**Pharmaceutical calculations:**

**Subtopic: Solving Pharmaceutical problems using alligation: Applications in dosage formulations**

**Learning Outcomes**

**After completing this session, students will be able to:**

1. Differentiate between alligation medial and alligation alternate
2. Apply alligation techniques to real-world pharmaceutical problems
3. Develop critical thinking and analytical skills through problem-solving exercises involving alligation**.**

**Contents**

**Problems**

examples:

**Problem 1: Alcohol Solution Mixture**

**Question:** A pharmacist mixes 300 mL of 30% v/v alcohol, 150 mL of 50% v/v alcohol, and 50 mL of 80% v/v alcohol. What is the final percentage strength (v/v) of alcohol in the mixture?

**So here is what is the Solution:**

**1. Multiply each volume by its concentration:**

300 mL × 30% v/v = 9000 parts

150 mL × 50% v/v = 7500 parts

50 mL × 80% v/v = 4000 parts

**2. Sum all parts:**

9000 parts + 7500 parts + 4000 parts =20,500 parts

**3. Calculate total volume:**

300 mL + 150 mL + 50 mL = 500 mL

**4. Determine final concentration:**

**Final % =** 20,500 parts / 500 mL

**= 41% v/v**

**Answer: The final alcohol strength is 41% v/v**

**Problem 2: Specific Gravity of a Liquid Mixture**

**Question:** What is the specific gravity (sp.gr.) of a mixture containing 500 mL of syrup (sp.gr. 1.4), 300 mL of glycerin (sp.gr. 1.25), and 200 mL of elixir (sp.gr. 0.9)?

**Solution:**

**1. Multiply each volume by its specific gravity:**

500 mL ×1.4 = 700 parts

300 mL ×1.25 = 375 parts

200 mL × 0.9 = 180 parts

**2. Sum all parts:**

700 parts + 375 parts + 180 parts =1255 parts

3. Calculate total volume:

500 mL +300 mL + 200 mL = 1000 mL

**4. Determine final concentration:**

Sp. gr. = 1255 parts / 1000 mL = 1.255

**Answer: Specific gravity of mixture is 1.255**

**Problem 3: Preparing a Dextrose Solution**

**Question:** A hospital pharmacy needs to prepare a dextrose solution with a concentration of 10%. They have a stock solution of 25% dextrose and another stock solution of 5% dextrose. What volumes of each stock should be mixed to obtain a total of 2 liters of the desired solution?

**Solution:**

**1. Identify Concentrations:**

Higher concentration (H) = 25%

Lower concentration (L) = 5%

Desired concentration (D) = 10%

**2. Calculate Differences:**

i) Difference between H & D

H-D = 25% -10% =15 parts of the lower concentration (5%)

ii) Difference between D & L

D – L = 10% - 5% = 5 parts of the higher concentration (25%)

**3. Determine Ratio:**

The ratio of the higher conc to the lower conc is: 5:15= 1:3

**4. Calculate Total Parts and Volumes:**

Total parts in the mixture = 1+ 3 = 4, Since we need a total volume of 2000 mL, calculate volumes for each component:

**Volume of higher concentration (25%):**

Volume = ¼ × 2000 mL = 500 mL

**Volume of lower concentration (25%):**

Volume = 3/4 × 2000 mL = 1500 mL

Thus, to prepare the desired dextrose solution, mix 500 mL of the stock solution at 25% dextrose with 1500 mL of the stock solution at 5% dextrose.

**Problem 4: Preparing a 50% alcohol**

**Question:** How many parts of 90%, 70%, 40% and 10% alcohols should be mixed to prepare 50% alcohol?

**Solution:** When more than two strengths are used for getting an intermediate strength the following method is useful.

1. Write the percentage strength in descending order on the left side of the vertical line.
2. Required percentage is written between the two vertical lines.
3. Link strength, which is lower than the required strength with higher ones.
4. Subtract the required strength from the higher strength and write the values horizontally against the lowest strength on the right hand side. The some of the two values indicates the parts of the lowest strength required.
5. Subtract the lowest strength from the required strength and put the result on the right hand side in front of the higher strength.

**1st method:**

|  |  |  |
| --- | --- | --- |
| **90%**  **70%**  **40%**  **10%** | **50%** | **10 parts**  **40 parts**  **40 parts**  **20 parts** |

**2nd method:**

|  |  |  |
| --- | --- | --- |
| **90%**  **70%**  **40%**  **10%** | **50%** | **40 parts**  **10 parts**  **20 parts**  **40 parts** |

Therefore, the proportions of 90%, 70%, 40% and 10% alcohols could be either 10:40:40:20 or 40:10:20:40 respectively. Both mixtures will provide 50% alcohol.