BP102T · B.PHARM THEORY

BP102T General Pharmacy

Unit III — Solid Dosage Forms

Pills & Python Notes
From-zero teaching standard: every technical term is defined before use.
Syllabus coverage: Unit III (9 hours).

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UNIT III — SOLID DOSAGE FORMS (9 hours)

BP102T General Pharmacy (Theory) · Pills & Python Notes

From-zero teaching standard: every technical term is defined before use. Syllabus coverage: Units III, IV and V (27 hours).

CHAPTER 9: POWDERS

Unit III · ~3 hours

9.1 Introduction

Long before tablets and capsules existed, medicines were powders. Even today, powders are everywhere in pharmacy: the ORS sachet dissolved in water for dehydration, the antacid powder stirred into a glass of water, the dusting powder sprinkled on skin. A powder is simply a drug in a finely divided solid form — and understanding powders teaches you the foundation of all solid dosage forms: particle size, mixing, and stability.

Learning objectives — after studying this chapter, you should be able to:

- define a powder and classify powders into bulk, divided, simple and compound types;
- list the advantages and disadvantages of powders as a dosage form;
- define and give examples of dusting powders, effervescent powders, efflorescent powders, hygroscopic powders and eutectic mixtures;
- explain the problems caused by hygroscopic, efflorescent and eutectic ingredients and how a pharmacist handles them;
- name the common excipients used in powders;
- describe the general method of preparation of powders.

9.2 Definition

Scientific definition: A powder is a solid dosage form containing one or more drugs in a dry, finely divided state, intended for internal or external use.

Simple explanation: A powder is medicine in the form of tiny dry particles — like fine flour or talcum powder. The patient either takes it directly, dissolves or suspends it in water, or applies it on the skin.

Particle size means how big each tiny particle is. Smaller particles dissolve faster and mix more evenly — this is why powders are ground finely and passed through sieves.

9.3 Key Terminology

Term	Meaning	Simple explanation
Powder	Dry, finely divided solid drug preparation	"Medicine dust"
Bulk powder	Multi-dose powder supplied in a wide-mouth container; patient measures each dose	The "family pack" — one container, many doses
Divided powder	Powder pre-weighed into single doses, each wrapped in a paper (powder paper/chartula)	The "single-serve sachet"
Simple powder	Contains only one drug	One ingredient
Compound powder	Contains more than one drug	A mixture of ingredients
Dusting powder	Powder applied externally on the skin	"Medicated talc"
Effervescent powder	Releases carbon dioxide bubbles when added to water	The "fizzing" powder
Efflorescence	Loss of water of crystallisation from a salt into dry air	A crystal "drying out and crumbling"
Hygroscopic	Absorbs moisture from the air	"Drinks water from the air"
Deliquescent	Absorbs so much moisture that it dissolves in it	"Drinks so much it melts"
Eutectic mixture	Two solids that liquefy when mixed together at room temperature	"Two powders that turn to liquid when mixed"
Trituration	Grinding in a mortar with a pestle	Hand-grinding in a bowl
Geometric dilution	Mixing by starting with the smallest quantity and doubling up	"Small into large, step by step"

9.4 Detailed Explanation

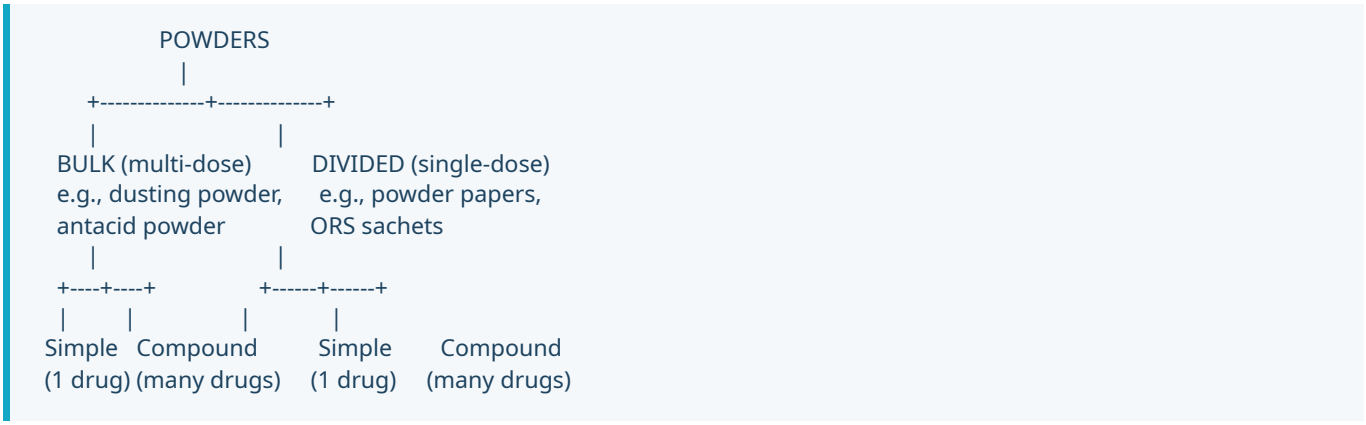
9.4.1 Classification of powders

By dose packaging:

