Pharmaceutical Formulations

PHR3307

Practicals Handbook

Practical 1: Uniformity of Weight
Practical 2: Extemporaneous Preparations – Powders
Practical 3: Extemporaneous Preparations – Solutions
Practical 4: Effect of concentration on viscosity

Compiled by Marie Clare Zammit
September 2009
Practical 1
Uniformity of Weight

Name: __________________ Group: ___________ Date: ___________

Read the handout provided regarding uniformity of weight taken from the BP 2002. Carry out and report on the test for uniformity of weight of tablets as per BP 2002, using the sample of tablets.

Method:
1. Weigh 20 tablets
2. Record the weight in both grams and milligrams

<table>
<thead>
<tr>
<th>Tablet number</th>
<th>Weight (grams)</th>
<th>Weight (milligrams)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
iii. Calculate the mean weight in mg.

Mean: _______________

iv. From Table 12G-1 (attached), choose the correct percentage deviation according to the mean weight of the tablets

Percentage deviation: _______________

v. Calculate the range in weight that the tablets should fall into according to the following equation:

Percentage deviation (%) × Average weight (mg) = Answer (x)

Range = Average ± x

Calculations:

Range: ___________________

vi. According to the British Pharmacopoeia, not more than 2 of the individual weights should deviate more than this percentage deviation and none should deviate more than twice that percentage.

2 × Percentage deviation (%) × Average weight (mg) = Answer (y)

Range = Average ± y (none should deviate more than this range)

Calculations:

Range: ___________________
Questions

1. Mention and give examples of other types of solid dosage forms apart from tablets

<table>
<thead>
<tr>
<th>Dosage form</th>
<th>Example (active ingredient)</th>
<th>Example (trade name)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

2. What other tests can be applied to tablets? Give a short description of these tests. Use the British Pharmacopoeia (2002) to answer this question.

Test: ______________________________________
Description:
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

Test: ______________________________________
Description:
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
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__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
3. What are the advantages of tablets over other solid dosage forms?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

4. What are the disadvantages of tablets over other solid dosage forms?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
G. Uniformity of Weight (Mass)  
(Ph. Eur. method 2.9.5)

Weigh individually twenty units taken at random or, for single-dose preparations presented in individual containers, contents of twenty units, and determine the average weight (mass). Not more than two of the individual weights (mass) must deviate from the average weight (mass) by more than the percentage deviation shown in Table 12G-1 and none deviates by more than twice that percentage.

Table 12G-1

<table>
<thead>
<tr>
<th>Pharmaceutical form</th>
<th>Average weight (mass)</th>
<th>Percentage deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tablets (uncoated and film-coated)</td>
<td>80 mg or less</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>More than 80 mg and less than 250 mg</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>250 mg or more</td>
<td>5</td>
</tr>
<tr>
<td>Capsules, Granules (uncoated, single-dose) and Powders (single-dose)</td>
<td>Less than 300 mg</td>
<td>10</td>
</tr>
<tr>
<td>Powders for Parenteral Use(*)</td>
<td>300 mg or more</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>More than 40 mg</td>
<td>10</td>
</tr>
<tr>
<td>Suppositories and pastilles</td>
<td>All weights (masses)</td>
<td>5</td>
</tr>
</tbody>
</table>

*When the average weight (mass) is equal to or below 40 mg, the preparation is not submitted to the test for uniformity of weight (mass) but is the test for uniformity of content, Appendix XII H (2.9.6). For capsules and powders for parenteral use, proceed as described below.

Capsules

Weigh an intact capsule. Open the capsule without losing any part of the shell and remove the contents as completely as possible. For soft shell capsules, wash the shell with ether or other suitable solvent and allow to stand until the odor of the solvent is no longer perceptible. Weigh the shell. The weight (mass) of the contents is the difference between the weighings. Repeat the procedure with another nineteen capsules.

Powders for parenteral use

Remove any paper labels from a container and wash and dry the outside. Open the container and without delay weigh the container and its contents. Empty the container as completely as possible by gentle tapping, rinse it if necessary with water and ethanol (96%) and dry at 100°C to 105°C for 1 hour, or, if the nature of the container precludes heating at this temperature, dry at a lower temperature to constant weight (mass). Allow to cool in a desiccator and weigh. The weight (mass) of the contents is the difference between the weighings. Repeat the procedure with another nineteen containers.

