



QUESTION WORKBOOK

Direct impact and Newton's law of restitution

Further Mechanics 1 · Year FM

6 questions · 23 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

- A1** State Newton's law of restitution and the range of values the coefficient can take, saying what each end means. [2]

- A2** A sphere of mass 3 kg moving at 6 m/s strikes a stationary sphere of mass 2 kg directly, with $e = 0.5$. Find both velocities afterwards. [3]

SECTION B · Standard

- B1** A sphere of mass 3 kg moving at 6 m/s strikes a stationary sphere of mass 2 kg directly. The coefficient of restitution is 0.5, and after the impact the spheres move at 2.4 m/s and 5.4 m/s in the original direction. Find the kinetic energy lost. [4]

B2 Explain why momentum is conserved in a collision but kinetic energy usually is not. [3]

B3 A sphere of mass 4 kg moving at 5 m/s meets one of mass 6 kg moving at 2 m/s towards it. After the impact the 4 kg sphere moves at 1 m/s in the reverse direction. Find the coefficient of restitution. [4]

SECTION C · Stretch

C1 A smooth sphere A of mass $3m$ moving with speed u strikes directly a smooth sphere B of mass m which is at rest on the same smooth horizontal surface. The coefficient of restitution between the spheres is e . Show that the kinetic energy lost in the impact is $3mu^2(1 - e^2)/8$. [7]