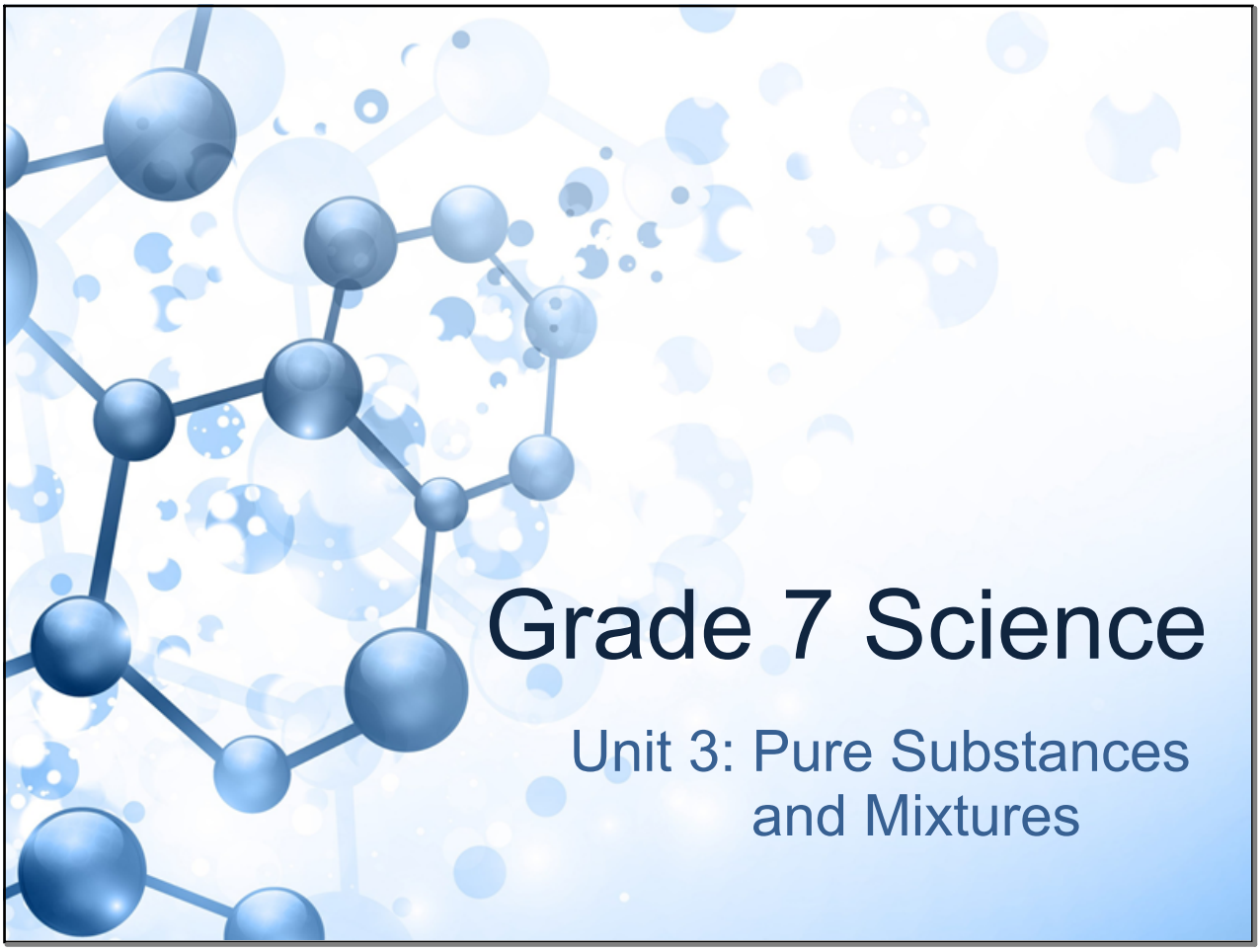

Grade 7 Science

Unit 3: Pure Substances and Mixtures

Determining Concentration

1. "Crystal Light on the Go Packets" are 54 grams. They are to be added to a standard 500 ml bottle of water. What is the concentration of Crystal Light in the water (3 marks)?