H. Uniformity of Content  
(Ph. Eur. method 2.9.6)

The test for uniformity of content is based on the assay of the individual contents of active ingredient of a number of single-dose units to determine whether the individual contents are within limits set with reference to the average content of the sample.

The test is not required for multivitamin and trace-element preparations and in other justified and authorised circumstances.

Method

Using a suitable analytical method, determine the individual contents of active ingredient of ten dosage units taken at random.

Apply the criteria of test A, test B or test C as specified in the monograph for the dosage form in question.

Test A

Tablets, powders for parenteral use and suspensions for injection

The preparation complies with the test if each individual content is between 85% and 115% of the average content. The preparation fails to comply with the test if more than one individual content is outside these limits or if one individual content is outside the limits of 75% to 125% of the average content.

If one individual content is outside the limits of 85% to 115% but within the limits of 75% to 125%, determine the individual contents of another twenty dosage units taken at random. The preparation complies with the test if not more than one of the individual contents of the thirty units is outside 85% to 115% of the average content and none is outside the limits of 75% to 125% of the average content.

Test B

Capsules, powders other than for parenteral use, granules, suppositories and pastilles

The preparation complies with the test if not more than one individual content is outside the limits of 85% to 115% of the average content and none is outside the limits of 75% to 125% of the average content. The preparation fails to comply with the test if more than three individual contents are outside the limits 85% to 115% of the average content or if one or more individual contents are outside the limits of 75% to 125% of the average content.

If two or three individual contents are outside the limits of 85% to 115% but within the limits of 75% to 125%, determine the individual contents of another twenty dosage units taken at random. The preparation complies with the test if not more than three individual contents of the thirty units are outside the limits of 85% to 115% of the average content and none is outside the limits of 75% to 125% of the average content.

Test C

Transdermal patches

The preparation complies with the test if the average content of the ten dosage units is between 90% and 110% of the labelled content and if the individual content of each dosage unit is between 75% and 125% of the average content.
WEIGHING USING BALANCES

The dispensing balance consists of a simple, light but rigid, equal-armed horizontal beam with central and terminal knife-edges. The beam turns about the central fulcrum under the influence of the loads placed on pans suspended from the terminal knife-edges. The oscillations of the beams are dampened to allow readings to be made quickly and easily. Deflection of the beam is indicated by movement of a pointer fixed below the centre of the beam. Although the pointer moves over a calibrated scale, this should be used for guidance only. Appropriate weights and the central zero on the scale should be used for accurate weighing.

Most dispensing balances are of class B types. Class B dispensing balances generally have a maximum capacity of 50g and a sensitivity of 20mg under load.

Minimum weighable amounts

The recommended minimum weighable quantity of any substance to be used in compounding is 50mg provided that a class A balance is available. For quantities less than 50mg, losses in transference on the weighed material become excessive. The recommended minimum weighable quantity for a class B balance is 100mg, although for highly potent substances a higher limit may be preferable.

Weighing technique for the dispensing balance

1. The balances should always be sited on a convenient level surface away from the influence of draughts.
2. Clean the balance and pans as necessary. A clean sheet of white demy paper should be placed under the pans helps to contain spillage and protect the balance.
3. Select a suitable weighing vessel or paper. Balance pans are usually made of glass or stainless steel and are resistant to direct contact with most medicaments with a few exceptions. Weighing papers are convenient for bulky powders and may facilitate transfer from the balance. For greasy or waxy constituents, greaseproof paper should be used since white demy partly absorbs greasy substances and transfer from the paper is difficult. Small lightweight disposable weighing boats are a useful alternative to weighing papers since they may also be used for viscous substances such as coal tar and for non-viscous liquids. If containers such as glass beakers or porcelain evaporating dishes are used as weighing vessels care should be taken to avoid exceeding the total (50g) capacity of the balance.
4. Check that the pointer is on the null point but is able to move freely. Counter balance the weighing vessel if necessary.
5. Place the required weights on the left-hand pan – use forceps to avoid contamination of the weights with consequent alteration in mass (especially small weights)
6. Close the balance drawer. This prevents spills from contaminating the weights.
7. Collect the medicament from the shelf. Check the label word for word with the formula.
8. Hold the bottle in the left hand. Keep the label uppermost so that it is visible during weighing.
9. Remove the lid or stopper. If possible hold the stopper between the little finger and the palm of the right hand. The thumb and remaining fingers of the right hand remain free to use a spatula. If it is not possible to hold the lid, it should be placed top uppermost on a clean tile to protect against contamination.
10. Use a spatula to transfer the medicament to the right hand pan until the pointer returns to the null point. Powders should not be shaken onto the pan from the container.
11. Close the stock container
12. Recheck the weights and the medicament against the formula.

