INKMATHS FLASHCARDS

Further Mechanics 1 impulse, energy and collisions

13 cards · fronts and backs

Print double-sided, flipping on the long edge, and each answer lands behind its question. Cut along the card borders.

Definitions in precise wording, the standard results the formulae booklet does not print, a check-yourself question per topic, and the slips that lose marks. The same cards run on the website with spaced-repetition scheduling, at inkphysics.co.uk/maths/flashcards.

STANDARD RESULT

Impulse:

I = ?

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

DEFINITION

Define: Conservation of momentum.

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

RECALL

State how impulse works in two dimensions.

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

STANDARD RESULT

Work and power, θ between force and displacement:

work = ?, P = ?

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

DEFINITION

Define: Work-energy principle.

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

STANDARD RESULT

Hooke's law:

T = ?

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

STANDARD RESULT

Elastic energy:

EPE = ?

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

STANDARD RESULT

Newton's law of restitution:

e = ?, range?

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

DEFINITION

In a collision the internal forces are equal and opposite for the same time, so the impulses cancel and the total momentum before equals the total after. It holds whatever happens to the energy.

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

STANDARD RESULT

mv − mu, equal to Ft for a constant force. A vector, in N s

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

STANDARD RESULT

Fd cos θ, Fv

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

RECALL

The i components and the j components each obey I = mv − mu on their own. Take magnitudes only at the end: a change of direction at constant speed still needs an impulse.

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

STANDARD RESULT

$(\lambda x)/(l)$, x the extension and l the natural length

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

DEFINITION

The total work done by all the forces equals the change in kinetic energy. The normal reaction never contributes, since it acts at right angles to the motion.

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

STANDARD RESULT

(separation speed)/(approach speed), $0 \leq e \leq 1$

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

STANDARD RESULT

$(\lambda x^2)/(2l)$, the triangle under the Hooke line

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

RECALL

State what happens to momentum and kinetic energy in an impact.

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

STANDARD RESULT

Bouncing ball, dropped from height h:

height after one bounce? total distance until it stops?

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

RECALL

State the rule for oblique impact on a smooth surface.

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

SPOT THE ERROR

Say what is wrong with this claim:

A ball that bounces back off a wall at the speed it arrived has received no impulse.

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

CHECK YOURSELF

Why is momentum not conserved when a ball bounces off the floor?

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

STANDARD RESULT

e^2h, $(h(1 + e^2))/(1 - e^2)$

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

RECALL

Momentum is conserved when no outside impulse acts, which covers two spheres meeting but not a bounce off a wall; kinetic energy is lost unless e = 1. Find the loss by adding ½mv² for both spheres before and after and subtracting.

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

SPOT THE ERROR

Momentum is a vector. Reversing it removes the original momentum and supplies the same again the other way, so the impulse is the mass times the sum of the two speeds, not their difference.

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

RECALL

A smooth surface leaves the parallel component untouched and multiplies the perpendicular one by -e. So unless e = 1 the outgoing path hugs the surface more closely than the incoming one, and the angle to the surface shrinks.

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS

CHECK YOURSELF

The floor is attached to the Earth, so the ball alone is not an isolated system and receives an external impulse. Only the law of restitution applies.

FURTHER MECHANICS 1: IMPULSE, ENERGY AND COLLISIONS