$m_{solute} = 54\ g$

$V_{solvent} = 500\ \text{mL}$

$C = ?$

$C = \frac{m_{solute}}{V_{solvent}}$

$C = \frac{54\ g}{500\ mL}$

$C = 0.108\ \frac{g}{mL}$

∴ The concentration of Crystal Light in the water is $0.108\ \frac{g}{mL}$.

2. Rachel and Caitlyn are having chocolate milk. Rachel has 400 ml of milk and adds 60 ml of chocolate sauce. Caitlyn has 250 ml and adds 40 ml of chocolate sauce. Whose chocolate milk is stronger (6 marks)?

Rachel

$V_{solute} = 60\ mL$

$V_{solvent} = 400\ mL$

$C_R = ?$

$C = \frac{V_{solute}}{V_{solvent}}$

$C_R = \frac{60\ mL}{400\ mL}$

$C_R = 0.15\ \frac{mL}{mL}$

∴ The concentration of Rachel's chocolate milk is $0.15\ \frac{mL}{mL}$.

Caitlyn

$V_{solute} = 40\ mL$

$V_{solvent} = 250\ mL$

$C_C = ?$

$C = \frac{V_{solute}}{V_{solvent}}$

$C_C = \frac{40\ mL}{250\ mL}$

$C_C = 0.16\ \frac{mL}{mL}$

∴ The concentration of Caitlyn's chocolate milk is $0.16\ \frac{mL}{mL}$.

3. The concentration of sugar in coke is said to be 0.106 g/ml. How much sugar would be in a 375 ml can of Coke (3 marks)?

$m_{solute} = ?$

$V_{solvent} = 375\ ml$

$C = 0.10\bar{6}\ g/ml$

$C = \frac{m_{solute}}{V_{solvent}}$

$0.10\bar{6}\ g/ml = \frac{m_{solute}}{375\ ml}$

$m_{solute} = 0.10\bar{6}\ \frac{g}{mL} \times 375\ ml$

$m_{solute} = 40\ g$

∴ There is $40\ g$ of sugar in a $375\ ml$ can of Coke.

4. According to an online source, a 250 ml can of Red Bull contains 80 mg of caffeine. A 473 ml can of Monster Energy Drink contains 160 mg. How much more caffeine per ml is in the Monster? If these companies decided to make a 2 L bottle, how much more caffeine would be in a 2 L bottle of Monster than in a 2 L bottle of Red Bull – carry 3 decimal places for all concentration values (8 marks)?

Red Bull

$m_{solute} = 80\ mg$

$V_{solvent} = 250\ ml$

$C_{Red\ Bull} = ?$

$C = \frac{m_{solute}}{V_{solvent}}$

$C_{Red\ Bull} = \frac{80\ mg}{250\ ml}$

$C_{Red\ Bull} = 0.320\ \frac{mg}{ml}$

∴ The concentration of caffeine in the Red Bull is $0.320\ \frac{mg}{ml}$.

Monster

$m_{solute} = 160\ mg$

$V_{solvent} = 473\ ml$

$C_{Monster} = ?$

$C = \frac{m_{solute}}{V_{solvent}}$

$C_{Monster} = \frac{160\ mg}{473\ ml}$

$C_{Monster} = 0.338\ \frac{mg}{ml}$

∴ The concentration of caffeine in the Monster is $0.338\ \frac{mg}{ml}$.

4. According to an online source, a 250 ml can of Red Bull contains 80 mg of caffeine. A 473 ml can of Monster Energy Drink contains 160 mg. How much more caffeine per ml is in the Monster? If these companies decided to make a 2 L bottle, how much more caffeine would be in a 2 L bottle of Monster than in a 2 L bottle of Red Bull – carry 3 decimal places for all concentration values (8 marks)?

Difference

$0.338 - 0.320 = 0.018\ \frac{mg}{ml}$

∴ There is $0.018\ \frac{mg}{ml}$ more caffeine in Monster than there is in Red Bull.

2 L Bottles

$Difference\ in\ Concentration \times Volume$

$0.018\ \frac{mg}{ml} \times 2000\ ml = 36\ mg$

∴ There would be $36\ mg$ more caffeine in a 2 L bottle of Monster.