



QUESTION WORKBOOK

Newton's laws with a variable force

Further Mechanics 2 · Year FM

6 questions · 24 marks

PRINT EDITION

SECTION A · Warm-up

- A1** State the two forms of acceleration available, and the rule for choosing between them. [2]

- A2** A particle of mass 3 kg starts from rest at the origin under a force $F = 12 - 3x$ newtons. Find its speed at $x = 2$. [3]

SECTION B · Standard

- B1** A particle of mass 2 kg starts from rest at the origin under a force $F = 6/(x + 1)^2$ newtons. Find its speed at $x = 2$. [4]

- B2** A planet has radius R and surface gravity g . Find the work done per unit mass against gravity in moving from the surface to a distance $3R$ from the centre.

[4]

- B3** Explain why the constant-acceleration equations cannot be used for a variable force, even with an average value of the force.

[3]

SECTION C · Stretch

- C1** Show that the escape speed from a planet of radius R and surface gravity g is $\sqrt{2gR}$, and evaluate it for $R = 6400$ km and $g = 9.8$ m/s². A body is then projected vertically from the surface with half the escape speed. Find, in terms of R , how far above the surface it rises.

[8]