SIZE REDUCTION OF SOLIDS

It is an advantage to use fine powders in pharmaceutical preparation because:
- They mix more uniformly and suspend more easily
- If soluble they dissolve more quickly
- They are absorbed more readily from the gastro-intestinal tract
- They yield preparations that are relatively free from grittiness. Consequently oral powders and suspensions are more pleasant to take and external powders are less irritating to apply.

Dry grinding
The material is broken down with a mortar and pestle. The mechanisms are ‘compression’ between the flat head of the pestle and the bottom of the mortar, and ‘attrition’ by the shearing action of the pestle.

Wet grinding (levigation)
For aqueous suspensions the material is made into a paste with the vehicle and ground in the mortar. Effort put in while the paste is thick, before the addition of more vehicle, produces most effect.

CLEANING OF APPARATUS

All glassware and apparatus must be adequately cleaned before use and rinsed several times with purified water.
POWDERS

Oral powders may be divided (each dose packaged individually) or undivided (powder in bulk). Undivided oral powders usually contain non-potent medicaments such as antacids where the accuracy with which the patient measures the dose is not critical. Divided oral powders are packaged individually and each dose is wrapped separately in paper or sealed in a sachet.

Oral undivided powders are usually formulated by a simple mixture of the prescribed medicaments without additional ingredients. The substances prescribed in this form are bulky powders such as light magnesium carbonate, heavy magnesium carbonate and magnesium trisilicate.

Oral divided powders may contain one or more active ingredients together with an inert diluent to produce a minimum quantity (using a pharmaceutical balance this is usually taken to be 120 mg) that can be weighed by the dispenser and handled by the patient. The usual diluent is lactose because it is colourless, odourless, soluble and generally harmless.

MIXING OF SOLIDS

It can be very difficult to ensure the effective mixing of powders because they do not mix spontaneously. The problem is greatest if the proportion of one ingredient is very small. Localised shear is necessary to move the particles relative to one another while a general circulation is required to bring the bulk of the material into the region of shear. A porcelain mortar is generally used except for materials that stain. It is important to use a sufficiently large mortar since the powder bed will dilate during mixing and space for adequate circulation of the mix should be allowed. Mortars should be perfectly dry before mixing dry powders. The following procedure is suitable:

1. Add to the mortar the ingredient present in the lowest bulk
2. Add a quantity of the second ingredient that approximately doubles the bulk already in the mortar.
3. Mix lightly since undue pressure may cause caking.
4. Occasionally loosen from the bottom of the mortar and scrape it from the sides using a large flexible spatula.
5. At each addition, add a quantity that approximately doubles the bulk in the mortar.
PREPARATION OF UNDIVIDED POWDERS

Add all ingredients to a mortar as per procedure outlined above and mix well. After mixing the powders should be passed through a 250µm sieve and lightly re-mixed using a spatula, since sieving may cause partial separation of the gradients. The powder may then be packed.

PREPARATION OF DIVIDED ORAL POWDERS

Manipulative losses are inevitable when small quantities are weighed from bulk, therefore it is necessary to prepare for at least one powder extra to requirement. The medicament is powdered if necessary in a small mortar and appropriate quantities of lactose or any other inert diluent added to raise the weight of each powder to a convenient amount, minimum 120mg. Bear in mind the total amount of medicament. If this is very small (less than 50mg), the minimum weighable quantity should be used and added to the proportional quantity of lactose.

Example

1. Prepare 4 sachets of propranolol 8mg.
2. Prepare mix for 5 sachets to account for manipulative losses. Therefore 5 x 8 = 40mg of active ingredient are required.
3. The minimum weighable amount of active ingredient on the balance is of 50mg (assuming a class A balance) therefore a minimum of 50mg propranolol can be weighed.
4. By simple proportion, if each sachet of 8mg active ingredient requires the addition of 112mg lactose, how much lactose must be added to 50mg active ingredient?
5. 112mg x 50mg/8mg = 700mg of lactose have to be added to 50mg of the active ingredient.
6. These are mixed, sieved and individual aliquots of 120mg are then taken, each containing 8mg of propranolol.

