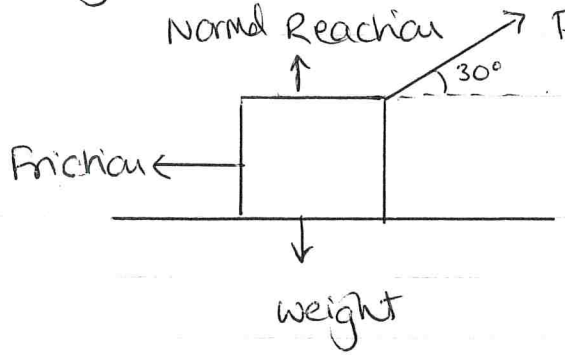
Mechanics K.

4.1 a) $3 \times 4g = 117.6\,Nm \rightarrow 118\,Nm$

b) $7 \times F = 7F\,Nm.$

c) $3 \times 4g = 7F \Rightarrow F = 16.8\,N \rightarrow 17\,N.$

5.3 a)



b) $(\uparrow)\quad R + P\sin 30 = 5g. \Rightarrow R + \frac{1}{2}P = 5g.$

$(\rightarrow)\quad P\cos 30 = \mu R. \quad \mu R = \frac{\sqrt{3}}{2}P.$

c) $P = 20 \Rightarrow R = 5g - 10 = 39.$

$\mu R = \frac{\sqrt{3}}{2}P \Rightarrow \mu \times 39 = 10\sqrt{3} \Rightarrow \mu = \frac{10\sqrt{3}}{39}.$

$\Rightarrow \mu > \frac{10\sqrt{3}}{39}$ (not in limiting equilibrium).

8.3 a).

b) $kv = 1g$

$\Rightarrow v = \frac{g}{k}.$

c) $F = ma$

$g - kv = 1 \times \frac{dv}{dt} \Rightarrow \frac{dv}{dt} = g - kv.$

d) LHS: $v = \frac{g}{k}(1 - e^{-kt}) \Rightarrow \frac{dv}{dt} = \frac{g}{k}(0 + ke^{-kt}) = ge^{-kt}$

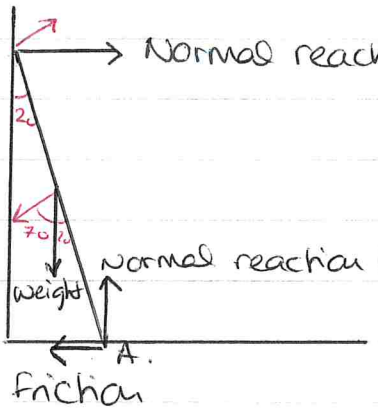
RHS: $g - kv = g - k \times \frac{g}{k}(1 - e^{-kt}) = g - g + ge^{-kt}$

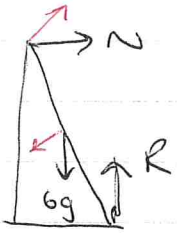
$\therefore$ LHS = RHS.

e) as $t \rightarrow \infty \quad v \rightarrow \frac{g}{k}(1 - 0) = \frac{g}{k}$ → terminal velocity.

f) Assumes fluid is same consitency throughout.

7.1





(↑) $R = 6g$. $\Rightarrow$ $F_{MAX} = 0.3 \times 6g = 17.64$.

A↺ $10 \times N\cos 20 = 5 \times 6g\cos 70$.

$\Rightarrow N = \dfrac{5 \times 6g\cos 70}{10 \times \cos 20} = 10.7$.

$N < F_{MAX}$ $\therefore$ doesn't slip.