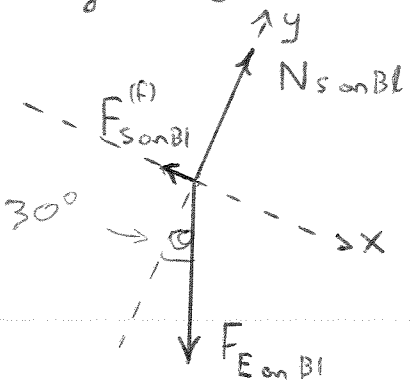
Question 7

(a) Free-body diagram for the block



(b)

① $a_y = \dfrac{N_{S\,on\,Bl} - F_{E\,on\,Bl}\cos\theta}{m_{Bl}} = 0$

② $a_x = \dfrac{F_{E\,on\,Bl}\sin 30° - F^{(R)}_{S\,on\,Bl}}{m_{Bl}}$

(c) Use: $F_{E\,on\,Bl} = m_{Bl}g$

From ① $N_{S\,on\,Bl} = F_{E\,on\,Bl}\cos 30°$

$= m_{Bl}g\cos 30°$

Use: $F^{(f)}_{S\,on\,Bl} = \mu_k N_{S\,on\,Bl} = \mu_k m_{Bl} g\cos 30°$

From ②

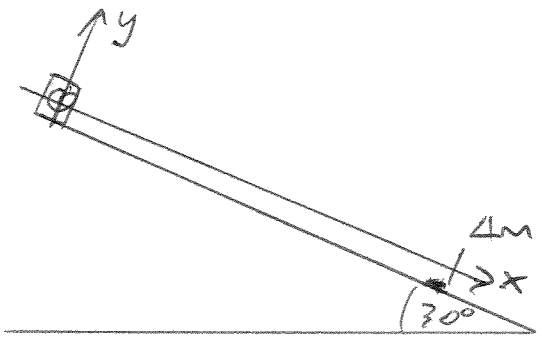
$$a_x = \frac{m_{Bl}g\sin 30° - \mu_k m_{Bl}g\cos 30°}{m_{Bl}}$$

$$= g(\sin 30° - \mu_k \cos 30°)$$

$$= 10\,m/s^2(\sin 30 - 0.2\cos 30°)$$

$$= \underline{3.27\,m/s^2 \rightarrow}$$

(d) I will set up co-ordinate system as follows:



In this co ordinate system:

$x_0 = 0m$

$v_0 = 0m$

$a = +3.27 m/s^2$

$t = ?$

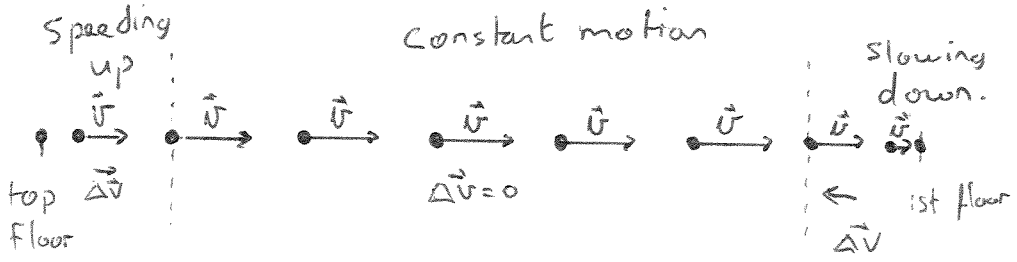
Use: $x(t) = x_0 + v_0 t + \frac{1}{2} a t^2$

$= \frac{1}{2} a t^2$

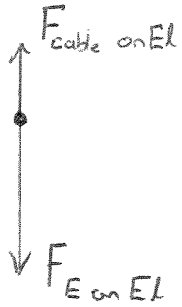
$t = \sqrt{\frac{2x}{a}} = \sqrt{\frac{(2 \times 4m)}{3.27 m/s^2}} = 1.56s \rightarrow$

Question 8

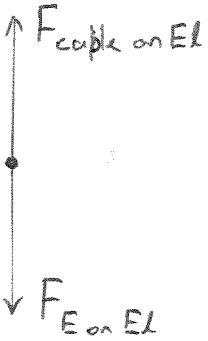
(a)



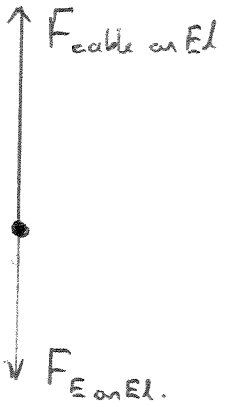
(b)



