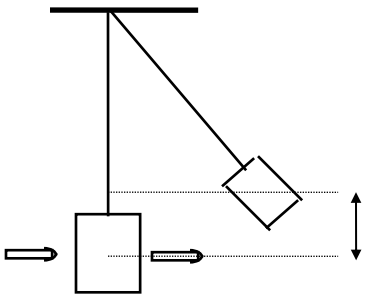
**Tutorial Sheet 5(2020/2021)**
**Linear Momentum & Collisions**

01. Car 1 was sitting at rest when it was hit from the rear by car 2 of identical mass. Both cars had their breaks on and they skidded together 6 m in the original direction of motion. If the stopping force is ~ 0.7 × (combined weight of the cars) , i.e., $\mu = 0.7$, find the approximate speed of car 2 just before the collision took place. [18.14 m/s]

02**. A bullet of mass 10 g and travelling at a speed of 500 m/s strikes a block of mass 2 kg which is suspended by a string of length 5 m. The bullet goes through the block in a very short time and the centre of gravity of the block is found to rise a vertical distance of 10 cm. What is the speed of the bullet just after it emerges from the block? [220 m/s]



03. A billiard ball at rest is struck by another billiard ball of the same mass whose speed is 6.0 m/s. After an elastic collision the striking ball goes off at an angle of $25^0$ with respect to its original direction of motion. Find the angle the struck ball makes with this direction and the final speeds of both balls. [$65.4^0$, 5.44 m/s, 2.53 m/s]

04**. A vessel at rest explodes, breaking into three pieces. Two of the pieces, with masses $m_1$ and $m_2$ ( $m_1 = 2m_2$ ), fly off perpendicular to one another with the same speed of 30 m/s. The third piece has mass $m_3 = 3m_2$. Find the magnitude and direction of its velocity just after the explosion. [22.4 m/s, $206.6^0$]

05**. A particle of mass $m$, moving with a velocity $u$ makes a head-on elastic collision with a particle of mass $2m$ initially at rest. Show that the particle of mass $m$ loses $(8/9)^{th}$ of its initial kinetic energy in the collision. [fractional loss of KE = 8/9]