- **Bulk powders** — supplied in wide-mouth jars; the patient measures each dose with a spoon or the enclosed measure. Examples: antacid powders, ORS powder (before single-dose sachets became common), dusting powders.
- **Divided powders** — each dose is individually weighed and wrapped in a paper fold called a **powder paper** or *chartula*. Examples: single-dose antacid sachets, paediatric powders.

By composition:

- **Simple powders** — one drug only (e.g., pure aspirin powder).
- **Compound powders** — two or more drugs mixed (e.g., a powder containing an antacid plus a carminative).



9.4.2 Advantages and disadvantages

Advantages	Disadvantages
Suitable for large doses that would make tablets too big to swallow	Bitter or unpleasant drugs are hard to mask
Dissolve quickly → faster onset than tablets	Hygroscopic drugs absorb moisture and cake
Easy for children and elderly (dissolved in water/milk)	Bulk powders need the patient to measure — dosing errors possible
More stable than liquids for moisture-sensitive drugs	Bulky to carry compared with tablets
Versatile — internal, external, or reconstituted use	Not suitable for very small potent doses (weighing accuracy)
Simple and cheap to prepare	Drugs that irritate the stomach hit it all at once

9.4.3 Special types of powders

A. Dusting powders — for external use on the skin.

- Applied with a powder puff or a sifter-top container; must be very fine so they spread evenly and do not irritate the skin.
- Examples: talc-based dusting powders, zinc oxide dusting powder.
- **Sterility note:** dusting powders used on broken skin, burns, or wounds (surgical dusting powders) must be sterile — ordinary skin powders need not be.

B. Effervescent powders — contain sodium bicarbonate plus an organic acid (citric acid and/or tartaric acid). When added to water they react and release **carbon dioxide** — the fizz.

- The fizz masks salty/bitter taste and helps the drug dissolve; also speeds absorption.
- Examples: effervescent antacid powders, effervescent vitamin preparations.
- Must be stored in **airtight containers** — even moisture from the air can start the reaction in the pack.

C. Efflorescent powders — contain salts that lose their **water of crystallisation** in dry air and crumble to powder (efflorescence).

- Example: washing soda (sodium carbonate decahydrate); ferrous sulphate can also effloresce.
- Such powders may lose weight on storage — they are kept in **well-closed containers**, and the pharmacist must be aware that the drug content per gram changes as water is lost.

D. Hygroscopic powders — absorb moisture from the air and become sticky or caked.

- **Deliquescent** substances go one step further and dissolve in the absorbed water (e.g., calcium chloride, zinc chloride).
- Handling: store in **airtight containers**, sometimes with a desiccant (a drying agent like silica gel); dispense quickly and advise the patient to keep the pack tightly closed.

E. Eutectic mixtures — some pairs of solids **liquefy when mixed** at room temperature because the mixture melts at a lower temperature than either solid alone.

- Classic pairs: **menthol + camphor**, **menthol + thymol**.
- This is a problem when such drugs are prescribed together in a powder — the powder turns damp or liquid.
- **Solutions:** (1) add an **adsorbent** (a powder that soaks up the liquid, e.g., light kaolin or magnesium carbonate); (2) triturate each drug separately with the adsorbent first, then mix lightly; (3) in extreme cases, dispense the two drugs in separate powders.

Problem ingredient	What happens	How the pharmacist handles it
Effervescent mix ($NaHCO_3$ + acid)	Reacts with atmospheric moisture, fizzes in the pack	Airtight container; keep dry
Efflorescent salt	Loses water, weight changes	Well-closed container; account for water loss
Hygroscopic/deliquescent drug	Absorbs moisture, cakes or liquefies	Airtight container, desiccant; dispense fast
Eutectic pair (menthol + camphor)	Liquefies on mixing	Add adsorbent (kaolin, $MgCO_3$) or dispense separately

9.4.4 Excipients used in powders

Excipient = any inactive ingredient added to help make, stabilise, or improve the dosage form (the drug itself is the *active* ingredient).

