1. $\Delta p = F \Delta t$

$= 0.1 \cdot 80 - 0.1(-40)$

$= 12 \text{ kg m/s}$

$F = \Delta p / \Delta t$

$= 12/0.1 = \boxed{120\text{ N}}$

2. $p_0 = 3 \cdot 80 = 240 \text{ kg m/s}$

$= p_f = (80 + 40) V_f$

$= 120 V_f$

$\Rightarrow V_f = 240/120 = \boxed{2\text{ m/s}}$

3. $p_0 = 0 = p_f$

$= 100 \cdot 5 + 50 \cdot V_{xBF}$

$= 500 + 50 V_{xBF}$

$\Rightarrow V_{xBF} = -500/50$

$= \boxed{-10\text{ m/s}}$

4. Must conserve p_x and p_y

$p_{x0} > 0$ so $p_{xf} > 0$

$p_{y0} = 0$ so $p_{yf} = M V_{Mfy} + m V_{mfy} = 0$

Only good one is

5. $\Delta\theta = \omega_0 t + \frac{1}{2}\alpha t^2$

$= \frac{1}{2} \cdot 4 \cdot 10^2$

$= \boxed{200 \text{ rad}}$

6. $s = \Delta x = r\,\Delta\theta = 100\text{ m}$

$= 0.1 \cdot \Delta\theta$

$\Rightarrow \Delta\theta = 100/0.1 = \boxed{1000 \text{ rad}}$

7. $\Delta KE = W$

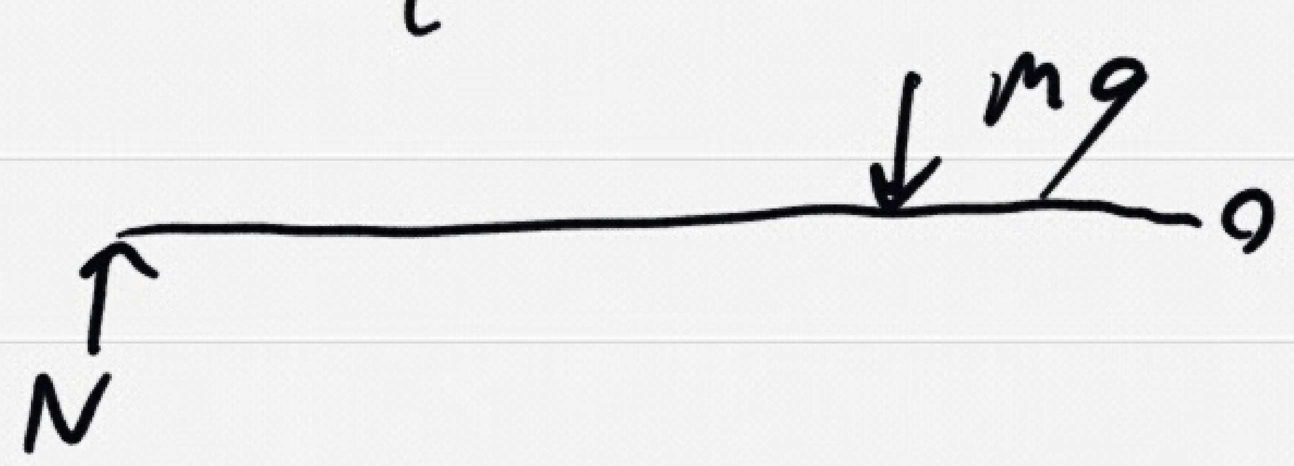
$\frac{1}{2} I \omega_f^2 - \frac{1}{2} I \omega_0^2$

$= -\frac{1}{2} I \omega_0^2 = -\tau\,\Delta\theta$

$= -\frac{1}{2} \cdot 2 \cdot 10^2 = -10 \cdot \tau$

$\Rightarrow \tau = -100/-10 = \boxed{10 \text{ Nm}}$

8. Torque about S2



$\tau_N = F_N \cdot 3\text{ m}$

$\tau_{weight} = mg \cdot 1\text{ m}$

$= 900 \text{ Nm}$

$\tau_N = \tau_{weight}$

$\Rightarrow F_N = 900/3$

$= \boxed{300 \text{ N}}$

9. Fixed PE split up into KE_{rot} and KE_{trans}
More I ⇒ more KE_{rot}
⇒ less KE_{trans} ⇒ less v

box, disk, hoop

10. @ x_m, $v = 0$
Adding mass doesn't change amplitude

$$\boxed{A_2 = A_1}$$

11. $f = \frac{1}{2\pi}\sqrt{k/m}$
so increasing k **increases f**
stiffer spring → more restoring force → **less amplitude**

12. $v_m = 2\ m/s = \sqrt{k/m} \cdot x_m$
$= \sqrt{8/2}\ x_m = 2\ x_m$
⇒ $x_m = v_m/2 = 1\ m$
$|F_{max}| = k|x_m|$
$= \boxed{8\ N}$

13. $F = PA = mg$
$10^5 \cdot 0.01 = 10^3 = 10 \cdot m$
⇒ $\boxed{m = 100\ kg}$

14. $F_B = W_{fluid\_displaced}$

$= \rho_f \cdot V_{fluid} \cdot g$

$= m/2 \cdot g$ since $\rho_f = \rho_{obj}/2$

$\Rightarrow W' = W - F_B$

$= mg - mg/2$

$= 20 - 10$

$= \boxed{10\ N}$

15. $P_2 = P_1 + \rho g D$

$= P_{atm} + \rho g D$

$= 2\ P_{atm}$

so $2 \cdot 10^5 = 10^5 + \rho g D$

$\Rightarrow \rho g D = 10^5$

$1000 \cdot 10 \cdot D = 10^5$

$\Rightarrow \boxed{D = 10\ m}$