The final powder mix should be passed through a 250µm sieve and lightly re-mixed before 120mg aliquots are taken and wrapped.
METHOD FOR WRAPPING DIVIDED POWDERS

1. Refer to figure 1 attached.
2. White glazed paper (known as demy paper) is used. Carry out the wrapping on a clean tile or a large sheet of demy to protect the product.
3. Arrange the papers with their long edge parallel to the front of the bench and turn up the long edge of each paper to about one-seventh of its width.
4. Weigh out the powder and place towards the front of the paper.
5. Carry the front of the paper over to the turned up edge, bring the turn up down and then fold this edge forward until it covers about two thirds of the distance to the near edge of the packet. Turn the edges of the packet so that the overlap is equal at both ends.
6. Firm the creases using a clean flexible spatula but avoid excessive pressure which would cause caking of the enclosed powder.
7. The packets are best packed in pairs, flap to flap and restrained with an elastic band.
8. In a well wrapped product there should not be powder within the flaps or folds. When opened by the user, the powder should appear in the centre of the paper, easily available for administration.

Figure 1: Wrapping divided powders
ASPIRIN SACHETS

Consider the following prescription:

Aldo Scerri  
22, Newstreet  
B/Kara  
Age: 45  

Rx

Aspirin 75mg pulv  
M. 5 sachets  
Once daily

Dr. Abraham Fillet MD Reg: 111  
The Clinic, 128, High Street  
High Town  
Tel: 79000000

Calculations:

What is the minimum weight of each sachet?  
___________________________

What is the minimum weight of active ingredient using a class B balance?  
___________________________

Total amount of aspirin added: ________________________________
Total amount of lactose added: ________________________________
Briefly describe the method of preparation used:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

What is the indication for this preparation?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Label:

________________________________________________________________________

What are the possible problems with the use of lactose as diluent?

________________________________________________________________________
________________________________________________________________________

What advice would you give to the patient when dispensing the prescription?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
COMPOUND MAGNESIUM CARBONATE POWDER

Consider the following prescription:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amounts added</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy Magnesium carbonate</td>
<td>940 mg</td>
</tr>
<tr>
<td>Sodium bicarbonate</td>
<td>310mg</td>
</tr>
<tr>
<td>Magnesium trisilicate</td>
<td>230mg</td>
</tr>
<tr>
<td>Ligt Kaolin</td>
<td>75mg</td>
</tr>
<tr>
<td>Prepared Chalk</td>
<td>945mg</td>
</tr>
<tr>
<td>Peppermint oil</td>
<td>0.5mls</td>
</tr>
</tbody>
</table>

Calculations:

Formula:

Dr. Abraham Fillet MD Reg: 111
The Clinic, 128, High Street
High Town
Tel: 79000000
PHR3307

Briefly describe the method of preparation used:

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

What is the indication for this preparation?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

Label:

Which is the diluents being used and why is it indicated over lactose?

______________________________________________________________________________
______________________________________________________________________________

What advice would you give to the patient when dispensing the prescription?

______________________________________________________________________________
______________________________________________________________________________

What are the appropriate storage conditions and shelf-life?

______________________________________________________________________________
______________________________________________________________________________
Powders: General Questions

1. Mention some other powders for **oral** use that are commonly found or requested in pharmacies.

<table>
<thead>
<tr>
<th>Class</th>
<th>Example (active ingredient)</th>
<th>Example (trade name)</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

2. Mention some other powders for **topical** use that are commonly found or requested in pharmacies.

<table>
<thead>
<tr>
<th>Class</th>
<th>Example (active ingredient)</th>
<th>Example (trade name)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. What other formulations can be used for topical application to the skin?

<table>
<thead>
<tr>
<th>Formulation</th>
<th>Example (active ingredient)</th>
<th>Example (trade name)</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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<td></td>
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<td></td>
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</tr>
</tbody>
</table>

4. What are the differences between bulk powders and divided powders?

_______________________________________________________________________________________________________________________
_______________________________________________________________________________________________________________________
_______________________________________________________________________________________________________________________

**Demonstrator Name** | **Signature**
Practical 3
Extemporaneous Preparations – Solutions

FILTRATION

Unwanted particulate matter may be removed from solutions by the process of filtration. Large particulate matter can be removed by coarse filtration. In coarse filtration traces of the particulate matter are tolerable (for example in solutions for use on intact skin or solutions of disinfectants not intended for use on or in the body). Coarse filtration can easily be carried out using a cotton wool plug or gauze, well rinsed to remove loose fibres.

