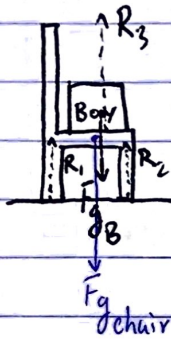


HOLIDAY HOMEWORK : NEWTON'S LAWS AND FORCES

P1

1. The reaction of the Earth pulling on an object with a force mg is the object pulling on the Earth with a force mg .

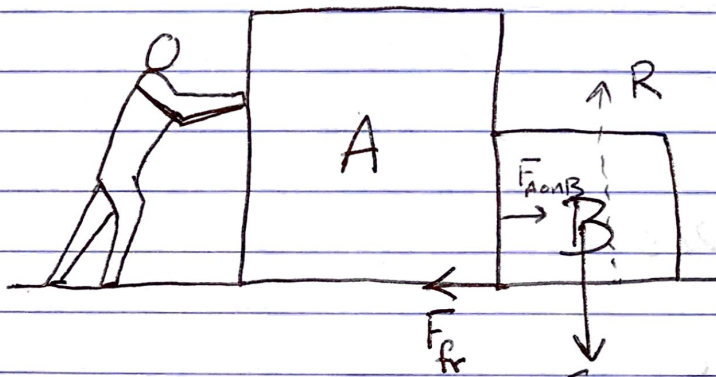
2.



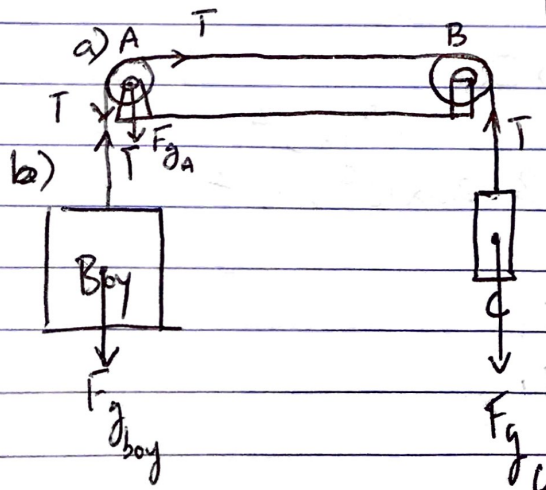
3. Coercive force { its meant to be a joke }

4. Pressure by me on the ~~notebook~~ pen
~~for~~ Thrust by the pen on the notebook
 Pressure by me on the notebook

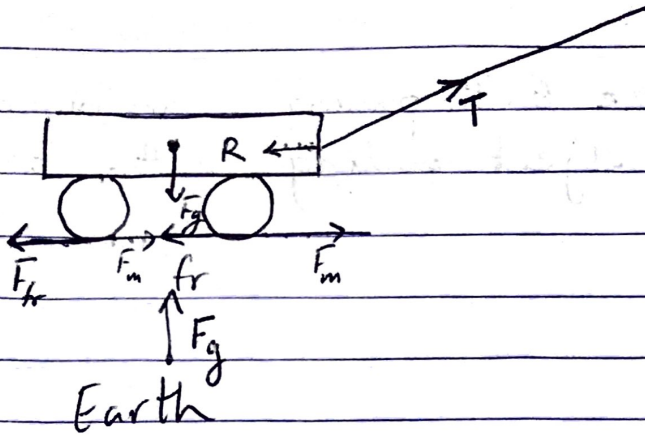
5.



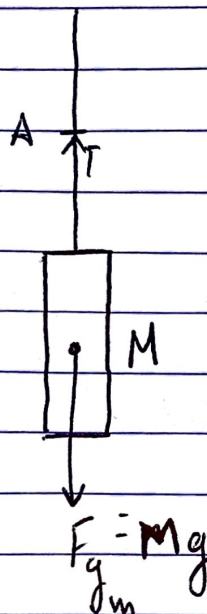
6.



7.



