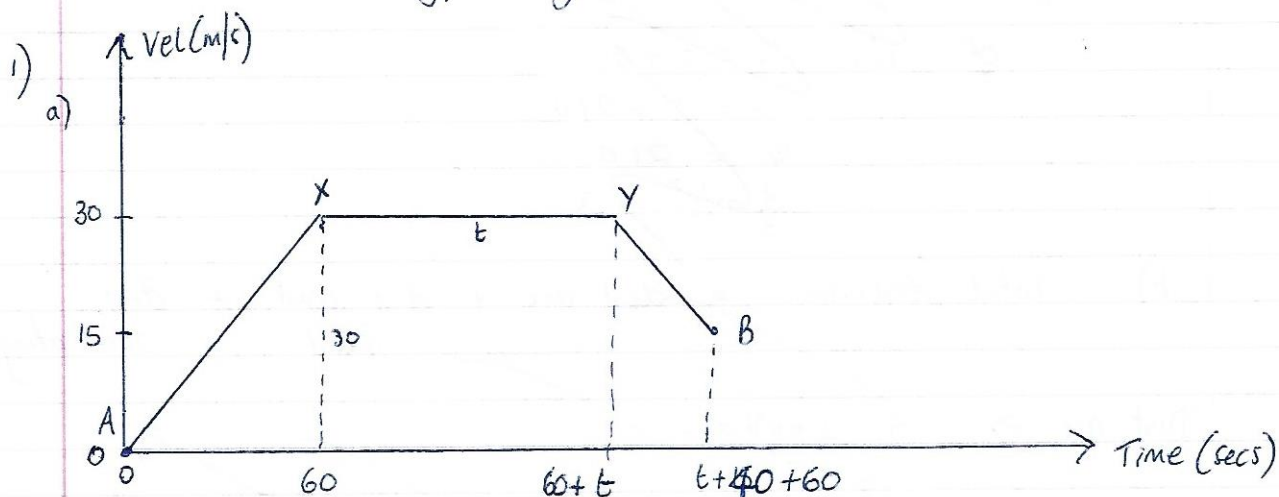


Velocity/Time Graph 2 : Answers.

Jan
2011



b) $\text{acc AX} = \text{gradient} = \frac{ht}{\text{base}} = \frac{30}{60} = 0.5 \text{ m/s}^2$

Distance AX = Area of triangle
 $= \frac{bh}{2}$
 $= \frac{60 \times 30}{2} = 900 \text{ m}$

