Class: Diploma in pharmacy Part I

Subject: Pharmaceutics I

Subject code - 7446

Model answers

Section A (Attempt all question) 12x2=24

1. **(i) Differentiate between lotion and liniments?**

Liniment	Lotion
1. It is a mono phasic liquid preparation meant for application to the skin 2. Applied to the skin with friction 3. Should not be applied to broken skin because it may cause excessive irritation 4. Used as counter irritant (or) rubefacient	1. It is a mono phasic liquid preparation meant for external application 2. Applied without friction 3. Applied with the help of cotton wool 4. Used for local action as cooling, soothing, protective

(ii) Calculate the quantity of dextrose required to prepare 8 fl oz of a 5% solution.

35 gr in 8 fl oz are required to make a 1% solution

35x5 gr (175 gr) in 8 fl oz are required to make a 5% solution

Therefore, 175 gr of dextrose is dissolved in water and diluted to 8 fl oz will produce a 5% w/v solution

(iii) What are the advantages and disadvantages of glass containers?

Advantages:

- ✓ They are transparent
- ✓ They are available in various shapes and sizes
- ✓ They can withstand the variation in temperature and pressure during sterilization
- ✓ They are economical under and readily available
- ✓ They are impermeable to moisture and atmospheric gases

Disadvantages:

- ✓ They are fragile, which are easily broken when dropped or knocked
- ✓ They are heavy, which increase the cost of its transportation
- ✓ They may release alkali

(iv) What are the mechanisms involved in size reduction?

- ✓ Cutting
- ✓ Impact
- ✓ Attrition
- ✓ Compression

(v) Define the term "aperture tolerance average size"?

Some variation in the aperture size is unavoidable and when this variation is expressed as a percentage it is known as aperture tolerance average size. In fact, it is a limit given by pharmacopoeia within a particular dimension or average aperture size can be allowed to vary and still be acceptable for the purpose for which it is used.

(vi) Define the term "mixing"?

Mixing is the most widely used operation in which two or more than two substances are combined together. Perfect mixing is that in which each particle of one material lies as nearly adjacent as possible to a particle of the other material.

(vii) Mention the factors which affect the filtration?

- ✓ Pressure differences
- ✓ Viscosity of sample
- ✓ Surface area of filter media
- ✓ Temperature of sample
- ✓ Particle size
- ✓ Pore size of the filter media
- ✓ Thickness of cake
- ✓ Nature of solid material

(viii) What do you mean by extraction?

Extraction may be defined as the treatment of the plant or animal tissues with solvent, whereby the medicinally active constituents are dissolved and most of the inert matter remains undissolved.

(ix) What are the applications of simple distillation?

- ✓ It is used for the preparation of distilled water and water for injection.
- ✓ Many volatile oils and aromatic waters are prepared by simple distillation.
- ✓ Purification of organic solvent
- ✓ Concentration of liquid and to separate non-volatile solid from volatile liquids such as alcohol and ether.

(x) Explain the theory of freeze drying process?

In freeze drying, water is removed from the frozen state by **sublimation**, i.e., direct change of water from solid into vapour without conversion of liquid phase.

(xi) Write the advantages of tablets?

- ✓ They are easy to be administered
- ✓ They are easy to be dispensed
- ✓ They are more stable dosage form
- ✓ They maintain the accuracy of dosage
- ✓ Bitter and nauseous substances can be given easily in tablet form after giving a suitable coating.
- ✓ They are better suited to a large scale production as compared with any other unit oral dosage form.
- ✓ They are an economical dosage form.

(xii) Define the term "capsules"?

Capsules are a solid dosage form in which the drug substance is enclosed in a water soluble shell or an envelope. A capsule shell is made from gelatin. The capsules are available both as hard gelatin capsule and soft gelatin capsule.

Section B (attempt any four) 4x14= 56

2. **Write the different factors affecting size reduction. With the neat diagram explain construction, working and application of Ball mill.**

Factors affecting size reduction:

- ✓ Hardness
- ✓ Toughness
- ✓ Stickiness
- ✓ Material structure
- ✓ Moisture content
- ✓ Softening temperature
- ✓ Purity required
- ✓ Physiological effect
- ✓ Ratio of feed size to product size
- ✓ Bulk density

Ball Mill

Principle:

Impact or attrition or both are responsible for the size reduction.

Construction:

It consists of a hallow cylinder, which is mounded on a metallic frame in such a way that it can be rotated on its longitudinal axis. The length of the cylinder is slightly greater than its diameter. Cylinder is made of a metal and is usually lined with chrome. The cylinder contains balls that occupy 30 to 50% of the mill volume. The weight of the balls is kept constant. The ball size depends on the size of the feed and the diameter of the mill. Balls are made of steel, iron or stoneware. These act as the grinding medium.

