Name: MASTER – 2018 – B.B **Total:** /11

Question 1

Is acceleration downslope independent of mass?

Small glider

Given

t_u = 0.10 s

t_v = 0.05 s

t between = 1.33 s

Calculations

$u = \frac{0.05}{0.10} = 0.50\ ms^{-1}$ (1)

$v = \frac{0.05}{0.05} = 1.00\ ms^{-1}$ (1)

$a = \frac{1.00 - 0.50}{1.33} = 0.375 \approx 0.4\ ms^{-1}$ (1) (3)

More massive glider

Given

t_u = 0.09 s

t_v = 0.05 s

t between photogates =

Calculations

$u = \frac{0.05}{0.09} = 0.555\ ms^{-1}$ (1)

$v = \frac{0.05}{0.05} = 1.00\ ms^{-1}$ (1)

$a = \frac{1.00 - 0.555}{1.27} = 0.350 \approx 0.4\ ms^{-1}$ (1)

Answer: Yes (1) ACCELERATION IS INDEPENDENT OF MASS AS $a_{(small)} \approx a_{(big)}$ (3) (1)

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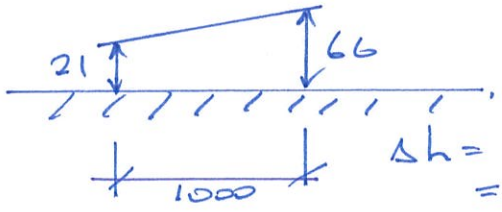
Question 2

Calculate the theoretical acceleration downslope and then determine the % difference between the theoretical acceleration downslope and the experimental acceleration downslope for the small glider.

(4)



$\Delta h = 66 - 21 = 45$ mm

$\sin\theta = \frac{45}{1000}$ (½)

$\therefore \theta = 2.579^\circ$

ACCEPT $2.0 \rightarrow 3.5^\circ$ (1)

For $a_{//\,(THEOR)}$

$a_{//} = g \sin\theta$ (½)

$= 9.80 \times \sin 2.579$

$= 0.440\ ms^{-2}$ (½)

For % DIFF

$$\%\ DIFF = \left| \frac{a_{//THEOR} - a_{//EXP}}{a_{//THEOR}} \right| \times \frac{100}{1}$$ (½)

$$= \left| \frac{0.440 - 0.375}{0.440} \right| \times \frac{100}{1}$$ (½)

$= 14.77$

$\approx 15\%$ (1)

CALCULATION FOR ACCEPTABLE % DIFF B.B

$\Delta h = (66+5) - (21-5)$

$= 71 - 16$

$= 55$ mm

NOW $\sin\theta_{WORST} = \frac{55}{995}$

$\therefore \theta = 3.168^\circ$

AND $a_{//WORST} = 9.80 \times \sin 3.168$

$= 0.5157$

$\therefore \%\ DIFF = \left| \frac{0.5157 - 0.440}{0.440} \right| \times 100$

$= 17.2\%$

THEREFORE, WE ACCEPT UP TO ... 20.0 %

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