density: $\rho = \frac{m}{V}$

pressure: $p = \frac{F}{A}$

fluids at rest: $p = p_0 + \rho g h$

absolute pressure

atmosphere pressure

gauge pressure

Pascal's law: $\frac{F_i}{A_i} = \frac{F_0}{A_0}$

Archimede's principal: $F_b = \rho_{fluid} g V$: buoyant force

Equation of continuity: $A_1 v_1 = A_2 v_2 = \text{constant}$

Bernoulli's equation:

$$p_1 + \frac{1}{2}\rho v_1^2 + \rho g y_1 = p_2 + \frac{1}{2}\rho v_2^2 + \rho g y_2 = \text{constant}$$

Chapter 2:

$$T(K) = T(C^0) + 273.15$$

thermal expansion:

- **Linear expansion:** (solids) $\Delta L = L\alpha\Delta T$
- **Area expansion:** (solids) $\Delta A = A\alpha_A \Delta T;\ \alpha_A = 2\alpha$
- **Volume expansion:** (solids and liquids)

$$\Delta V = V\beta\Delta T;\ \beta = 3\alpha$$

Heat capacity: $Q = C\,\Delta T = C\,(T_f - T_i)$

specific capacity: $$Q = cm\,\Delta T = cm\,(T_f - T_i)$$

- **Latent heat:** $$Q = Lm$$

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Heat Transfer Mechanisms:

- **Conduction:** $$P_{cond} = \frac{Q}{t} = kA\,\frac{T_H - T_C}{L}$$ (Unit: W = J/s)

steady-state: $$P_{cond} = \frac{k_2 A(T_H - T_X)}{L_2} = \frac{k_1 A(T_X - T_C)}{L_1}$$

If the slab consists of n materials:

$$\frac{A(T_H - T_X)}{\left(\frac{1}{k}\cdot L_2\right)}$$

$$P_{cond} = \frac{A(T_H - T_C)}{\sum_{i=1}^{n}(L_i/k_i)}$$

Chapter 3:

$$\Delta E_{int} = E_{int,f} - E_{int,i} = Q - W$$

Three special cases:

1. Adiabatic processes: $Q = 0 \Rightarrow \Delta E_{int} = -W$

2. Constant-volume (isochoric) processes: $W = 0 \Rightarrow \Delta E_{int} = Q$

3. Cyclical processes: $\Delta E_{int} = 0 \Rightarrow Q = W$

- **Work done by the gas:**

  -Expansion: $W > 0$

  -Compression: $W < 0$

- **Energy transferred as heat Q:**

  -Heat transferred to the gas (receiving energy as heat):

  $$Q > 0$$

  -Heat transferred from the gas (releasing energy as heat):

  $$Q < 0$$