- **Diluents** (fillers) — add bulk when the drug dose is tiny, e.g., lactose.
- **Adsorbents** — soak up moisture or eutectic liquids, e.g., light kaolin, magnesium carbonate.
- **Colouring agents, flavouring agents, sweeteners** — make the powder acceptable, e.g., sucrose, fruit flavours (mainly for internal powders).

9.4.5 General method of preparation

1. **Size reduction** — each ingredient is triturated (ground) separately in a mortar to a fine powder.
2. **Sieving** — pass through a sieve of suitable fineness to get uniform particle size.
3. **Mixing by geometric dilution** — place the *smallest* quantity in the mortar, add an approximately equal quantity of the next ingredient, triturate well, and keep doubling up. This guarantees even mixing even when one drug is present in a tiny amount.
4. **Weighing** — for divided powders, weigh each single dose accurately.
5. **Packaging** — wrap divided doses in powder papers; pack bulk powders in wide-mouth, well-closed (or airtight, if needed) containers; label clearly.

9.5 Easy Analogy

- **Geometric dilution** is like mixing a spoon of strong *masala* into a pot of rice: you first mix the masala into one spoon of rice, then mix that spoon into two spoons, then into the whole pot. If you threw the masala straight into the pot, some bites would be fiery and some bland. Powders work the same way.
- **A eutectic mixture** is like two ice cubes pressed together melting faster than one alone — two solids that "agree" to become liquid together.

9.6 Diagram — Classification of Powders

(See the tree chart in 9.4.1 — draw it as a branching diagram: Powders → Bulk / Divided → Simple / Compound, with one example under each end branch.)

> **AI Image Prompt:** "Clean educational textbook diagram, white background, hierarchical tree chart titled 'Classification of Powders' branching into Bulk powders (multi-dose, wide-mouth jar icon, e.g., dusting powder) and Divided powders (single-dose sachet icon, e.g., ORS sachet), each further branching into Simple (one drug) and Compound (multiple drugs), small simple icons, clear black labels, minimal decoration, professional pharmacy textbook style."

9.7 Flowchart — Preparation of Divided Powders

Prescription received
↓
Weigh each ingredient accurately
↓
Triturate each separately → sieve to uniform fineness
↓
Mix by geometric dilution (smallest quantity first)
↓
Weigh single doses
↓
Wrap each dose in a powder paper
↓
Label and dispense (with "shake/storage" advice if needed)

9.8 Examples

- **ORS powder** — divided powder dissolved in water for dehydration.
- **Dusting powder with zinc oxide** — soothing external powder.
- **Effervescent antacid powder** — fizzes in water, relieves acidity.
- **Menthol + camphor** — the classic eutectic pair students must remember.
- **Compound powder** — e.g., a powder containing an antacid and a carminative together.

9.9 Pharmacy Relevance

- **Dispensing:** you will weigh, triturate, mix and wrap powders in the dispensing lab — geometric dilution is an examined practical skill.
- **Counselling:** tell the patient to dissolve the powder fully in the stated amount of water, and to keep effervescent/hygroscopic powders tightly closed in a dry place.
- **Problem-spotting:** when a prescription contains menthol with camphor, or a hygroscopic drug in bulk, you must choose the right packing and handling — this is exactly what examiners test.

9.10 India Context

Powders remain widely used in India: ORS sachets are a frontline treatment for childhood diarrhoea under national health programmes; ayurvedic *churnas* are traditional compound powders; and dusting powders are common in India's hot, humid climate. The Indian Pharmacopoeia includes powder preparations and their quality requirements.

9.11 High-Yield Points

1. **Remember:** Powder = dry, finely divided solid dosage form for internal or external use.
2. **Exam Pearl:** Bulk = multi-dose (patient measures); Divided = single-dose (pharmacist weighs each dose).
3. **Exam Pearl:** Simple = one drug; Compound = more than one drug.
4. Dusting powders for broken skin/burns must be **sterile**.
5. **Exam Pearl:** Effervescent = $NaHCO_3$ + citric/tartaric acid → CO_2 fizz in water; store airtight.
6. Efflorescent = loses water of crystallisation; Hygroscopic = absorbs moisture; Deliquescent = absorbs so much it dissolves.
7. **Exam Pearl:** Eutectic pair = menthol + camphor (liquefy on mixing) → add adsorbent (kaolin, $MgCO_3$) or dispense separately.
8. Mixing method = **geometric dilution** (smallest quantity first, doubling up).
9. Excipients: diluent (lactose), adsorbent (kaolin, $MgCO_3$), sweetener/flavour/colour.

