Author: Sumayyah Noor

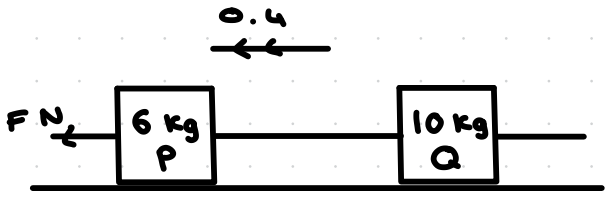
This step-by-step solution guide has been created by **Sumayyah Noor** for educational purposes. While we have made every effort to ensure the accuracy of the information presented, it is possible that there may be errors or omissions. We encourage users to critically evaluate and verify the content. BF Maths and the author cannot be held responsible for any errors or inaccuracies in this guide.

If you find any mistakes or have any suggestions for improvements, please contact us at bfmathshello@gmail.com. Your feedback is invaluable in helping us maintain the quality and accuracy of our resources. Please specify *which exercise* and *which question* in the email.

Thank you for using BF Maths for your maths revision!

10.5 connected particles

1.



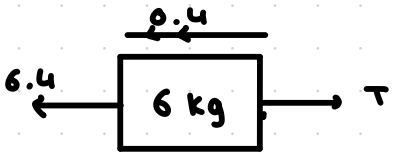
a. consider whole system

$F = ma$

$F = (6 + 10) \times 0.4$

$F = 6.4\ N$

b. consider P alone



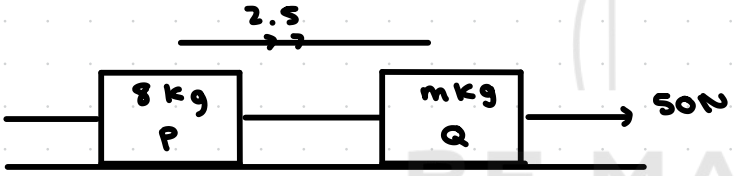
$F = ma$

$6.4 - T = 6 \times 0.4$

$6.4 - T = 2.4$

$T = 4\ N$

2.



a. Consider whole system

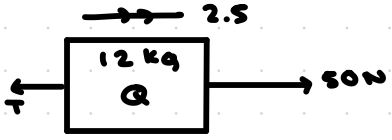
$F = ma$

$50 = (8 + m) \times 2.5$

$20 = 8 + m$

$m = 12\ kg$

b. Consider Q alone



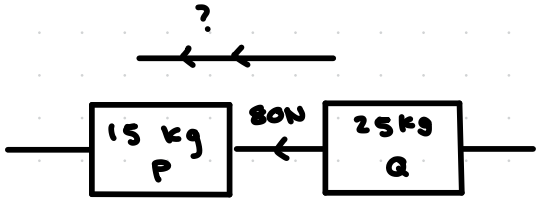
$F = ma$

$50 - T = 12 \times 2.5$

$50 - T = 30$

$T = 20\ N$

3.

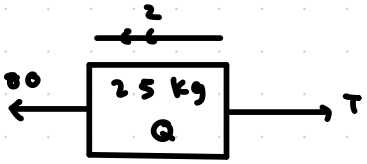


a. $F = ma$

$80 = 40a$

$a = 2\ ms^{-2}$

b.



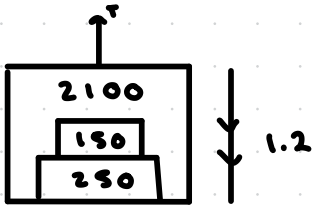
$F = ma$

$80 - T = 25 \times 2$

$80 - T = 50$

$T = 30\ N$

4.



a. consider whole system

$2100 + 150 + 250 = 2500$

$F = ma$

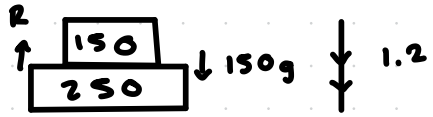
$2500g - T = 2500 \times 1.2$

$2500(9.8) - T = 3000$

$24500 - T = 3000$

$T = 21500\ N$

bi.



$F = ma$

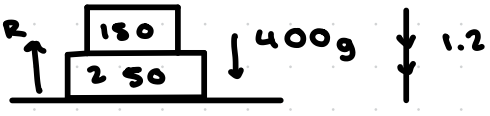
$150g - R = 150 \times 1.2$

$150(9.8) - R = 180$

$1470 - R = 180$

$R = 1290\ N$ upwards

bii.



$F = ma$

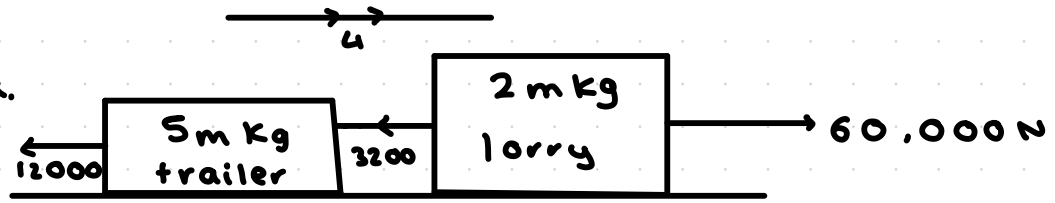
$400g - R = 400 \times 1.2$

$400(9.8) - R = 480$

$3920 - R = 480$

$R = 3440\ N$ downwards

5a.