Diagram:

Diagram should be drawn as per text book

Working:

The sample to be ground is put into cylinder of the mill in such a quantity that it is filled to about 60% of the volume. A fixed number of balls are introduced and the cylinder is closed. The mill is allowed to rotate on its longitudinal axis.

At low speeds, the balls roll over each other and **attrition** will be a predominant mode of stress.

At high speeds, the balls are thrown out to the wall by centrifugal force. Hence, grinding will not occur. The **compression** by the balls against the wall will not be sufficient for effective size reduction of the substance.

At correct speeds (optimum speed), the balls are picked up by the mill and carried nearly to the top, where they break contact with the wall and fall to the bottom to be picked up. In this manner, **impact** stress will also be induced and the size reduction is made effective.

Application:

Fine grinding with a particle size of 100 to 5 mm or less can be obtained.

3. **How will you classify plastics? Write in detail about composition of plastic and its merits and demerits.**

Classification of plastic

a. **Thermoplastic type:**

This type of plastic gets softened to a viscous fluid on heating and hardens again on cooling. The hardness after cooling is influenced by the degree of cross linkage or inter-molecular attraction between the long chain molecules.

e.g. nylon, polystyrene, polymethyl methaacrylate

b. **Thermosetting type:**

This type of plastic may flexible but does not become fluid on heating. They are generally hard and brittle at room temperature because of a high degree of cross linking. They retain their shape even up to the temperature of decomposition.

e.g. phenol formaldehyde resins and urea formaldehyde resin.

Composition of plastic

a. **Polyethylene (polythene)**

It is flexible, very light but tough plastic. Its melting point being in the range of 110 to 115° C, containers made from it cannot be sterilized by heat.

b. **Polyvinyl chloride (PVC)**

It has high clarity and is not effected by sunlight. It is used for preparing eye-oinment tubes.

c. **Polymethyl methoacrylate (PMMA)**

It is a hard, strong but light, transparent plastic. Its soften at about 100° C. it is used for preparing bottles and tubes.

d. **Polystyrene**

It can be easily moulded into any shape.

e. **Polytetra fluoroethylene**

It is translucent, opaque and possesses high resistances to solvents and chemicals. It is unchanged even at a temperature of 250° C.

f. **Polypropylene**

It is very light and heat resistant. It is used for preparing disposable syringes, tubing, squeeze bottle and packaging film.

g. **Polyamide (Nylon)**

It is very tough plastic having great amount of flexibility and heat resistance.

h. Polycarbonate

It is transparent, has high impact strength and very good heat resistance. It is used in the preparation of surgical equipment.

Merits

- ✓ They are light in weight and can be handled easily
- ✓ They are poor conductor of heat
- ✓ They have sufficient mechanical strength
- ✓ They can be transported easily
- ✓ They are unbreakable
- ✓ They are available in various shaped and sizes
- ✓ They are resistant to inorganic chemicals
- ✓ They have good protection power

Demerits

- ✓ They are permeable to water vapour and atmospheric gases.
- ✓ They cannot withstand heat
- ✓ They may absorb chemical substances, such as preservatives for solution.
- ✓ They are relatively expensive

4. With the neat diagram explain construction, working and application of cyclone separator.

Principle:

Centrifugal force is used to separate the solids from fluids. The separation process depends not only on the particle size, but also on the density of particles. Depending on the fluid velocity, the cyclone separator can be used to separate all types of particles. It is also possible to allow fine particles to be carried by the fluid.

Diagram:

Diagram should be drawn as per text book

Construction:

It consists of a short vertical, cylindrical vessel with a conical base. The upper part of the vessel is fitted with a tangential inlet. The outlet (solid outlet) is arranged at the base. Fluid outlet is provided at the centre of the top portion, which extends inwardly into the separator. Such an arrangement prevents the air short-circulating directly from the inlet to the outlet of the fluid.

Working:

The solids to be separated are suspended in a stream of gas (air). Such a feed is introduced tangentially at a very high velocity, so that rotary movement takes place within the vessel. The centrifugal force and vortexing throws the solids to the walls. As the speed of air diminishes, the particles fall to the conical base and are discharged through the solid outlet. The fluid (air) can escape from the central outlet at the top.

Applications:

- ✓ It is used to separate the solids from gases.
- ✓ It is also used for size separation of solids in liquids.
- ✓ It is used for separating the heavy or coarse fraction from fine dust.

