

所別：地球物理研究所碩士班 一般生 科目：普通物理學

- (a) (10%) What is Young's modulus?

(b) (10%) An iron rod 4 m long and 0.5 cm^2 in cross section stretches 1 mm when a mass of 225 kg is hung from its lower end. Compute Young's modulus for the iron.
- A spring-mass oscillator has a total energy E_0 and an amplitude x_0 .

(a) (10%) How large will K (kinetic energy) and U (potential energy) be for it when $x = x_0/2$?

(b) (10%) For what value of x will $K = U$?
- A number of tiny spheres made of steel with density ρ_s , and having various radii r_s , are released from rest just under the surface of a tank of water, whose density is ρ .

(a) (10%) Show that the "net gravitational force" acting on a sphere (the combined effect of weight and buoyancy) has magnitude $(4\pi/3)r_s^3(\rho_s - \rho)g$. g is the gravitational acceleration.

(b) (10%) Assuming that the fluid flow around each descending sphere is laminar, find the terminal speed v of a sphere in terms of r_s , ρ_s , ρ and the viscosity η of the water.
- In a p - V diagram an adiabatic and an isothermal curve for an ideal gas intersect. Denote the intersection point by (p_0, V_0) .

(a) (10%) Show that the absolute value of the slope of the adiabatic is γ times that of the isotherm. γ is the specific heat ratio.

(b) (10%) Which curve is steeper? Why?
- (a) (10%) Sketch the profile of the wave $f(x, t) = Ae^{-B(x-vt)^2}$ at $t = 0$ sec and $t = 1$ sec, using $A = 1.0$ m, $B = 1.0 \text{ m}^{-2}$, and $v = +2.0$ m/s.

(b) (10%) Verify by partial differentiation that the wave function in (a) satisfies the one-dimensional wave equation.