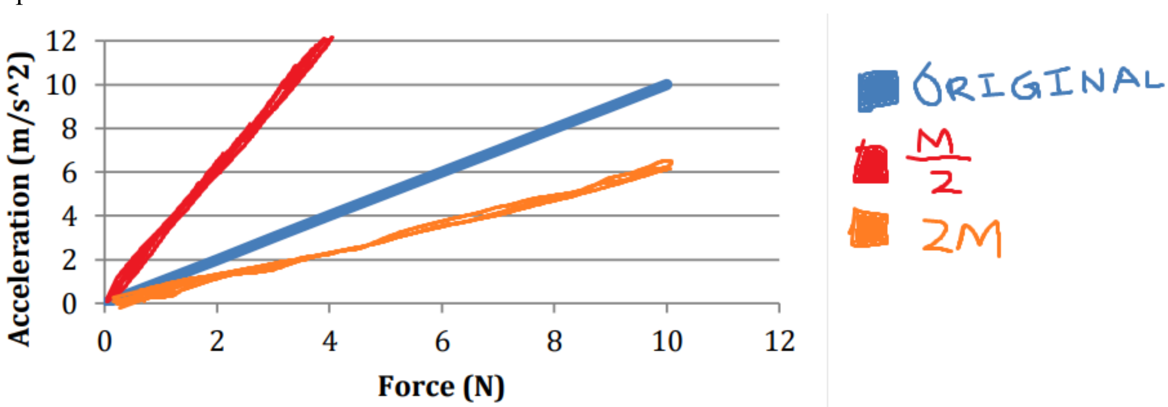
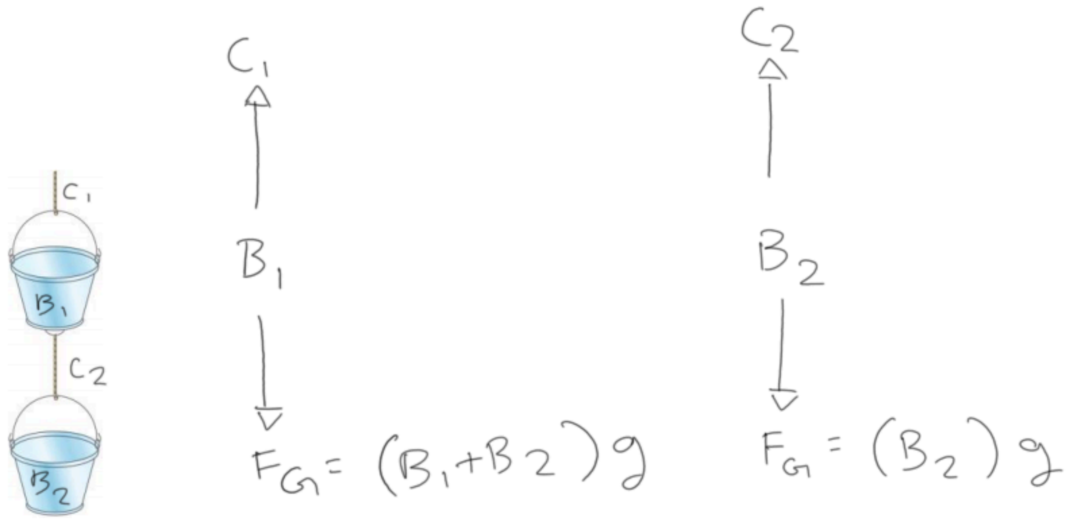
1. When the BART trains slow down, you experience the effects of inertia. Inertia is the tendency of an object to resist change in velocity. You are currently at rest, when the BART accelerates, it's because of inertia you lean backwards (i.e you want to stay at rest)
2. If acceleration is 0, that means there are no net forces acting on it. This is because Newtons first law says, "Every object continues at its state of rest, or uniform velocity in a straight line, as long as no net force acts on it." If there are no net forces acting on it, then there cannot be acceleration. There can be forces acting on it, but the net force must be 0 if there is no acceleration.
3. This is said in Newton's third law of motion: whenever one object (you) exerts a force on the second object (log) the second object (log) exerts an equal force in the opposite direction on the first. The log movement is visible to you because water is a very smooth surface and does not have much friction (or viscosity?).
4. Graph



The red line should reach 10 m/s^2 when N = 5, the orange line should reach 5 m/s^2 when N = 10. The drawing kind of sucks.