5. **With the neat diagram explain construction, working and merits and demerits of evaporating pan and evaporating still.**

Evaporating pan

Construction:

It is a hemispherical structure consisting of an inner pan called 'kettle'. It is enveloped with an outer pan called 'jacket'. The two pans are joined to enclose a space through which steam is passed. Copper is an excellent material for the kettle, because of its good conductivity. For acidic materials tinned copper is used. Iron is used for the construction of the jacket, the iron is either tinned or enameled on inner surface.

An inlet for the steam and an outlet for non-condensed gases are provided near the top of the jacket. Condensate leaves the jacket through the outlet provided at the bottom. The kettle is provided with one outlet for product discharge at its bottom.

Diagram:

Diagram should be drawn as per text book

Working:

Sample to be evaporated is placed in the kettle. Steam is supplied through the inlet. Steam gives out its heat to the contents and the condensate leaves through the outlet. The contents must be stirred manually for smaller volumes and mechanically for large volumes. The rate of evaporation is fast in the initial stage and decreases gradually as the liquid gets concentrated.

Merits

- ✓ It is constructed both for small scale and large scale operation.
- ✓ It is simple in construction and easy to operate, clean and maintain.

- ✓ Its cost of installation and maintenance is low

Demerits

- ✓ It is not suitable for heat sensitive materials due to long time of exposure.
- ✓ The heating area decreases as the product gets more concentrated.
- ✓ As it is open type, vapour passes into the atmosphere, which can lead to saturation of the atmosphere, slowing evaporation as well as causing discomfort.

Evaporating still

Diagram:

Diagram should be drawn as per text book

This type of evaporator is commonly known as a 'still' because the evaporating pan is converted and is connected to a condenser so that the vapours are condensed into liquid. Construction is similar to the evaporating pan with a cover that connects it to the condenser, so that the liquid is distilled off.

Merits

- ✓ It is simple in construction
- ✓ It is easy to clean and maintain
- ✓ The vapours are condensed in it. It increases the speed of evaporation and the costly solvents can be recovered.
- ✓ There can be a provision for evaporating under a reduced pressure in case the vacuum pump is connected to the evaporating still.

Demerits

- ✓ The heating surface is limited
- ✓ It is not suitable for the thermolabile materials as the sample is heated all the time in it.
- ✓ Due to natural circulation the coefficient of the heat transfer is poor.

6. Write short notes on: (any two)

(a) Methods used for tests for sterility

(i) Membrane filtration method

(ii) Direct inoculation method

(i) Membrane filtration method:

The method is preferred in the following cases:

- ✓ An oily or oily preparation
- ✓ An ointment that can be put into solution
- ✓ A non-bacteriostatic solid not readily soluble in culture medium
- ✓ A soluble powder or a liquid that possesses bacteriostatic and fungistatic properties
- ✓ Liquid product where the volume in a container is 100 ml or more.

The method involves the filtration of the sample under test through a membrane filter having normal porosity of 0.45 µ, and a diameter of 47 mm. after the filtration, the membrane is removed aseptically from the metallic holder and divided into two halves. The first half is transferred into 100 ml of culture media meant for fungi and incubated at 20 to 25° C for not less than seven days. The other half is transferred into 100 ml of fluid thioglycollate medium and incubated at 30 to 35° C for not less than seven days. Observe the growth in the media.

(ii) Direct inoculation method

In this method the specified quantity of sample under test is drawn aseptically from the container and transferred into a vessel of culture medium. Mix the liquid with the medium and incubate for not less than 14 days. Observe the growth of microorganisms in the medium.

(b) Autoclave

Moist heat sterilization is more effective than dry heat method. This is due to the fact that steam has more penetration power than dry heat and thermal capacity of steam is more than of dry heat. The moist steam penetrates the spores and capsules of bacteria, rupture it and escaping protoplasm is coagulated. Moist heating is done in an autoclave.

Autoclave consists of a strong metallic chamber usually made of stainless steel. It has a cover fitted with a steam vent, a pressure gauze and a safety valve. Rubber gasket is fitted on the inner side of the lid, in order to make autoclave air tight. The cover is closed with wing nuts and bolts. The electrically heated element is fitted at the bottom to heat the water to convert into steam. The perforated inner chamber is placed on the stand. The material to be sterilized is loosely packed into it.

Diagram:

Diagram should be drawn as per text book

A sufficient quantity of water is poured into the chamber after removing the perforated chamber. The level of the water is adjusted in such a way that it does not touch the bottom of the perforated chamber. The material is packed in the perforated chamber. The lid is then closed with wing nuts and bolts.

