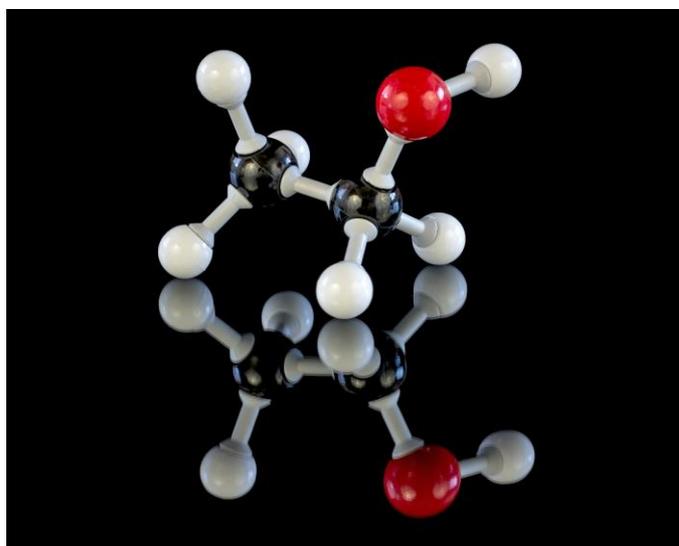




Driving Questions:

How does the molecular mass of an evaporating alcohol affect the rate of evaporation?



Thinking about the question

In this activity you will measure temperature changes during evaporation of different alcohols and investigate how the molecular mass of the alcohol affects the rate of evaporation. In your investigations you will use primary alcohols, which have a general formula of $C_nH_{2n+1}OH$. These are methanol CH_3OH , ethanol C_2H_5OH , 1-propanol C_3H_7OH , 1-butanol C_4H_9OH etc.

Materials

In your investigations you will use:

- Data-logger e.g. CMA VinciLab,
- 1 to 3 temperature sensors,
- Tissue paper or cotton wool,
- Pipette,
- Test tubes (3x) and test tube rack
- Alcohols: Methanol CH_3OH , ethanol C_2H_5OH , 1-propanol C_3H_7OH and 1-butanol C_4H_9OH .

Safety

Warning: The compounds used in this experiment are flammable and poisonous. Avoid inhaling their vapors. Avoid contacting them with your skin or clothing.

Investigations

1. To compare results use 3 temperature sensors simultaneously. Connect the temperature sensors to input 1, 2 and 3 of your data-logger.

Tip: If you have only 1 temperature sensor then perform 3 separate measurements for each type of alcohol. Use the *Copy column* option in Coach to keep the measurement data in the same diagram

2. Open the Coach Activity 'Evaporation of alcohols'.
3. Wrap a cotton wool around the end of each of the temperature sensors. If needed secure the wool with small rubber bands.
4. Place three test tubes in a test tube rack. Pour methanol, about 3 cm deep, into a first test tube. Pour approximately the same volume of ethanol to a second test tube and 1-propanol into a third test tube. Stand the sensor 1 in the methanol test tube, the sensor 2 in the ethanol test tube and the sensor 3 in the 1-propanol test tube.
5. After the temperature sensors have been in the tubes for at least 45 s start your measurement.
6. Monitor the temperature for a few second to establish the initial temperature of each liquid.
7. Simultaneously remove the temperature sensors from the test tubes and tape them to the table so that the wrapped ends extend 5 cm over the edge of the bench top.
8. Determine the temperature change ΔT during evaporation for each type of alcohol.
9. Which of the alcohols evaporates the fastest? Which the slowest?
10. Which of the alcohols has the strongest intermolecular forces of attraction? Which the weakest intermolecular forces? Explain using the results of this experiment.
11. Knowing the temperature changes ΔT for these three alcohols predict the temperature change for 1-butanol C_4H_9OH .
12. If possible test your prediction by measurement.
13. What do you think causes the difference in evaporation speed between the different alcohols?



Resources:

Coach Activity: Evaporation of alcohols.cma7

Coach Result: Evaporation of alcohols.cmr7