Practical Pharmaceutical Compounding

Prepared by:
Dr. rer. nat. Rebaz H. Ali
Some useful abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>aa</td>
<td>Of each</td>
<td>a.c.</td>
<td>Before meals</td>
</tr>
<tr>
<td>ad</td>
<td>Up to</td>
<td>a.d.</td>
<td>Right ear</td>
</tr>
<tr>
<td>a.m.</td>
<td>Morning</td>
<td>amp.</td>
<td>ampul</td>
</tr>
<tr>
<td>a.q.</td>
<td>Water</td>
<td>a.s.</td>
<td>left ear</td>
</tr>
<tr>
<td>a.u.</td>
<td>Each ear</td>
<td>b.i.d.</td>
<td>twice a day</td>
</tr>
<tr>
<td>c.</td>
<td>With</td>
<td>cap.</td>
<td>capsule</td>
</tr>
<tr>
<td>cc</td>
<td>Cubic centimeter</td>
<td>Comp.</td>
<td>compound</td>
</tr>
<tr>
<td>disc.</td>
<td>Discontinue</td>
<td>Disp.</td>
<td>dispense</td>
</tr>
<tr>
<td>DW</td>
<td>Distilled water</td>
<td>Fl</td>
<td>fluid</td>
</tr>
<tr>
<td>Ft.</td>
<td>Make</td>
<td>gr</td>
<td>grain</td>
</tr>
<tr>
<td>gtt.</td>
<td>Drop</td>
<td>hr.</td>
<td>hour</td>
</tr>
<tr>
<td>h.s.</td>
<td>At bed time</td>
<td>noct.</td>
<td>night</td>
</tr>
<tr>
<td>non rep.</td>
<td>Don't repeat</td>
<td>NOP</td>
<td>nothing by mouth</td>
</tr>
<tr>
<td>o.d.</td>
<td>Right eye</td>
<td>o.l.</td>
<td>left eye</td>
</tr>
<tr>
<td>o.s.</td>
<td>Left eye</td>
<td>o.u.</td>
<td>each eye</td>
</tr>
<tr>
<td>p.c.</td>
<td>After meals</td>
<td>p.m.</td>
<td>after noon, evening</td>
</tr>
<tr>
<td>p.o.</td>
<td>Per mouth</td>
<td>q.d.</td>
<td>every day</td>
</tr>
<tr>
<td>q.h.</td>
<td>Every hour</td>
<td>q.i.d.</td>
<td>four times daily</td>
</tr>
<tr>
<td>q.o.d</td>
<td>Every other day</td>
<td>q.s.</td>
<td>sufficient quantity</td>
</tr>
<tr>
<td>sig.</td>
<td>Write on label</td>
<td>ss</td>
<td>half</td>
</tr>
<tr>
<td>tbsp.</td>
<td>Tablespoonful</td>
<td>t.i.d.</td>
<td>three times a day</td>
</tr>
<tr>
<td>t.i.w.</td>
<td>Three times a week</td>
<td>tsp.</td>
<td>teaspoonful</td>
</tr>
</tbody>
</table>

SS = ½, I = 1, V = 5, X = 10, L = 50, C = 100, D = 500, M = 1000

<table>
<thead>
<tr>
<th>Liquid measure</th>
<th>Weight measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mL = 16.2 minims (drops)</td>
<td>1 kg = 2.2 lb (poud)</td>
</tr>
<tr>
<td>1 fluidounce = 29.6 mL</td>
<td>1 g = 15.4 gr</td>
</tr>
<tr>
<td>1 pint = 473 mL</td>
<td>1 gr = 64.8 mg</td>
</tr>
<tr>
<td>1 tumblerful = fl oz viii = 240 mL</td>
<td></td>
</tr>
<tr>
<td>1 teacupful = fl oz iv = 120 mL</td>
<td></td>
</tr>
<tr>
<td>1 tablespoonful = fl oz ss = 15 mL</td>
<td></td>
</tr>
<tr>
<td>1 teaspoonful = fl dm l = 5 mL</td>
<td></td>
</tr>
</tbody>
</table>
Simple solution

It is a liquid pharmaceutical preparation consists of one or more chemical substance in one phase system which is physically homogeneous.

Types of solution
- Liquid in liquid like alcohol in water.
- Gas in liquid like ammonia in water.
- Solid in liquid like NaCl in water.

Classification according to method of preparation:
- Solution prepared by simple solution method.
- Solution prepared by chemical reaction.
- Solution prepared by simple method with sterilization like ophthalmic solution, irrigation solution, anticoagulant.
- Solution prepared by extraction.

Classification according to their use:
Gargle, mouth wash, injection, drops, spray, oral solution.....etc.

General method for preparation of simple solution:
- Weigh solid ingredients and mix them together, then dissolve it in ¾ volume of the vehicle in a beaker or conical flask.
- Subtract any volume of liquid if exist in the prescription from ¾, and then dissolve the solid ingredient in remainder of ¾.
- After dissolution of solid ingredients add any liquid ingredient if exist then complete the volume by adding the vehicle.
- Keep prepared dosage form in a suitable container then label it.
Notes:

- If the solid ingredient in form of crystal; use mortar and pestle to grind it well so as to decrease particle size (increase solubility by increasing surface area).
- Choose the solvent that dissolves solid ingredient easily (like dissolve like).
- Pink label use for external preparation and white label for internal preparations.

Rx  Sodium Chloride Solution

Sodium chloride  9 g
Purified water  1000 mL

Procedure: dissolve sodium chloride in sufficient amount of purified water to produce 1000mL and filter.

Use: electrolyte replenisher.

Explanation: sodium chloride solution 0.9%w/v is also known as normal saline solution which is used to make the preparation isotonic with blood serum, that is, the solution has the same osmotic pressure as blood serum, and therefore readily diffuses through the walls of small arteries, veins and capillaries, without causing dilation or collapse. Similarly RBCs are unaffected. Sometime sodium chloride solution is also used as irrigation fluid.

Rx  Hydrogen Peroxide Solution

Hydrogen peroxide  30 mL
Water  100 mL

Uses: mild antiseptic, astringent and 1.6% is used in the deodorant, gargle and mouth wash.
### R, Carminative Mixture for Infant

- Sodium Bicarbonate: 0.06 g (antacid)
- Aromatic Spirit of Ammonia: 0.06 mL (carminative)
- Compound Tr. Of Cardamom: 0.12 mL (carminative and flavor)
- Glycerin: 0.3 mL (sweetening agent)
- Peppermint water q.s.: 4 mL (vehicle)

Fit. Mist.
Mitt. 40 mL

### R, Carminative Mixture for Adult

- Sodium bicarbonate: gr vii
- Aromatic Spirit of Ammonia: ɱ xv
- Comp. Tr. Of Cardamom: ɱ x
- Strong Tr. Of ginger: ɱ x
- Peppermint water q.s.: fl oz

Fit. Mist.
Mitt. fl oz iii
Sig. fl dm ss t.i.d p.c.

### R, Carminative Pediatric Mixture with Chloralhydrate

- Chloralhydrate: 0.03 g
- Compound Tr. Cardamom: 0.18 mL
- Aromatic Spirit of Ammonia: 0.12 mL
- Glycerin: 0.3 mL
- Peppermint water q.s.: 5 mL

Fit. Mist.
Mitt. 30 mL
Sig. fl dm t.i.d. p.c.
**Peppermint water**

Peppermint oil has carminative, antiseptic and flavoring properties and has been included to a range of official and non-official pharmaceutical preparations; which is a saturated solution of peppermint oil (0.05% v/v) in water.

