For Examiner's Use

1 The Brownian motion of smoke particles in air may be observed using the apparatus shown in Fig. 2.1.

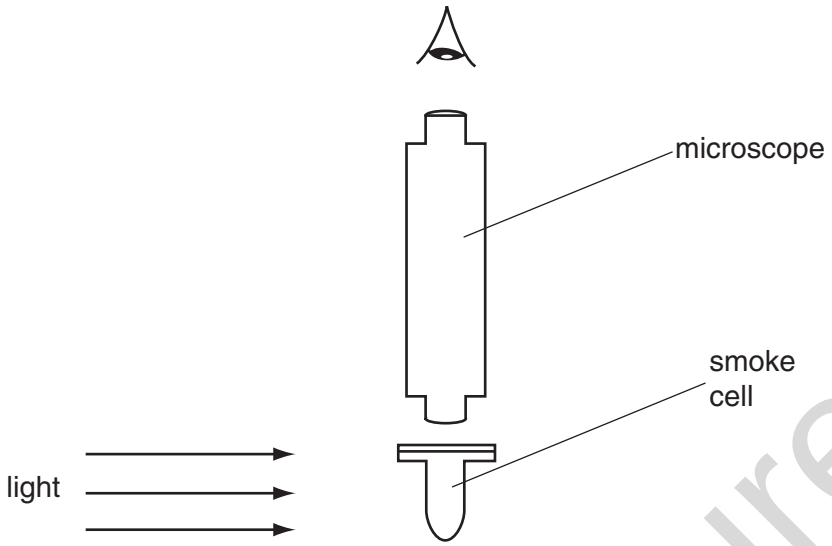

Fig. 2.1

(a) Describe what is seen when viewing a smoke particle through the microscope.

.....

.....

.....[2]

(b) Suggest and explain what difference, if any, would be observed in the movement of smoke particles when larger smoke particles than those observed in **(a)** are viewed through the microscope.

.....

.....

.....[2]

2 **(a)** Define *density*.

.....

.....

..... [1]

(b) A U-tube contains some mercury. Water is poured into one arm of the U-tube and oil is poured into the other arm, as shown in Fig. 4.1.

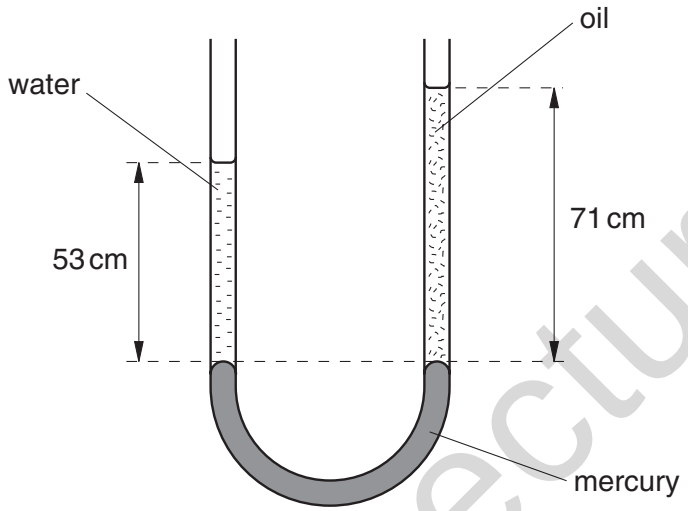

Fig. 4.1

The amounts of oil and water are adjusted until the surface of the mercury in the two arms is at the same horizontal level.

(i) State how it is known that the pressure at the base of the column of water is the same as the pressure at the base of the column of oil.

.....

..... [1]

(ii) The column of water, density $1.0 \times 10^3\,\text{kg m}^{-3}$, is 53 cm high. The column of oil is 71 cm high.

Calculate the density of the oil. Explain your working.

density = ... kg m^{-3} [3]

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3 **(a)** Define *density*.

.....[1]

(b) Liquid of density ρ fills a container to a depth h, as illustrated in Fig. 3.1.

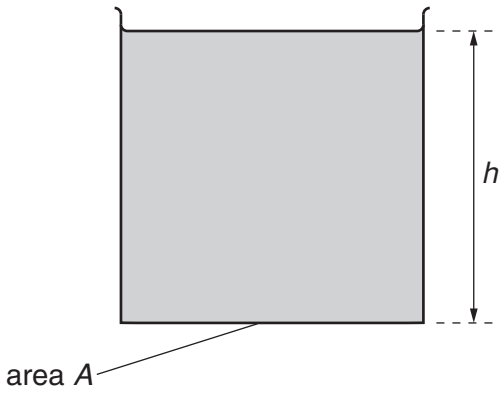

Fig. 3.1

The container has vertical sides and a base of area A.

(i) State, in terms of A, h and ρ, the mass of liquid in the container.

.....[1]

(ii) Hence derive an expression for the pressure p exerted by the liquid on the base of the container. Explain your working.

[2]

(c) The density of liquid water is $1.0\,g\,cm^{-3}$. The density of water vapour at atmospheric pressure is approximately $\frac{1}{1600}\,g\,cm^{-3}$.

Determine the ratio

(i) $\frac{\text{volume of water vapour}}{\text{volume of equal mass of liquid water}}$,

ratio = ...[1]

(ii) $\frac{\text{mean separation of molecules in water vapour}}{\text{mean separation of molecules in liquid water}}$.

ratio = ...[2]

(d) State the evidence for

(i) the molecules in solids and liquids having approximately the same separation,

.....

.....[1]

(ii) strong rigid forces between molecules in solids.

strong: .....

rigid: .....[2]

For Examiner's Use

4 Some smoke particles are viewed through a microscope, as illustrated in Fig. 5.1.

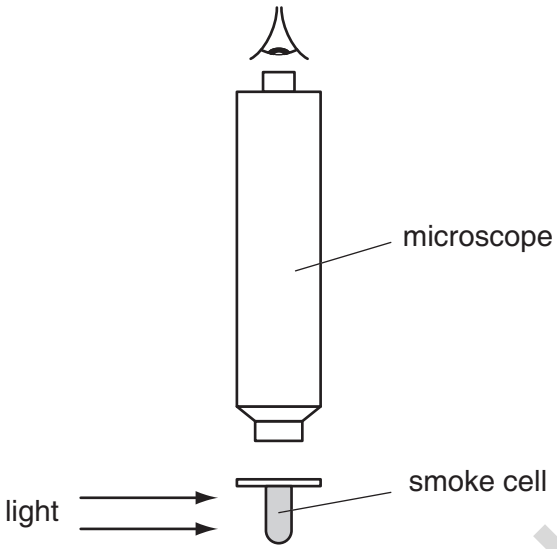

Fig. 5.1

Brownian motion is observed.

(a) Explain what is meant by *Brownian motion.*

.....

.....

..... [2]

(b) Suggest and explain why Brownian motion provides evidence for the movement of molecules as assumed in the kinetic theory of gases.

.....

.....

.....

..... [2]

(c) Smoke from a poorly maintained engine contains large particles of soot.
Suggest why the Brownian motion of such large particles is undetectable.

.....

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..... [2]