Fine filtration

For oral solutions and solutions for application to mucous membranes or broken skin, a higher degree of filtration is necessary. This is achieved with filter papers or sintered glass filters. Many grades of filter papers are available: in Whatmann® series three of the most useful types are number 1 (suitable for general filtration purposes for removal of medium particles), 50 (better if a particularly clean filtrate is required, removes fine particles) and 54 (suitable for acid and alkaline solutions and removes coarse particles).

Sintered glass filters are expensive and require special cleaning and therefore are not universally available in practice. They are useful for substances that attack filter paper such as potassium permanganate (due to oxidation) and zinc chloride (due to dissolution).

Adjustment to volume after filtration

It is preferable to add the solutions that are used to adjust the final volume through the filter. A suitable procedure is as follows:
Wash through the filter with a little of the vehicle and discard.
Make the solution almost to volume and pass through the filter into a measure.
Rinse through the filter with sufficient vehicle to make the final volume.
EPHEDRINE NASAL DROPS

Consider the following prescription:

<table>
<thead>
<tr>
<th>Aldo Scerri</th>
<th>22, Newstreet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B/Kara</td>
</tr>
<tr>
<td>Age: 45</td>
<td></td>
</tr>
</tbody>
</table>

**Rx**

Ephedrine Nasal Drops B.P.C 1973

M. 10mls

s. 2 drops in each nostril as directed.

Dr. Abraham Fillet MD Reg: 111
The Clinic, 128, High Street
High Town
Tel: 79000000

**Formula:**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Formula</th>
<th>Calculate amounts required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ephedrine hydrochloride</td>
<td>0.5g</td>
<td></td>
</tr>
<tr>
<td>Chlorbutol powder</td>
<td>0.5g</td>
<td></td>
</tr>
<tr>
<td>Sodium chloride powder</td>
<td>0.5g</td>
<td></td>
</tr>
<tr>
<td>Purified water up to</td>
<td>100 mls</td>
<td></td>
</tr>
</tbody>
</table>

Prepare 100mL of Solution A (1 solution for every 4 students):

- Weigh 500 mg of Chlorbutol powder on the balance.
- Grind the Chlorbutol powder in the mortar using the pestle.
- Select a small conical flask with a suitable stopper.
- Heat 100mls of purified water to 60°C in an open conical flask. The flask must NOT be heated with the stopper in place.
- Add the chlorbutol powder, finely ground, to the hot water.
• Quickly insert the stopper and shake until dissolution is complete – examine the solution and make sure it is clear.
• Allow to cool and label the flask as ‘SOLUTION A’.

Preparation of drops (every student must prepare this solution):

• Weigh the required amounts of ephedrine hydrochloride powder and sodium chloride powder.
• Grind these powders separately to a fine powder in the mortar using the pestle.
• Dissolve these fine powders in 5mls of the solution A (ensure that solution A is cool). This is carried out by transferring the powders to the same mortar and adding the solution slowly, grinding with each addition.
• Continue grinding until dissolution is effected and transfer to a 10mL measuring cylinder.
• Adjust to the required volume with the remainder of solution A. Use aliquots of the solution to rinse any remaining particles in the mortar.
• Filter the solution into the appropriate container using a funnel housing a filter paper.
• Examine the solution for clarity, cap and label with a shelf-life of 14 days.

Attach copy of label here:

Describe the container used.

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
What is the indication for this preparation?

Why are the following included in the formulation?
   i. Ephedrine hydrochloride

   ii. Chlorbutol

   iii. Sodium Chloride

Why was water heated to produce solution A?

Why was it important to use a conical flask with a stopper when preparing solution A?

Why was the solution filtered before bottling?

What is meant by ‘B.P.C. 1973’ after formula name?
What advice would you give to the patient when dispensing the prescription?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

What other ingredient would you consider if chlorbutol was not available?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

What is the main factor affecting the preservative function in a solution and how would you check this?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Why is it so important that glassware must be thoroughly cleaned before use?