Peppermint water usually prepared by diluting one part of concentrated peppermint water (2% v/v peppermint oil in solution, ethanol has to be included in the formulation as a co-solvent) with 39 parts of purified water (1 in 40 dilution).

Rx
Prepare 500mL potassium permanganate solution 0.2% and label with directions for preparing 2 liters quantities of a 1 in 8000 solution for use as an antiseptic footbath.

- Prepare concentrated solution (0.2%) as follow:

  **Potassium permanganate** 1 g  
  **Water for preparations** qs 500 mL

  Strength of dilute solution is 1 in 8000 = 0.0125%

  \[
  \text{dilution factor} = \frac{\text{strength of the concentrate}}{\text{strength of the dilute solution}}
  \]

  \[
  \frac{0.2\%}{0.0125\%} = 16
  \]

  **Method 1:**
  - Divide the request (2 L) by the dilution factor, the result is the amount of the concentrated that required to be diluted to the request.
  - 2000 mL ÷ 16 = 125 mL of the concentrated solution
  - Take 125 mL of the concentrated solution, then add water to 2 L.

  **Method 2:**
  
  \[
  C_1 \times V_1 = C_2 \times V_2
  \]

  0.002 X ? = 0.000125 X 2000 mL (2 L)

  ? = 125 mL

  So, take 125 ml of the concentrated solution (0.2%) and add water to 2 L.
Rx Calculate the quantity of potassium permanganate required to prepare 200mL of a 0.25% w/v solution and give dilution directions for 100mL quantities of a 0.0125% solution of potassium permanganate.

Potassium permanganate 0.25 g
Water qs 100 mL

- Weigh 0.5 g potassium permanganate
- Put it in a beaker and add some water to dissolve it
- Complete the volume of the solution to 200 by using volumetric flask.

\[
\frac{0.25\%}{0.0125\%} = 20
\]
\[
100 \div 20 = 5 \text{ mL}
\]
- Take 5 mL of 0.25% solution and add water to 100 mL.

**Homework**

Make a calculation according to \( C_1 \times V_1 = C_2 \times V_2 \)
Rx, **Aqueous Iodine Solution (Lugol’s solution)**

Iodine 50 g  
Potassium Iodide 100 g  
Purified water q.s. 1000 mL  

Fit. Mist.  
Mitt. 20 mL  

Sig. 0.3 mL diluted with water or milk t.i.d.  

**Use:** Treatment of hypothyroidism

**Procedure:**  
- Dissolve iodine in concentrated solution of KI.  
- Shake it well until iodine dissolve.  
- Complete the volume by purified water up to 1000 mL.

Rx, **Weak Iodine Solution or Tr. Iodine (external use)**

Iodine 20 g  
Nal 24 g  

DW 500 mL  

Alcohol (96%) q.s. 1000 mL  

Fit. Mist.  
Mitt. 50 mL  

Sig. b.i.d externally

**Procedure:** dissolve Iodine and Nal in 500 mL of DW, and then add alcohol to 1000 mL.
**R, Strong Iodine Tincture Solution**

Iodine 70 g  
KI 50 g  
DW 50 mL  
Alcohol (96%) q.s. 1000 mL  

**Use:** both weak and strong iodine solution use as antiseptic.

Dissolve the KI in DW, add iodine and agitated until get a solution, then add alcohol to 1000 mL.
Ear preparations

Ear preparations are liquid, semi-solid or solid preparations intended for instillation, for spraying, for insufflation, for application to the auditory meatus or as an ear wash. Ear drops and ear sprays are solutions, emulsions or suspensions of one or more active substances in liquids suitable for application to the auditory meatus without exerting harmful pressure on the eardrum (for example, water, glycols or fatty oils). They may also be placed in the auditory meatus by means of a tampon impregnated with the liquid.

Ear drops are usually supplied in multidose containers of glass or suitable plastic material that are fitted with an integral dropper or with a screw cap of suitable materials incorporating a dropper and rubber or plastic teat. Alternatively, such a cap assembly is supplied separately.

**Rx, Sodium Bicarbonate Ear Drop**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sod. Bicarb</td>
<td>5 g</td>
<td>(was softener)</td>
</tr>
<tr>
<td>Glycerin</td>
<td>30 mL</td>
<td>(viscosity builder, lubricant)</td>
</tr>
<tr>
<td>D.W.</td>
<td>q.s.</td>
<td>100 mL</td>
</tr>
</tbody>
</table>
Nasal preparations

Nasal preparations are liquid, semi-solid or solid preparations intended for administration to the nasal cavities to obtain a systemic or local effect. They contain one or more active substances. Nasal preparations are as far as possible non-irritating and do not adversely affect the functions of the nasal mucosa and its cilia. Aqueous nasal preparations are usually isotonic and may contain excipients, for example, to adjust the viscosity of the preparation, to adjust or stabilize the pH, to increase the solubility of the active substance, or to stabilize the preparation.

Nasal preparations are supplied in multi-dose or single-dose containers, provided, if necessary, with a suitable administration device which may be designed to avoid the introduction of contaminants.

Unless otherwise justified and authorized, aqueous nasal preparations supplied in multi-dose containers contain a suitable antimicrobial preservative in appropriate concentration, except where the preparation itself has adequate antimicrobial properties.

Over use of topical decongestant can lead to oedema of the nasal mucosa and they should only be used for short periods of time about 5 days.

R. Ephedrine Nasal Drop

Ephedrine HCl  500 mg (decongestant)
NaCl  500 mg (to makes the solution isotonic)
Chlorbutol  500 mg (preservative)
D.W. q.s.  100 mL

Procedure:

Prepare chlorbutol solution by using warm water.
Dissolve salt in the warm chlorbutol solution.
Cool and filter if necessary then complete the volume by adding vehicle.
Rx Nasal drop

Glycerin 20 mL (humectant, preservative)
Ethanol 70% 40 mL (preservative, antiseptic)
Normal saline solution qs 500 mL
Dispense 60mL
Mouthwash and Gargles

Mouthwashes and gargles: These are aqueous solutions for prevention and treatment of mouth and throat infections. They usually contain antiseptics, analgesics, and/or astringents. These solutions are used directly or diluted with warm water.

Gargles: A gargle is a liquid medicine intended to be retained in the mouth and placed in contact with the back of the throat by throwing back the head and agitated by air released from the larynx.; while Mouthwashes are aqueous solutions intended for use in contact with the mucous membrane of the oral cavity. They are not to be swallowed. They are supplied as ready-to-use solutions or concentrated solutions to be diluted. They may also be prepared from powders or tablets to be dissolved in water before use.

R, Compound Sodium Chloride Mouthwash

Sodium Bicarbonate 10 g  
Sodium Chloride 15 g  
Concentrated Peppermint Emulsion 25 mL  
Double-strength Chloroform Water 500 mL  
Water q.s 1000 mL  

Concentrated Peppermint Emulsion

Peppermint Oil 20 mL  
Polysorbate 20 1 mL  
Double-strength Chloroform Water 500 mL  
Purified Water freshly boiled and cooled q.s 1000 mL  

Shake the Peppermint Oil with the Polysorbate 20 and add gradually, shaking well after each addition, the Double-strength Chloroform Water and sufficient Purified Water to produce 1000 mL.

