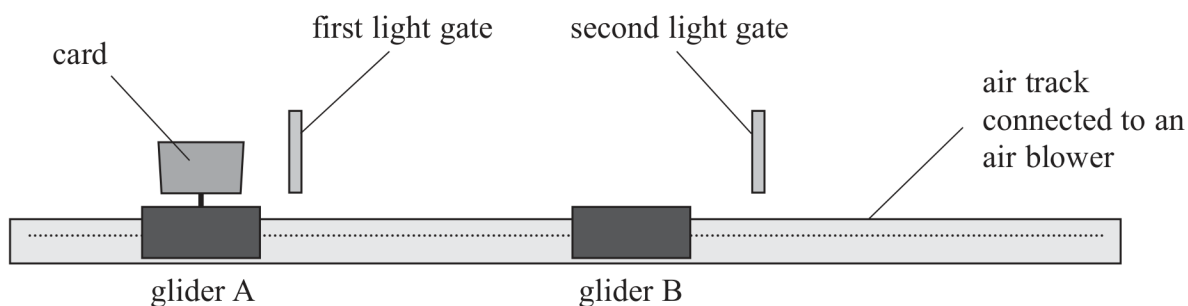


Answer ALL questions.

- 1 A student used light gates connected to a data logger to investigate the collision between two gliders on a level air track, as shown.



Glider B was initially stationary.

Glider A moved through the first light gate and then collided with glider B.

The two gliders joined together, then moved through the second light gate.

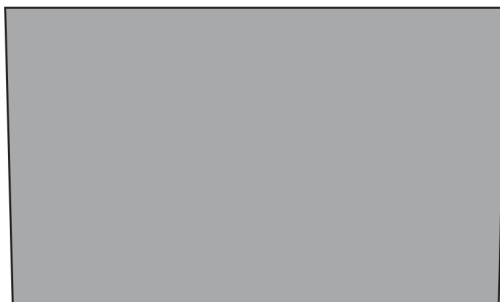
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- (a) The diagram below shows the actual size of the card that was fixed to glider A.



- (i) Determine an accurate value for the length of the card.

(2)

Length of card =

- (ii) Calculate the percentage uncertainty in your value.

(2)

Percentage uncertainty =

(b) The student repeated the collision using a card of length 10.5 cm.

The results are shown in the table.

	Mass / kg	Time / ms	Velocity / m s^{-1}	Momentum / kg m s^{-1}
Glider A moving through first light gate	0.147	108	0.972	0.143
Gliders A and B moving through second light gate	0.274	205		

(i) Calculate the values missing from the table.

(4)

Velocity = m s^{-1}

Momentum = kg m s^{-1}

(ii) Determine whether the student's values show that momentum was conserved in this collision.

(2)



- (c) In the experiment, the student applied a small force with her hand to start glider A moving.

The student repeated the experiment and calculated the mean values of the time taken to pass through each light gate.

Discuss how this affected the uncertainty in the calculated values of momentum.

(3)

- (d) Another student used a stopwatch to measure the time taken for the gliders to travel a known distance.

Explain the advantage of using light gates and a data logger, instead of using a stopwatch.

(2)

(Total for Question 1 = 15 marks)