2 Fig. 2.1 shows a laboratory thermometer that is calibrated to measure temperature in degrees Celsius.
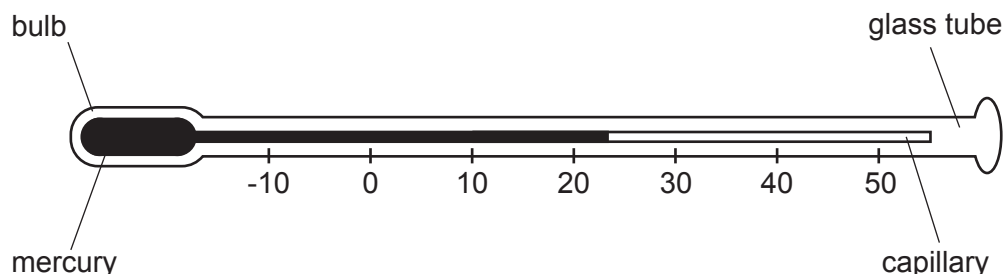

Fig. 2.1

The thermometer makes use of the fact that the density of mercury varies with temperature.

(a) State **two** other physical properties of materials, apart from the density of a liquid, that can be used for measuring temperature.

1 ....

2 ....
[2]

(b) The thermometer is initially at 23.0 °C, as shown in Fig. 2.1. It is used to measure the temperature of an insulated beaker of water that is at 37.4 °C. The bulb of the thermometer is inserted into the water, and the water is stirred until the reading on the thermometer becomes steady.

The mass of water in the beaker is 18.7 g.
The mass of mercury in the thermometer is 6.94 g.
The specific heat capacity of water is 4.18 J g^{-1} K^{-1}.
The specific heat capacity of mercury is 0.140 J g^{-1} K^{-1}.
The glass of the thermometer and the beaker containing the water can be considered to have negligible heat capacity.

(i) Calculate, to three significant figures, the final steady temperature indicated by the thermometer in the water.

temperature = ... °C [4]

(ii) Suggest **one** change that could be made to the design of the thermometer that would enable it to give a more accurate measurement of temperature.

....

.... [1]

(c) (i) Explain why the thermometer in Fig. 2.1 does **not** provide a direct measurement of thermodynamic temperature.

....

....

.... [2]

(ii) Thermodynamic temperature T may be determined by the behaviour of a type of substance for which T is proportional to the product of pressure and volume.

State the name of this type of substance.

.... [1]

[Total: 10]