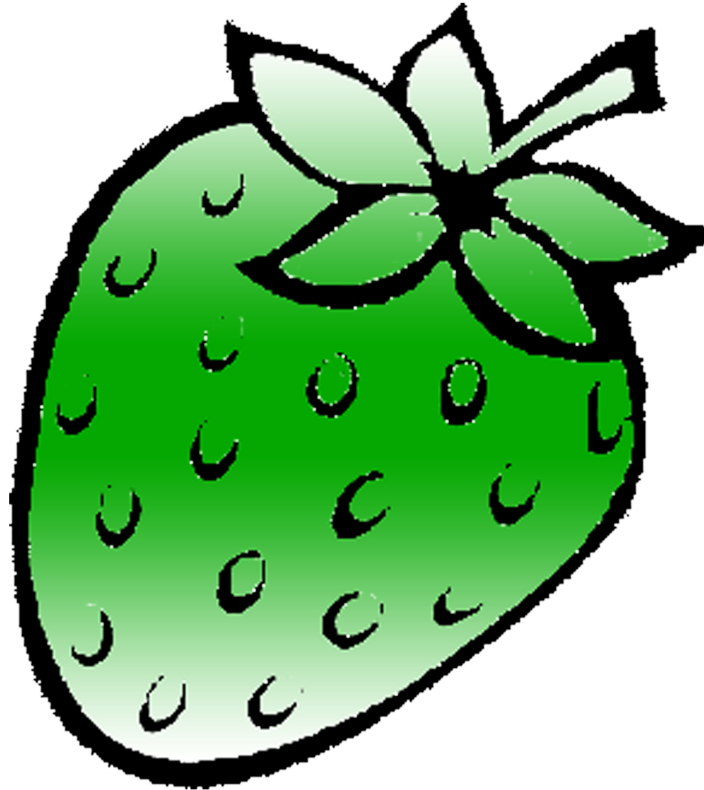


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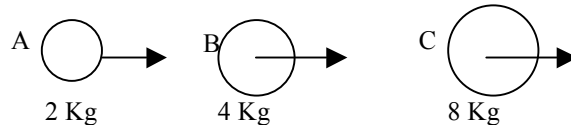
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IMPACT & COLLISION

1. Two particles of masses 10 kg and 20 kg are moving along a straight line towards each other at velocities of 4m/s and 1 m/s respectively. If $e = 0.6$, determine the velocities of the particles immediately after their collision and loss of K.E.

Ans: $v = 4/3$ m/s & $5/3$ m/s in opposite direction & 53.33J

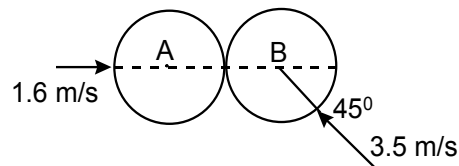
2. Three balls A, B and C of masses 2kg, 4kg and 8kg respectively move along the same straight line and in the same direction, with velocities 4m/sec, 1m/sec and 0.75 m/s. If ball A collides with ball B and ball B collides with C show that the balls A and B will be brought to rest by the collision which will take place. Take coefficient of restitution as unity.



3. Two identical balls each of mass m collide with velocities as shown in figure. Find the final velocities of the balls after impact.

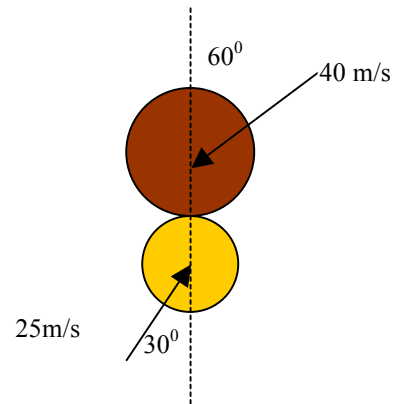
Assume $e=0.9$

Ans. : -2.27 m/sec, 2.84 m/sec 60.45° with Horizontal.



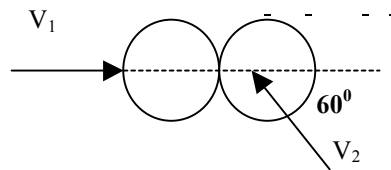
4. Two smooth balls A (mass 3 kg) and B (mass 4 kg) are moving with the velocities 25 m/sec and 40 m/sec respectively. Before impact, the directions of velocity of two balls are 30° and 60° with the line joining the centers as shown in figure. If $e = 0.8$, find the magnitude and direction of velocities of these balls after impact.

