To demonstrate root respiration.

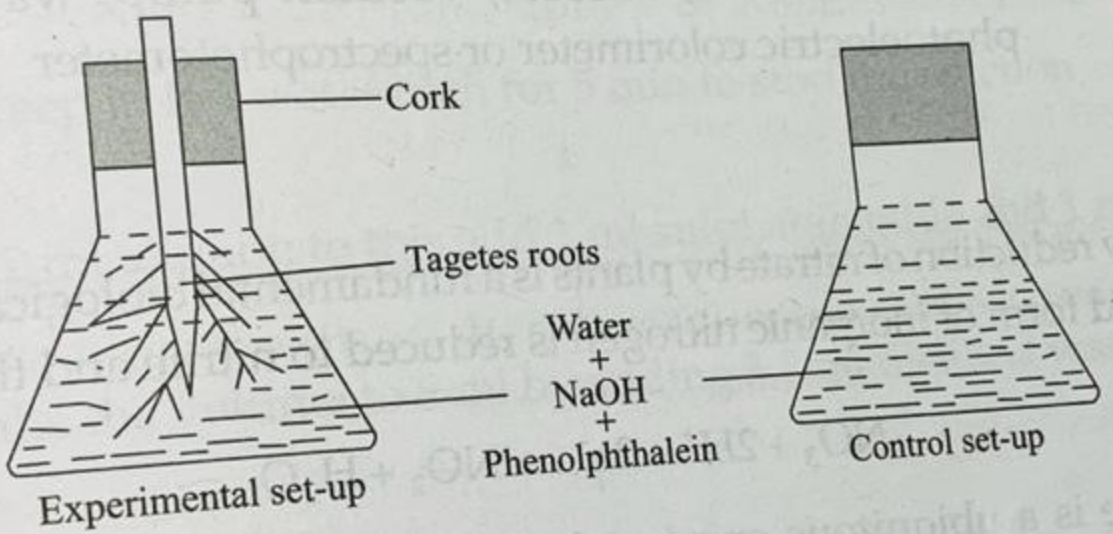
Place a small rooted plant (e.g., *Tagetes*) with the intact root in a bottle or flask containing water made slightly alkaline with dilute NaOH solution and coloured red with phenolphthalein. Prepare a second flask to serve as control, stopper tightly and leave without a plant. Allow both flasks to stand in diffuse light and examine the solution after some time.

Observe that the control flask does not show change in the colour while the one with the roots becomes colourless. The respiring roots release CO_2, which reacts with water to form carbonic acid (H_2CO_3).

$$CO_2 + H_2O \rightarrow H_2CO_3$$

Carbonic acid neutralizes NaOH present in the flask and the alkalinity of the solution starts decreasing, thus fading the red colour (phenolphthalein is colourless in the neutral medium).

$$H_2CO_3 + 2NaOH \rightarrow Na_2CO_3 + 2H_2O$$



Questions

1. Explain the physiological mechanism involved in this set-up, giving an equation.
2. What would happen if the solution in the flask contains a buffer solution of pH 7.8?
3. What will happen if a drop of HCl is added to the experimental flask?
4. What results do you expect, if the roots in the experimental flask are pre-boiled?
5. Will there be any change if the set-up is shifted to darkness?
6. In which way is root respiration helpful in the nutrient uptake from the soil? Explain.

7. What makes the colour pink in the flask?
8. How does this process differ from photosynthesis?
9. What are the three major steps of aerobic respiration?
10. How do the environmental factors affect this process?
11. Name two other plant materials which can be used in this set up.