c) ~~the~~ Total distance = 24000 m

$$\therefore 24000 = 900 + 30t + \frac{(30+15)40}{2}$$

$$24000 = 900 + 30t + 900$$

$$24000 - 1800 = 30t$$

$$22200 = 30t$$

$$\frac{22200}{30} = t$$

$$740 \text{ secs} = t$$

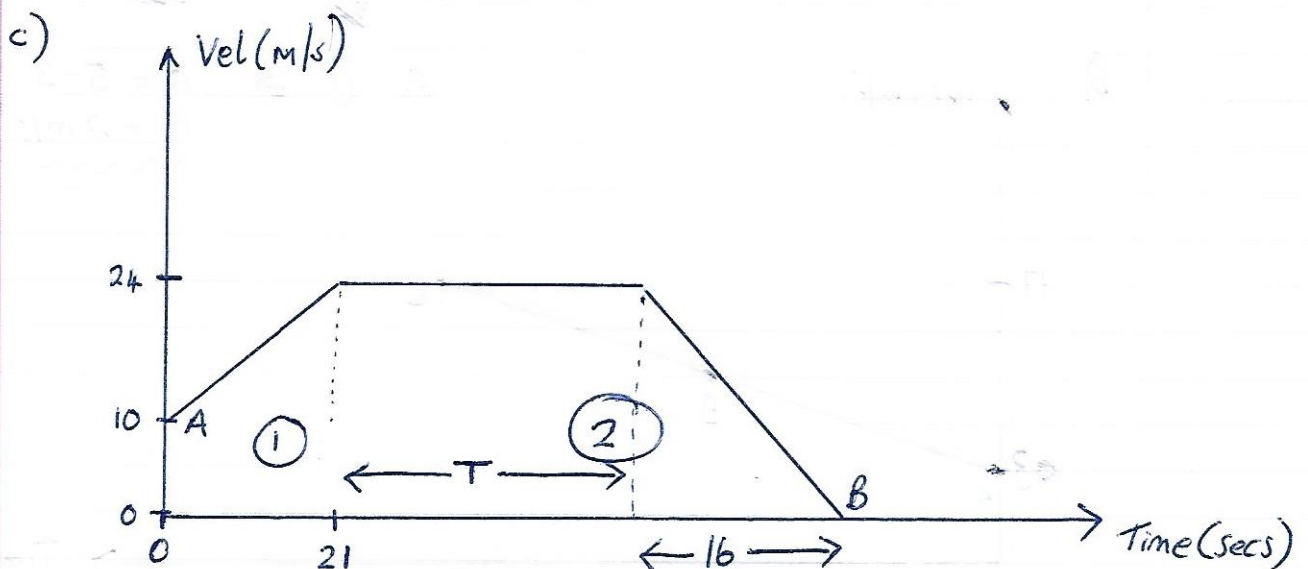
$\therefore$ Total time AB

is $t + 40 + 60$
 $= 840 \text{ secs.}$

2) a) Use $v = u + at$
 $24 = 10 + 21a$
 $14 = 21a$
 $\frac{2}{3} \text{ m/s}^2 = a$

b) From $v = u + at$
 $0 = 24 + 16a$
 $-\frac{24}{16} = a$
 $-\frac{3}{2} = a$
 $-1.5 \text{ m/s}^2 = a$

$\therefore v^2 = u^2 + 2as$
 $0 = 24^2 + 2(-1.5)s$
 $3s = 576$
 $s = \frac{576}{3}$
 $s = 192 \text{ m}$



d) Total distance = area under graph

$$15000 = \text{trapezium area (1)} + \text{trapezium area (2)}$$

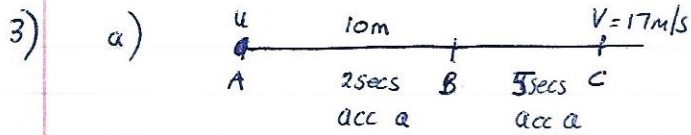
$$15000 = \frac{(10+24)21}{2} + \frac{[T+(16+T)]24}{2}$$

$$\times 2$$

$$30000 = 34 \times 21 + (2T+16)24$$

$$30000 = 714 + 48T + 384$$

$$\frac{30000 - 714 - 384}{48} = T = 602.125 \text{ secs.}$$



AB

$$u = u$$

$$s = 10 \text{ m}$$

$$t = 2 \text{ secs}$$

$$a = a$$

AC

$$u = u$$

$$V = 17$$

$$a = a$$

$$t = 7 \text{ secs}$$

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

$$10 = 2u + 2a$$

$$5 = u + a$$

$$5 - u = a \quad \text{--- (1)}$$

$$v = u + at$$

$$17 = u + 7a$$

$$17 - 7a = u \quad \text{--- (2)}$$

The u
and the a
are the same
for both AB
and AC.

