KINEMATICS: CONSTANT ACCELERATION EQUATIONS 1

lesson link: parkermaths.com/y1motion

Objective

- Apply the constant acceleration equations (SUVAT).

Key Facts

SUVAT EQUATIONS

VARIABLE	QUANTITY
s	displacement
u	initial velocity
v	final velocity
a	acceleration
t	time

$$v = u + at$$

$$s = \frac{1}{2}(u + v)t$$

$$s = ut + \frac{1}{2}at^2$$

$$s = vt - \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

Examples

3.2e. A van accelerates uniformly from $13\ \text{ms}^{-1}$ to $30\ \text{ms}^{-1}$ in 6 seconds.

(a) Calculate the acceleration of the van.

(b) Find the distance travelled by the van in the first 4 seconds.

3.2p. A scooter decelerates uniformly from $28\ \text{ms}^{-1}$ to $17\ \text{ms}^{-1}$, covering a distance of $240\ \text{m}$.

(a) Calculate the magnitude of the deceleration.

(b) The scooter continues to decelerate uniformly. Calculate the velocity of the scooter after 21 s.

3.3e. A cyclist is travelling at $16\ \text{kmh}^{-1}$ when she reaches the top of a hill. She pedals down the hill with constant acceleration of magnitude $1.2\ \text{ms}^{-2}$.

Given that the length of the hill is $130\ \text{m}$, calculate the time taken for the cyclist to reach the bottom of the hill.

3.3p. A train is travelling at $140\ \text{kmh}^{-1}$. At point P, the driver applies the brakes producing a uniform deceleration of $0.6\ \text{ms}^{-2}$ until the train reaches point Q, which is $1.25\ \text{km}$ from P.

Calculate the time taken for the train to travel between P and Q.

3.4e. The driver of a car travelling at $26\ \text{ms}^{-1}$ in mist suddenly sees a stationary lorry $120\ \text{m}$ ahead. With the brakes full on, the car can decelerate at $3\ \text{ms}^{-2}$.

Can the driver stop in time?

3.4e. A girl kicks a ball up a hill. To reach the top of the hill, the ball must travel $55\ \text{m}$.

Given that the ball decelerates at $0.6\ \text{ms}^{-2}$, determine the minimum initial velocity of the ball if it is to reach the top of the hill.