Double-strength Chloroform Water

Chloroform 5 mL  
Purified Water freshly boiled and cooled q.s. 1000 mL
**Rx Mandle's (throat) paint (used in case of laryngitis and tonsillitis)**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>KI</td>
<td>25 g</td>
</tr>
<tr>
<td>I₂</td>
<td>12.5 g</td>
</tr>
<tr>
<td>Alcohol 96%</td>
<td>40 mL</td>
</tr>
<tr>
<td>Water</td>
<td>25 mL</td>
</tr>
<tr>
<td>Peppermint oil</td>
<td>4 mL</td>
</tr>
<tr>
<td>Glycerin q.s</td>
<td>1000 mL</td>
</tr>
</tbody>
</table>
Ophthalmic solutions:
Ophthalmic solutions are sterile, free from foreign particles, and specially prepared for instillation in the eye. Most ophthalmic solutions are dispensed in eye dropper bottles. Patients should be shown how to properly instill the drops in their eyes, and every effort should be made to emphasize the need for instilling only one drop per administration, not two or three. When more than one drop is to be administered, wait at least five minutes between administrations. Immediately after instilling a drop on the eye, place pressure on the lacrimal sac for one or two minutes. This will reduce the rate of drug loss through this pathway.

Formulations used include aqueous solutions, aqueous suspensions, ointments, and inserts. Every ophthalmic product must be sterile in its final container to prevent microbial contamination of the eye. Preservatives are added to the formulation to maintain sterility once the container has been opened. Ophthalmic formulations also require that the pH, buffer capacity, viscosity, and tonicity of the formulation is carefully controlled.

Rx: Atropine ophthalmic solution

Atropine Sulfate       2%
NaCl                qs
Aqua. dist. q.s. ad.  30 mL
M.ft. isotonic solution

1. Determine the amount of NaCl to make 30 mL of an isotonic solution

\[
\frac{0.9 \text{ g}}{100 \text{ ml}} = \frac{X}{30 \text{ ml}}
\]

\[X = 0.27 \text{ g}\]

2. Calculate the contribution of atropine sulfate to the NaCl equivalent
30 mL × 2 g/100 mL = 0.6 g atropine sulfate

E atropine sulfate = 0.13

0.6 g × 0.13 = 0.078 g

3. Determine the amount of NaCl to add to make the solution isotonic by subtracting (2) from (1)

0.27 g - 0.078 g = 0.192 g or 192 mg

Other substances may be used, in addition to or in place of NaCl, to render solutions isotonic. This is done by taking the process one step further and calculating the amount of the substance that is equivalent to the amount of NaCl calculated in step 3.

For example, boric acid is often used to adjust isotonicity in ophthalmic solutions because of its buffering and anti-infective properties. If E for boric acid is 0.50, then the amount of boric acid needed to replace the NaCl in step 3 can be calculated:

\[
\frac{0.192 \text{ g NaCl}}{X \text{ g Boric Acid}} = \frac{0.50 \text{ g NaCl equiv.}}{1 \text{ g Boric acid}}
\]

or \( X = 0.38 \text{ g} \)

or, more simply: \( 0.192 \text{ g} ÷ 0.50 = 0.38 \text{ g} \)

Thus, 0.38 g or 380 mg of boric acid would be required to render the previous ophthalmic solution isotonic.
General information:

Buffers: are compounds that resist changes in pH upon the addition of limited amounts of acids or bases. Buffer systems are usually composed of a weak acid or base and its conjugate salt.

The pH of a buffer system is given by the Henderson-Hasselbach equation:

(for a weak acid and its salt)

\[ \text{pH} = pK_a + \log \frac{[\text{salt}]}{[\text{acid}]} \]

(for a weak base and its salt)

\[ \text{pH} = pK_w - pK_b + \log \frac{[\text{base}]}{[\text{salt}]} \]

Buffer capacity is a measure of the efficiency of a buffer in resisting changes in pH. Conventionally, the buffer capacity (\(\beta\)) is expressed as the amount of strong acid or base, in gram-equivalents, that must be added to 1 liter of the solution to change its pH by one unit.

Calculate the buffer capacity as:

\[ \beta = \frac{\Delta B}{\Delta \text{pH}} \]

\(\Delta B\) = gram equivalent of strong acid/base to change pH of 1 liter of buffer solution

\(\Delta \text{pH}\) = the pH change caused by the addition of strong acid/base

The relationship between buffer capacity and buffer concentrations is given by the Van Slyke equation:

\[ \beta = 2.3 C \frac{K_a[H_3O^+]}{(K_a + [H_3O^+])^2} \]
Sample calculation:

Using acetic acid and sodium acetate prepare 500 mL of a buffer solution at pH 4.5 with a buffer capacity of 0.05.

Acetic Acid MW = 60; Ka = 1.75 x 10^-5; pKa = 4.76; density (glacial acetic acid) = 1.05 g/mL; Na Acetate MW = 82

Salt to Acid Ratio:

\[
\frac{[\text{salt}]}{[\text{acid}]} = \text{antilog} (4.5 - 4.76) = 0.55
\]

\[ [\text{salt}] = 0.55 \times [\text{acid}] \]

Total Buffer Concentration:

\[
\beta = 2.3 C \frac{K_a[H_3O^+]}{(K_a + [H_3O^+])^2}
\]

\[ [H_3O^+] = \text{antilog}(- \text{pH}) = \text{antilog}(- 4.5) \]

\[ 0.05 = 2.3 C \frac{(1.75 \times 10^{-5})(3.16 \times 10^{-5})}{[(1.75 \times 10^{-5}) + (3.16 \times 10^{-5})]^2} \]

\[ 0.05 = 0.53 C \]

\[ C = 0.095 M \]

Final Calculations:

\[ C = [\text{salt}] + [\text{acid}] \]

\[ C = 0.55 \times [\text{acid}] + [\text{acid}] = 1.55 \times [\text{acid}] = 0.095 M \]

\[ [\text{acid}] = 0.095 M \div 1.55 = 0.061 M \text{ or } 0.061 \text{ moles/L} \times 0.5 \text{ L} \times 60 \text{ g/mole} = 1.85 \text{ g acetic acid} \]

So glacial acetic acid = 1.85 g ÷ 1.05 g/mL = 1.76 mL

\[ [\text{salt}] = 0.55 \times [\text{acid}] = 0.55 \times 0.061 M = 0.034 M \text{ or } 0.034 \text{ moles/L} \times 0.5 \text{ L} \times 82 \text{ g/mole} = 1.38 \text{ g sodium acetate} \]
Syrups

Are sweet, liquid and viscous pharmaceutical preparations; Syrups do not contain active ingredients. They are not intended to be administered as such but are used as vehicle ingredients for their flavoring and sweetening properties.

R, Simple syrup B.P
Sucrose 667 g
D.W. q.s. 1000 g
- Weigh an empty beaker then add sucrose and weigh it.
- Add small quantity of water.
- Heat it gently in water bath with continuous stirring.
- Weigh again and complete the volume by hot water!

R, Simple syrup U.S.P
Sucrose 850 g
D.W. qs 1000 mL

R, potassium citrate mixture BP
Potassium Citrate 300 g
Citric Acid Monohydrate 50 g
Lemon Spirit 5 mL
Quillaia Tincture 10 mL
Syrup 250 mL
Double-strength Chloroform Water 300 mL
Water Sufficient to produce 1000 mL

Use: alkalinization of urine to relieve discomfort in mild urinary tract infections or cystitis.

Procedure: Weigh and dissolve solids in the double strength chloroform water and syrup. The quillaia tincture should be added before the lemon spirit is added with...
stirring, so that emulsification of the old will be achieved, make up the volume with water.