sub (1) into (2)

$$(2) \Rightarrow 17 - 7(5 - u) = u$$

$$17 - 35 + 7u = u$$

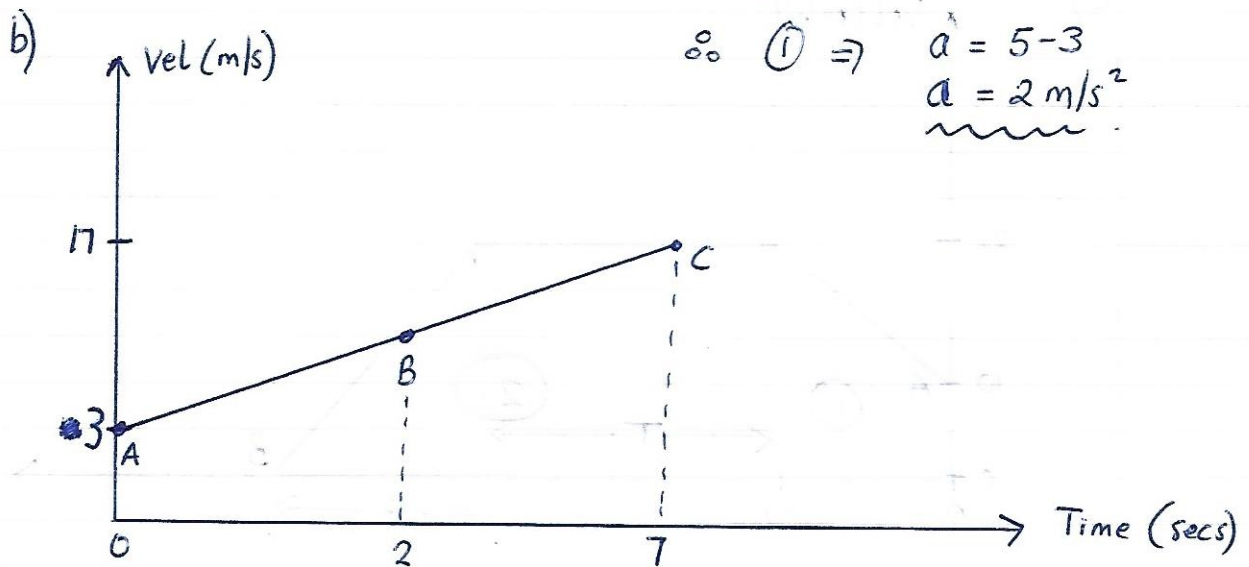
$$6u = 18$$

$$u = \frac{18}{6} = 3 \text{ m/s}$$

$$\cancel{u} = \cancel{3} \text{ m/s}$$

$$\therefore (1) \Rightarrow a = 5 - 3$$

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



c) Dist AC = area under graph

$$= \text{area trapezium}$$

$$= \frac{(3 + 17) \times 7}{2}$$

$$= 10 \times 7$$

$$= 70 \text{ m}$$

4)

a) Acceleration :
 $u = 0 \text{ m/s}$
 $a = 0.4 \text{ m/s}^2$
 $v = 16 \text{ m/s}$