8.



since $\sum F = 0$
 $\Rightarrow T = Mg$

P2

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

$v = 0$

$u = 250$

$s = 0.05 \text{ m}$

$-62500 = 0.2a$

$a = -3.125 \times 10^5 \text{ ms}^{-2}$

$|a| = 3.125 \times 10^5 \text{ ms}^{-2}$

$F = m|a|$

$m = 0.01$

$F = 3125 \text{ N}$

2. No diagram [i.e. invalid question]

3. No diagram

4. No diagram

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

$$v = 0$$

$$u = 40 \text{ km/h} = 11.11$$

$$s = 4 \text{ m}$$

$$8a = -123.4568$$

$$a = -15.43$$

$$|a| = 15.43$$

$$F = m|a|$$

$$m = 2000$$

$$F = 3.086 \times 10^4 \text{ N}$$

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

$$u = 0$$

$$v = 5 \times 10^6$$

$$s = 0.01 \text{ m}$$

$$0.02a = 2.5 \times 10^{13} \text{ ms}^{-2}$$

$$a = 1.25 \times 10^{15} \text{ ms}^{-2}$$

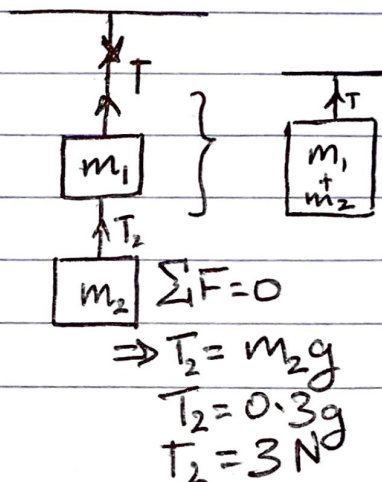
$$|a| = 1.25 \times 10^{15} \text{ ms}^{-2}$$

$$|F| = m|a|$$

$$m = 9.1 \times 10^{-31} \text{ kg}$$

$$|F| = 1.14 \times 10^{-15} \text{ N}$$

7.



$$\Rightarrow T_2 = m_2 g$$

$$T_2 = 0.3g$$

$$T_2 = 3 \text{ N}$$

$$\Sigma F = 0$$

$$\Rightarrow T = (m_1 + m_2)g$$

$$m_1 = 0.2, m_2 = 0.3$$

$$T = 0.5g$$

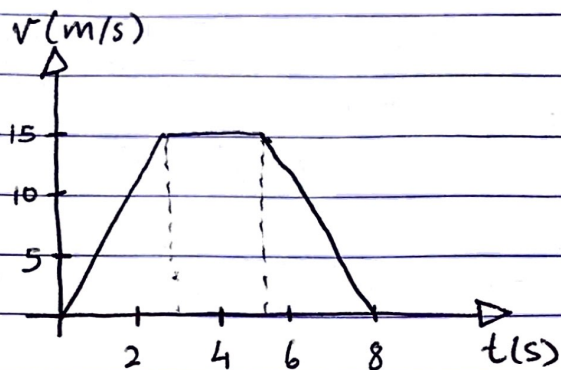
$$T = 5 \text{ N}$$

8.



Assuming no friction,
 $T = F$

9.



$$a_{at2} = \frac{\Delta v}{\Delta t} = \frac{10}{2} = 5$$

$$F = ma$$

$$m = 0.05$$

$$F = 0.05 \times 5$$

$$= 0.25 \text{ N}$$

$$a_{at4} = \frac{\Delta v}{\Delta t} = \frac{0}{2} = 0$$

$$F = 0$$

$$a_{at6} = \frac{\Delta v}{\Delta t} = -\frac{10}{2} = -5$$

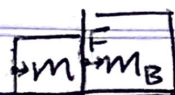
$$F = ma$$

$$m = 0.05$$

$$F = 0.05 \times -5$$

$$= -0.25 \text{ N}$$

9.



Assuming no friction:
the force exerted by
the experimenter = F

10.

raindrop
Head

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

$$v = 0$$

$$u = 30 \text{ ms}^{-1}$$

$$s = 10^{-3} \text{ m}$$

$$20a = -900$$

$$a = -45 \text{ ms}^{-2}$$

$$|F| = m|a|$$

$$F = 4 \times 10^{-3} \times 45$$

$$F = 0.18 \text{ N}$$

11.

$$F = -kx$$

~~$$F = -kx$$~~

~~$$F = -kx$$~~

$$k = 15 \text{ N/m}$$

$$x = 0.2 \text{ m}$$

~~$$F = -15 \times 0.2$$~~

$$= -3 \text{ N}$$

~~$$F = ma$$~~

~~$$0.3a = -3$$~~

$$a = -10 \text{ ms}^{-2}$$

12.