**R. Ipecac syrup U.S.P**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powdered Ipecac</td>
<td>70 g</td>
</tr>
<tr>
<td>Glycerin</td>
<td>100 mL</td>
</tr>
<tr>
<td>Syrup q.s</td>
<td>1000 mL</td>
</tr>
</tbody>
</table>

Exhaust the powdered ipecac by percolation, using a mixture of 3 volumes of alcohol and 1 volume of water as the menstruum, macerating for 72 hours, and percolating slowly. Reduce the entire percolate to a volume of 70 mL by evaporation at a temperature not exceeding 60° and preferably in vacuum, and add 140mL of water. Allow the mixture to stand overnight, filter, and wash the residue on the filter with water. Evaporate the filtrate and washings to 40mL, and to this add 2.5 mL of hydrochloric acid and 20 mL of alcohol, mix, and filter. Wash the filter with a mixture of 30 volumes of alcohol, 3.5 volumes of hydrochloric acid, and 66.5 volumes of water, using a volume sufficient to produce 70 mL of the filtrate. Add 100 mL of glycerin and enough syrup to make the product measure 1000mL and mix.

Ipecacuanha has been used as an expectorant in productive cough in doses of up to about 1.4 mg of total alkaloids.

Ipecacuanha may also be used in larger doses as an emetic. Vomiting usually occurs within 30 minutes of an emetic dose by mouth, due to an irritant effect on the gastrointestinal tract and a central action on the chemoreceptor trigger zone. Doses are usually followed by a copious drink of water or fruit juice. Adults have been given doses of 21 to 42 mg of total alkaloids; children aged 6 months to 1 year have been given 7 to 14 mg of total alkaloids and older children 21 mg. Each 5 mL of Ipecac Syrup supplies 7 mg of total alkaloids. Doses may be repeated once only after 20 to 30 minutes if emesis has not occurred.
**R. Ferrous Sulfate Syrup U.S.P**

Ferrous Sulfate 40 g  
Citric Acid, hydrous 2.1 g  
Peppermint Spirit 2 mL  
Sucrose 825 g  
Purified water q.s 1000 mL  

Dissolve the Ferrous sulfate, the citric acid, and peppermint spirit, and 200 g of sucrose in 450 mL of purified water. And filter the solution until clear. Dissolve the remainder of the sucrose in the clear filtrate, and add purified water to make 1000 mL. Mix, and filter if necessary.

**R. Peppermint spirit B.P**

Peppermint oil 100 mL  
Ethanol 90% qs 1000 mL  

Dissolve the Peppermint Oil in Ethanol (90%) and add sufficient Ethanol (90%) to produce 1000 mL. If the solution is not clear, shake with previously sterilized Purified Talc and filter. Peppermint oil is an aromatic carminative that relaxes gastrointestinal smooth muscle and relieves flatulence and colic. Usual doses in adults and adolescents from the age of 15 years are 0.2 mL three times daily by mouth, (increased to 0.4 mL three times daily if necessary)

**R. Chloral-hydrate Syrup (non-official)**

Chloral hydrate 0.5 g  
Sorbitol 70 g  
D.W. qs 100 mL
**Spirits**

Spirits are alcoholic solutions of volatile substances (usually volatile oils) with alcohol contents ranging from 62-85%. They are most frequently used as flavoring agents, e.g. Peppermint Spirit USP. Some spirits are used for their medicinal effect, but most spirits are a convenient means of obtaining a proper amount of flavoring oil.

### R. Camphor spirit

- Camphor: 100 g
- Alcohol qs: 1000 mL

### R. Compound orange spirit

- Terpeneless Orange Oil: 2.5 mL
- Terpeneless Lemon Oil: 1.3 mL
- Anise Oil: 4.25 mL
- Coriander Oil: 6.25 mL
- Ethanol q.s.: 1000 mL
**Aromatic Elixir, USP**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compound Orange Spirit</td>
<td>12 mL</td>
</tr>
<tr>
<td>Syrup</td>
<td>375 mL</td>
</tr>
<tr>
<td>Talc</td>
<td>30 g</td>
</tr>
<tr>
<td>Alcohol, Purified Water, each q.s.</td>
<td>1000 mL</td>
</tr>
</tbody>
</table>

**Preparation:**

Add to the Compound Orange Spirit sufficient quantity of alcohol to make 250 mL, add to this the syrup in several portions, agitating vigorously after each addition and then add in the same manner the required quantity of purified water. Mix the talc with the liquid and filter through a filter wetted with diluted alcohol, returning the filtrate until a clear liquid is obtained.

**Uses:** Pleasantly flavored vehicle used in the preparation of many elixirs.

**Compound Benzaldehyde Elixir, NF**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzaldehyde</td>
<td>0.5 mL</td>
</tr>
<tr>
<td>Vanillin</td>
<td>1 g</td>
</tr>
<tr>
<td>Orange Flower Water</td>
<td>150 mL</td>
</tr>
<tr>
<td>Alcohol</td>
<td>50 mL</td>
</tr>
<tr>
<td>Syrup</td>
<td>400 mL</td>
</tr>
<tr>
<td>Purified Water, q.s</td>
<td>1000 mL</td>
</tr>
</tbody>
</table>

**Preparation:**

Dissolve the benzaldehyde and the vanillin in alcohol; add the syrup, orange flower water and sufficient quantity of purified water in several portions, shaking the mixture thoroughly after each addition, to make 1000 mL. Filter, if necessary, until clear.

**Uses:** Vehicle for administering bromides and other salts, especially when a low alcoholic content is desired.
Three Bromides Elixir, NF

- Ammonium Bromide: 80 g
- Potassium Bromide: 80 g
- Sodium Bromide: 80 g
- Amaranth Solution: 3 mL
- Compound Benzaldehyde Elixir q.s. 1000 mL

Preparation:
Dissolve the bromides in 800 ml of Compound Benzaldehyde Elixir; add the amaranth solution and sufficient compound benzaldehyde elixir to make the product measure 1000 mL. Filter, if necessary, until clear.

Use: Sedative action from bromine ion.
Gels

Cellulosic Solutions—Various cellulosics have been used as binders in solution form. Hydroxypropyl methylcellulose (HPMC) has been used widely in this regard. Typical of a number of cellulosics, HPMC is more soluble in cold water than hot. It is also more dispersible in hot water than cold. Hence, to obtain a good, smooth gel that is free from lumps or “fisheyes,” it is necessary to add the HPMC in hot, almost boiling, water and, under agitation, cool the mixture down as quickly as possible, as low as possible. Other water-soluble cellulosics, such as hydroxyethylcellulose (HEC) and hydroxypropylcellulose (HPC), have been used successfully in solution as binders.

Carbomer 941 gel
Carbomer 941  0.5 (% w/w)
Glycerine  10.0 (% w/w)
Triethanolamine  0.5 (% w/w)
Water  89.0 (% w/w)
Preservative q.s.

Procedure: Water, glycerine, and preservative are mixed and the carbomer added by sprinkling on the surface while constantly mixing at high speed. Triethanolamine is added with slow agitation until a clear viscous gel forms.

Carbomer 934 alcoholic gel
Carbomer 934 resin  3.0 (% w/w)
Glycerine  10.0 (% w/w)
Ethanol  40.0 (% w/w)
2-Ethylhexylamine  2.5 (% w/w)
Water  44.5 (% w/w)

Procedure: The carbomer is dispersed in the glycerine and water, and a solution of the 2-ethylhexylamine in ethanol is added to the water solution with mixing until a clear transparent gel is formed.
Preparation of hydroxypropylmethylcellulose (HPMC) gel (2%)

HPMC (Methocel K100M) 2 g
Distilled Water q.s. 100 ml

- Heat the distill water in a beaker to 80 – 90 °C
- Disperse the polymer with contentious stirring
- After complete dispersion of the polymer in the hot water, put the beaker in an ice bath with continuous stirring.

