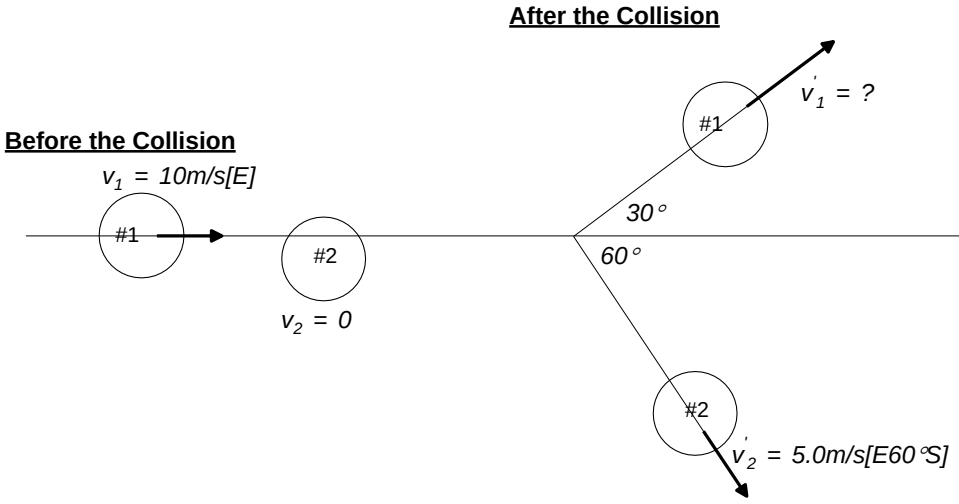
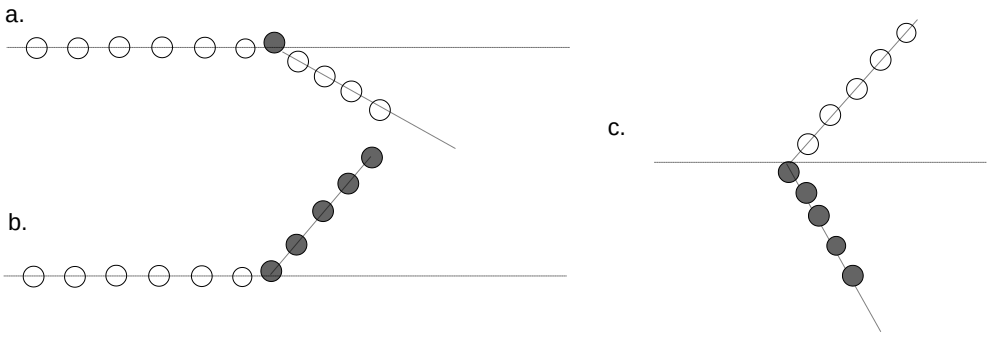
Pool Hall Physics

1. The diagram below shows two identical billiard balls before and after a "glancing collision". Using a vector diagram find the final velocity of ball 1.

(**Hint** : Since the masses of the two balls are the same, you can draw velocity vectors instead of momentum vectors).



2. The following three diagrams are partial diagrams of a moving ball (the white one) striking a stationary ball (the black one). The masses of the balls are equal. Find the velocity (including direction of the missing ball).
   a. V_1=4.2cm/s[E], V_2=0, V_1'=3.0cm/s[E31°S], find V_2'
   b. V_1=52.5cm/s[E], V_2=0, V_2'=21cm/s[E60°N], find V_1'
   c. V_2=0, V_1'=37.5cm/s[E45°N], V_2'=38cm/s[S36°E], find V_1



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1. V_1'=8.7m/s[E30°N], 2a. V_2'=2.2cm/s[E43°N], 2b. V_1'=45.8cm/s[E23°S], 2c. V_1=49.0cm/s[E5°S]

Explosions

Momentum before something "pops" apart must equal the momentum after

$P_i = P_f$

If it is stationary at the beginning then the total momentum must equal zero.

1. A device that "pops" apart into three separate pieces is initially at rest on a horizontal surface. It pops into three pieces and all of them fly off horizontally. The first piece is 2.0kg and flies off at 20.0m/s[N], the second piece is 3.0 kg and flies off at 12 m/s [E30°N]. The third piece flies off at 30.0m/s
    a. Find the direction that the third piece goes off at.
    b. What is the mass of the third piece?
2. A large 1.2 kg firecracker is thrown horizontally at a velocity of 1.5m/s [E]. If blows into 3 pieces that fly off on the same horizontal plane. A 0.50 kg piece flies to the north at 3.0m/s and a 0.30kg piece goes southwest at 4.0m/s. Find the velocity of the third piece (remember to include a direction).

Linear Momentum (along a line)

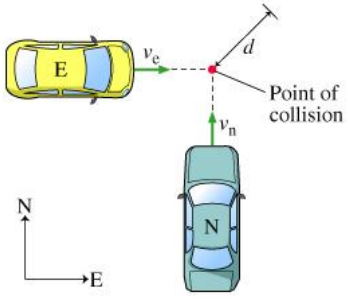
3. Suppose that a 75.0kg soccer goalie catches a 0.40 kg ball that is moving at 32m/s. With what forward velocity must the goalie jump when she catches the ball so that the goalie and the ball have a resultant horizontal velocity of zero?

Momentum with Angles

4. A billiard ball of mass 0.155 kg is rolling directly North at 3.5 m/s. It collides with a stationary golf ball of mass 0.052kg. The billiard ball rolls off at an angle [N15°E] with a velocity of 3.1 m/s.
    What is the resultant velocity of the golf ball?
5. A 750g red ball travelling at 0.30 m/s [E] approaches a 550g blue ball travelling at 0.50m/s[W]. They have a glancing collision and the red ball moves away at 0.15m/s [E30°S] and the blue ball moves away in a north-westerly direction.
    What is the final velocity of the blue ball?
6. The police are investigating an accident involving a collision at an intersection between two cars. After colliding, the cars locked together and skidded off the road. One street runs north-south and the other street runs east-west, the two streets meet at a 90°.

    The car travelling North had a mass of 2275kg and the one travelling East had a mass of 1525kg. From the skid marks and the data for the friction between the tires and concrete, the police determined that the cars when they were locked together had a velocity of 31 km/hr at an angle of 43° North of the East bound street.

    If the speed limit on both streets was 35km/hr, should one or both cars be ticketed for speeding?



1a. [W62°S] 1b. 2.2kg 2. 6.8 m/s[E14°S] 3. 0.18m/s 4. 2.8m/s[N58°W] 5. 0.29m/s[W21°N] 6. north car V=35.3km/hr[N], east car V=56.5 km/hr [E]