9.12 Common Confusions & Common Mistakes

Do not confuse:

- **Effervescent ≠ Efflorescent:** effervescent *releases gas* in water (fizz); efflorescent *loses water* to dry air (crumbles). Both start with "eff" — examiners love this pair.
- **Hygroscopic ≠ Deliquescent:** hygroscopic absorbs moisture (cakes); deliquescent absorbs so much it *dissolves*.
- **Bulk ≠ Divided:** bulk is measured by the patient; divided is pre-weighed by the pharmacist.
- **Adsorbent ≠ Absorbent:** an adsorbent (kaolin) holds liquid *on its surface*; keep the syllabus term "adsorbent".

> **Common mistakes:** mixing all ingredients at once instead of geometric dilution (uneven potent drug distribution — dangerous); packing effervescent powders in ordinary containers; forgetting that surgical dusting powders must be sterile.

9.13 Memory Tricks

- "**B**ulk = **B**ig jar, patient measures; **D**ivided = **D**oses pre-weighed."
- "**E**ffer**v**escent = **V**apour (gas) released; **Efl**orescent = **L**oses water."
- "Eutectic pair: **M**enthol **M**eets **C**amphor → **M**elts — **MMC**."

9.14 Exam-Oriented Summary

Powders are dry, finely divided solid dosage forms. Bulk (multi-dose) vs divided (single-dose); simple (one drug) vs compound (many). Advantages: large doses, fast dissolution, cheap; disadvantages: taste, moisture sensitivity, measuring errors. Special types: dusting (external; sterile if for wounds), effervescent ($NaHCO_3$ + acid → CO_2; airtight pack), efflorescent (lose water of crystallisation), hygroscopic/deliquescent (absorb moisture; airtight pack + desiccant), eutectic mixtures (menthol + camphor liquefy; add adsorbent). Excipients: diluents, adsorbents, flavours, sweeteners. Preparation: triturate → sieve → geometric dilution → weigh → pack.

One-Minute Revision: Bulk/divided; simple/compound. Dusting external (sterile for wounds). Effervescent fizzes (airtight). Efflorescent loses water; hygroscopic gains water; deliquescent dissolves. Eutectic: menthol + camphor → adsorbent. Mix by geometric dilution.

9.15 Questions

Very Short Answer (1–2 marks)

1. Define a powder. 2. What is a divided powder? 3. Define effervescent powder. 4. Name one eutectic pair. 5. What is geometric dilution? 6. Name one adsorbent used in powders.

Short Answer (3–5 marks)

1. Classify powders with one example of each type.
2. Write the advantages and disadvantages of powders.
3. What problems do eutectic mixtures cause? How does a pharmacist overcome them?
4. Distinguish between effervescent, efflorescent and hygroscopic powders.

Long Answer (5–10 marks)

1. Define powders. Classify them and describe the general method of preparation of divided powders.
2. Write short notes on: (a) dusting powders, (b) effervescent powders, (c) eutectic mixtures.

MCQs

1. A powder containing more than one drug is called: (a) simple powder (b) compound powder (c) bulk powder (d) dusting powder — **Ans: (b)**. Compound = more than one ingredient.
2. Which pair forms a eutectic mixture? (a) Lactose + sucrose (b) Menthol + camphor (c) Talc + zinc oxide (d) NaCl + KCl — **Ans: (b)**. The classic eutectic pair liquefies on mixing.
3. Effervescent powders release which gas on adding water? (a) Oxygen (b) Nitrogen (c) Carbon dioxide (d) Hydrogen — **Ans: (c)**. $NaHCO_3$ + acid → CO_2.
4. Dusting powders for use on burns must be: (a) coloured (b) sterile (c) sweetened (d) effervescent — **Ans: (b)**. Broken-skin application needs sterility.
5. In geometric dilution, mixing starts with: (a) the largest quantity (b) the smallest quantity (c) the diluent (d) any ingredient — **Ans: (b)**. Smallest first, doubling up for uniformity.

Viva: Why are effervescent powders packed in airtight containers? What is the difference between hygroscopic and deliquescent? Why is geometric dilution used instead of mixing everything at once? What adsorbent would you add to a menthol–camphor powder? When must a dusting powder be sterile?