The lab supervisor could divide the student into 3 group, each group prepare a different concentration, 2%, 3% and 4%, than compare the results.
**Suspensions**

Oral suspensions are oral liquids containing one or more active ingredients suspended in a suitable vehicle; suspended solids may slowly separate on standing but are easily re-dispersed.

Common pharmaceutical products that are suspensions include: otic, ophthalmic, oral, topical and inhalation suspensions.

Advantages and disadvantages of suspensions as dosage forms:

**Advantages**

- Insoluble drugs may be more palatable.
- Insoluble drugs may be more stable.
- Suspended insoluble powders are easy to swallow.
- Absorption will be quicker than solid dosage forms.
- It is theoretically possible to formulate sustained-release preparations.

**Disadvantages**

- Preparation requires shaking before use.
- Accuracy of dose is likely to be less than with equivalent solution.
- Storage conditions can affect disperse system.
- Suspensions are bulky, difficult to transport and prone to container breakages.

Classification of suspension:

1. **Suspensions containing diffusible solid.**

They are suspensions that can be prepared by using insoluble powder, that can be wet by water readily and disperse easily throughout the vehicle (water) for long enough to ensure even distribution for each dose.

General method for preparation:

- Grind and mix all insoluble powder by using mortar and pestle, starting from smallest portion then to larger (ascending order- geometrical dilution).
- Add enough amount (¼ for preparing paste, ¼ for diluting of the paste and ¼ for washing of the mortar) of vehicle gradually you get a smooth past.
• Dilute the paste and wash the mortar and pestle by using proper amount of the vehicle.
• Added enough amount of vehicle until you get desire volume.

**Note:**
• Add non-volatile soluble substance like sodium bicarbonate into the paste during dilution.
• Syrup and glycerin should be added into dry powder before formation of the paste.
• Dye should be added into the paste before dilution.

**R, Magnesium Trisilicate Oral Suspension; Compound Magnesium Trisilicate Mixture**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium trisilicate</td>
<td>50 g</td>
</tr>
<tr>
<td>Light magnesium carbonate</td>
<td>50 g (diffusible)</td>
</tr>
<tr>
<td>Sodium bicarbonate</td>
<td>50 g (soluble)</td>
</tr>
<tr>
<td>Concentrated peppermint emulsion</td>
<td>25 mL</td>
</tr>
<tr>
<td>Double strength Chloroform water</td>
<td>500 mL</td>
</tr>
<tr>
<td>Water q.s.</td>
<td>1000 mL</td>
</tr>
</tbody>
</table>

**Use:** Its use as antacid and cathartic

**Dose:** 10 mL three times daily

2. **Suspension produced by dispersion of oil in inhalations**

One class of inhalation consists of one or more volatile oil in water and to ensure uniform dispersion of the oil on shaking light magnesium carbonate, a diffusible solid, is added to adsorb some of the oil and finely subdivided the remainder. Unlike emulsification which might seem a better method of dispersing the oil, the powder does not interfere with free vaporization of the oil when the inhalation is added to water at about 65° C for use. If the quantity is not included in the formula, 1g of light magnesium carbonate for each 2 mL of volatile oil or 2g of solid should be used.
R₄ Menthol and Eucalyptus inhalation

Menthol  20 g  
Eucalyptus Oil  100 mL  
Light Magnesium Carbonate  70 g  
Purified water to  1000 mL

**Use:** Used to relieve symptoms of bronchitis and nasal obstruction in acute rhinitis or sinusitis.

**Direction:** Add 1 teaspoonful to a pint of hot, not boiling, water and inhale the vapor when required.
3. **Suspension containing in-diffusible solid**

Solid can be regarded as in-diffusible when it cannot be wet by liquid vehicle readily and it cannot remain evenly distributed throughout the vehicle long enough to ensure the uniformity of the measured dose; e.g. acetyl salicylic acid, salicylic acid, benzoic acid, phenobarbition, and calcium carbonate.

This problem can be overcome by adding thickening agent; and amount of suspending agent is depending on the volume of the mixture.

Suspending agent: acacia is a protective colloid and has a good value as suspending agent. Its useful in mixture contain resinous tincture but less satisfactory for suspending heavy powder unless be combined with other thickening as in *compound powder of tragacanth* which contains acacia (20%), tragacanth (15%), starch (20%) and sucrose (45%). It is useful when the vehicle is liquid other than water and chloroform-water and in proportion of 2% w/v.

Compound powder of tragacanth is used for internal use and not external use, because both acacia and tragacanth oxidize readily on exposure to atmosphere that produce bad odor and cause skin shrinkage.

The second suspending agent is tragacanth mucilage (12.5g tragacanth, 25mL alcohol and qs 1000mL chloroform-water) which can be use as 25% v/v. It can be used when we have water or chloroform-water.

Method of preparation:

- Using compound powder tragacanth
  1. Add in-diffusible solid in a mortar and start grinding, then add all other diffusible solid by geometrical dilution, finally add compound powder tragacanth with continuous trituration.
  2. Add ¾ of the vehicle then start trituration, until you get smooth cream.
  3. Then transfer it into a graduate cylinder then rinse the mortar and pestle and complete the volume.

- Using tragacanth mucilage.
1. Add in-diffusible solid into a mortar and start grinding, then add diffusible substance with continuous mixing.
2. Triturate the mixture with tragacanth mucilage.
3. Add half of the vehicle for dilution.
4. Complete the volume.

R. Aspirin Suspension

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin</td>
<td>500 mg</td>
</tr>
<tr>
<td>Orange syrup</td>
<td>1 mL</td>
</tr>
<tr>
<td>Conc. CHCl₃ water</td>
<td>0.25 mL</td>
</tr>
<tr>
<td>Water q.s.</td>
<td>10 mL</td>
</tr>
</tbody>
</table>

Because the vehicle is water so tragacanth mucilage should be used.

R. Calamine lotion

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calamine</td>
<td>150 g (astringent, antipruritic)</td>
</tr>
<tr>
<td>Zinc oxide</td>
<td>50 g (astringent, antipruritic)</td>
</tr>
<tr>
<td>Bentonite</td>
<td>30 g (suspending agent)</td>
</tr>
<tr>
<td>Sod. Citrate</td>
<td>5 g</td>
</tr>
<tr>
<td>Liquefied phenol</td>
<td>50 mL (preservative, antipruritic)</td>
</tr>
<tr>
<td>Glycerol</td>
<td>50 mL</td>
</tr>
<tr>
<td>D.W qs</td>
<td>1000 mL</td>
</tr>
</tbody>
</table>

Procedure: Triturate the Calamine, the Zinc Oxide and the Bentonite with a solution of the Sodium Citrate in about 700 mL of the Purified Water and add the Liquefied Phenol, the Glycerol and sufficient Purified Water to produce 1000 mL.

Sodium citrate: caused partial deflocculation of the calamine and transfer the bentonite from a gel into solution, in its absence the suspension is thicker and very difficult to pour from the bottle.
3. Suspension containing poorly wettable solids

Some solids like sulphur insoluble in water and cannot wet by water readily, so adding wetting agent is required for initial dispersion.

