Elastic Collisions in One Dimension (Chapter 4)

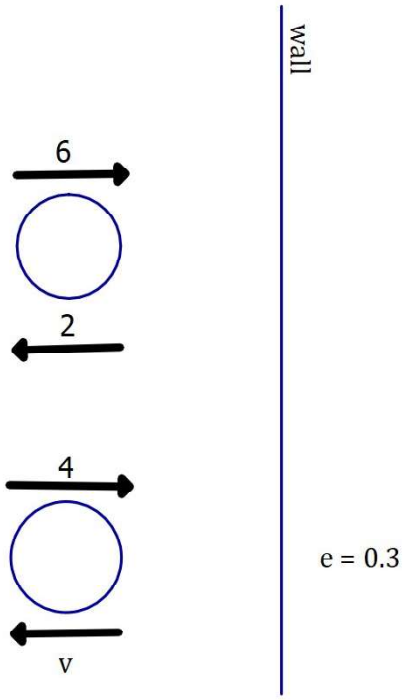
Newton's Law of Restitution

$$0 \le e \le 1$$

$$e = \frac{\text{speed of separation}}{\text{speed of approach}}$$

Inelastic, e = 0
- plasticine
- particles immediately stop on collision and form one particle
- kinetic energy lost in collision

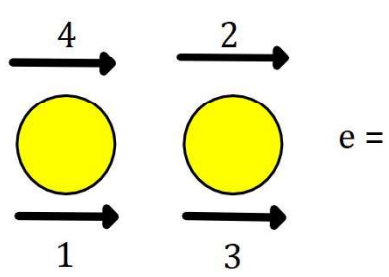
Perfectly elastic, e = 1
- table tennis ball (0.95)
- all kinetic energy is conserved

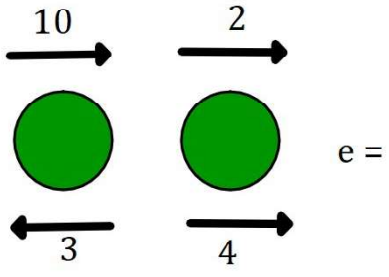


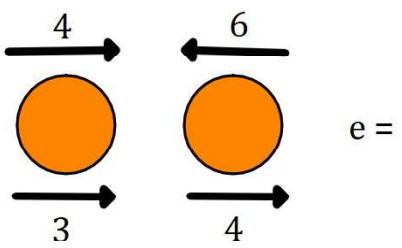
Ex 4B Q1-4

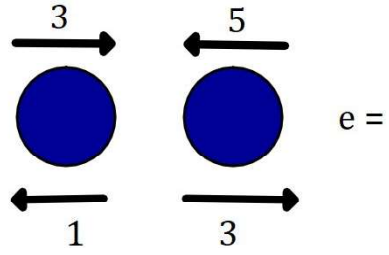
2 balls colliding

Speed of separation and speed of approach









Newton's Law of Restitution

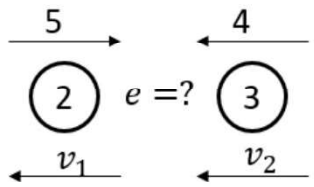
$$e = \frac{\text{speed of separation}}{\text{speed of approach}}$$

Inequalities with collisions

Harder questions often ask for an inequality.
It is sometimes tricky to know where to start.
There are 4 common starting points:

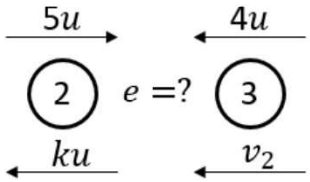
A. 'Direction of a particle is unchanged'
B. $0 \leq e \leq 1$
C. collision logic
D. 'the particles collide again' (considered later)

A.



Given that the direction of the 3kg particle is unchanged find the range of possible values of e.

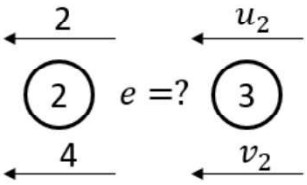
B.



Find the range of possible values of k.

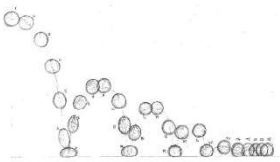
$0 \leq e \leq 1$

C.



Find the maximum value of v_2

A ball falls 22.5cm from rest onto a smooth horizontal plane.
It then rebounds to a height of 10cm.
Find the coefficient of restitution between the ball and the plane.
Give your answer to 2 significant figures.



Ex 4B
Q5-9