2 **(a)** **(i)** Define pressure.

....

.... [1]

(ii) Explain how hydrostatic pressure results in an upthrust force acting on a solid object immersed in a liquid.

....

....

....

.... [2]

(b) A small steel ball of radius r and mass m falls vertically at terminal speed v through oil.

The viscous drag force D that acts on the ball is given by

$$D = 6\pi\eta rv$$

where η is a property of the oil called its viscosity.

(i) On Fig. 2.1, draw labelled arrows from the ball to show the directions of the **three** forces that act on the ball as it falls.

Fig. 2.1

[3]

(ii) Determine the SI base units of η.

base units .... [2]

(c) The oil in **(b)** has a density of $920\,kg\,m^{-3}$ and a viscosity of 4.7 in SI units.

The steel ball has a mass of $2.4 \times 10^{-3}\,kg$ and a radius of $4.2 \times 10^{-3}\,m$.

(i) Show that the upthrust force acting on the ball is $2.8 \times 10^{-3}\,N$.

[1]

(ii) Determine the terminal speed v of the ball.

v = ... $m\,s^{-1}$ [3]

[Total: 12]