Ans: 24.58m/s $\theta = 59.44^\circ$, 36.7m/s $\theta = 19.3^\circ$



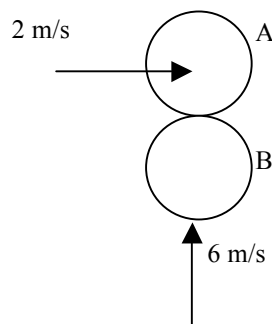
5. Two billiard balls of equal masses collide with velocities $v_1 = 1.5$ m/s and $v_2 = 2$ m/s as shown in figure. Find velocities of balls after impact and percentage loss in K.E. Coefficient of restitution is 0.9.

Ans.: For ball no. 1 $v = 0.875$ m/s and for ball no. 2 $v = 2.21$ m/s, $\theta = 51.55^\circ$, 9.6 %



6. Two identical balls of 120 gm collide when they are moving with velocity perpendicular to each other as shown in figure. Assuming that the line of impact is in the direction of motion of ball B, determine the velocity of ball A and ball B completely after the impact. Take $e = 0.8$.

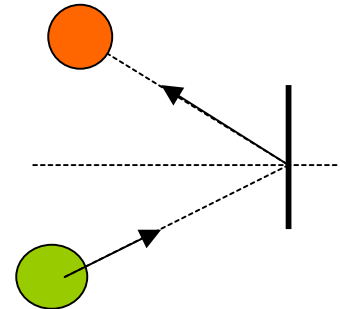
Ans. : $V_A = 6.96$ m/s, $V_B = 0.6$ m/s



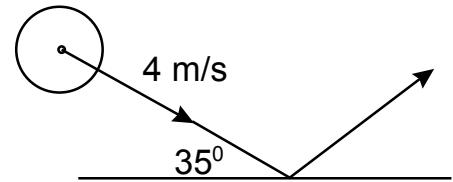
7. A ball is dropped from a height of 9m upon a horizontal slab. If it rebounds to a height of 6meters, show that the coefficient of restitution is 0.82

8. A boy throws a ball vertically downwards. He wants the ball to rebound from floor and just touch the ceiling of room which is at a height of 4m from ground. If coefficient of restitution e is 0.8, the velocity with which the ball should strike the floor taking $g = 10\text{m/s}^2$ is
 Ans. : 11.18m/s

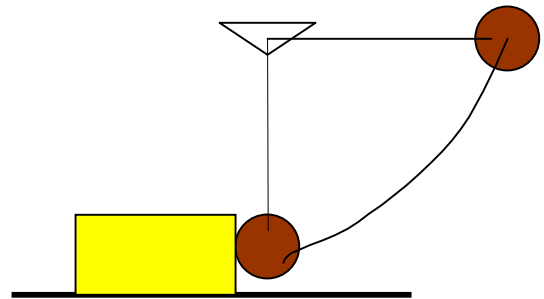
9. A ball is thrown against a wall with a velocity v forming an angle of 30° with the horizontal. Assuming friction less conditions and $e = 0.50$ determine the magnitude and direction of the velocity of the ball as it rebounds from the wall.
 Ans. : $0.661v, 49.1^\circ$



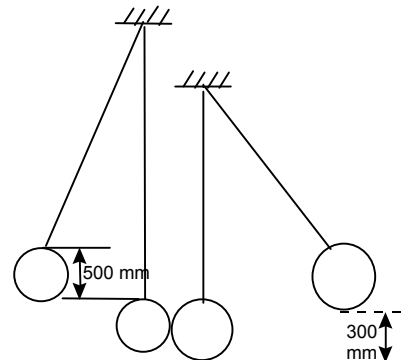
10. A billiard ball moving 4m/sec strikes a smooth horizontal plane at an angle of 35° as shown in fig. If the coefficient of restitution is 0.6, what is the velocity with which the ball rebounds?
 Ans. : 3.55m/sec, 22.8°



