

- 1 (a) It is suggested that the mass flow rate Q of grains through a hopper can be given by

$$Q = C\rho\sqrt{g}(D - kd)^{3/2}$$

where C and k are constants, ρ is the density of the grains, D is the diameter of the aperture of the hopper, d is the diameter of the circular grain and g is the acceleration due to free fall.

Determine the units of C and k in terms of the SI base units

units of k =

units of C =

[3]

- (b) The mass of a steel ball is (500 ± 1) g. The density of steel is (7.75 ± 0.01) g cm⁻³. Calculate the radius of the steel ball with its associated uncertainty.

radius = \pm cm [3]

- (c) A small car of mass 800 kg is moving in the north-east direction with a speed of 20.0 m s^{-1} . At a bend in the road, the car took 3.0 s to turn and move off with a speed of 25.0 m s^{-1} towards the east after the turn. Calculate the magnitude of the average force experienced by the car in those 3.0 s.

force =N [3]

[Total: 9]

