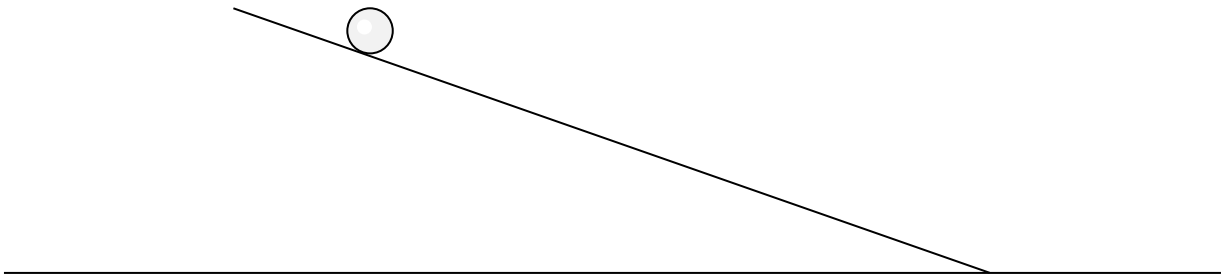
15th April

1. A large marble is placed on a smooth slope as shown. The slope is at an angle θ to the horizontal.

   a. Add labels to show the weight, W, and components of the weight parallel and perpendicular to the slope, Wsinθ and Wcosθ, respectively.



A student investigates the acceleration of the marble by recording three repeat values for the time it takes the marble to roll 30 cm down the slope from rest.

   b. Calculate the **mean time** and use one of the suvat equations to calculate the **acceleration** in the table below

Angle of slope / °	Time 1 / s	Time 2 / s	Time 3 / s	Mean Time / s	Acceleration / m s^{-2}	g sinθ / m s^{-2}
15	0.47	0.51	0.52	0.50	2.4	
30	0.37	0.35	0.36	0.36		
45	0.32	0.28	0.31			
60	0.28	0.28	0.26			

   c. Complete the last column by calculating values of **g sinθ** (where g = 9.81 N kg^{-1})

   d. **Compare** the values in the last two columns

   e. Suggest a factor that is likely to **reduce** the measured acceleration compared to the theoretical acceleration in this experiment

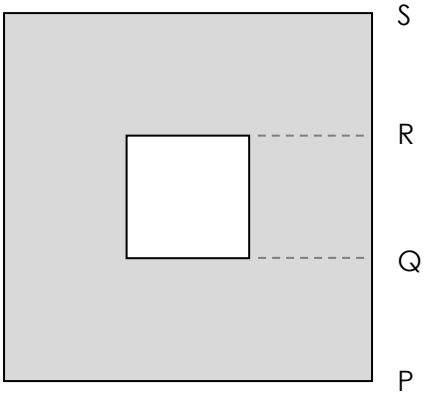
16th April

1. A student is using a light gate and a double interrupt card to find a value for the acceleration due to gravity.

   The light gate is clamped so that the light beam is horizontal. The double interrupt card is shown in the diagram to the right. The square outer card has sides of length 15.0 cm and a 5.0 cm square hole in the centre.

   The first time recorded by a data logger as the card between P and Q interrupts the beam is 100 ms

   A short time later a time of 34 ms is recorded as the card between R and S passes through the light gate.



   Calculate the:

   a. The **initial velocity** as the bottom strip of card (PQ) interrupts the beam

   b. The **final velocity** as the top strip of card (RS) interrupts the beam

   c. The **acceleration** of the card

   d. Suggest two **advantages** of attaching small masses along the bottom edge of the double interrupt card before it is dropped