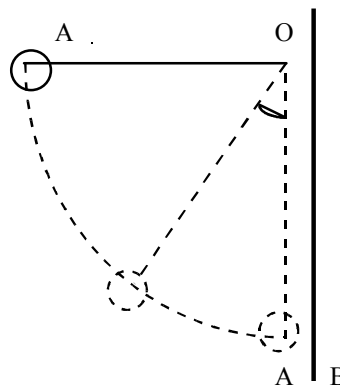
11. A sphere of a mass 2 kg is released from rest and strikes a block of mass 2.5 kg resting on a horizontal surface. How far the block will move after the impact? Assume $e = 0.75$ and the coefficient of friction between the block and the floor is 0.25.
 Ans. : $v_b=3.77\text{m/s}, 2.9\text{m}$



12. Figure shows spheres A and B suspended by cords 2.5 m and 2.0m long respectively. Masses of spheres A and B are 1.5 kg and 2 kg respectively. Sphere A is pulled to a position 'A', 500 mm above A and released from rest. Sphere B is at rest when struck by A with direct impact. After impact the sphere B rises to a height of 300 mm above its lowest point. Determine the coefficient of restitution.
 Ans. : 0.808

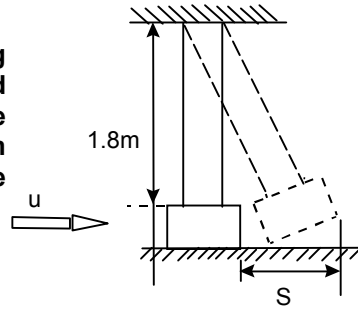


13. A simple pendulum OA when released from rest in the horizontal position falls under gravity and strikes a vertical wall at B as shown in figure. If the coefficient of restitution between the wall and the ball is 0.5, find the angle θ defining the total rebound of the ball.
 Ans.: $\theta = 41.42^\circ$



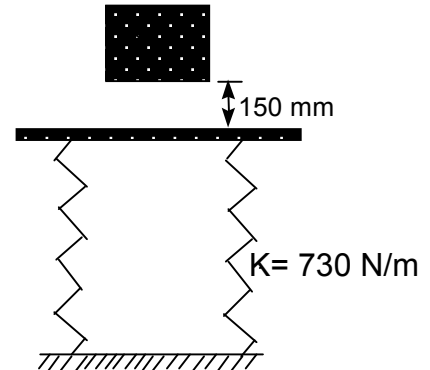
14. A ballistic pendulum consisting of a block of mass 30kg suspended from two wires each of length 1.8m is used to measure the muzzle velocity of the gun. If the pendulum swings through a horizontal distance $s=25\text{cm}$ when a 40gm bullet is fired into it, determine the muzzle velocity v of the gun.

Ans. : 439 m/sec



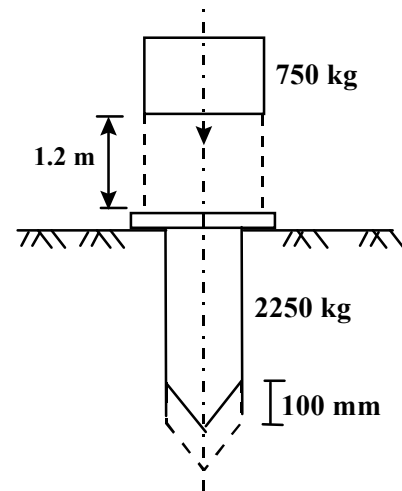
15. A 2kg mass falls 150mm onto a 1 kg platform mounted on springs whose combined $k=730\text{N/m}$. If the impact is fully plastic, determine the maximum distance the platform moves down from its position before impact?

Ans. : 121mm



16. A 750 kg hammer of a drop hammer pile driver falls from a height of 1.2m onto the top of a pile of mass 2250 kg. The pile is driven 100mm into the ground. Assuming perfectly plastic impact, determine the average resistance of the ground to penetration.

Ans. : $R = 51.5 \text{ KN}$



17. A ball is thrown downwards with a velocity of 12m/s and at a 30° with the horizontal from the top of a building 12m high. Find where the ball will hit the ground second time if coefficient of restitution between ball and ground is $e = 0.75$.

Ans. : $x = 37.3\text{m}$

18. Determine the horizontal velocity at which the girl must throw the ball so that it bounces once on the smooth surface and then lands into the cup at C. Take $e=0.6$. Neglect the size of the cup.