**R₂ Sulphur lotion**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precipitated Sulphur</td>
<td>4 g</td>
</tr>
<tr>
<td>Quillaia tr.</td>
<td>5 mL</td>
</tr>
<tr>
<td>Glycerol</td>
<td>20 mL</td>
</tr>
<tr>
<td>Industrial methylated spirit</td>
<td>6 mL</td>
</tr>
<tr>
<td>Calcium hydroxide solution</td>
<td>qs 100 mL</td>
</tr>
</tbody>
</table>

**R₂ Calcium hydroxide solution**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium hydroxide</td>
<td>10 g</td>
</tr>
</tbody>
</table>

Purified Water, freshly boiled and cooled qs. 1000 mL

**Use:** it’s used as a treatment for acne, scabies and as a mild antiseptic.

**Procedure:** Mix the quillaia tr. IMS and glycerol and triturate the mixture with the Sulphur in a mortar.

Gradually dilute with lime water.

**Note:** if quillaia tr. is not available, try alcohol.
**Emulsions**

**Rx, Castor oil emulsion**

Castor oil 8 mL  
Water qs 30 mL

Castor oil is a fixed oil and is not miscible with water. To make it miscible gum acacia can be used of ratio 4:2:1 so:

Oil: water: gum will be 8 mL : 4 mL : 2 g respectively.

**Procedure:** weight out 2 g gum acacia and transfer it to the mortar. Measure 4 mL water and triturate it with gum so as to form mucilage. To this add 8 mL castor oil in small quantities at a time with thorough trituration after each addition. At this stage the emulsion is known as primary emulsion. Add about 10 mL more of vehicle in small quantities at a time with constant trituration so as to get a homogeneous product. Then complete the volume.

**Use:** castor oil is used as purgative.

**Rx, Olive oil emulsion**

Olive oil 30 mL  
Water qs 120 mL

**Procedure** like castor oil

**Use:** can be given as a nitrogen free diet during the treatment of renal failure, also acts as mild laxative.

**Rx, Liquid paraffin emulsion**

Liquid paraffin 30 mL  
Water qs 100 mL

**Procedure:** like castor oil

**Use:** it’s used as a laxative in chronic constipation especially during pregnancy and old age.
**Rx Cod liver oil emulsion**

Cod liver oil 08 30 mL  
Syrup 12 mL  
Ferric ammonium citrate 4 g  
Chloroform 0.4 mL  
Cinnamon qs 90 mL  

Because cod liver oil is fixed oil so we should use this ratio 4:2:1 and follow dry gum method for preparing primary emulsion.

Dilute the syrup with about 20mL of cinnamon water to this dissolve ferric ammonium citrate. Add this solution to primary emulsion with continuous trituration then complete the volume by adding cinnamon water.

**Use:**

1. Cod liver oil is source of vitamin A and D; it’s used as dietary supplement for infants and children to prevent the occurrence of rickets and to improve calcification of bones.
2. Ferric ammonium citrate is added as an antianaemic drug and help in patient who are suffering from iron deficiency anaemia.

**Rx**

Liquid paraffin 50 mL  
Vanillin 50 mg  
Chloroform 0.25 mL  
Benzoic acid solution 2 mL  
MC 20 2 g  
Saccharin sodium 5 mg  
Water to 100 mL  

Methylcellulose 20 at a concentration of 2% acts as an emulsifying agent for the mineral oil, liquid paraffin. Benzoic acid and chloroform act as preservative and vanillin and
saccharin sodium act as flavoring and sweetening agents. The amount of saccharin sodium is not weighable and will be obtained by trituration using water as the diluent.

**Procedure:** Prepare mucilage by mixing the MC 20 with about six times its weight of boiling water and allow standing for 30 minutes to hydrate. Add an equal weight of ice and stir mechanically until the mucilage is homogenous. Dissolve the vanillin in the benzoic acid solution and chloroform, as it is more soluble in organic solvents. Add this solution to the mucilage and stir for 5 minutes. Make up the saccharin sodium trituration and stir in the appropriate volume of solution to the mucilage. Make the emulsion by adding together 50mL of liquid paraffin and 50mL of prepared mucilage with constant stirring.

**Use:** as lubricant laxative for chronic constipation.

\[ Rx \]

Mineral oil 50 mL
Span 60 qs
Tween 40 qs
Cherry syrup 40 mL
Distilled water qs 120 mL

Note: required HLB for mineral oil is 12, total amount of required emulsifying agent is 5% and (HLB of span 60 is 4.7 and HLB of tween 40 is 15.6).

\[ Rx \]

Castor oil 45 mL
Tween 80 qs
Span 20 qs
Orange syrup qs 100 mL

Note: required HLB for castor oil o/w emulsion is 14, total emulsifier concentration is 5% and (HLB for span 20 is 8.6 and for tween 80 is 15).
A = \frac{100 \ (\text{tHLB} - \text{HLB of B})}{(\text{HLB of A} - \text{HLB of B})}

A = \frac{100 \ (14 - 8.6)}{(15 - 8.6)} = 84.4\

B = 100 - 84.4 = 15.6\

Tween = 84.4\% \times 5 = 4.22 \text{ g and B 0.78 g}

Weigh tween 80 and span 20, pour castor oil into the bottle upto 45\text{ mL}, then transfer the tween and span into the bottle and agitate well to mix. Add orang syrup to the 90 \text{ mL mark}, and shake well to form the emulsion.

Peppermint Oil \quad 20 \text{ mL}
Polysorbate 20 \quad 1 \text{ mL}
Double-strength Chloroform Water \quad 500 \text{ mL}
Purified Water, freshly boiled and cooled
Sufficient to produce \quad 1000 \text{ mL}

Shake the Peppermint Oil with the Polysorbate 20 and add gradually, shaking well after each addition, the Double-strength chloroform water and sufficient purified water to produce 1000 \text{ mL}.

What is the HLB value of a surfactant system composed of 20 \text{ g Span 20} (\text{HLB} = 8.6) and 5 \text{ g Tween 20} (\text{HLB} = 13.3)\

\text{HLB} = \frac{(\text{Quantity of surfactant1})(\text{HLB surfactant1}) + (\text{quantity of surfactant 2})(\text{HLB surfactant2})}{\text{quantity of surfactant 1} + \text{quantity of surfactant 2}}

\text{HLB} = \frac{(20 \text{ g})(8.6) + (5 \text{ g})(13.3)}{(20 \text{ g} + 5 \text{ g})} = 9.54
Oral Powders

Oral powders may be formulated as divided powders, with each dose packaged individually or undivided, as a bulk powder. Undivided oral powders are usually non-potent medicaments, such as antacids, where the accuracy by which the patient measures the dose is not critical.

Oral undivided powders are usually formulated by a simple mixture of the prescribed medicaments without the addition of other ingredients.

Oral divided powders may contain one or more active ingredients together mixed with inert diluents.

Class II dispensing balance or electronic equivalent usually is used at laboratory scale, it would be better to weigh 200 mg as minimum amount.

As the amount of the active ingredient may be less than 200 mg, diluent could be added to increase the bulk. The usual diluent used to provide ‘bulk’ is lactose monohydrate because it is inert, water-soluble, colourless, odourless and generally harmless.

Mixing of solids

Since powders do not mix spontaneously, it may be very difficult to ensure a final homogenous mixture of powders and energy must be introduced for the successful mixing of powders. This problem is increased when the proportion of one ingredient is very small.

