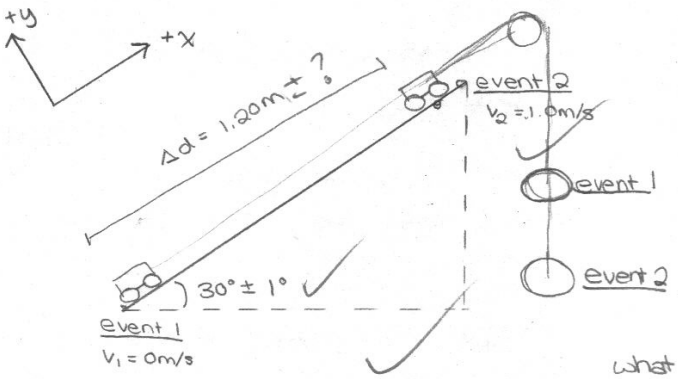
CGPS Problem:

Recorder: _____
Manager: _____
Speaker: _____
0 1 2 3 4 5

A: Pictorial Representation

Sketch, coordinate system, label givens & unknowns using symbols, **measurements with uncertainty**, conversions, describe events, **precise physics question**



a = ?

$\vec{F}_t$ = ?

F_g = ?

m_w = ?

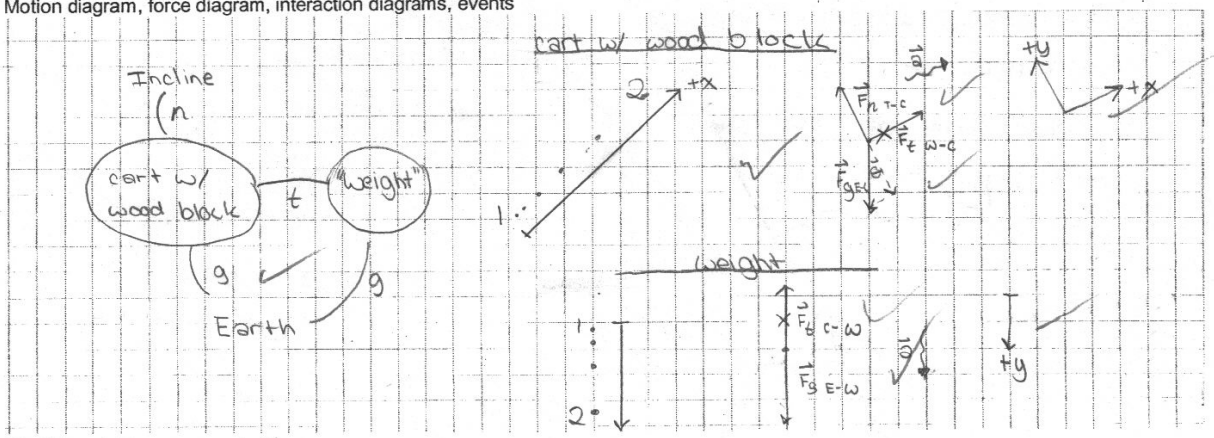
m_{cart} = 110.3g + 499g

= 0.6093kg

what is the mass of the "weight" needed to allow the cart to have a velocity of 1.0m/s at the top?

B: Physics Representation

Motion diagram, force diagram, interaction diagrams, events



C: Word Representation

Describe motion (no numbers), explain why, assumptions

The cart will accelerate up the incline and the "weight" will accelerate downwards. The acceleration will be the same b/c the force of tension will be the same everywhere on the string. We assume friction is negligible.

Describe solution steps

1) Find the cart's acceleration using: $(v_2)^2 + (v_1)^2 = 2a\Delta x$

2) Determine force of gravity acting upon the cart using: $\vec{F} = mg$ ← gravitational field strength

3) Find the force of tension using Newton's 2nd law

4) Determine the mass of the "weight" using Newton's 2nd law

D: Mathematical Representation

Describe steps, complete equations, algebraically isolate, substitutions with units, final statement **with estimated uncertainty**

1) Determine acceleration of cart:

$(v_2)^2 = (v_1)^2 + 2a\Delta x$

$2a\Delta x = (v_2)^2 - (v_1)^2$

$a = \frac{(v_2)^2 - (v_1)^2}{2\Delta x}$ ✓

$= \frac{(1.0m/s)^2 - (0m/s)^2}{2(1.20m)}$

$= 0.417 m/s^2$ ✓

∴ the acceleration is $0.417 m/s^2$

2) Determine force of gravity acting upon the cart:

$F_g = mg$

$= 0.6093kg(9.8N/kg)$

$= 5.97N$ ✓ (5.97114

∴ the force of gravity acting upon the cart is 5.97N ✓

3) Determine the force of tension using Newton's 2nd law: ✓

$F_{netx} = ma_x$

$F_{t\,w-c} - F_{gx\,E-C} = m_C a_x$

$F_t = m_C a_x + F_{gx}$ ✓

$= 0.6093kg(0.417m/s^2) + 5.97N \sin 30°$

$= 3.49N$ ✓

∴ the force of tension is 3.24N ✓

4) Find the mass of the "weight":

$F_{nety} = ma_y$

$F_{g\,E-w} - F_{t\,c-w} = ma_y$

$mg - F_t = ma_y$

$ma_y - mg = -F_t$

$m(a_y - g) = -F_t$

$m = \frac{-F_t}{a_y - g}$ ✓

$= \frac{-3.24N}{0.417m/s^2 - 9.8N/kg}$ ✓

$= 0.35kg \pm 0.05kg$ ✓

E: Evaluation

Does answer have reasonable size, direction and units? Why?

The answer has a reasonable size because we have to remember that the cart is on an incline, so it is okay that the "weight" has a smaller mass than the cart. There is no direction and the units are kg b/c we are dealing with mass. ✓