$$F = ma$$

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

$$10 = 5a$$

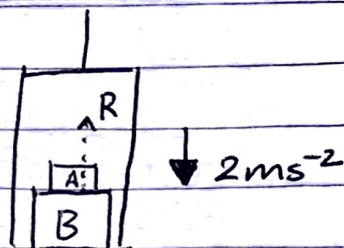
$$a = 2 \text{ ms}^{-2}$$

$$u = 0, a = 2, s = 0.2 \text{ m}$$

$$t^2 = 0.2$$

$$t = 0.447 \text{ s}$$

13



for A : $\sum F = 2m$
 $m = 0.5$

$$\sum F = F_g - R$$

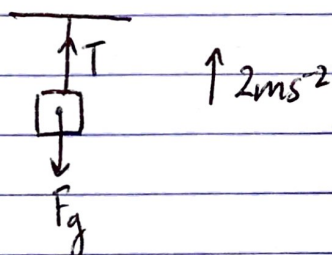
Block A exerts the same amount of force as the reactionary force.

$$1 = mg - R$$

$$R = 5 - 1 = 4 \text{ N}$$

Block A exerts 4N on Block B.

14. a)



$$\sum F = T - F_g = 1.2m$$

$$T - 0.5 = 0.06$$

$$T = 0.56 \text{ N}$$

b) $\sum F = 0$

since it is going up at a constant speed;

$$T - F_g = 0$$

$$T = 0.5 \text{ N}$$

$$d) \sum F = T - F_g - T = 0.06$$

$$T = 0.44 \text{ N}$$

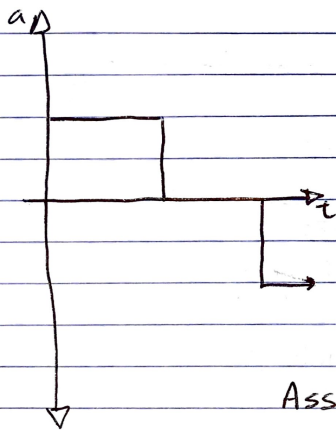
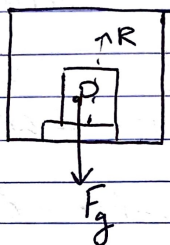
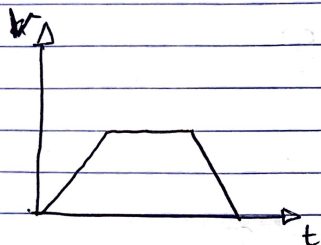
$$f) \sum F = 0$$

$$F_g - T = 0$$

$$T = 0.5 \text{ N}$$

14b & 14e do not make any sense.

13.



Assuming that the way the scale measures the weight is through;

$$m = \frac{R}{10}$$

maximum force: 720 N

minimum force: 600 N

#

$R = 10m$ {according to the scale}

Maximum force occurs when a is positive
Minimum force occurs when a is negative.

$$\sum F = ma$$

when going up (accelerating)

$$R - F_g = ma$$

$$720 - mg = ma$$

$$10m + ma = 720 \quad \text{--- (1)}$$

when decelerating:

$$F_g - R = ma$$

$$10m - 600 = ma$$

$$10m - ma = 600 \quad \text{--- (2)}$$

Solving (1) and (2) simultaneously:

$$10m + ma = 720$$

$$+ \underline{10m - ma = 600}$$

$$20m = 1320$$

$$m = 66 \text{ kg}$$

a)

b)

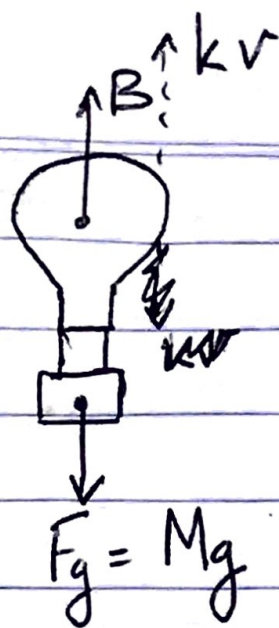
substituting m into (1):

$$66a = 720 - 660$$

$$66a = 60$$

$$a = 0.91 \text{ ms}^{-2}$$

16.



$$B - Mg + kv = 0$$

it falls with a velocity v

~~$$kv = B - Mg$$~~

We want it to rise with a velocity v ;

$$B - Mg - kv = 0$$

$$v = \frac{Mg - B}{k}$$

we want

$$-v = \frac{B - Mg}{k}$$

to go from v to $-v$;

