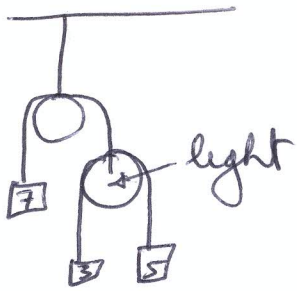
1996 (APM) HLC

Q4



(i) mass: 7kg Light 3kg 5kg

Forces: T, 7g | T, S, S | S, 3g | S, 5g

Accel: a | a | a, f | a, f

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(ii)

NII: $T - 7g = 7a$ (1) | $2S - T = 0$ (2) | $S - 3g = 3(a - f)$ (3) | $5g - S = 5(a + f)$ (4)

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$T - 7g = 7a$ (1)
$2S - T = 0$ (2)
$S - 3g = 3a - 3f$ (3)
$5g - S = 5a + 5f$ (4)

$\Rightarrow$ (3) + (4) $\Rightarrow$ $2g = 8a + 2f$ (*)

(1) $T - 7g = 7a$
(2) $2S - T = 0$
$-$(3) $-S + 3g = -3a + 3f$
(4) $5g - S = 5a + 5f$

$g = 9a + 8f$ (**)

$-4 \times$ (*) $\Rightarrow$ $-8g = -32a - 8f$

(**) $\Rightarrow$ $g = 9a + 8f$

$-7g = -29a \Rightarrow \boxed{a = \frac{7g}{29}}$

5,5

$\therefore$ (*) $\Rightarrow$ $g = 9\left(\frac{7g}{29}\right) + 8f \Rightarrow \boxed{f = \frac{g}{29}}$ (accel pulley and 7kg)

$\therefore$ $p - f = \frac{6g}{29}$ (accel 3kg) $p + f = \frac{8g}{29}a$ (Accel 5g)

(iii) Replace 3kg with m kg and m kg accel $= 0$. $\Rightarrow \boxed{a - f = 0}$

$\Rightarrow \boxed{a = f}$ (5)

(1) $T - 7g = 7a$
(2) $2S - T = 0$
(3) $S - mg = 0$
(4) $5g - S = 5(2a)$

(2), (3), (4) $\Rightarrow \boxed{-2g + mg = 17a}$

$\boxed{(5 - m)g = 10a}$

$\Rightarrow 3g = 27a \Rightarrow \boxed{a = \frac{g}{9}}$

$\therefore$ $-2g + mg = 17\left(\frac{g}{9}\right)$

$m = \frac{17}{9} + 2 \Rightarrow m = \frac{35}{9}$ (5)