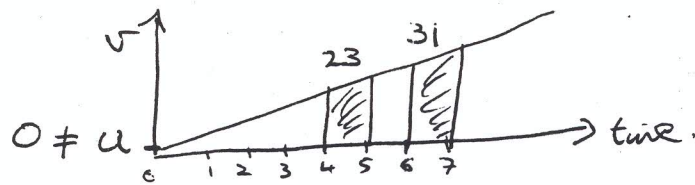


(a)



Distance travelled in 5<sup>th</sup> second  
 = Distance travelled in 5secs - distance travelled in 4 secs

$$\begin{aligned}
 &= S_5 - S_4 \\
 &= (u5 + \frac{1}{2}a5^2) - (u4 + \frac{1}{2}a(4)^2) \\
 &= 5u + \frac{25}{2}a - 4u - 8a \\
 &= u + \frac{9}{2}a \quad \Rightarrow \quad \boxed{23 = u + \frac{9}{2}a} \quad (1)
 \end{aligned}$$

Distance travelled in 7<sup>th</sup> second.

$$\begin{aligned}
 &= S_7 - S_6 \\
 &= (u7 + \frac{1}{2}a7^2) - (u6 + \frac{1}{2}a6^2) \\
 &= 7u + \frac{49}{2}a - 6u - 18a \\
 &= u + \frac{13}{2}a \quad \Rightarrow \quad \boxed{31 = u + \frac{13}{2}a} \quad (2)
 \end{aligned}$$

Solve (1) and (2) : (2) - (1)  $\Rightarrow$   $8 = \frac{4}{2}a \Rightarrow \boxed{a = 4}$

$\therefore$  (1)  $\Rightarrow$   $23 = u + \frac{9}{2}(4) \Rightarrow \boxed{u = 5 \text{ m s}^{-1}}$

(b)

$a$  Reg I  $a = g$  Find  $S$  For first three seconds (Reg I)  
 $S = x$   
 $t = 3$   
 $u = u$

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$b$  Reg II  $a = g$   
 $S = 2x$   
 $t = 2$   
 $(u = 0 \text{ for Reg I})$

$$x = u(t) + \frac{1}{2}at^2$$

$$x = u(3) + \frac{1}{2}g(3)^2$$

$$\boxed{x = 3u + \frac{9}{2}g} \quad (1)$$

Need second equation for  $u$  and  $a$ .

Consider first 5 seconds together

$$\left. \begin{aligned}
 S &= 2x \\
 u &= u \\
 a &= g \\
 t &= 5
 \end{aligned} \right\} \begin{aligned}
 S &= u + \frac{1}{2}at^2 \\
 2x &= u(5) + \frac{1}{2}g(5)^2 \\
 4x &= 10u + 25g \quad (2)
 \end{aligned}$$

Solve (1) and (2) for  $x$

$$(1) \Rightarrow u = \frac{1}{3}(x - \frac{9}{2}g)$$

$$(2) \Rightarrow 4x = \frac{10}{3}(x - \frac{9}{2}g) + 25g$$

$$\Rightarrow 12x = 10x - 45g + 75g$$

$$\Rightarrow 2x = 30g$$

$$\Rightarrow x = 15g = 147 \text{ metres}$$