The autoclave is switched on to heat the water. The vent is opened and safety valve is set at the required pressure. When steam starts coming out from the vent and it continue for 5 minutes, it is then closed. It indicates that air has been removed. The steam pressure starts rising and it comes to the desired pressure i.e. **15 lbs/Sq. inch with corresponding temperature 121° C for 12 min**. After the stated period, switch off the autoclave and allow it to cool to about 40° C before opening the vent. When whole of the steam inside the autoclave is removed, the lid is opened and the sterilized material is taken out.

Applications:

- ✓ It is used for sterilization of surgical dressings, surgical instruments, containers and closures.
- ✓ It is used for the sterilization of a majority of official injections which can withstand the pressure of 15 lbs/Sq. inch for 30 min.

(c) Hot air oven

All microorganisms including bacterial spores can be destroyed by heat. This is due to the oxidation of essential cell constituents.

Hot air oven is a double walled chamber made of steel. Insulation material such as glass fibres or asbestos is filled between the two walls of the oven to avoid heat loss. The door is also double-walled having asbestos gasket on its inner side. Two or three perforated shelves are fixed inside the oven to place the material for sterilization. An electric fan is also fitted to ensure the uniform circulation of hot air in the oven in order to maintain the required temperature in all the shelves. Heating elements are fitted on the bottom of the oven and it is thermostatically controlled. A thermometer is fitted in the oven to note down the temperature inside the oven.

Diagram:

Diagram should be drawn as per text book

The materials to be sterilized are placed on the perforated shelves of the oven. The following precautions are to be taken while placing the material meant for sterilization:

- ✓ Glass apparatus must be wrapped with clean cloth or filter paper and container must be plugged with non-absorbent cotton wool.
- ✓ Materials should not be placed at the floor of the oven as it receives direct heat and becomes much hotter.
- ✓ The oven should not be overloaded with the materials meant for sterilization.
- ✓ There should be sufficient space in between the articles, so that there is uniform distribution of heat.

After heating the contents of the oven for two hours at 160° C, the articles are allowed to remain there, till the temperature comes down to 40° C. The sterilized material is then removed from the oven.

Applications:

- ✓ It is mainly used for sterilization of glass wares, powders, scalpels, scissors, spatula, blades and glass syringes.
- ✓ Injections where oil is used as vehicle e.g. injection of progesterone.

7. What are the common defects which can occur in compressed tablets? How can such defects be removed?

a. Capping:

In this case there is partial or complete removal of top or bottom portion of the tablet. The reasons for this defect usually are:

- ✓ Excessive fines in granules which entrap air in a tablet
- ✓ Defective punches and dies
- ✓ High speed of the tablet machine
- ✓ The granules are too dry

These defects can be removed by:

- ✓ Setting the dies and punches properly
- ✓ Reduce the percentage of fines

- ✓ Punches should be either buffed or polished before its use. Defective punches should be replaced.
- ✓ Maintain the desired moisture content level in granules
- ✓ Regulate the speed of tablet machine

b. Picking and sticking

In picking the material is removed or picked up by the upper punch from the upper surface of the tablet. In case of sticking, the material sticks to the wall of the die. These defects appear due to the following reasons:

- ✓ Use of worn out dies and punches
- ✓ Lack of lubricants
- ✓ Presence of moisture in the granules

Theses defects can be removed by

- ✓ A new set of die and punches
- ✓ A proper quantity of lubricants in the granules
- ✓ Maintain the desired moisture content level in granules

c. Mottling

Mottling means an unequal distribution of colour on the surface of coloured tablets.

Reasons:

- ✓ Migration of dye in the granules during the process of drying
- ✓ Use of different coloration of medicament and excipients

Remedy:

- ✓ Drying the granules at a low temperature
- ✓ Using the dye which can mask the colour of all the ingredients of tablet formulation

d. Weight variation

During the compression of granules in a tablet machine, the tablets do not have a uniform weight

Reasons:

- ✓ Granules are not uniform in size
- ✓ Presence of excess amount of powder in the granules
- ✓ No proper mixing of lubricants
- ✓ No uniform flow of granules from the hopper to the die
- ✓ Variation in the speed of the tablet machine

These defects can be avoided by correcting and checking the above mentioned points.

e. Hardness variation

Hardness variation is a problem having the same cause as weight variation. In this case, the tablets do not have a uniform hardness. Hardness depends on the weight of the material and the space between the upper and the lower punches during the stage of compression. If the volume of the material varies or the distance between punches varies, the hardness will also vary.

f. Double impression

This defect occurs when the lower punch has a monogram or some other engraving on it. During compression, the tablet receives an imprint of the punch. Due to some defect in the machine, the lower punch moves slightly upward before ejection of a tablet and gives a second, though light imprint on the tablet. This defect can be removed by controlling the undesirable movement of the lower punch.