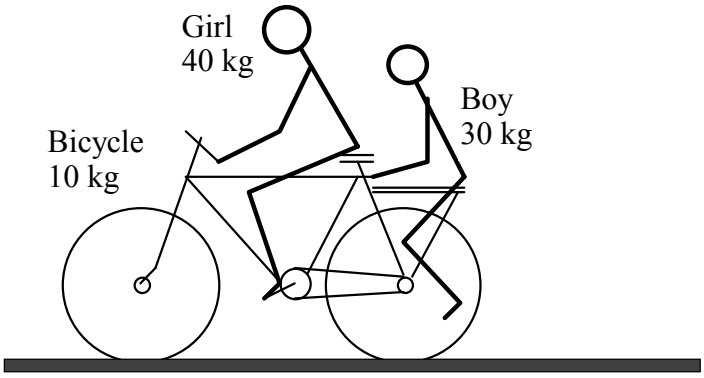
SECTION B

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

B1. This question is in **three** parts. **Part 1** is about children on a bicycle, **Part 2** is about the hydrogen atom and spectrum and **Part 3** is about waves in a ripple tank. Answer **all** the parts in this question.

Part 1. Children and bicycle

A boy of mass 30 kg is being given a lift on the back of a 10 kg bicycle by a girl of mass 40 kg. They are travelling at a steady speed of 2.5 m s^{-1}.



The boy wishes to get off the back of the bicycle while it is still moving.

(a) He knows that if he just puts his feet on the ground and stands up he is likely to fall over. Explain why this is so. *[2]*

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So instead he pushes himself off the back of the bicycle by pushing forward on the bicycle frame with his hands, so that he lands on the ground with zero horizontal velocity.

(b) Calculate the velocity of the bicycle and the girl immediately after the boy has left the bicycle. *[4]*

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(Question B1 Part 1 continued)

(c) Calculate the total kinetic energy of the system (bicycle and both children) before and after the boy gets off. Explain the reason for any difference. *[4]*

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