6 Charles' law states that for a fixed amount of ideal gas, the volume is directly proportional to the thermodynamic temperature if the pressure is kept constant.

A student is investigating the validity of Charles' law. The student uses a syringe that has a volume of 100 cm^3 as shown in Fig. 6.1.

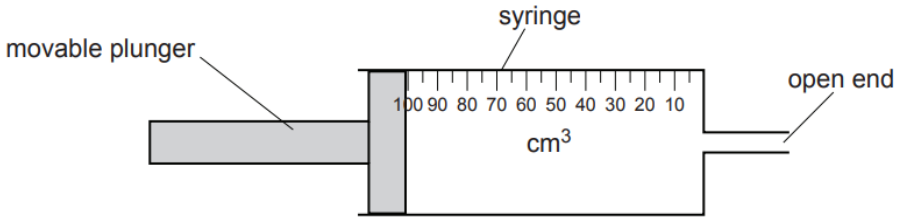

Fig. 6.1

The student moves the plunger of the syringe so that the volume of the air in the syringe is approximately 50 cm^3. The student then seals the open end of the syringe and clamps the syringe so that it is immersed in a large beaker of water, as shown in Fig. 6.2. The plunger is air-tight but free to move up and down.

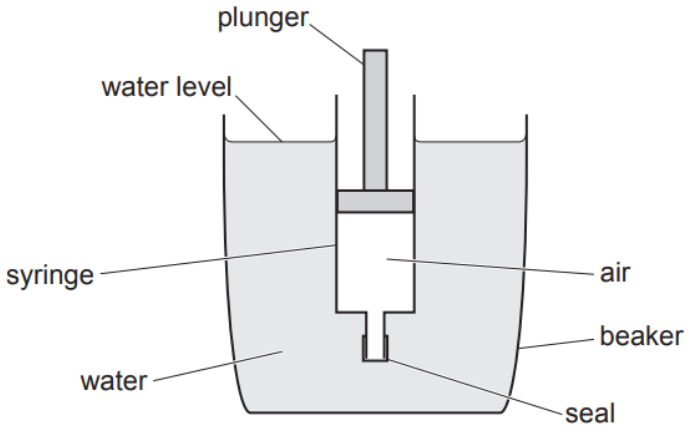

Fig. 6.2

The water in the beaker is heated, and the volume of air in the syringe is recorded at different temperatures of the water.

(a) The student recorded that at a temperature of 41 °C the volume of the air in the syringe was 52.1 cm^3.

Calculate the expected volume of the air in the syringe when the temperature is 58 °C.

expected volume = …… cm^3 [2]

(b) The student recorded that at a temperature of 58 °C the volume of the air in the syringe was 54.3 cm^3.

Suggest a reason the calculated value in **(a)** is not the same as the experimental value.

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…… [1]

(c) The experimental set-up ensures that the physical quantities, pressure and the amount of gas, remains constant.

Describe how the set-up of the experiment ensures these physical quantities remain constant.

Pressure: ……

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Amount of gas: ……

…… [2]

(d) Use the kinetic theory to explain the variation of V with T while pressure remains constant.

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…… [3]

[Total: 8]