

## 4.4 Elastic and Inelastic Collisions

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**Total: 13 marks**

**KEY WORDS** inelastic 非弹性 • elastic collision 弹性碰撞 • inelastic collision 非弹性碰撞  
 • deformation 形变 • perfectly inelastic collision 完全非弹性碰撞

### Objective

Build the skills to answer exam questions on **elastic and inelastic collisions**.

**You must be able to:**

- distinguish an **elastic collision** 弹性碰撞 (kinetic energy conserved) from an **inelastic** 非弹性 one
- state that momentum is conserved in **both** kinds of collision
- identify a **perfectly inelastic** collision (objects stick together)
- reason about where the lost kinetic energy goes

### 1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

#### ■ Momentum always, kinetic energy sometimes

- Elastic:** momentum **and** kinetic energy are both conserved.
- Inelastic:** momentum is conserved, but some kinetic energy is lost (to heat, sound, deformation).

#### ■ Perfectly inelastic

The objects stick together and move as one. This loses the most kinetic energy of any collision that conserves momentum.

#### ■ Checking the type

Compute the total kinetic energy before and after. If it is the same, the collision is elastic; if less, it is inelastic.

### 2 Practice

Now apply the methods above.

**2.1** State what is conserved in **every** collision. [1]

**2.2** State the extra quantity conserved in an elastic collision. [1]

**2.3** In a perfectly inelastic collision, what do the objects do? [1]

**2.4** In an inelastic collision, where does the lost kinetic energy go? [1]

### 3 Exam-style questions

**3.1** In an inelastic collision, which is conserved? [1]

|   |   |
|---|---|
| A | B |
| C | D |

**A** kinetic energy only

**B** momentum only

**C** both momentum and kinetic energy

**D** neither

**3.2** Two balls collide and stick together. This collision is [1]

|   |   |
|---|---|
| A | B |
| C | D |

**A** elastic

**B** perfectly inelastic

**C** frictionless

**D** impossible

**3.3** Before a collision the total KE is 50 J; after, it is 32 J.

(a) State whether the collision is elastic or inelastic. [1]

(b) State how much kinetic energy was lost, and where it went. [2]

**3.4** A 2 kg ball at  $6 \text{ m s}^{-1}$  hits a stationary 2 kg ball and they stick.

(a) Find the speed after (momentum conservation). [2]

(b) Show that kinetic energy is not conserved. [2]