Speeding up

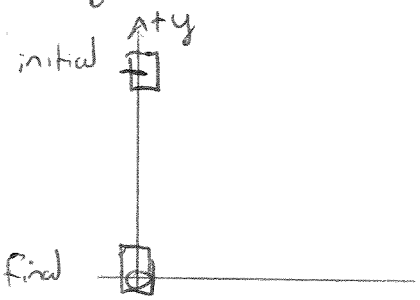


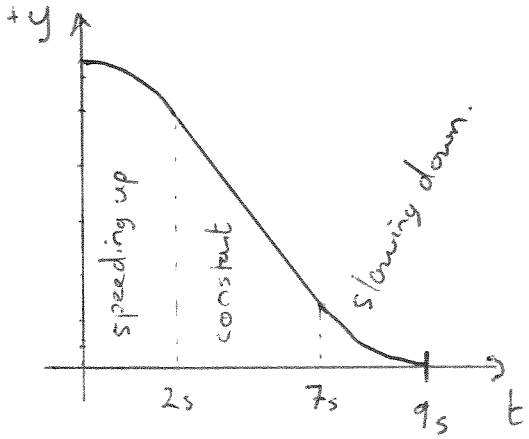
constant motion



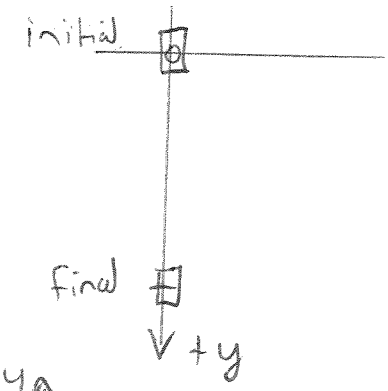
slowing down

(c) There are many ways to draw these. I will show 2 likely possibilities.

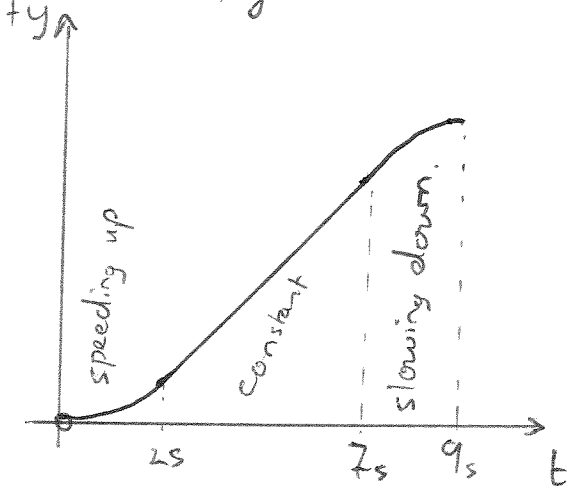




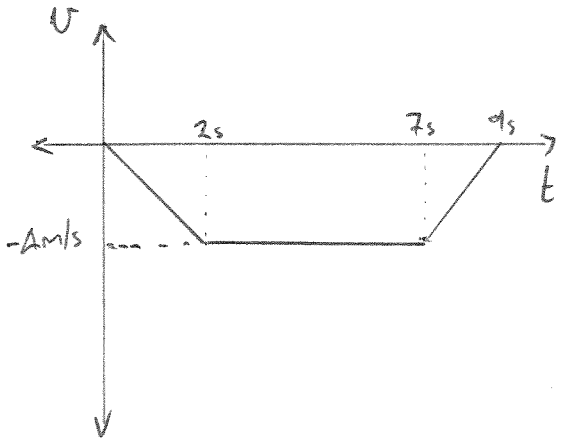
OR



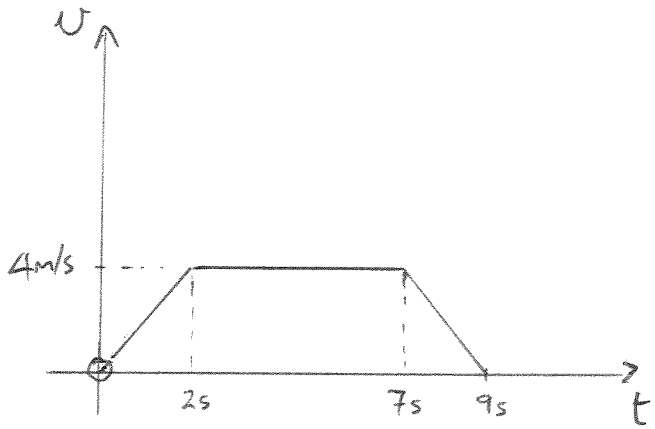
OR



(d)



OR



(e) speeding up:

$$\Delta x = \frac{1}{2}(v_i + v_f)t$$

$$= \frac{1}{2}(0 + 4\,m/s)\,2s$$

$$= \underline{4\,m}\rightarrow$$

constant motion:

$$\Delta x = \frac{1}{2}(v_i + v_f)t$$

$$= \frac{1}{2}(4\,m/s + 4\,m/s)\,5s$$

$$= \underline{20\,m}\rightarrow$$

slowing down:

$$\Delta x = \frac{1}{2}(4\,m/s + 0\,m/s)t$$

$$= \underline{4\,m}\rightarrow$$

(f) Total distance $= \underline{28\,m}\rightarrow$