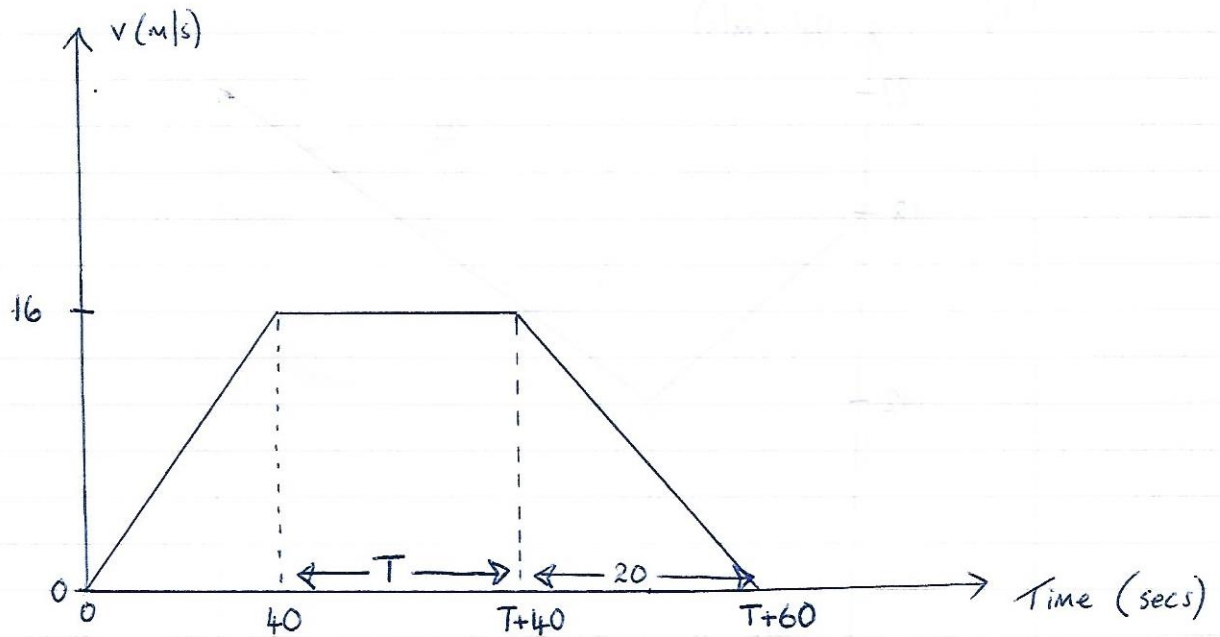
$$v = u + at$$

$$16 = 0 + 0.4t$$

$$\frac{16}{0.4} = t$$

$$40 \text{ secs} = t \quad \text{Time spent accelerating}$$

b)



c) Area under graph = Distance covered

$$\frac{(a+b)h}{2} = 2400$$

$$\frac{[T + (T+60)] \cancel{16}^8}{\cancel{2}_1} = 2400$$

$$2T + 60 = \frac{2400}{8}$$

$$2T + 60 = 300$$

$$2T = 240$$

$$T = 120 \text{ secs}$$

5)

a)