At small scale a porcelain mortar is generally used and it should be sufficiently large to ensure enough space for adequate mixing. It should be perfectly dry before mixing dry powders.
Mixing process

1. Add the smallest (minimum amount) in to the mortar
2. Add the second ingredient in approximately the same amount that is present in the mortar, therefore doubling-up the bulk already in the mortar.
3. Continue until you add of you ingredients (this process is known as geometrical dilution).

Example

1. Prepare 4 sachets each containing 8 mg of propranolol
2. Prepare mix for 5 sachets to account for manipulative losses. Therefore 5 x 8 = 40 mg of active ingredient are required
3. The minimum weighable amount of active ingredient on the balance is of 200 mg (assuming a class B balance) therefore a minimum of 200 mg propranolol can be Weighed
4. If each sachet of 8 mg active ingredient requires the addition of 192 mg lactose (200 mg minus 8 mg), how much lactose must be added to 200 mg active ingredient?
5. 192 mg x 200 mg/8 mg = 4800 mg of lactose have to be added to 200 mg of the active ingredient
6. Geometrical dilution
   a. Add 200 mg propranolol in a mortar then add 200 mg lactose and start mixing (total 400 mg)
   b. For the mixed 400 mg, then added 400 mg lactose
   c. For the 800 mg powder mixture, add another 800 mg lactose and continue
Method for wrapping the divided powder
Here the lab supervisor teaches you how to fold the paper!

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Add the powder here

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Capsules

Many dosage forms including capsules and tablets are available in more than one strength. If a capsule or a tablet of higher strength is prescribed but unavailable, two capsules or tablets of one-half the strength may be dispensed. Thus, a pharmacist or a health care professional may need to administer one-half or some other portion of the tablet. A few helpful tips for such calculations are provided below:

(1) Do not break the tablets that are not scored.
(2) Enteric coated tablets are designed to resist the acidic environment in the stomach and release the medication in the small intestine. If such tablets are broken, their enteric properties may be lost. Therefore, do not break them.
(3) As a general rule, do not divide sustained/controlled release medications as they may lose their controlled release properties.

<table>
<thead>
<tr>
<th>Capsule Size</th>
<th>Volume (ml)</th>
<th>Mg of Lactose</th>
<th>Mg of Aspirin</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>1.37</td>
<td>1340</td>
<td>1000</td>
</tr>
<tr>
<td>00</td>
<td>0.95</td>
<td>929</td>
<td>600</td>
</tr>
<tr>
<td>0</td>
<td>0.68</td>
<td>665</td>
<td>500</td>
</tr>
<tr>
<td>1</td>
<td>0.50</td>
<td>489</td>
<td>300</td>
</tr>
<tr>
<td>2</td>
<td>0.37</td>
<td>362</td>
<td>250</td>
</tr>
<tr>
<td>3</td>
<td>0.30</td>
<td>293</td>
<td>200</td>
</tr>
<tr>
<td>4</td>
<td>0.20</td>
<td>195</td>
<td>125</td>
</tr>
<tr>
<td>5</td>
<td>0.13</td>
<td>127</td>
<td>60</td>
</tr>
</tbody>
</table>

"Punch" Method of Compounding Capsules

To hand fill capsules at the prescription counter, the pharmacist generally uses the "punch" method. The ingredients are triturated to the same particle size and then mixed by geometric dilution.

The powder is placed on a powder paper or ointment slab and smoothed with a spatula to a height approximately half the length of the capsule body. The base of the capsule is held vertically and the open end is repeatedly pushed or "punched" into the powder until the capsule is filled; the cap is then replaced to close the capsule. Each filled capsule is weighed using an empty capsule as a counterweight. Powder is added or...
removed until the correct weight has been placed in the capsule. The filled capsule is
tapped so that no air spaces are visible within the contents.
The simplest method by which a capsule may be kept free of moisture during
compounding is to wash the hands well, dry them, and keep the fingers dry by stripping
a towel through the cleansed fingers until warmth is felt.
An alternative method is to use the base of one capsule as a holder for other bases
during the filling operation. The capsules do not come in contact with the fingers.
The surest method of protecting the capsule is to wear finger cots or rubber gloves.
Semisolid dosage forms

Ointments are the soft semisolid preparations meant for external application to the skin or mucous membrane, they usually contain a medicament or medicament dissolved, suspended or emulsified in the base. Ointments are used for their emollient and protective action to the skin. They may also be used as vehicle or bases for the topical application of medicinal substances.

Ointments bases are oleaginous bases, absorption bases emulsion bases and water soluble basis.

And it can be prepared by:

1. **Trituration method.** Powder the medicament if already not in fine powder. Triturate it with a small amount of base on an ointment slab with a stainless steel spatula with long blade. Incorporate this to the rest of the base thorough trituration until uniform. If liquids are also to be incorporated, pestle and mortar should be used for the purpose.

2. **Fusion method:** when an ointment bas contains a number of solid substances. Melt them in decreasing order of their melting points to avoid over-heating of low melting point substance. Add the medicament to the melted bases and stir thoroughly until the mass cools down and a homogenous product is formed. If any liquid or aqueous substance is also to be incorporated, that must be heated to about the same temperature as the melted bases. After mixing the tow portions they should be stirred uniformly and thoroughly until a homogenous mass is obtained. Rapid cooling should be avoided.

If dilution or mixing of different concentration of ointment is required we should follow allegation method that has been clarified in the following example.
Ointment Bases

There are five (5) classes or types of ointment bases which are differentiated on the basis of their physical composition. These are:

- oleaginous bases
- absorption bases
- water in oil emulsion bases
- oil in water emulsion bases
- water soluble or water miscible bases

Oleaginous Base (White Ointment)

White Wax 5%
White Petrolatum 95%

Procedure for Preparation:

a) Melt the white wax on a hot plate. No need to heat beyond 70 - 75°C
b) When the wax has completely melted, add the petrolatum and allow the entire mixture to remain on the hot plate until liquefied.
c) Following liquefaction, remove from heat and allow the mixture to congeal. Stir the mixture until it begins to congeal.

Absorption Base

Cholesterol 3%
Stearyl Alcohol 3%
White Wax 8%
White Petrolatum 86%

Procedure for Preparation:

a) Melt the stearyl alcohol, white wax, and petrolatum together on a hot plate.
b) Add the cholesterol to the mixture; stir until completely dissolved.
c) Remove the mixture from the hot plate and stir until congealed.
**W/O Emulsion Base (Cold Cream type base)**

White wax 12%
Cetyl Esters Wax (or Spermaceti) 12.5%
Mineral Oil (Sp Gr = 0.9) 56%
Sodium Borate 0.5%
Water 19%

Procedure for Preparation:

a) Melt the white wax and spermaceti on a hot plate.

b) Add the mineral oil to this mixture and bring the temperature to 70°C.

c) Dissolve the sodium borate in water.

d) Heat the sodium borate solution to 70°C.

e) When both phases have reached the desired temperature, remove both phases from the hot plate and add the aqueous phase slowly and with constant stirring to the oil phase.

f) Stir briskly and continuously until congealed.

**O/W Emulsion Base (Hydrophilic Ointment)**

Sodium Lauryl Sulfate 1%
Propylene Glycol (SP Gr = 1.035) 12%
Stearyl Alcohol 25%
White Petrolatum 25%
Purified Water 37%

Procedure for Preparation:

a) Melt the stearyl alcohol and white petrolatum on a hot plate.

b) Heat this mixture to 70°C.

c) Dissolve remaining ingredients in water and heat the solution to 70°C.

d) Add the oleaginous phase slowly to the aqueous phase, stirring constantly.

e) Remove from heat and stir the mixture until it congeals.
**Water Soluble Base**

Polyethylene Glycol 400 (SP Gr = 1.12) 60%

Polyethylene Glycol 3350 40%

Procedure for Preparation:

a) Melt the PEG 400 and Carbowax 3350 on a hot plate.

b) Warm the mixture to about 65°C.

c) Remove from the hot plate and stir until congealed.

