Section A

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

1 Fig. 1.1 shows a man standing on a stationary sailboard floating in the sea. The sailboard consists of a surfing board, mast and sail.

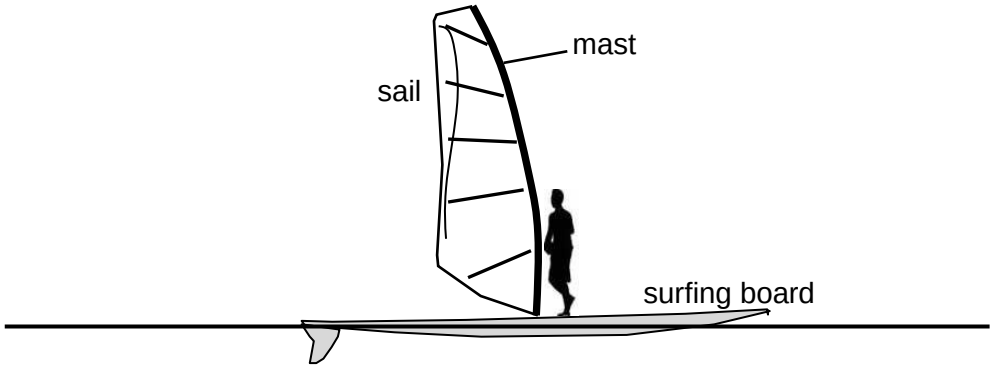

Fig. 1.1

(a) The total mass of the sailboard and the man is 90 kg. Taking the density of seawater to be 1020 kg m^{-3}, calculate the volume of seawater displaced by the sailboard.

volume of seawater displaced = ... m^3 [2]

(b) The sailboard then cruises at constant speed. Fig. 1.2 shows some of the forces acting on the mast and sail of the sailboard.

The uniform mast has length 4.3 m and the base of the mast is connected to the surfing board by a smooth hinge. The wind exerts a force of 200 N on the sail, perpendicular to the mast at a distance 3.5 m away from the hinge.

The man pulls the sail with a force *T* at distance 1.5 m away from the hinge and the weight of the mast and sail is 50 N.

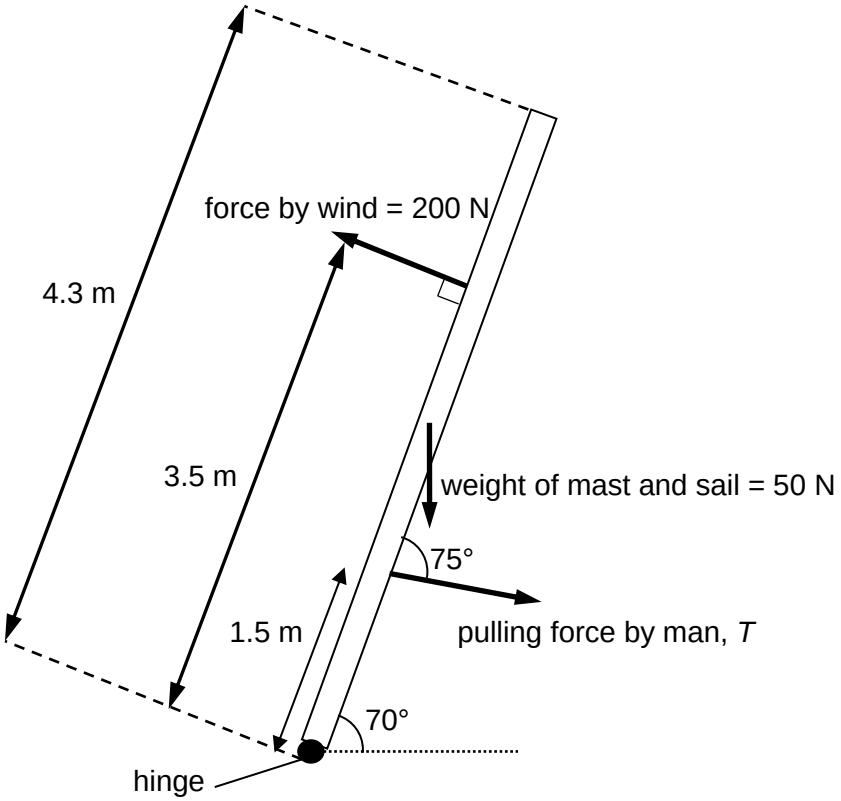

Fig. 1.2

(i) Show that pulling force *T* by the man is 460 N.

[2]

(ii) Determine the magnitude of the force, *R*, exerted by the hinge.

magnitude of *R* = ... N [3]

(c) The surfing board is designed with the foot straps at the rear part of the board rather than at the centre part of the board, as shown in Fig. 1.3.

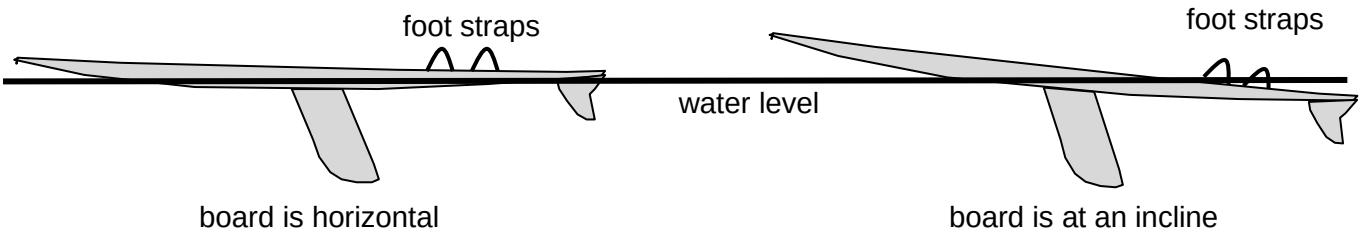

Fig. 1.3

Such a design allows the surfing board to move across the water surface while inclined at an angle to the surface.

Suggest why when the man is moving horizontally with the board at an incline, the volume of seawater displaced by the sailboard is lower than your answer in **(a).**

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.....[1]

[Total: 8]