Deceleration

$u = 18 \text{ m/s}$

$t = 9 \text{ secs}$

$v = 12 \text{ m/s}$

Acceleration

$u = 12 \text{ m/s}$

$a = 0.5 \text{ m/s}^2$

$v = 22 \text{ m/s}$

$t = t$

$v = u + at$

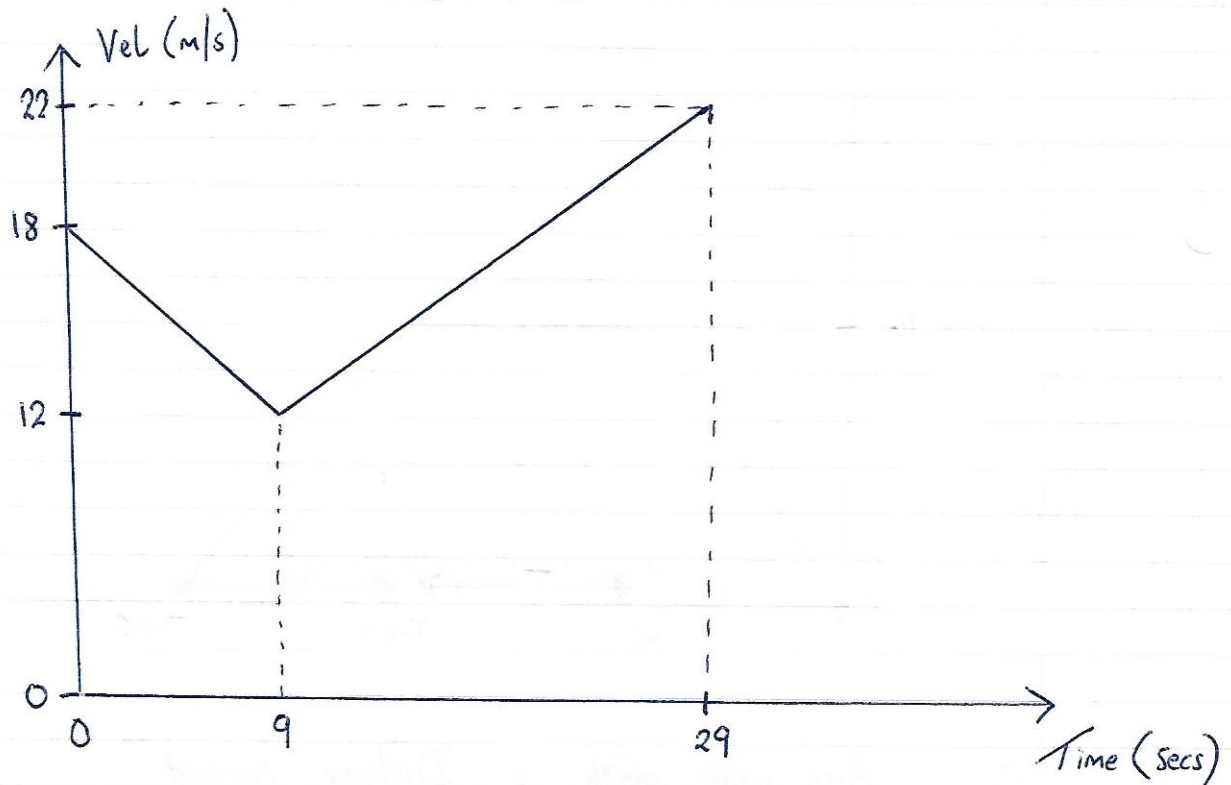
$22 = 12 + 0.5t$

$10 = 0.5t$

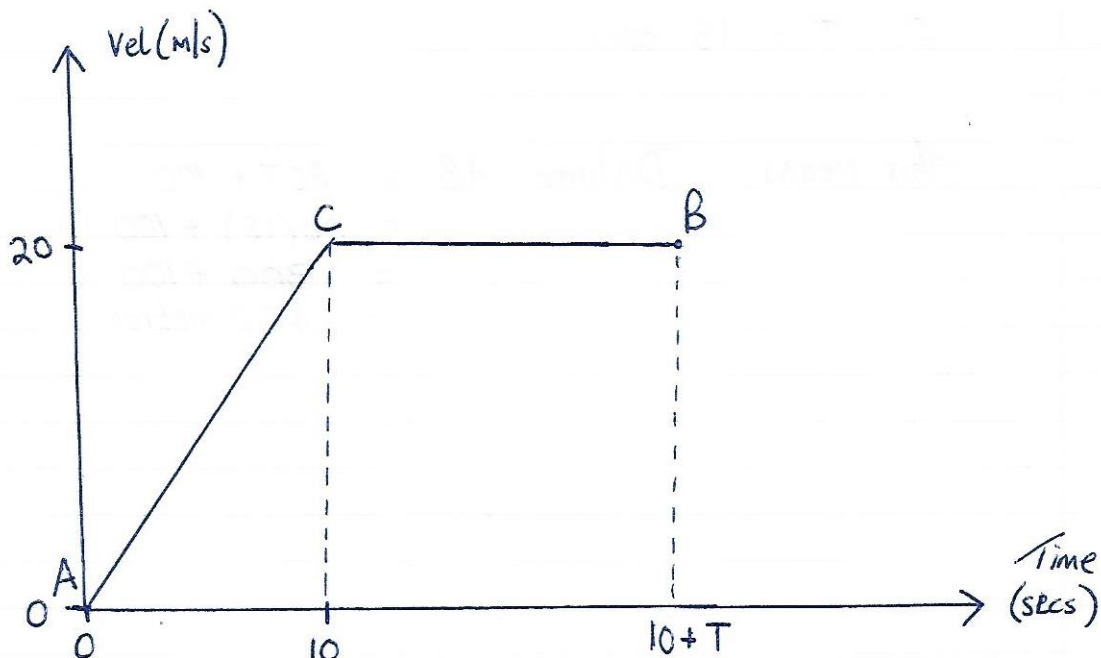
$20 \text{ secs} = t$

time spent accelerating

b)