5. Object C is the lightest, Object A is heavier than Object C but lighter compared to Object B. C, A, B (Lightest mass to Heaviest mass)
6. A. If the force is increased by a factor of 2, the acceleration will also double of its original (20 m/s^2)
   B. If the mass is increased by a factor of 2, the acceleration will be ½ of its original (5 m/s^2)
   C. If both mass and force are increased by a factor of 2, the acceleration will remain the same as its original (10 m/s^2)
   D. If force is increased by a factor of 2 and the mass is halved, then the acceleration will be 4 times as large as its original (40 m/s^2)
7. All zero because there is no acceleration on the boxes because the velocity is constant
8. D > B > A = C
9. B = C > A > D

10. A.

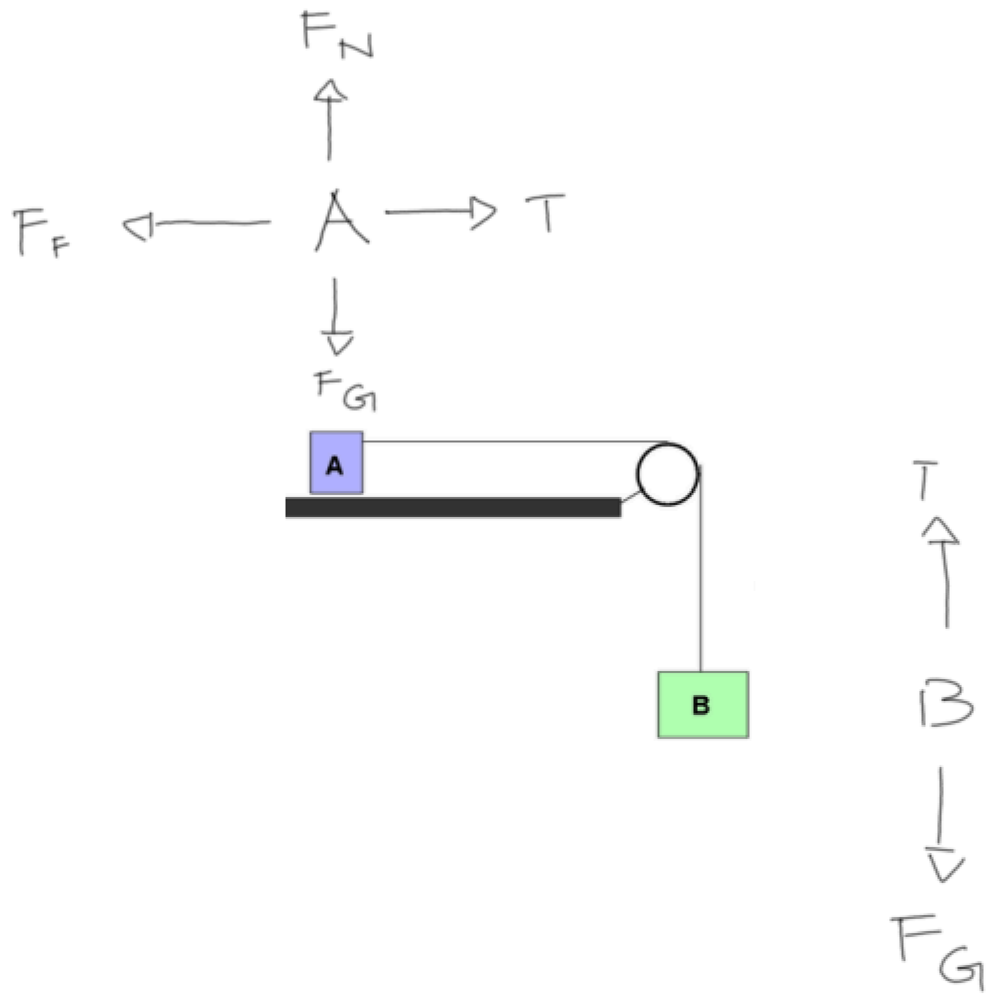


B. C_1 will be experiencing a tension of B_1 and B_2's weight, which will be **~62.72 N.** C_2 only holds B_2's weight, therefore it's tension is **~31.36 N**

C. If both buckets are pulled up with an acceleration of $1.6\ m/s^2$ then C_1 experiences a tension of **~72.96 N**. We get this because the upwards tension caused by the acceleration is ~10.24 N, then we add that to what we got in part B. (i.e ~62.72 N) C_2 experiences a tension of **~36.48 N**.

