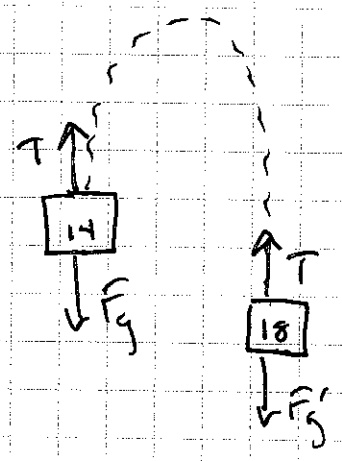
Dynamics 3

①



$$\Sigma F = F_g' - F_g$$

$$(m+m')a = m'g - mg$$

$$(14+18)a = (18)(9.8) - (14)(9.8)$$

$$32a = 39.2$$

$$a = \boxed{1.225 \text{ m/s}^2 \text{ [cw]}}$$

Isolate 18 Kg:

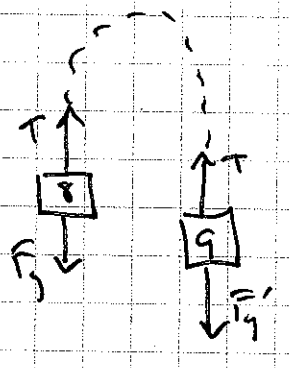
$$\Sigma F = F_g' - T$$

$$m'a = m'g - T$$

$$(18)(1.225) = (18)(9.8) - T$$

$$T = \boxed{154.35 \text{ N}}$$

②



$$\Sigma F = F_g' - F_g$$

$$(m+m')a = m'g - mg$$

$$17a = (9)(9.8) - (8)(9.8)$$

$$17a = 9.8$$

$$a = \boxed{0.576 \text{ m/s}^2 \text{ [cw]}}$$

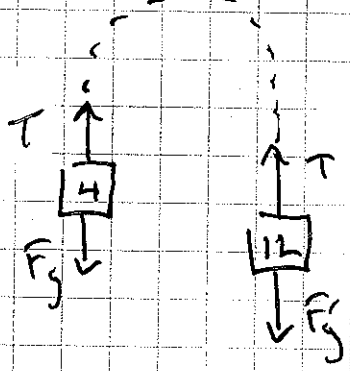
Isolate 9 Kg:

$$\Sigma F = F_g' - T$$

$$(9)(0.576) = (9)(9.8) - T$$

$$T = \boxed{83.016 \text{ N}}$$

③



a) $\Sigma F = F_g' - F_g$

$(m+m')a = m'g - mg$

$16a = 12(9.8) - 4(9.8)$

$16a = 78.4$

$a = \boxed{4.9 \text{ m/s}^2 \text{ [cw]}}$

Isolate 4 kg:

$\Sigma F = T - F_g$

$ma = T - mg$

$(4)(4.9) = T - (4)(9.8)$

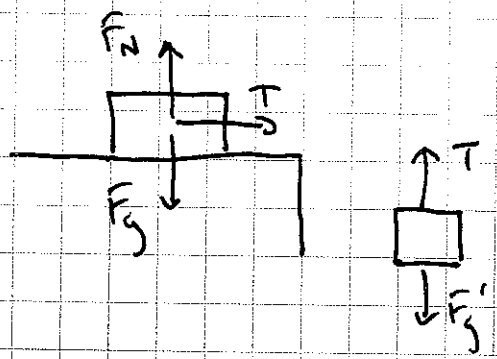
$\boxed{T = 58.8 \text{ N}}$

b) $v_f = v_i + at$

$= 0 + (4.9)(2)$

$v_f = \boxed{9.8 \text{ m/s [cw]}}$

④



Note: "smooth table" = no friction

$\Sigma F = F_g'$

$(m+m')a = m'g$

$(20+3)a = 3(9.8)$

$23a = 29.4$

$a = \boxed{1.278 \text{ m/s}^2 \text{ [cw]}}$

Isolate 20 kg:

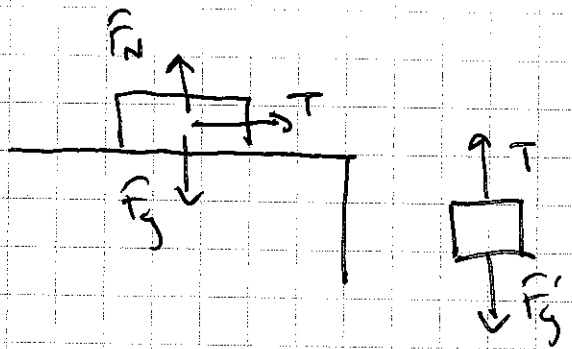
$\Sigma F = T$

$ma = T$

$(20)(1.278) = T$

$T = \boxed{25.56 \text{ N}}$

⑤



a) $\Sigma F = F_g'$

$(m+m')a = m'g$

$(6+3)a = 3(9.8)$

$9a = 29.4$

$a = \boxed{3.267 \text{ m/s}^2 \text{ [cw]}}$

Isolate 6 kg:

$\Sigma F = T$

$ma = T$

$(6)(3.267) = T$

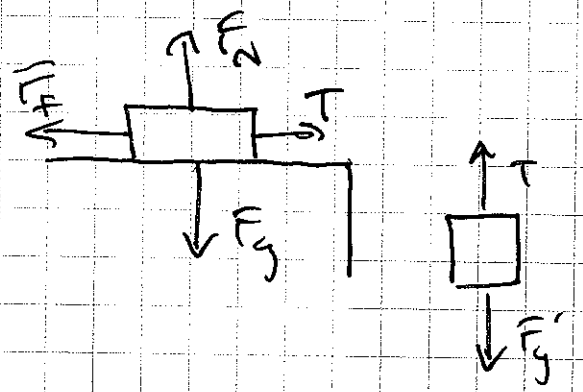
$T = \boxed{19.6 \text{ N}}$

b) $v_f = v_i + at$

$= 0 + 3.267(1.5)$

$v_f = \boxed{4.9 \text{ m/s [cw]}}$

⑥



$\Sigma F = F_g' - F_f$

$(m+m')a = m'g - F_f$

$(100+25)a = (25)(9.8) - 40$

$125a = 205$

$a = \boxed{1.64 \text{ m/s}^2 \text{ [cw]}}$

Isolate 25 kg:

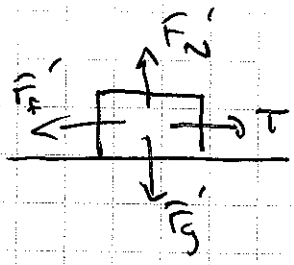
$\Sigma F = F_g' - T$

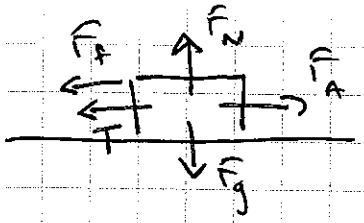
$m'a = m'g - T$

$(25)(1.64) = (25)(9.8) - T$

$T = \boxed{204 \text{ N}}$

⑦





$$\Sigma F = F_A - F_f - F_f'$$

$$(m+m')a = F_A - \mu \cdot mg - \mu \cdot m'g$$

$$(2+5)a = 50 - 0.12(2)(9.8) - 0.12(5)(9.8)$$

$$7a = 41.768$$

$$a = \boxed{5.967 \text{ m/s}^2 \text{ [Right]}}$$

Isolate 5 kg:

