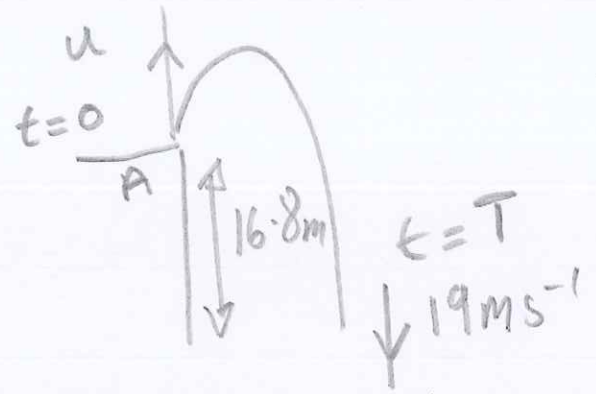
① Edexcel GCE October 2020

Maths 8MA0/22 Applied

Mechanics AS

① 

↓ g 10ms^{-2}

freely

$a = -10$

$v = -19$

$s = -16.8$

$v = u + at$

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

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

(a) $v^2 = u^2 + 2as$

$(-19)^2 = u^2 + 2 \times -10 \times -16.8 \Rightarrow u = 5ms^{-1}$

(b) $v = u + at$

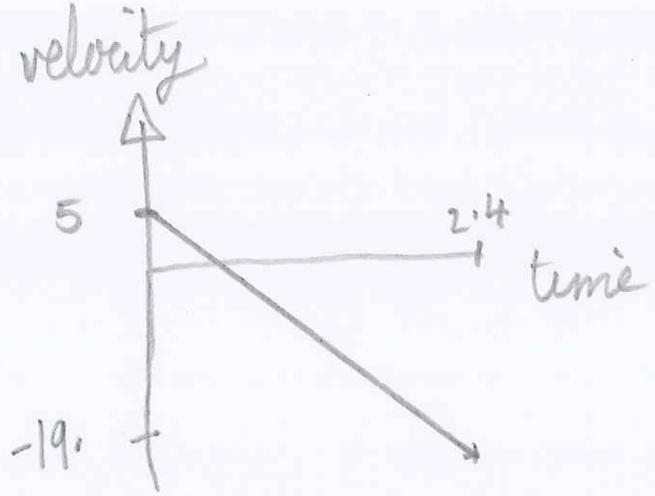
$-19 = 5 + -10 \times t \Rightarrow t = 2.4s$ $T = 2.4s$

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

$-1.2 = 5t - 4.9t^2 \Rightarrow t = \underline{1.22s}$ or -0.20

(1d)

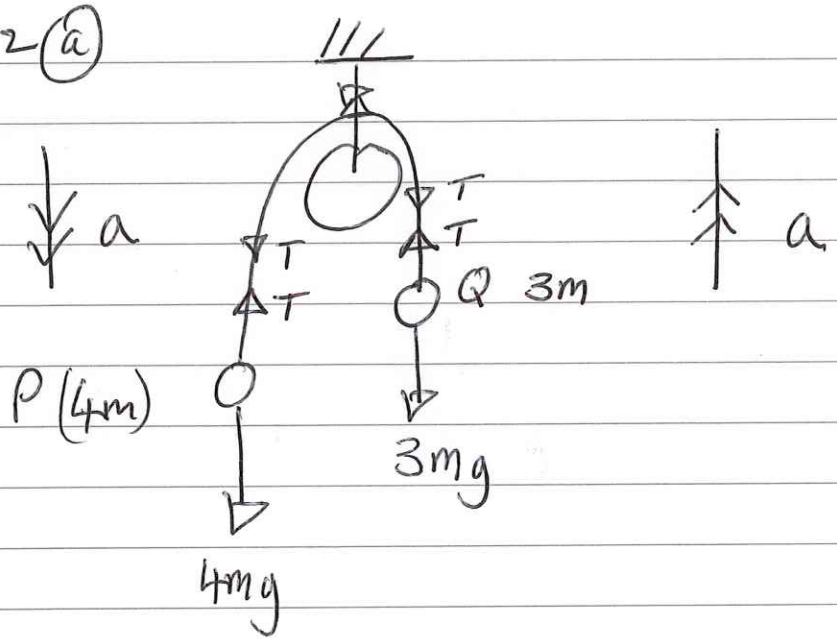
(2)



(e) Air resistance have a bigger impact slowing when going down than up, as longer time going down. So need to start with higher down velocity, ie setting off slower.

(f) We could have used a more accurate value for g. 9.8 or 9.81 ms^{-2}.

(3) 2(a)



Consider P $F = ma$

$4mg - T = 4a$

+

Consider Q $T - 3mg = 3a$

$mg = 7a$

$a = \frac{mg}{7}$

But $T - 3mg = 3a$

$T - 3mg = \frac{3mg}{7}$

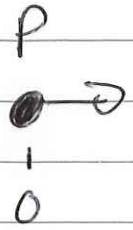
$T = 3mg + \frac{3mg}{7} = \frac{24}{7} mg\ N$

The pulley has $2T$ on it pulling down so $\frac{48}{7} mg\ N$

(b) We have assumed the pulley is smooth, which may not be the case.

(4) (3)

(a)



$t = 0$

$V = (7 - 2t)(t + 2)$

$V = 7t + 14 - 2t^2 - 4t$

$V = -2t^2 + 3t + 14$

$$a = \frac{dv}{dt} = -4t + 3$$

$a = 0 \qquad 0 = -4t + 3$

$4t = 3$

$t = 3/4$

(b) Want maximum distance

$$x = \int -2t^2 + 3t + 14 \, dt = \frac{-2t^3}{3} + \frac{3t^2}{2} + 14t + c$$

when $t = 0 \quad c = 0$ so $x = \frac{-2t^3}{3} + \frac{3t^2}{2} + 14t$

when $V = 0 \qquad 0 = (7 - 2t)(t + 2)$

$0 = 7 - 2t \qquad 0 = t + 2$

$t = \frac{7}{2} \qquad t = -2$ X

when $t = 7/2 \quad x = \frac{-2(7/2)^3}{3} + \frac{3(7/2)^2}{2} + 14(7/2)$

$x = \frac{931}{24}$ m