

Name of the Student: \_\_\_\_\_

Max. Marks : 11 Marks

Time : 11 Minutes

Q1.

Carbon monoxide gas is produced in a pond by the decay of organic matter.

A bubble of carbon monoxide rises at a steady speed through the still water of the pond. The weight of the bubble is negligible.

The free-body force diagram below shows the forces acting on the bubble.



diameter of bubble = 1.5 mm

(i) Show that the upthrust acting on the bubble is about  $1.7 \times 10^{-5}$  N.

density of water =  $997 \text{ kg m}^{-3}$

(3)

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(ii) Calculate the steady speed at which the bubble rises.

viscosity of water =  $0.0011 \text{ Pa s}$

(2)

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Speed = .....

**(Total for question = 5 marks)**

**Q2.**

(a) State what is meant by centre of gravity.

(1)

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(b) The picture shows a snooker cue. It is made from wood of uniform density and takes the form of a rod with decreasing diameter towards one end.



(i) On the picture, mark the position of the centre of gravity of the snooker cue.

(1)

(ii) State a simple method to test if this is the correct position.

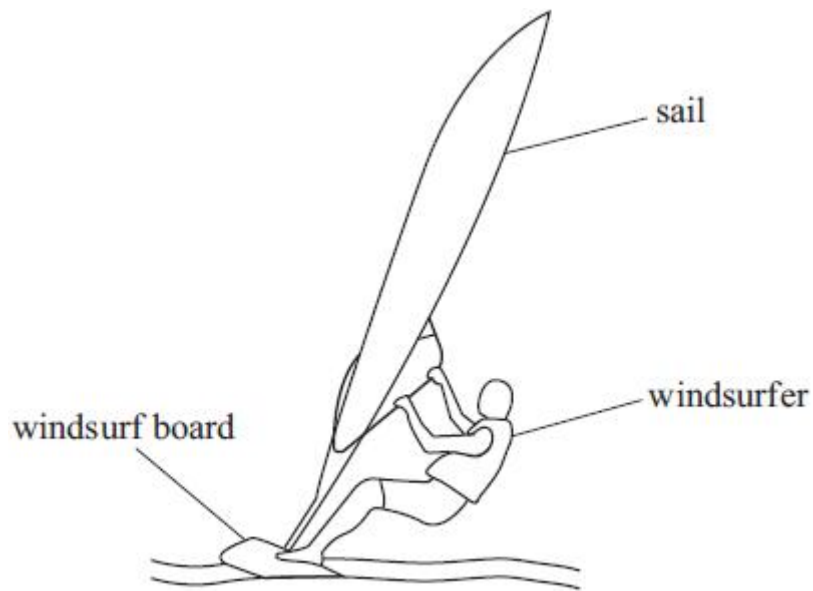
(1)

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**(Total for Question = 3 marks)**

**Q3.**

A windsurfer stands on a windsurf board and holds onto the sail, as shown.



As the force from the wind increases, the windsurfer leans back further.

Explain how leaning back further keeps the windsurfer in equilibrium. Your explanation should make reference to moments.

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**(Total for question = 3 marks)**