4. Two trains depart from a station at the same time. The trains travel side by side in the same direction, along parallel tracks.

Train A is travelling at 3.5 $m\,s^{-1}$ relative to the platform and train B is travelling at 4.0 $m\,s^{-1}$ relative to the platform.

(a) Determine the speed of train B relative to train A. **1**

Space for working and answer

(b) Once the trains are moving, a passenger on train A walks towards the rear of the train at a speed of 1.3 $m\,s^{-1}$.

Determine the speed of the passenger on train A relative to a passenger seated on train B. **1**

Space for working and answer

4. (continued)

(c) Two physics students on train A are discussing the possibility of travelling at relativistic speeds. The students consider the train travelling at a speed of $0.9c$ relative to a stationary observer.

(i) The train emits a beam of light towards the stationary observer.

State the speed of the emitted light as measured by the stationary observer.

Justify your answer. **2**

(ii) Train A has a length of 142 m, as measured in the frame of reference of the students on the train.

Calculate the length of train A when travelling at $0.9c$ as measured by the stationary observer. **3**

Space for working and answer

[Turn over