$F = ma$

$60,000 - 3200 - 12000 = 7m \times 4$

$44800 = 28m$

$1600 = m$

lorry $= 1600 \times 2 = 3200$ kg

trailer $= 1600 \times 5 = 8000$ kg

b. only consider trailer

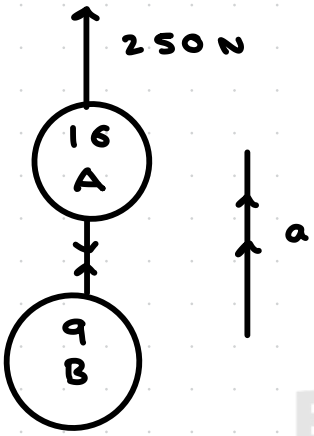
$F = ma$

$T - 12000 = 8000 \times 4$

$T - 12000 = 32000$

$T = 44000$ N

6.



a. $F = ma$

$250 - 16g - 9g = 25a$

$5 = 25a$

$a = 0.2 ms^{-2}$

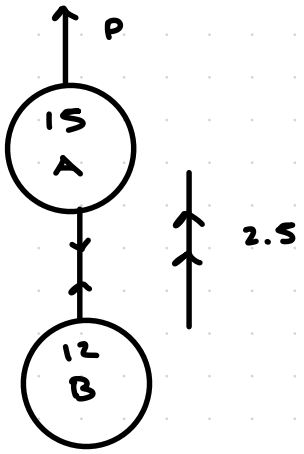
b. only consider B

$T - 9g = 9 \times 0.2$

$T - 9(9.8) = 1.8$

$T = 90$ N

7.



a. $F = ma$

$P - 15g - 12g = 27 \times 2.5$

$P - 147 - 117.8 = 67.5$

$P = 332.5\ N$

b. only consider B

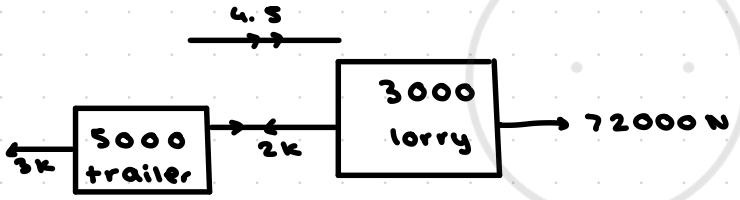
$F = ma$

$T - 12g = 12 \times 2.5$

$T - 117.8 = 30$

$T = 147.8\ N$

8.



$F = ma$

$72000 - 5k = 8000 \times 4.5$

$72000 - 5k = 36000$

$36000 = 5k$

$k = 7200\ N$

b. only consider trailer

$T - 21600 = 5000 \times 4.5$

$T - 21600 = 22500$

$T = 44100\ N$

C. when trailer breaks only force is 21600N

$F = ma$

$21600 = 5000 \times a$

$a = 4.32\ ms^{-2}$

$s = ?$
$u = 8$
$v = 0$
$a = -4.32$
$t =$

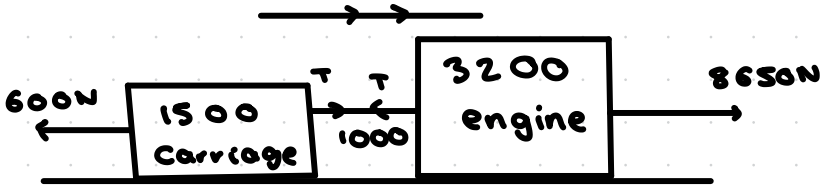
$v^2 = u^2 + 2as$

$0 = 8^2 + 2(-4.32)s$

$s = 7.41\ m$

d. assume acceleration of lorry and trailer are equal

9.



a. $F = ma$

$8650 - 600 - 1000 = (3200 + 1500) \times a$

$7050 = 4700a$

$a = 1.5 ms^{-2}$

b. only consider carriage

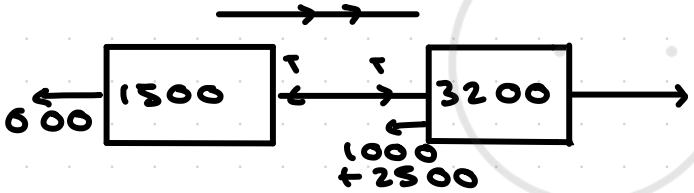
$F = ma$

$T - 600 = 1500 \times 1.5$

$T - 600 = 2250$

$T = 2850 N$

c. under braking :



$F = ma$

$-600 - 1000 - 2500 = 4700 \times a$

$-4100 = 4700a$

$a = -0.8723$

only consider carriage

$F = ma$

$T - 600 = 1500 \times -0.8723$

$T - 600 = -1308.45$

$T = -708.45 N$

tension cannot be negative so take absolute value

$\therefore T = 709 N$