

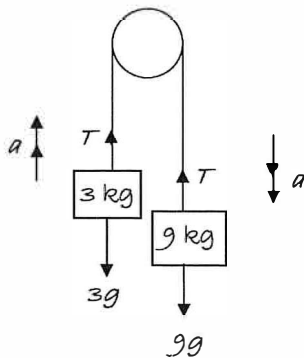
## Mechanics 7 – Connected Particles 2

### Section 1

- (i)  $v = 11$       (ii)  $v = -2$       (iii)  $s = 7$       (iv)  $s = 22.5$
- (i)  $a = -4.375$       (ii)  $a = 0$       (iii)  $u = 9.80$       (iv)  $u = 9$
- (i)  $v = 1, s = 24$       (ii)  $a = -2.5, u = 2$

### Section 2

1.



Considering 3 kg mass:  $T - 3g = 3a$  ✓ (1)

Considering 9 kg mass:  $9g - T = 9a$  ✓ (2)

Adding:  $6g = 12a$  ✓

$a = \frac{1}{2} \times 9.8 = 4.9$

The acceleration of the system is  $4.9 \text{ ms}^{-2}$ . ✓

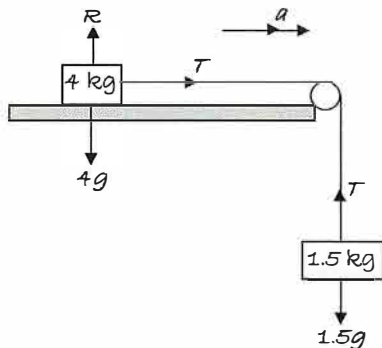
(1) gives  $T = 3g + 3a$  ✓

$= 3(9.8 + 4.9)$

$= 44.1$

The tension in the string is  $44.1 \text{ N}$ . ✓ (6 marks)

2.



For the 4 kg mass:  $T = 4a$  ✓ (1)

For the 1.5 kg mass:  $1.5g - T = 1.5a$  ✓ (2)

Adding:  $1.5g = 5.5a$  ✓

$a = \frac{1.5 \times 9.8}{5.5} = 2.67$  ✓

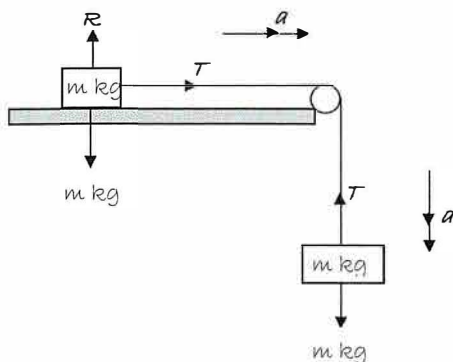
The acceleration of the system is  $2.67 \text{ ms}^{-2}$  (3 s.f.) ✓

Substituting into (1):  $T = 4a$  ✓

$T = 4 \times \frac{1.5 \times 9.8}{5.5} = 10.7$

The tension in the string is  $10.7 \text{ N}$  (3 s.f.) ✓ (7 marks)

3.



For particle on table:  $T = ma$  ✓ (1)

For particle hanging:  $mg - T = ma$  ✓ (2)

(1) + (2)  $\Rightarrow mg = 2ma \Rightarrow a = \frac{g}{2} = 4.9 \text{ N}$  ✓

$s = ?, u = 0, v = ?, a = 4.9, t = 0.5$  ✓

$s = ut + \frac{1}{2}at^2 \Rightarrow s = 0.613 \text{ m}$  (3 s.f.) ✓

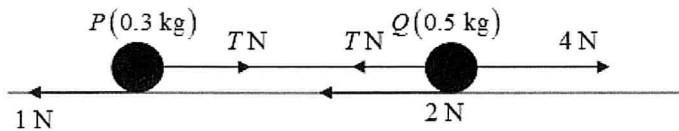
$v = u + at \Rightarrow v = 2.45 \text{ ms}^{-1}$  ✓

(9 marks)



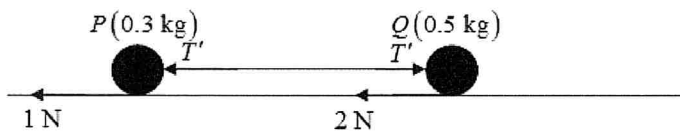
## Section 3

(a)	For system, $(\uparrow), T - 950g - 50g = 1000 \times -2$ $T = 7800 \text{ N}$	M1 A1 A1 (3)
(b)	For woman, $(\uparrow), R - 50g = 50 \times -2$ $R = 390 \text{ N}$	M1 A1 A1 (3) [6]



(a)	For system N2L $4 - 3 = 0.8a$ $a = 1.25 \text{ (m s}^{-2}\text{)}, 1.3$	M1 A1 A1 (3)
(b)	$v = u + at \Rightarrow v = 0 + 1.25 \times 6 = 7.5 \text{ (m s}^{-1}\text{)}$	M1 A1 (2)
(c)	For P N2L $T - 1 = 0.3 \times 1.25$ $T = 1.375 \text{ (N)} 1.38, 1.4$	fit their $a$ M1 A1ft A1 (3)

OR For Q N2L  $4 - 2 - T = 0.5 \times 1.25$



(d)	For system N2L $-3 = 0.8a \Rightarrow a = -3.75$ $v^2 = u^2 + 2as \Rightarrow 0^2 = 7.5^2 - 2 \times 3.75s$ $s = 7.5 \text{ (m)}$	M1 A1 M1 A1 (4)
(e)	For P N2L $T' + 1 = 0.3 \times 3.75$ $T' = 0.125 \text{ (N)}, 0.13$	M1 A1 A1 (3) [15]