4. A Motor Starts from rest to Speed of 20kmph over a distance of 200m. Calculate the acceleration & Time taken. If further acceleration raises the Speed to 50kmph in 8 Sec, Find the acceleration & the further distance moved

Given: Case (i)

$u = 0$

$s = 200\,m$

$v = 20\,kmph$

$= \frac{20 \times 1000}{3600}$

$= 5.555\,m/s$

Using Equation,

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

$(5.555)^2 = 0 + (2 \times a \times 200)$

$a = 0.077\,m/s^2$

$v = u + at$

$5.555 = 0 + (0.077)t$

$t = 72.14\,Sec$

Case (ii)

u = final velocity of (i)

$= 5.555\,m/s$

$v = 50\,kmph = \frac{50 \times 1000}{3600} = 13.89\,m/s$

$t = 8$ Sec

$v = u + at$

$13.89 = 5.555 + (a \times 8)$

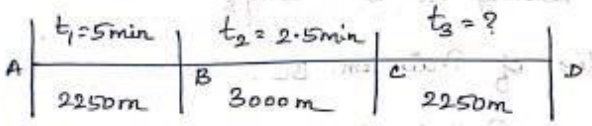
$a = 1.0418 \text{ m/s}^2$

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

$= (5.555 \times 8) + \left(\frac{1}{2} \times 1.0418 \times 8^2\right)$

$= 77.78 \text{m}$

5. A Train is travelling from A to D along the track as shown in figure. Its initial velocity at A is zero. The Train takes 5 min to cover the distance AB, 2250 m length & 2.5 min to cover the distance BC, 3000 m in length, on reaching the Station C, the brakes are applied & the train stops 2250m beyond, at D (i) Find the retardation on CD, (ii) the times it takes the train to get from A to D & (iii) its average Speed for the whole distance



Given:

Distance, AB = 2250m, t = 5min

BC = 3000m, t = 2.5min

CD = 2250m ; t = ?

Brakes are applied at C

Train starts from A & Stops at D.

(i) Retardation of Train on CD

u (at A) = 0

S = 2250m

Final Velocity (at B) = V

t = 5 min = 5x60 = 300 Sec

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

$2250 = 0 + \left(\frac{1}{2} \times a \times 300^2\right)$

$a = 0.05\ m/s^2$

$V = u + at$

$= 0 + (0.05 \times 300)$

$= 15\ m/s$

Velocity at B = 15m/s

Motion of Train on BC.

Initial velocity at B = 15 m/s

Final velocity at C = V

$S = 2000\ m$

$t = 2.5\ min = 2.5 \times 60$

$= 150\ Sec$

Train moving @ Same acceleration,

$v = u + at$

$= 15 + (0.05)(150)$

$= 22.5\ m/s$

Motion of Train on CD

Initial velocity at C, $U = 22.5\ m/s$

Final velocity @ D = $v = 0$ (∵ Stops)

$S = 2250\ m$

$t = ?$

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

$0 = (22.5)^2 + 2(a)(2250)$

$a = -0.1125\ m/s^2$ (retardation)

$v = u + at$

$0 = 22.5 + (-0.1125 \times t)$

$t = 200\ Sec$

$= 3.333\ min$

Retardation of CD : $0.1125\ m/s^2$

Time taken from A to D

$T = t_1 + t_2 + t_3$

$= 57 + 2.5 + 3.333$

$= 10.833$ min

Average Speed = $\frac{\text{Total distance travelled}}{\text{Total Time taken}}$

$= \frac{2250 + 3000 + 2250}{10.833 \times 60}$

$= 11.538$ m/s

$= \frac{11.538}{1000} \times 3600$

$= 41.53$ kmph.