________________________________________________________________________
________________________________________________________________________
Consider the following prescription:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Formula</th>
<th>Calculate amounts required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorinated Lime</td>
<td>12.5g</td>
<td></td>
</tr>
<tr>
<td>Boric Acid powder</td>
<td>12.5g</td>
<td></td>
</tr>
<tr>
<td>Purified water up to</td>
<td>1000 mls</td>
<td></td>
</tr>
</tbody>
</table>

Preparation:

1. Weigh the required amount of chlorinated lime and boric acid powder.
2. Reduce the chlorinated lime to a fine powder using and mortar and pestle and triturate it with sufficient water to form a paste, then add a further portion of the water.
3. Grind the boric acid powder to a fine powder using a clean mortar and pestle.
4. Add the boric acid to the solution, triturate well, and add some more water.
5. Transfer the contents to a measuring cylinder and make up to the required volume with water. Add the water in aliquots, using each aliquot to rinse the mortar of any residue prior to addition to the measuring cylinder.

6. Allow the solution to stand and filter the solution prior to bottling.

7. Examine the solution for clarity, cap and label with a shelf-life of 14 days.

Attach copy of label here:

What is the use of the preparation?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

What storage conditions are required for the preparation?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

What advice would you give to the patient when dispensing the preparation?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
GENERAL QUESTIONS ON COMPOUNDING OF SOLUTIONS

1. What compounding techniques could aid dissolution of powders?
   _____________________________________________________
   _____________________________________________________
   _____________________________________________________

2. What compounding techniques could minimise microbial contamination of solutions?
   _____________________________________________________
   _____________________________________________________
   _____________________________________________________

3. Extemporaneous compounding requires examination of the resulting solution prior to signing off the release. What parameters would you check?
   _____________________________________________________
   _____________________________________________________
   _____________________________________________________

4. What are three parameters of stability that must be addressed when determining stability of a preparation?
   _____________________________________________________
   _____________________________________________________
   _____________________________________________________

5. Why are plastic bottles rarely used for pharmaceutical solutions?
   _____________________________________________________
   _____________________________________________________
   _____________________________________________________

6. Mention 3 types of products found in the pharmacy which are simple solutions
   _____________________________________________________
   _____________________________________________________
   _____________________________________________________

7. Water is the most common vehicle found in pharmaceutical solutions. Give 3 other vehicles commonly used in pharmaceutical solutions
   _____________________________________________________
8. Which routes are commonly used for the administration of solutions?

9. Glucose is used as a 5%w/v solution in water for intravenous fluids. What amount of glucose has been administered to a patient who has received 2 litres of this iv fluid?

Calculations:

10. Pholcodine Linctus contains pholcodine 5mg/5mL and citric acid monohydrate 1%w/v in a suitable flavoured vehicle.
   i. What is the percentage of pholcodine in this product?
   ii. What amount of citric acid monohydrate would be administered to the patient with each 5mL dose?

Calculations:

Demonstrator Name  Signature  Mark

<table>
<thead>
<tr>
<th>Demonstrator Name</th>
<th>Signature</th>
<th>Mark</th>
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<tbody>
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Practical 4
Effect of concentration on viscosity

Name: Group: Date:

**AIM:** To determine the effect of concentration on viscosity.

**APPARATUS**

- Beaker 250ml
- Bunsen Burner
- Electronic Balance
- Measuring Cylinder 1 x 100 ml
- Pipette 50ml
- Pipette filler
- Pipette with long spout
- Rubber tubing
- Stop watch
- Thermometer 0 -100°C
- U-Tube viscometer size C
- Volumetric flask 200ml x 2
- Water bath maintained at 37°C

**MATERIALS**

- Distilled water
- Sucrose

**WARNING:** The viscometer is a very fragile instrument. Handle with utmost of care.

**METHOD**

1. Prepare 200ml of Syrup BP by heating 667g of sucrose in water until it dissolves and make up to 1000ml with hot water.
2. Fill the viscometer through arm L using the pipette with the long spout up to a level a few mm above mark G while trying not to wet the sides.
3. Clamp the viscometer by arm N in the water bath ensuring that marks E and F are visible and wait until the viscometer warms up.
4. Bring the meniscus to level G by removing the excess fluid using the pipette with the long spout.
5. Fit the rubber tubing to arm L and blow to push the level of the syrup a few mm above mark E.
6. Stop blowing and measure the time for the fluid to fall from mark E to mark F.
7. Repeat steps 5 and 6 one more time.
8. Pipette 100 ml of the solution prepared in step 1, into a 200ml volumetric flask and make up with water to 200ml while mixing.
9. Empty the viscometer and rinse it with a few mls of the solution prepared in step 8.
10. Repeat steps 2 to 7 but using the solution prepared in step 8.
11. Pipette 100ml of the solution prepared in step 8 into a 200ml volumetric flask and make up to the mark with water while mixing.
12. Empty the viscometer and rinse it with a few ml of the solution prepared in step 11.
13. Repeat steps 2 to 7 but using the solution prepared in step 11.
14. Pipette 100ml of the solution prepared in step 11 into a 200ml volumetric flask and make up to the mark with water while mixing.
15. Empty the viscometer and rinse it with a few ml of the solution prepared in step 14.
16. Repeat steps 2 to 7 using the solution prepared in step 14.
17. Empty the viscometer and rinse it with water.
18. Repeat steps 2 to 7 but now using water.

