

To Note the Change in Level of Liquid in a Container on Heating and Interpret the Observations

Aim

To note the change in level of liquid in a container on heating and interpret the observations.

Apparatus

A round bottom glass flask with volume graduations in the neck, liquid (having boiling point above 100°C), water bath, heating arrangement, thermometer with hanging arrangement.

Theory

1. Real cubical expansion of a liquid = Apparent cubical expansion of the liquid + Cubical expansion of the vessel.
2. $V_r = V_a + V_g$

Diagram

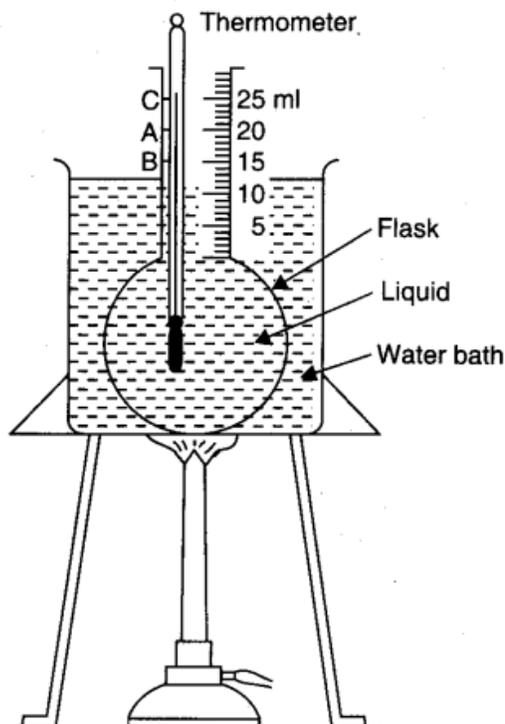


Fig. Real and apparent cubical expansion of a liquid.

Procedure

1. Clean and dry the round bottom glass flask.
2. Fill it with the experimental liquid up to a known mark A to have a known volume of liquid.
3. Put the flask in water bath kept on a tripod stand, under which some heating arrangement (gas burner) is fitted.
4. Suspend a thermometer in the liquid with its bulb in the middle of the flask.
5. Note and record least count of the thermometer.
6. Note initial temperature ($t_1^\circ\text{C}$) of the liquid.
7. Start heating the liquid and keep your eye on the mark A. You will find that liquid level falls down.
8. When water in water-bath starts boiling, temperature of liquid in flask becomes steady and liquid level falls to mark B.
9. Note the liquid temperature ($t_2^\circ\text{C}$) and position of mark B. (Volume between marks A and B gives cubical expansion of the glass flask.)
10. Continue heating the liquid through water bath. Liquid level rises, because now liquid starts expanding. The level reaches A and continues moving up. The level becomes steady at mark C.
11. Note the position of mark C. (Volume between B and C gives real cubical expansion of the liquid.)
12. Record your observations as given below.

Observations

Least count of thermometer = $^\circ\text{C}$

Initial (room) temperature of liquid (t_1) = $^\circ\text{C}$

Final (bath) temperature of liquid (t_2) = $^\circ\text{C}$.

Table for position of marks

Serial No. of Obs.	Position of mark			Cubical expansion of vessel V_{AB} (ml)	Real cubical expansion of liquid (V_{BC}) (ml)	Apparent cubical expansion of liquid (V_{AC}) (ml)
	A (ml)	B (ml)	C (ml)			

Calculations

Difference of positions of marks A and B gives cubical expansion (VAB) of the vessel. Find difference of positions of marks B and C. This gives real cubical expansion (VBC) of the liquid.

Find difference of positions of marks A and C. This gives apparent cubical expansion (VAC) of the liquid.

Result

Real cubical expansion of the liquid is more than the apparent cubical expansion. The difference will be less if the vessel is made of a material having very small coefficient of cubical expansion.

Interpretation

The liquid level falls due to initial thermal expansion of the container.

Precautions

1. Boiling point of liquid should be higher than that of bath liquid (water).
2. Liquid heating should be uniform through a bath.
3. Observations should be taken when temperature becomes steady.

Sources of error

1. Heating of liquid may not be uniform.
2. Temperature may not be steady.