6) a)



b) $Acc = \text{Gradient AC}$
 $= \frac{20}{10} = 2 \text{ m/s}^2$

c) Dist AB = area under graph
 $= \frac{(a+b)h}{2}$ ← trapezium area
 $= \frac{[T + (10+T)] 20}{2}$
 $= 10 [2T + 10]$
 $= 20T + 100 \text{ metres}$

d) Car

$$u = 0 \text{ m/s}$$

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

$$s = 20T + 100$$

$$t = \del{10+T} 10+T - 5 = 5+T$$
 ← Car takes 5 sec less to reach B

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

$$20T + 100 = 0 + \frac{1}{2}(2)(5+T)^2$$

$$20T + 100 = (5+T)^2$$

$$20T + 100 = 25 + T^2 + 10T$$

$$0 = T^2 - 10T - 75$$

$$0 = (T - 15)(T + 5)$$

$$T = 15 \text{ or } T = -5$$

$$\therefore T = 15 \text{ secs.}$$

This means Distance $AB = 20T + 100$

$$= 20(15) + 100$$

$$= 300 + 100$$

$$= 400 \text{ metres.}$$

7) a) Falling

$$u = 0 \text{ m/s}$$

$$a = 9.8 \text{ m/s}^2$$

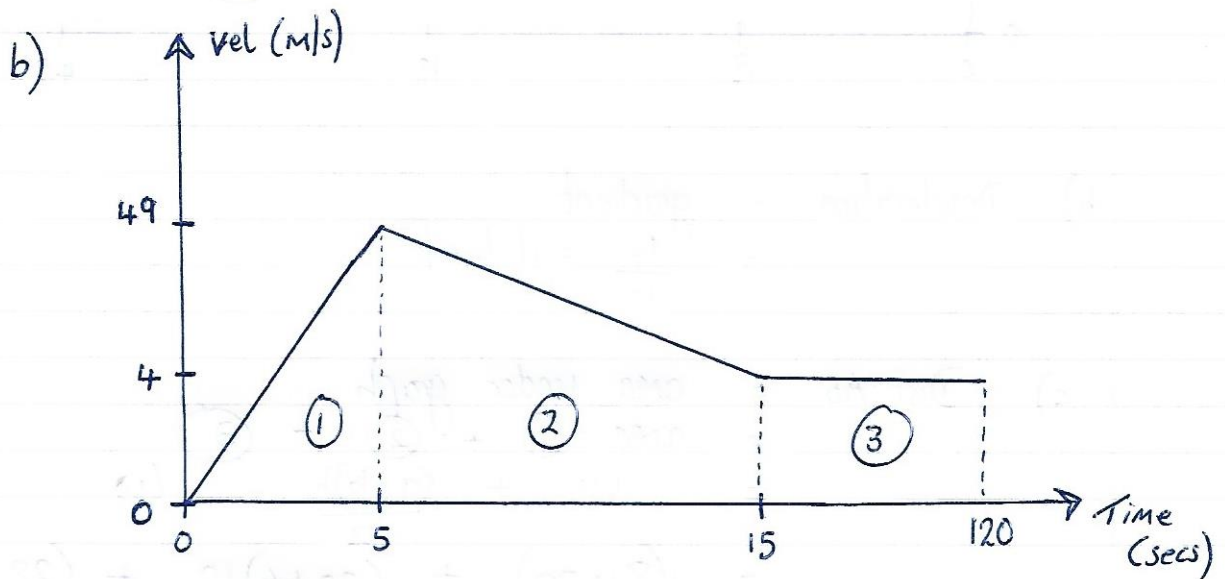
$$t = 5 \text{ secs}$$

$$V = v$$

$$V = u + at$$

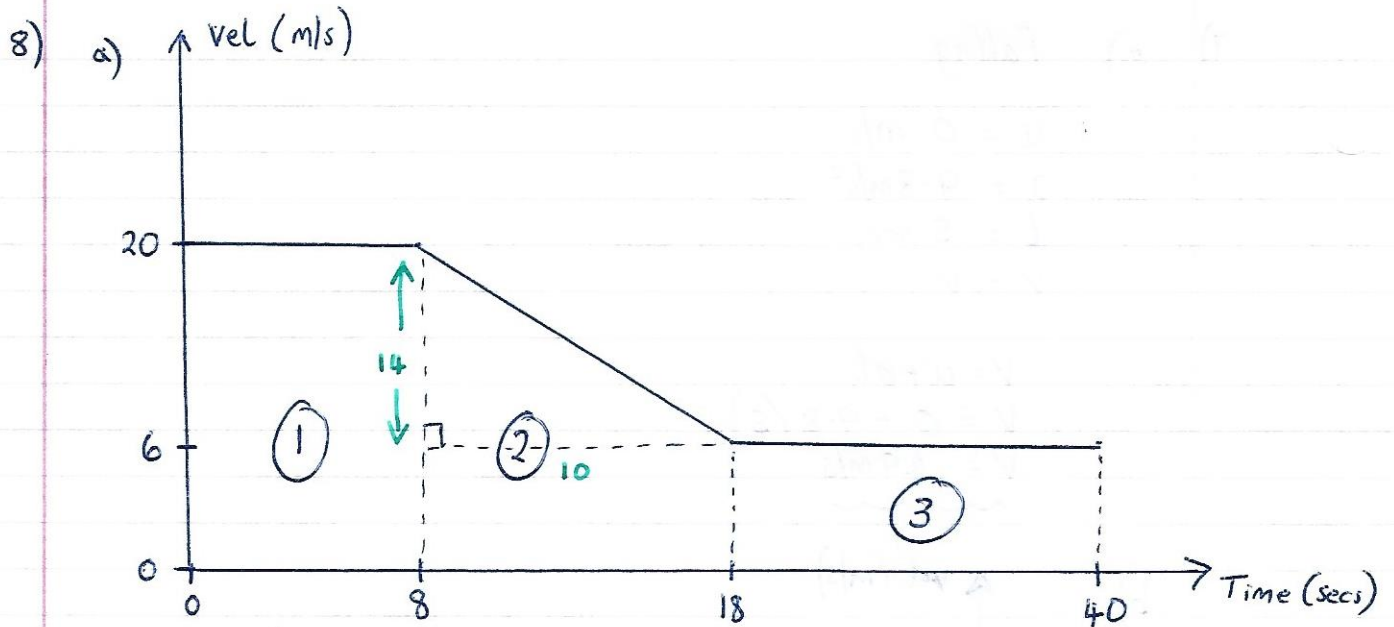
$$V = 0 + 9.8(5)$$

$$V = 49 \text{ m/s}$$



c) Find distance travelled = area under graph

$$= \text{area (1)} + \text{(2)} + \text{(3)}$$
$$= \frac{bh}{2} + \frac{(a+b)h}{2} + lw$$
$$= \frac{5(49)}{2} + \frac{(49+4)10}{2} + (105 \times 4)$$
$$= 122.5 + 265 + 420$$
$$= 807.5 \text{ m}$$



b) Deceleration = gradient

$$= \frac{14}{10} = 1.4 \text{ m/s}^2$$

c) Dist AB = area under graph

$$= \text{area } ① + ② + ③$$

$$= lw + \frac{(a+b)h}{2} + lw$$

$$= (8 \times 20) + \frac{(20+6)10}{2} + (22 \times 6)$$

$$= 160 + 130 + 132$$

$$= 422 \text{ m}$$