2 **(a)** Fig. 2.1 shows the head-on collision of two blocks on a frictionless surface.

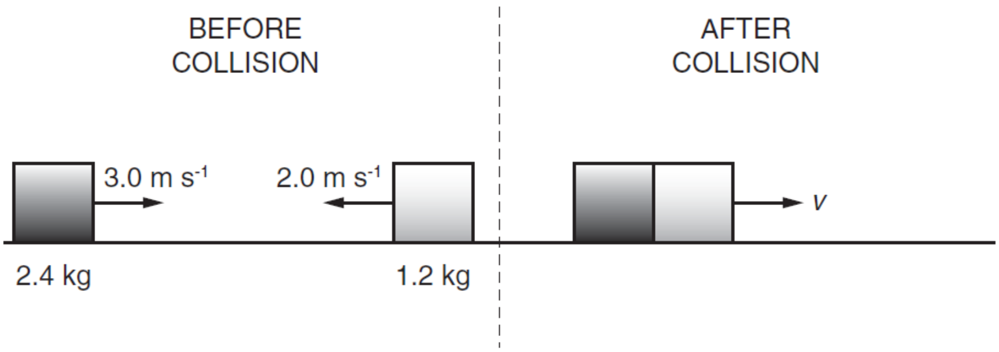

Fig. 2.1

Before the collision, the 2.4 kg block is moving to the right with a speed of 3.0 m s^{-1} and the 1.2 kg block is moving to the left at a speed of 2.0 m s^{-1}. During the collision, the blocks stick together. Immediately after the collision the blocks have a common speed *v*.

(i) State the *principle of conservation of momentum.*

....

.... [1]

(ii) Calculate the speed *v*.

v = ... m s^{-1} [2]

(iii) Use your answer in **(a)(ii)** to show that the collision is inelastic.

[2]

(b) Fig. 2.2 shows a helicopter viewed from above.

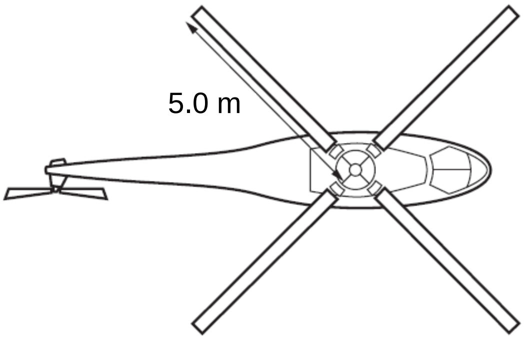

Fig. 2.2

The blades of the helicopter rotate in a circle of radius 5.0 m. When the helicopter is hovering, the blades propel air vertically downwards with a constant speed of 12 m s^{-1}.

Assume that the descending air occupies a uniform cylinder of radius 5.0 m.
The density of air is 1.3 kg m^{-3}.

(i) Explain, in terms of Newton's laws of motion, the forces on the helicopter as it is hovering.

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(ii) Show that the mass of air propelled downwards is 6100 kg in a time of 5.0 seconds.

[1]

(iii) Hence or otherwise, determine the force provided by the rotating helicopter blades to propel this air downwards,

force = ……………………………... N [2]

[Total: 11]