RESULTS

Table 1: Time taken for fluid to fall from mark E to F

<table>
<thead>
<tr>
<th>Solution</th>
<th>$T_1$(s)</th>
<th>$T_2$(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
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<td>2</td>
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<td>5</td>
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CALCULATIONS

1. Determine the kinematic viscosity $v$ for each solution using the following formula:

$$v = kt$$

Where: $v = \text{kinematic viscosity in (mm}^2\text{s}^{-1})$

$k = \text{viscometer constant} = 0.03\text{mm}^2\text{s}^{-2}$

$t = \text{time in seconds}$

Table 2: Average kinematic viscosity

<table>
<thead>
<tr>
<th>Solution</th>
<th>$v_1$ (mm$^2$s$^{-1}$)</th>
<th>$v_2$ (mm$^2$s$^{-1}$)</th>
<th>$v_{av}$ (mm$^2$s$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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</table>

2. Calculate the sugar concentration for each solution

Table 3: Concentrations of each solution

<table>
<thead>
<tr>
<th>Solution</th>
<th>Concentration g/ml</th>
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<tbody>
<tr>
<td>1</td>
<td></td>
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<td>2</td>
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3. Using the following formula check if the graph fits a straight line

\[ R = \frac{\Sigma (x - x') (y - y')}{\sqrt{\Sigma (x - x')^2(y - y')^2}} \]

Where:  
- \( x' \) = mean value for \( x \)
- \( y' \) = mean value for \( y \)

Table 4: Calculation for regression analysis

<table>
<thead>
<tr>
<th></th>
<th>( x )</th>
<th>( x - x' )</th>
<th>( (x - x')^2 )</th>
<th>( y )</th>
<th>( y - y' )</th>
<th>( (y - y')^2 )</th>
<th>( (x - x')^2(y - y')^2 )</th>
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<tbody>
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<tr>
<td>Summation</td>
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<td>( \Sigma )</td>
<td>( \Sigma )</td>
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\[ R = \]

4. What do you conclude?

___________________________________________________________________________________

5. Plot a graph of kinematic viscosity against sugar concentration.

Table 5: Values for graph: kinematic viscosity vs sugar conc.

<table>
<thead>
<tr>
<th>Sugar conc. (g/ml)</th>
<th>Kinematic viscosity g/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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QUESTIONS

1. List 3 precautions.

2. List 1 source of error

3. Discuss the data obtained.

4. What is viscosity?

5. Define kinematic viscosity?

6. Give 5 examples of viscosity modifiers used to modify suspension viscosity.
7. Give an example where the viscosity of a formulation is important in the administration of a drug.

___________________________________________________

___________________________________________________

___________________________________________________

8. What happens to the viscosity of the following system on increasing the temperature?
   a) Gas ____________________________________________
   b) Liquid _________________________________________

9. List three parameters that are constant in this experiment.

___________________________________________________

___________________________________________________

___________________________________________________

10. Why are viscosity-increasing agents important in ophthalmic preparations? Give 2 examples of such agents

___________________________________________________

___________________________________________________

___________________________________________________

___________________________________________________

___________________________________________________

11. What are the maximum viscosity (in centipoises) that can be used in eye preparations? What happens if this value is exceeded?

___________________________________________________

___________________________________________________

___________________________________________________

___________________________________________________

___________________________________________________
12. What is the importance of viscosity in relation to the bioavailability of drugs? Explain giving 4 examples.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

13. Should the temperature be constant when measuring viscosity? Explain

________________________________________________________________________
________________________________________________________________________

14. How is the viscometer constant (k) for an Oswald-type viscometer determined? Explain briefly.

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REFERENCES