Application-based: 1. *A prescription orders a divided powder containing 200 mg menthol and 200 mg camphor per dose. What problem will occur during preparation, and how will you solve it? (Ans: Eutectic liquefaction — triturate each with light kaolin/magnesium carbonate adsorbent separately, then mix lightly; or dispense the two drugs in separate powders.)* 2. *A patient complains their effervescent antacid powder has become a hard lump. Explain the likely cause and counsel them. (Ans: Moisture entered the pack and triggered partial reaction; advise airtight storage in a dry place and to discard the caked pack.)*

CHAPTER 10: TABLETS

Unit III · ~3 hours

10.1 Introduction

The tablet is the most widely used dosage form in the world — the paracetamol strip in every Indian home is a tablet. A tablet packs an exact dose into a small, stable, portable disc. But not all tablets are the same: some dissolve in the mouth, some fizz in water, some release drug slowly over 12 hours, and some are tiny moulded pellets for potent drugs. This chapter maps the whole tablet family.

Learning objectives — after studying this chapter, you should be able to:

- define a tablet and distinguish compressed tablets from moulded tablets and pills;
- classify tablets into their major types with one example each;
- list the advantages and disadvantages of tablets;
- name the excipients used in tablet manufacture and state the function of each;
- describe the three general methods of tablet preparation (wet granulation, dry granulation, direct compression).

10.2 Definition

Scientific definition: Tablets are solid unit dosage forms containing a drug with or without excipients, prepared by compression or moulding.

Simple explanation: A tablet is a small, hard disc (or other shape) containing one exact dose of medicine, made by squeezing powder tightly in a machine — or, less commonly, by moulding a moist mass.

Compressed tablet = made by high-pressure compression in a tablet press (the common type). **Moulded tablet** (tablet triturate) = made by pressing a moist powder mass into a mould and drying — used for small, potent drugs needing rapid disintegration (e.g., nitroglycerin tablets). **Pill** = the traditional small, round, solid dosage form, rolled by hand; largely replaced by tablets today but still asked in exams as the historical predecessor.

10.3 Key Terminology

Term	Meaning	Simple explanation
Tablet	Compressed or moulded solid unit dose	The "medicine disc"
Excipient	Inactive ingredient aiding manufacture or performance	The "helper" ingredients
Granules	Small aggregated particles of powder, free-flowing	Powder "clumped" into grains for smooth machine flow
Disintegration	Break-up of the tablet into small particles in liquid	The tablet "falling apart" in the stomach
Dissolution	Drug molecules dissolving into the liquid	The drug "melting into" the fluid
Coating	Outer layer applied on the tablet	The tablet's "jacket"
Sustained release (SR)	Drug released slowly over many hours	"Slow-drip" tablet

10.4 Detailed Explanation

10.4.1 Types of tablets

Type	What it is	Example
Compressed (conventional)	Standard tablet that disintegrates in the GIT	Paracetamol tablet
Moulded (tablet triturate)	Small moulded tablet for potent, low-dose drugs	Nitroglycerin tablet
Chewable	Chewed before swallowing; for children	Chewable vitamin C / antacid
Effervescent	Dissolved in water before use; fizzes ($NaHCO_3$ + acid)	Effervescent vitamin C tablet
Sublingual	Placed under the tongue; rapid absorption into blood	Nitroglycerin sublingual tablet
Buccal	Placed between cheek and gum; slow absorption	— (class concept)
Dispersible	Dispersed in water before swallowing	Dispersible paediatric tablets
Enteric-coated	Coating resists stomach acid; dissolves in intestine	Enteric-coated aspirin
Sugar-coated	Sugar layer masks taste, looks attractive	Older vitamin preparations
Film-coated	Thin polymer film; masks taste, protects from moisture	Many modern tablets
Sustained-release (SR)	Releases drug slowly over 8–12 hours or more	SR theophylline-type preparations
Lozenges / troches	Dissolved slowly in the mouth for local throat action	Throat lozenges

Pills vs tablets: pills are the old hand-rolled round masses; tablets are the modern machine-made version. In exams: "pills are now largely replaced by tablets."

10.4.2 Advantages and disadvantages

Advantages	Disadvantages
Exact, accurate unit dose	Hard to swallow for children, elderly, unconscious patients
Stable, long shelf life	Slower onset than liquids
Portable, light, easy to carry	Cannot be split accurately for dose adjustment (except scored)
Tamper-evident and easy to identify	Some drugs irritate the stomach in concentrated form
Taste/odour masked by coating	Poor for drugs that are difficult to compress or very low-dose (uniformity issues)
Controlled (sustained) release possible	Needs water and swallowing ability
Cheap to mass-produce	

10.4.3 Excipients used in tablets

Excipient	Function	Examples
Diluent (filler)	Adds bulk when drug dose is small	Lactose, microcrystalline cellulose, starch
Binder	Glues particles into granules	Starch paste, PVP (povidone), gelatin
Disintegrant	Breaks the tablet apart in liquid	Starch, croscarmellose sodium, sodium starch glycolate
Lubricant	Stops granules sticking to punches/dies	Magnesium stearate, stearic acid
Glidant	Improves powder flow into the die	Talc, colloidal silicon dioxide
Colouring / flavouring	Identification and acceptability	Approved colours, sweeteners
Coating materials	Taste masking, protection, controlled release	Sugar, HPMC film, enteric polymers

10.4.4 General methods of preparation

All methods end at the **tablet press**: powder/granules flow into a **die** (a hole), and two **punches** (upper and lower) squeeze them into a hard tablet.

