

Practical Discussion Problems

Q1: What thickness of rubber tread is worn off of the tire of a typical automobile as it travels one mile?

- (A) 2.5×10^{-3} in/mi (B) 2.5×10^{-5} in/mi
(C) 2.5×10^{-6} in/mi (D) 2.5×10^{-7} in/mi

Q2: The time t it takes for a seed of a given plant to germinate increases with the size of the seed. Assume a simple model, where the physical quantities which influence germination are: ρ , the density of the seed, S , the surface area of the seed, and P , the permeability of the seed coat, which is the amount (mass) of water that permeates through the surface per unit area per unit time.

Using dimensional analysis, one can show that

- (A) $t \propto \frac{\rho}{P} \sqrt{S}$ (B) $t \propto \frac{\rho}{P \sqrt{S}}$ (C) $t \propto \rho P \sqrt{S}$
(D) $t \propto \sqrt{\frac{\rho}{P}} S$ (E) $t \propto S \frac{\rho}{P}$ (F) none of the above

Q3: Joe Cool can barely manage to lift a barbell consisting of two identical spheres joined together by a strong light bar. To impress his girl friend, Jill Cool, he orders a new set of barbells, each of whose spheres has twice the radius but half the density of the first set. It follows that to lift the new weights, Joe Cool will require

- (A) one quarter of the force that he needed for the first set
(B) one half of the force that he needed for the first set
(C) the same force that he needed for the first set
(D) Alas, Joe Cool can't lift the weights (Jill Cool is decidedly unimpressed).
(E) There is not enough information to choose one of the above.