SECTION B

*This section consists of four questions: B1, B2, B3 and B4. Answer **two** questions.*

B1. This question is in **two** parts. **Part 1** is about momentum and energy and **Part 2** is about gravitation.

Part 1 Momentum and energy

(a) Define *impulse of a force* and state the relation between impulse and momentum. *[2]*

definition

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relation

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(b) By applying Newton's laws of motion to the collision of two particles, deduce that momentum is conserved in the collision. *[5]*

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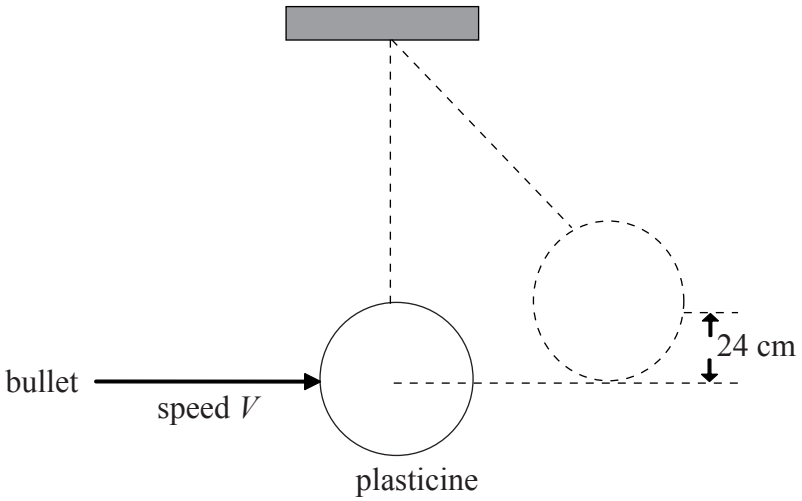
(Question B1 part 1 continued)

(c) In an experiment to measure the speed of a bullet, the bullet is fired into a piece of plasticine suspended from a rigid support by a light thread.



The speed of the bullet on impact with the plasticine is V. As a result of the impact, the bullet embeds itself in the plasticine and the plasticine is displaced vertically through a height of 24 cm. The mass of the bullet is $5.2\times10^{-3}\,\text{kg}$ and the mass of the plasticine is 0.38 kg.

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(Question B1 part 1 continued)

(i) Ignoring the mass of the bullet, calculate the speed of the plasticine immediately after the impact. *[2]*

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(ii) Deduce that the speed V with which the bullet strikes the plasticine is about $160\ \text{m s}^{-1}$. *[2]*

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(iii) Estimate the kinetic energy lost in the impact. *[3]*

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(Question B1 part 1 continued)

(d) Another bullet is fired from a different gun into a large block of wood. The block remains stationary after impact and the bullet melts completely. The temperature rise of the block is negligible. Use the data to estimate the minimum impact speed of the bullet. *[5]*

mass of bullet	$= 5.2 \times 10^{-3}$ kg
specific heat capacity of the material of the bullet	$= 130$ J kg^{-1}K^{-1}
latent heat of fusion of the material of the bullet	$= 870$ J kg^{-1}
melting point of the material of the bullet	$= 330\,^{\circ}$C
initial temperature of bullet	$= 30\,^{\circ}$C

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