11. A. 100 N
    B. 60 N
    C. 80 N
    D. 40 N
    E. 100 N
    F. 40 N
    G. 120 N
    H. 60 N

12. A.

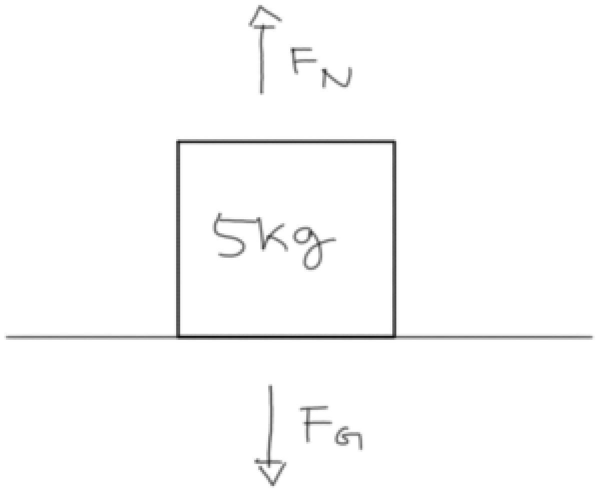


B. $a_A = \frac{Bg}{A+B}$, using $a = \frac{\Sigma F}{m}$. Substitute net force with Bg (force being applied) and mass with A+B's mass

$a_b = \frac{Bg}{A+B}$. This must be equal to box A's acceleration, if it doesn't then the string broke or its elastic.

$T = \frac{ABg}{A+B}$. Multiply $\frac{Bg}{A+B}$ with A because $\Sigma F = ma$, replace acceleration with our previous answer, and replace mass with the mass of A.

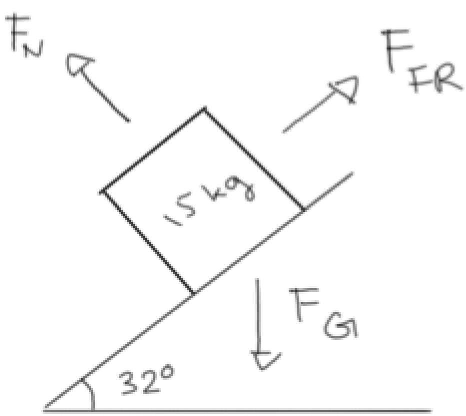
13. A.



B. The coefficient of static friction between the box and the floor is $\frac{48}{49}$ which is around **0.97**. This is because $F_N = 49$, and by using $F_{fr} \leq \mu_s F_N$, we can substitute F_{fr} with 48, and substitute F_N with 49. By solving for μ_s, we get ~0.97

C. The coefficient of kinetic friction between the box and the floor is around **0.9**. We get this by using $a = \frac{48-\Sigma F}{m}$, acceleration is 0.7 m/s^2, mass is 5 kg. By solving for net force, we can plug it into $F_{fr} = \mu_k F_N$, thus μ_k is around 0.9

14. A.



B. Friction impends **73.4 N**. We can calculate that $F_{G_y} = 147 \times cos(32) \approx 124.66$ and that $F_{G_x} = 147 \times sin(32) \approx 77.89$. From there, we can use $a = \frac{F_{G_x} - F_{fr}}{m}$, substitute acceleration for 0.30 m/s^2, mass for 15 kg, and solve for F_{fr}(73.4 N)

C. The coefficient of kinetic friction is around **0.59**. We get this by using $F_{fr} = \mu_k F_N$. Substitute F_{fr} with 73.4 N, and substitute F_N with 124.66, and solve for μ_k(0.59)

15. A = B > D = E > C