

- 1 (a) The drag force  $F_D$  acting on a sphere moving through a fluid is given by the expression

$$F_D = K\rho v^2$$

where  $K$  is a constant,  
 $\rho$  is the density of the fluid  
and  $v$  is the speed of the sphere.

Determine the SI base units of  $K$ .

base units .....[3]

- (b) A ball of weight 1.5 N falls vertically from rest in air. The drag force  $F_D$  acting on the ball is given by the expression in (a). The ball reaches a constant (terminal) speed of  $33 \text{ m s}^{-1}$ .

Assume that the upthrust acting on the ball is negligible and that the density of the air is uniform.

the instant when the ball is travelling at a speed of  $25 \text{ m s}^{-1}$ , determine

- (i) the drag force  $F_D$  on the ball,

$$F_D = \dots\dots\dots \text{ N [2]}$$

- (ii) the acceleration of the ball.

$$\text{acceleration} = \dots\dots\dots \text{ m s}^{-2} [2]$$

(c) Describe the acceleration of the ball in (b) as its speed changes from zero to  $33\text{ ms}^{-1}$ .

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.....[3]

[Total: 10]