Example 1: In what proportion should a 20% coal tar ointment be mixed with white petrolatum (diluent) to produce a 2% coal tar ointment?

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>2%</td>
<td>2 parts of 20% ointment</td>
</tr>
<tr>
<td>0%</td>
<td></td>
<td>18 parts of white petrolatum</td>
</tr>
</tbody>
</table>

answer: 2:18

Example 2: In what proportion should a 10% and 4% zinc oxide ointments be mixed to prepare a 6% ointment?

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>6%</td>
<td>2 parts of 10% ointment</td>
</tr>
<tr>
<td>4%</td>
<td></td>
<td>4 parts of 4% ointment</td>
</tr>
</tbody>
</table>

answer: 2:4

Example 3: A physician ordered 20% monobenzone (Benoquin®) ointment to be used for the temporary bleaching of hyperpigmented skin. In what proportion may 25%, 10%,
and 5% monobenzone ointments be mixed in order to prepare an ointment of the desired concentration?

\[
\begin{array}{ccc}
\text{Column 1} & \text{Column 2} & \text{Column 3} \\
25\% & 10 + 15 = 25 \\
10\% & 20\% & 5 = 5 \\
5\% & 5 = 5 \\
25:5:5 \\
\end{array}
\]

**Rx, Calamine ointment**

Calamine powder \(15 \text{ g}\)

White soft paraffin \(85 \text{ g}\)

Procedure: trituration method

Use: calamine has a mild astringent action of the skin and is used in ointments to relieve discomfort of dermatitis.

**Rx, Sulphur ointment**

Sulphur \(10 \text{ g}\)

Simple ointment prepared with white soft paraffin \(90 \text{ g}\)

Procedure: trituration method

Use: sulphur ointment is used as fungicidal ointment and is also used in scabies and right worm infestation.

**Rx, Zinc oxide ointment**

Zinc oxide \(15 \text{ g}\)

Simple oint. \(85 \text{ g}\)

Procedure: trituration method

Use: zinc oxide is used in ointments as a mild astringent for the skin, as a soothing and protective application in eczema.
Rx whitfield’s ointment
Salicylic acid 3 g  
Benzoic acid 6 g  
Emulsifying oint. 91 g  
**Procedure:** trituration method  
**Use:** as a fungicidal.

Rx Emulsifying ointment
Emulsifying Wax 300 g  
White Soft Paraffin 500 g  
Liquid Paraffin 200 g  
**Procedure:** melt together and stir until cool

Rx Emulsifying wax
Cetostearyl Alcohol 800 g  
Macrogol Cetostearyl Ether (22) 200 g  
**Procedure:** melt together and stir until cool

Rx Cold Cream
White Beeswax 10 g  
Liquid paraffin 30 g  
Borax 0.5 g  
Water 9.5mL  
Grate the beeswax, melt it with liquid paraffin and raise the temperature to 70°C.  
dissolve the borax in the water and heat the solution to 70°C then gradually add the  
solution to the melted mixture and stir.  
Borax soaps are generally made by the interaction of borax and free acid in beeswax.
Cream prepared with Sorbian ester.

- Sorbitan mono-oleate: 6 g
- White beeswax: 3 g
- White soft paraffin: 36 g
- Liquid paraffin: 15 g
- Purified water freshly boiled and cooled: 40 g

**R不舍 Compound Zinc paste**

- Zinc oxide: 250 g
- Starch: 250 g
- White soft paraffin: 500 g
**Suppositories**

Suppositories are special shaped solid dosage form of medicament for insertion into body cavities other than mouth. They may be inserted into rectum, vagina or urethra. These products are so formulated that after insertion, they will either melt or dissolve in the cavity fluids to release the medicament. Suppositories vary in shapes, size and weight. Generally suppositories weighing 1-2 g are prepared. The bases used for the preparation of suppositories include cocoa butter, glycerol gelatin and soap glycerin.

Displacement value: since the volume of suppositories from a particular mould remains same but its weigh varies due to the variation in densities of medicaments and the base with which the mould was calibrated. To get a product of uniform and accurate weight, allowance must be made for the change in densities of the mass due to added drugs. For this purpose the displacement value of the medicament is taken into consideration. Displacement value may be defined as the quantity of the drug which displaces one part of medicament.

\[ R_x \]

- Boric acid \[200 \text{ mg}\]
- Theobroma oil \[q.s.\]

Prepare 8 suppositories.

DV of boric acid = 1.5

Use 1 g mould

Instead of 8 we make calculation for preparing 10 suppositories.

- Each mould will occupy by 1 g of theobroma oil, so we need 10 g of TO for preparing 10 suppositories.
- Total amount of BA require: if 200 mg for each supp. So we need \((200 \times 10)\) 2000 mg
- DV of boric acid is 1.5 which occupy just 1 part of TO; so: \(2g \times 1/1.5 = 1.3 \text{ g}\)
- 10 g of TO – 1.3 g = 8.7 g total amount of TO.

**Use**: it used as antibacterial and antifungal
Rx

Prepare 4 suppositories; each contains 300mg bismuth subgallate and glycerol as a base.

DV of bismuth subgallate = 3 and use 1 g mould

- Total amount of bismuth subgallate = 300 x 5 = 1500 mg
- Total amount of glycerol = 5 x 1 = 5 g, but glycerol is 1.2 times denser than theobroma oil; so: 1.2 x 5 = 6 g of base.
- DV = 1.5 x 1 / 3 = 0.5 g
- 6 g – 0.5 g = 5.5 g of base

If 12 cocoa butter suppositories containing 40% zinc oxide weigh 17.6 grams, what is the displacement value of zinc oxide? Assume that the suppositories are made in a 1 g mold.

Given weight of 12 suppositories with zinc oxide = 17.6 g

Weight of zinc oxide in the suppositories = (40/100) × 17.6 = 7.04 g

Weight of cocoa butter in the suppositories = (60/100) × 17.6 = 10.56 g

Theoretical weight of 12 suppositories without zinc oxide = 12 g

Cocoa butter displaced by 7.04 g of zinc oxide = 12 – 10.56 = 1.44

Displacement value of zinc oxide = (7.04/1.44) = (X/1); X = 4.89

General method for preparing suppository: Using 12 cavity molds, a quantity of vehicle known to be insufficient is added to the correct amount of drug for 12 suppositories. The mixture is poured into the mold, leaving one or two cavities unfilled; the excess is scraped off after congealing and returned to the pouring dish; a little more pure vehicle is added, melted together with the excess of drug-vehicle mixture, and poured into the unfilled cavities. More pure vehicle is added in the same way until all 12 holes are correctly filled. After removing the hardened suppositories from the molds, they are again melted, mixed and poured. Since actually a slight excess is poured into each cavity and some mass adheres to the pouring vessel, less than 12 suppositories are obtained on the final pouring.
The second method is called double casting.

**Double Casting Method of Suppository Preparation**

1. Mix all of the drug with a portion of the base and use the mixture to partially fill each of the suppository mold cavities.

2. Use plain base to overfill each cavity.

3. Let cool, then remove excess base from top of mold. Remove suppositories, remelt, and recast to evenly distribute the drug.