2 A high-altitude balloon is stationary in still air. A solid sphere is suspended from the balloon by a string, as shown in Fig. 2.1.

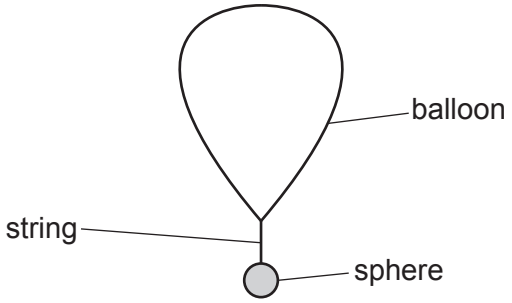

Fig. 2.1 (not to scale)

The volume of the balloon is 7.5 m^3. The total weight of the balloon, string and sphere is 65 N. The upthrust acting on the string and sphere is negligible.

(a) Calculate the density of the air surrounding the balloon.

density = ... $kg\,m^{-3}$ [2]

(b) The string breaks, releasing the sphere.

(i) State the magnitude of the acceleration of the sphere immediately after the string breaks.

acceleration = ... $m\,s^{-2}$ [1]

(ii) State and explain the variation, if any, in the magnitude of the acceleration of the sphere when it is moving downwards **before** it reaches terminal (constant) velocity.

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..... [3]

(c) The sphere has a mass of 4.0 kg.

Calculate the total resistive force acting on the sphere at the instant when its acceleration is $1.9\,m\,s^{-2}$.

resistive force = ... N [2]

[Total: 8]