17 A small sphere is moving horizontally through a viscous liquid.

(a) Stokes' law can be used to calculate the drag force on an object.

State the conditions that must apply for Stokes' law to be valid.

(2)

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(b) There is a constant force of $2.3 \times 10^{-5}\,\text{N}$ acting horizontally on the sphere.

diameter of sphere $= 4.5 \times 10^{-3}\,\text{m}$
viscosity of liquid $= 7.1 \times 10^{-2}\,\text{Pa s}$

(i) At one instant, the speed of the sphere is $5.2 \times 10^{-3}\,\text{m s}^{-1}$.

Calculate the resultant horizontal force on the sphere.

(3)

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Resultant horizontal force = ...

(ii) Calculate the maximum speed of the sphere in the horizontal direction.

(2)

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Maximum horizontal speed = ...

(c) A larger diameter sphere in the same liquid is acted upon by the same constant force as in (b). The liquid is at a lower temperature.

Explain the effect these changes have on the maximum speed of this sphere.

(4)

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(Total for Question 17 = 11 marks)