2 **(a)** A helicopter with rotor blades of radius 5.5 m is hovering above the ground at a particular instant. Its blades are rotating such that they are pushing air downwards at a constant speed of 18 m s^{-1}. The density of the surrounding air can be taken as 1.02 kg m^{-3}.

(i) Using Newton's law of motions, explain how the rotor blades of the helicopter generate an upward thrust to keep the helicopter hovering.

……

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…… [2]

(ii) Determine the volume of air pushed down by the blades in one second.

volume = ... m^3 [2]

(iii) Hence, calculate the upward force acting on the blades.

force = ... N [2]

(b) The helicopter releases a supply package of mass 50 kg using a mechanical ejector system. The ejector launches the package vertically downward with a relative speed of 4.0 m s^{-1} over a time interval of 0.20 s. Assume the helicopter is stationary at the moment of release.

(i) Define *impulse* and use it to explain why the package needs to be acted on by a resultant force during ejection.

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……

……

…… [2]

(ii) Calculate the average force acting on the package.

force = ... N [2]