3 **(a)** A metal ball is released in a liquid. With the aid of a free body diagram, explain how the metal ball falling through the liquid can reach terminal velocity.

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………… [3]

(b) Fig. 3.1 shows a ladder resting against a smooth vertical wall at point A and on a rough ground at point B. Three forces, *P*, *Q* and *W* are acting on the uniform ladder which is 6.0 m long and has a weight of 150 N.
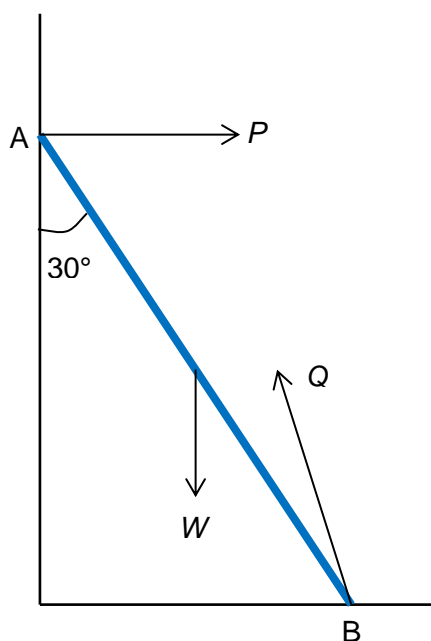

Fig. 3.1 (not to scale)

(i) Show that the magnitude of force *P* is 43 N.

[1]

(ii) Explain why the ground must exert a force on the ladder at B to keep the ladder in equilibrium.

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

…………………………………………………………………………………….. [2]

(iii) Calculate the magnitude of force *Q*.

force Q = ………………….. N [1]

[Turn over

(iv) Assuming that there is now friction between the ladder and the vertical wall, draw possible directions of the forces acting on points X and Y in Fig. 3.2.
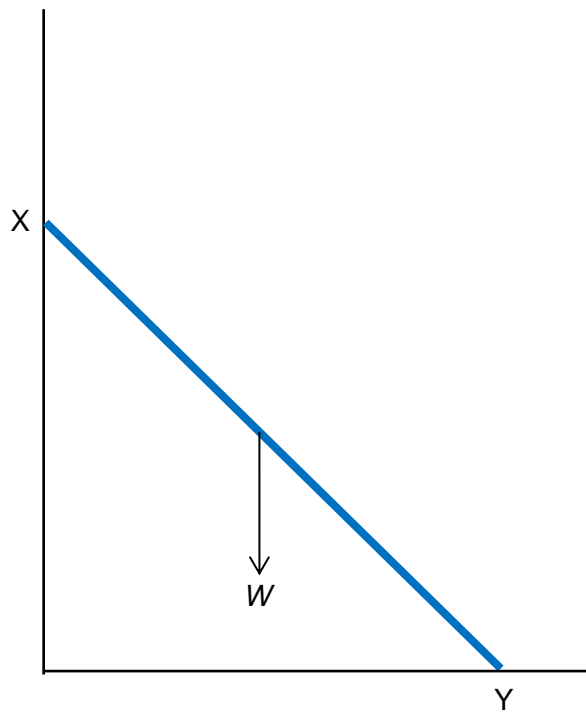

Fig. 3.2

[1]

[Total: 8]