1. **Wet granulation** — powder + binder solution → damp mass → passed through a sieve to form granules → dried → lubricated → compressed. Best for most drugs; improves flow and uniformity.
2. **Dry granulation (slugging)** — dry powder is first compressed into large slugs, which are broken into granules, then compressed into tablets. Used when the drug is **sensitive to moisture or heat** (can't use wet method).
3. **Direct compression** — powder blend (drug + directly compressible excipients) is compressed straight away, no granulation. Fastest and cheapest; needs excipients with excellent flow.



10.5 Easy Analogy

- Making a tablet is like making a *samosa* filling hold together: loose powder (like loose potato masala) won't hold a shape — you add a binder (like the dough's moisture), form it into workable portions (granules), and press it into shape. Disintegrant is the opposite friend — the one who helps it fall apart at the right time, in the stomach.
- **Enteric coating** is like a raincoat that survives the "acid rain" of the stomach but dissolves in the "milder weather" of the intestine.

10.6 Diagram — Tablet Types at a Glance

Draw a panel of tablet shapes: round conventional, small moulded triturate, large effervescent (with fizz marks), sublingual (small, under a tongue outline), capsule-shaped SR tablet (caplet), coated tablet (cutaway showing coating layer). Label each.

> **AI Image Prompt:** "Clean educational textbook diagram, white background, panel of six tablet types with simple shapes: conventional round tablet, small moulded tablet triturate, large effervescent tablet with fizz bubbles in a glass of water, small sublingual tablet under a tongue outline, capsule-shaped sustained-release caplet, coated tablet cutaway showing the coating layer, clear black labels under each, minimal decoration, professional pharmacy textbook style."

10.7 Flowchart — Wet Granulation

Weigh drug + excipients (diluent, part of disintegrant)
↓
Mix dry powders
↓
Add binder solution → damp coherent mass
↓
Pass through sieve → wet granules
↓
Dry the granules
↓
Add lubricant + glidant + remaining disintegrant
↓
Compress in tablet press (die + punches)
↓
(Optional) Coat → pack

10.8 Examples

- **Paracetamol 500 mg** — conventional compressed tablet.
- **Nitroglycerin** — moulded tablet triturate / sublingual tablet (angina).
- **Chewable antacid** — chewed, for quick relief.
- **Effervescent vitamin C** — dissolved in water.
- **Enteric-coated aspirin** — protects the stomach.
- **SR tablet** — once-daily dosing.

10.9 Pharmacy Relevance

- **Dispensing:** never crush or split SR or enteric-coated tablets (destroys the release design) — a classic counselling point.
- **Counselling:** "Swallow whole with a full glass of water"; chewable tablets must be chewed; effervescent tablets must be fully dissolved first; sublingual tablets go under the tongue, not swallowed.
- **Identification:** colour, shape and scoring help identify tablets — but always verify against the label, never by appearance alone.

10.10 India Context

India is one of the world's largest manufacturers of tablets ("pharmacy of the world"); most essential medicines in Indian hospitals and Jan Aushadhi stores are tablets. The Indian Pharmacopoeia prescribes quality tests for tablets such as disintegration, dissolution, uniformity of weight and assay.

10.11 High-Yield Points

1. **Remember:** Tablet = solid unit dose made by compression or moulding.
2. **Exam Pearl:** Moulded tablets (triturates) = small, potent, low-dose drugs (e.g., nitroglycerin).
3. **Exam Pearl:** Pills = traditional hand-rolled round dosage form, now replaced by tablets.
4. Types to memorise: chewable, effervescent, sublingual, buccal, dispersible, enteric-coated, sugar-coated, film-coated, SR, lozenges.
5. **Exam Pearl:** Enteric coating resists stomach acid, dissolves in intestine.
6. Excipients: diluent–binder–disintegrant–lubricant–glidant (memorise the five).
7. **Exam Pearl:** Lubricant (magnesium stearate) prevents sticking; glidant (talc) improves flow — do not swap them.
8. Methods: wet granulation (most drugs) → dry granulation/slugging (moisture/heat-sensitive) → direct compression (fastest, needs special excipients).
9. Tablet press parts: **die + upper and lower punches**.