~~$$kv = B - Mg$$~~

we want ~~$Mg < B$~~ $Mg < B$

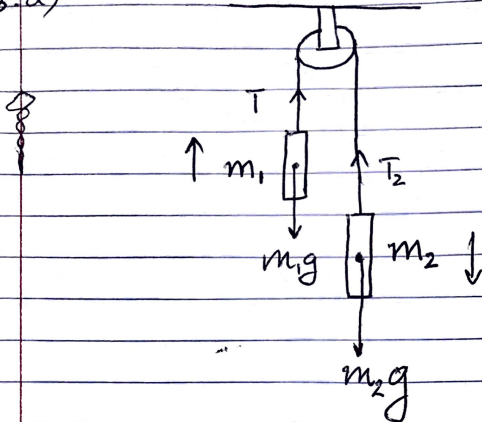
$$M < \frac{B}{g}$$

let ~~$\Delta M = M$~~

$$\Delta M = M - \frac{B}{g}$$

We need to remove $M - \frac{B}{g}$

B a)



$$\sum F = T - m_1 g$$

$$m_1 = 0.3 \quad T = m_2 g, \quad m_2 = 0.6$$

$$T = 6$$

$$0.3 a = 6 - 3$$

$$a = 10 \text{ ms}^{-2}$$

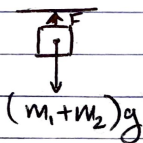
$$s = ut + \frac{1}{2} at^2$$

$$u = 0, \quad a = 10, \quad t = 2$$

$$s = \frac{1}{2} \times 10 \times 4 = 20 \text{ m}$$

b) $T = 6 \text{ N}$

c)



$$\sum F = 0$$

$$F - (m_1 + m_2)g = 0$$

$$F = (m_1 + m_2)g$$

$$F = 9 \text{ N}$$

19. When the larger mass is stopped:



where $a = g$

$$s = 20 \text{ m}$$

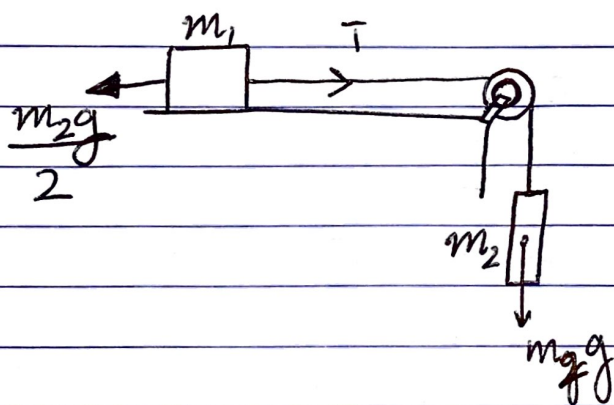
$$u = 0$$

$$a = 10$$

$$\therefore t = 2 \text{ s}$$

the string tightens after 2 seconds

20.



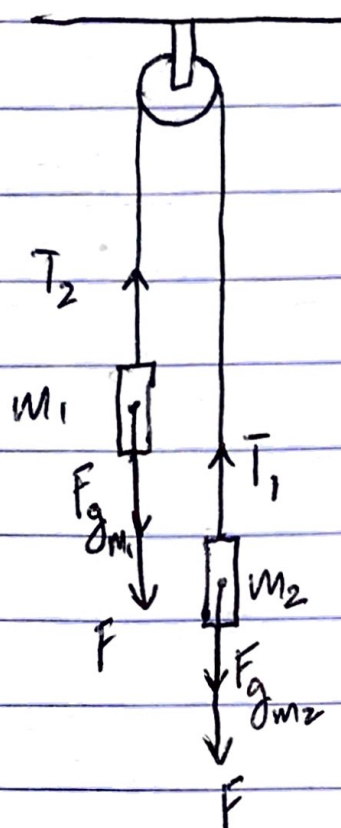
$$\sum F = \frac{m_2g}{2} - T$$

$$m_1a = \frac{m_2g}{2} - T$$

$$m_1a = \frac{m_2g}{2} - m_2g$$

$$a = -\frac{m_2 g}{2m_1}$$

21.



$$\text{let } m_1 = 5\text{kg} \\ m_2 = 2\text{kg}$$

$$\sum F = m_1 a$$

$$m_1 a = T_2 - F_{g m_1} - F$$

$$T_2 = m_2 g + F$$

$$= 41\text{ N}$$

$$m_1 a = 41 - 51$$

$$5a = -10$$

$$a = -2$$

which means it is travelling
(accelerating)

m_1 2 ms^{-2} downward.

$$\sum F_{m_2} = m_2 a$$

$$m_2 a = T_1 - F_{g m_2} - F$$

$$T_1 = m_1 g + F \\ = 51\text{ N}$$

$$2a = 51 - 41$$

$$a = 5\text{ ms}^{-2}$$

which means that m_2 is accelerating 5 ms^{-2}
upwards.

Rest of the question cannot be
solved.

