Section A

Answer **all** the questions in this Section in the spaces provided.

1   An object is dropped from a hot-air balloon. The variation with time t of the vertical velocity v of the object for the first 8.0 s of its descent is shown in Fig. 1.1.
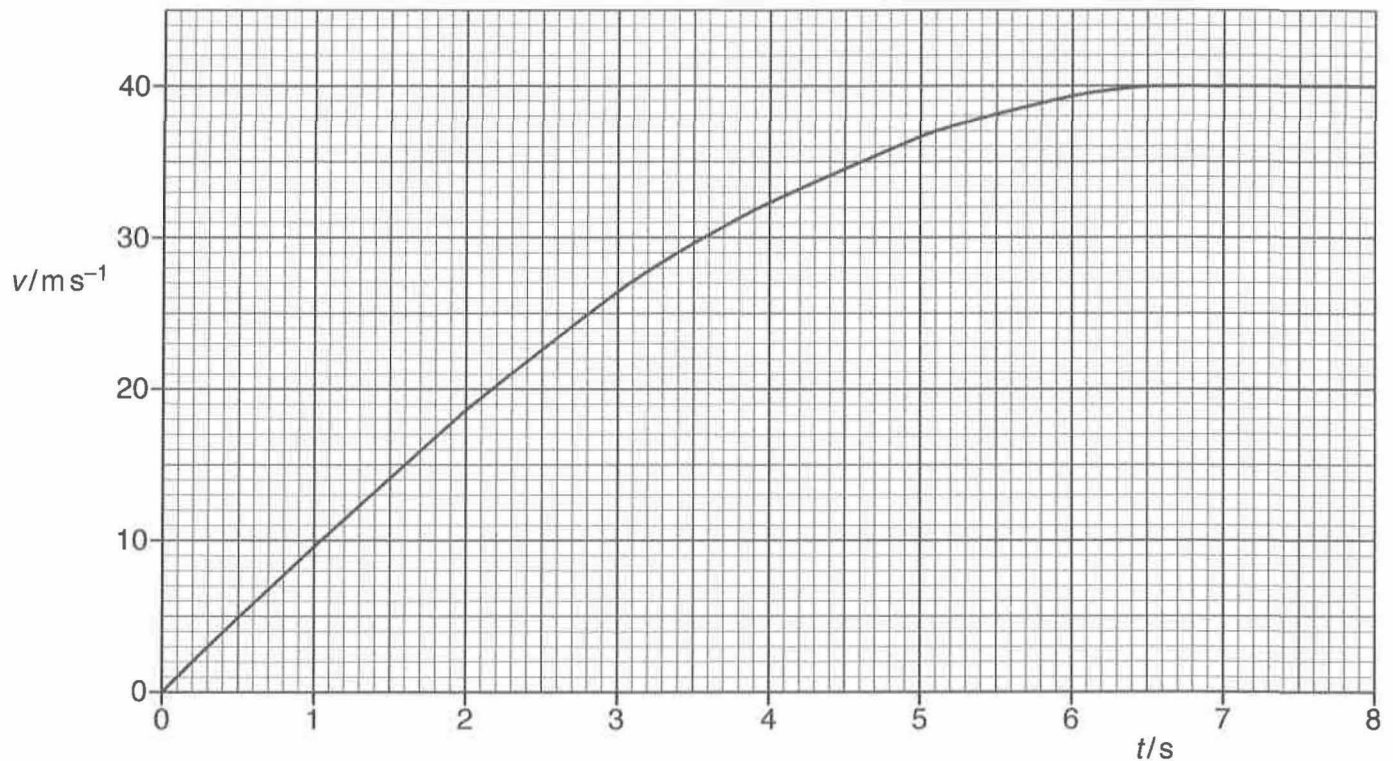

Fig. 1.1

(a) Explain why the object reaches a constant velocity.

....

....

....

.... [3]

(b) A student suggests that the resistive force F acting on the object of mass m is proportional to its velocity. That is

$$F = kv$$

where k is a constant.

At speed v, the acceleration of the object is a.

(i) Show that, based on the suggestion of the student, and without using data from the graph in Fig. 1.1,

$$(g - a) = \frac{kv}{m}$$

where g is the acceleration of free fall.

[2]

(ii) Use information from Fig. 1.1 or otherwise to complete Fig. 1.2.

velocity v/m s^{-1}	acceleration a/m s^{-2}	$(g - a)$/m s^{-2}
0	....	....
20	8.2	1.6
30	....	....
40	....	....

Fig. 1.2

[4]

(iii) Use the completed Fig. 1.2 to deduce whether the student's suggestion for velocities of 20 m s^{-1} and 30 m s^{-1} is correct.

[2]