10.12 Common Confusions & Common Mistakes

Do not confuse:

- **Disintegration ≠ Dissolution:** disintegration = tablet breaks into particles; dissolution = drug molecules dissolve. Disintegration comes first.
- **Lubricant ≠ Glidant:** lubricant stops sticking to machinery; glidant improves flow of powder.
- **Moulded ≠ Compressed:** moulded = moist mass in moulds (potent low-dose); compressed = high-pressure press (routine).
- **Enteric-coated ≠ Film-coated:** enteric resists stomach acid specifically; film is a general thin coat.

> **Common mistakes:** crushing SR/enteric-coated tablets for patients who can't swallow (ask the pharmacist for an alternative instead); calling all coated tablets "enteric"; thinking sublingual tablets should be swallowed.

10.13 Memory Tricks

- Tablet excipients: "**D**iluent **B**inder **D**isintegrant **L**ubricant **G**lidant — **D**octor **B**ought **D**elicious **L**arge **G**rapes."
- "Sublingual = **SUB** (under) the **LINGUAL** (tongue)."

10.14 Exam-Oriented Summary

Tablets are solid unit doses made by compression (common) or moulding (triturates for potent low-dose drugs like nitroglycerin); pills are the traditional hand-rolled predecessors. Types: chewable, effervescent, sublingual, buccal, dispersible, enteric/sugar/film-coated, sustained-release, lozenges. Advantages: accurate dose, stable, portable, cheap; disadvantages: swallowing difficulty, slower onset. Excipients: diluent, binder, disintegrant, lubricant, glidant, colours, coatings. Preparation: wet granulation, dry granulation (slugging, for moisture-sensitive drugs), direct compression — all finished in a tablet press (die + punches).

> **One-Minute Revision:** Compression vs moulded (nitroglycerin); pills = old hand-rolled. Types: chewable, effervescent, sublingual, enteric, SR. Five excipients: DBDLG. Wet → dry/slugging → direct compression. Never crush SR/enteric-coated.

10.15 Questions

Very Short Answer (1–2 marks)

1. Define a tablet. 2. What is a moulded tablet? Give one example. 3. What is a pill? 4. Name the two parts of a tablet press that shape the tablet. 5. Give one example of a lubricant and a glidant. 6. What is a sustained-release tablet?

Short Answer (3–5 marks)

1. Classify tablets with one example of each type.
2. Write the advantages and disadvantages of tablets.
3. Name the excipients used in tablets with the function of each.
4. Distinguish between wet granulation and dry granulation.

Long Answer (5–10 marks)

1. Define tablets. Classify them with examples and describe the general methods of tablet preparation.
2. Write short notes on: (a) moulded tablets and pills, (b) excipients used in tablets.

MCQs

1. Tablet triturates are prepared by: (a) compression (b) moulding (c) fusion (d) sublimation — **Ans: (b)**. Triturates are moulded tablets for potent low-dose drugs.
2. Which excipient prevents granules sticking to punches? (a) Talc (b) Magnesium stearate (c) Starch (d) Lactose — **Ans: (b)**. Magnesium stearate is the classic lubricant.
3. Enteric coating is designed to: (a) taste sweet (b) resist stomach acid (c) dissolve in the mouth (d) colour the tablet — **Ans: (b)**. It protects drug from acid / stomach from drug, dissolving in the intestine.
4. Dry granulation (slugging) is preferred when the drug is: (a) very cheap (b) sensitive to moisture/heat (c) highly soluble (d) coloured — **Ans: (b)**. No water or heat is used.
5. A sublingual tablet is placed: (a) in the stomach (b) under the tongue (c) in water (d) on the skin — **Ans: (b)**. For rapid absorption through the oral mucosa.

Viva: Why should sustained-release tablets not be crushed? What is the difference between a disintegrant and a binder? Name the parts of a tablet press. Why is nitroglycerin made as a moulded tablet? What is the difference between a lubricant and a glidant?

> **Application-based:** 1. *An elderly patient cannot swallow tablets and crushes her once-daily SR tablet to take it with water. What is the danger, and what should you advise? (Ans: Crushing destroys the slow-release design → the full day's dose is released at once (dose dumping) → toxicity risk; advise asking the doctor/pharmacist for a liquid or immediate-release alternative.)* 2. *A drug degrades in the presence of water during manufacture. Which granulation method would you choose and why? (Ans: Dry granulation (slugging) — no binder solution or drying heat is involved.)*

CHAPTER 11: CAPSULES

Unit III · ~3 hours

11.1 Introduction

Some drugs taste terrible, some are damaged by compression, and some are oils that can never become tablets. Capsules solve all three problems: a smooth, tasteless shell hides the drug inside. From the two-piece hard capsules filled with powder to the one-piece soft capsules filled with oils like vitamin E, capsules are the dosage form patients often find easiest to swallow.