$$\Sigma F = T - F_f'$$

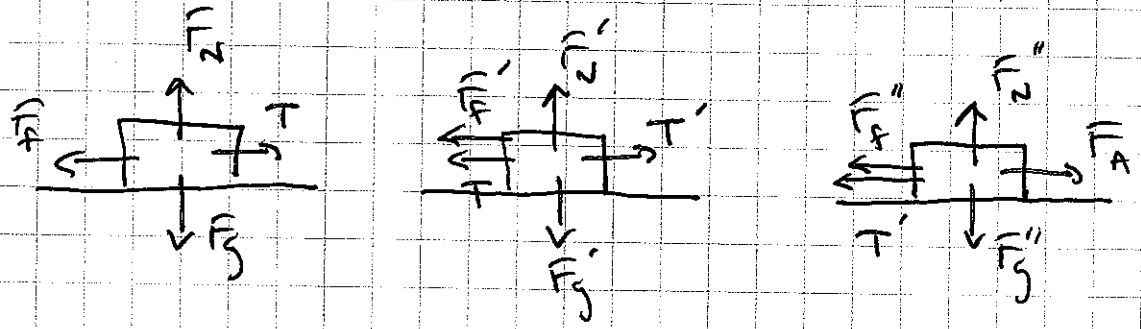
$$m'a = T - \mu m'g$$

$$5(5.967) = T - (0.12)(5)(9.8)$$

$$29.835 = T - 5.88$$

$$T = \boxed{35.7 \text{ N}}$$

(8)



$$\Sigma \vec{F} = \vec{F}_A - \vec{F}_f'' - \vec{F}_f' - \vec{F}_f$$

$$(m + m' + m'')a = \vec{F}_A - \mu \cdot m''g - \mu \cdot m'g - \mu \cdot mg$$

$$(5+3+1)a = 100 - 0.25(1)(9.8) - 0.25(3)(9.8) - 0.25(5)(9.8)$$

$$9a = 77.95$$

$$a = \boxed{8.661 \text{ m/s}^2 \text{ [Right]}}$$

Isolate 1 Kg:

$$\Sigma \vec{F} = \vec{F}_A - \vec{F}_f'' - T'$$

$$m''a = \vec{F}_A - \mu \cdot m''g - T'$$

$$(1)(8.661) = 100 - 0.25(1)(9.8) - T'$$

$$8.661 = 97.55 - T'$$

$$T' = \boxed{88.9 \text{ N}}$$

Isolate 5 Kg:

$$\Sigma \vec{F} = T - \vec{F}_f$$

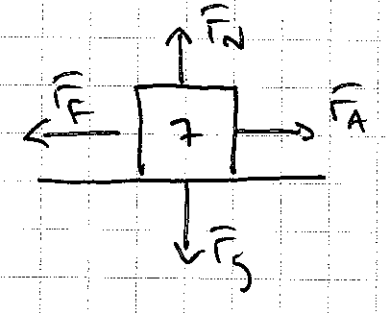
$$ma = T - \mu mg$$

$$(5)(8.661) = T - 0.25(5)(9.8)$$

$$43.305 = T - 12.25$$

$$T = \boxed{55.6 \text{ N}}$$

⑨ To find a, treat the 2 objects as 1



$\sum \bar{F} = \bar{F}_A - \bar{F}_f$

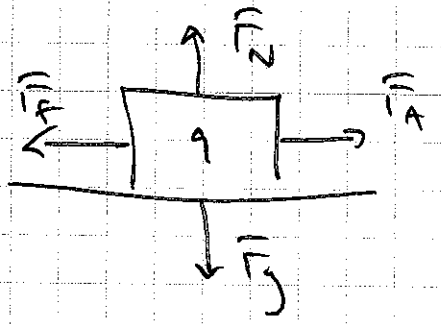
$ma = \bar{F}_A - \mu mg$

$7a = 90 - 0.2(7)(9.8)$

$7a = 76.28$

$a = \boxed{10.9 \text{ m/s}^2 \text{ [Right]}}$

⑩ Same as # 9



$\sum \bar{F} = \bar{F}_A - \bar{F}_f$

$ma = \bar{F}_A - \mu mg$

$9a = 60 - (0.1)(9)(9.8)$

$9a = 51.18$

$a = \boxed{5.69 \text{ m/s}^2 \text{ [Right]}}$