

2010 A/L Structured Essay Question No (02)

2. The variation of saturated vapour pressure of water with temperature can be investigated using a narrow glass tube with one end closed, and having a column of air trapped between the closed end and a thread of water.

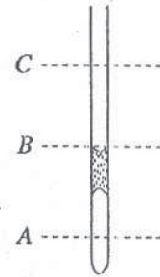


Figure 1

(a) In this experiment, the tube is mounted in a beaker of water. Figure 1 shows three possible positions A, B and C for the water level of the beaker.

(i) Which one of these should be the correct position at the beginning of the experiment?

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(ii) Give the reason for your choice.

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(b) An incomplete diagram of the experimental setup is shown in figure 2. Complete the diagram and label the items inside the beaker.

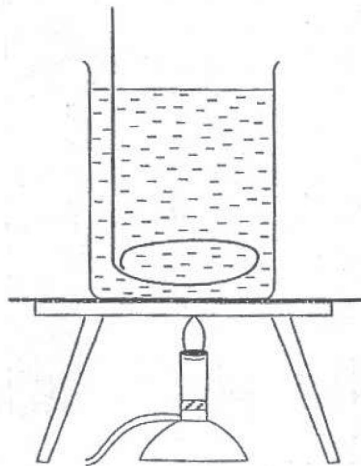


Figure 2

(c) Write down the measurements that you would take after properly setting up the apparatus.

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(d) A student carried out this experiment with an air column of length 3 cm at 27 °C temperature and 100 kPa atmospheric pressure. Saturated vapour pressure of water at 27 °C is 5 kPa.

(i) Using the above data, obtain an equation relating the length of the air column l (cm) and the saturated vapour pressure of water p (kPa) at temperature θ (°C). (Assume that the pressure due to the water thread is negligible.)

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(ii) Assuming that the water thread was 1 cm long, calculate the pressure exerted by the water thread and show that its effect on the results of the experiment is negligible.

(Density of water = 10^3 kg m^{-3})

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(e) Another student did this experiment with the same apparatus, but used a small volume of mercury and a small water thread to trap air as shown in figure 3.

When this student plotted the measured length l of the air column with temperature θ , he obtained a curve with the shape shown in figure 4.

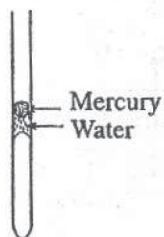


Figure 3

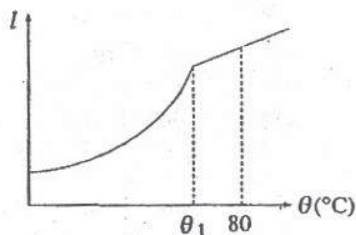


Figure 4

What could be the reason for the change in shape of the graph at θ_1 ?

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