Learning objectives — after studying this chapter, you should be able to:

- define a capsule and distinguish hard gelatin from soft gelatin capsules;
- list the capsule sizes in order and state which are commonly used;
- list the advantages and disadvantages of capsules;
- name the excipients used in hard and soft capsules;
- describe the general methods of preparation (filling) of capsules.

11.2 Definition

Scientific definition: Capsules are solid unit dosage forms in which the drug (with or without excipients) is enclosed in a shell, usually of gelatin.

Simple explanation: A capsule is medicine packed inside a smooth, tasteless shell — like a tiny container you swallow whole. The shell dissolves in the stomach and releases the drug.

Hard gelatin capsule = two-piece shell (a **cap** that fits over a **body**), filled with dry powders, granules or pellets. **Soft gelatin capsule (softgel)** = one-piece sealed shell, filled with liquids, oils or semi-solids (e.g., vitamin E oil).

11.3 Key Terminology

Term	Meaning	Simple explanation
Capsule shell	The outer covering, usually gelatin	The "container"
Cap and body	The two halves of a hard capsule	"Lid" and "box"
Softgel	One-piece soft capsule for liquids/oils	The "oil-filled" capsule
Plasticizer	Added to gelatin to keep soft capsules flexible	Keeps the shell "soft, not brittle"
Hermetic sealing	Airtight sealing of the capsule	"Locked" against air and moisture

11.4 Detailed Explanation

11.4.1 Types of capsules

Feature	Hard gelatin capsules	Soft gelatin capsules
Shell	Two-piece (cap + body)	One-piece, sealed
Fill	Dry powders, granules, pellets	Liquids, oils, semi-solids
Flexibility	Rigid	Soft and flexible (plasticizer added)
Examples	Antibiotic capsules, omeprazole pellets	Vitamin E, cod liver oil, evening primrose oil
Opening	Can be pulled apart	Cannot be opened without cutting

11.4.2 Capsule sizes

Capsule sizes are numbered **000, 00, 0, 1, 2, 3, 4, 5** — and the rule students always forget: **the bigger the number, the smaller the capsule** (000 is the largest, 5 is the smallest).

Size	Approx. fill weight (powder)	Use
000	~900–1000 mg	Largest; veterinary/large doses
00	~600–700 mg	Large human doses
0	~400–500 mg	Common human size
1	~300–400 mg	Common human size
2	~200–300 mg	Common human size
3	~150–200 mg	Small doses
4	~100–150 mg	Very small doses
5	~50–100 mg	Smallest

Sizes **0, 1 and 2** are most commonly used for humans. (Fill weights are approximate — they depend on the powder's density.)

Diagram — Capsule sizes: draw the eight capsules in a row from largest (000) to smallest (5), each labelled with its number, like Russian dolls in a line.

11.4.3 Advantages and disadvantages

Advantages	Disadvantages
Tasteless shell masks bitter/unpleasant drugs	Not suitable for very young children (choking/swallowing)
Smooth and easy to swallow	Gelatin shells absorb moisture → must be stored dry
Accurate unit dose	Cannot easily split or adjust the dose
Flexible fill: powders, granules, pellets, liquids (softgels)	More expensive than tablets
Attractive appearance; available in colours for identification	Hygroscopic/efflorescent drugs or liquids that dissolve gelatin are problematic
Incompatible drugs can be kept apart (e.g., pellets)	Gelatin is animal-derived (vegetarian alternatives like HPMC exist)

11.4.4 Excipients used in capsules

Hard capsules: diluents (lactose), glidants and lubricants (for smooth filling), disintegrants (to break up the fill). **Soft capsules:** the shell itself contains **plasticizers** (glycerin, sorbitol) to keep it soft, plus preservatives; the fill may contain oils, suspending agents and antioxidants.

11.4.5 General methods of preparation

Hard capsules — shell making: metal pins are dipped into warm gelatin solution, dried, cut, and the cap and body are joined. (In industry this is fully automatic.) **Hard capsules — filling:**

1. **Hand filling** (small scale): powder is weighed, placed on a tile, and the capsule body is pressed into it (punch method), then capped.
2. **Semi-automatic / automatic machines:** empty capsules are separated (cap from body), the body is filled by tamping or dosator systems, and the cap is replaced — thousands per hour.

Soft capsules — rotary die process (from zero): two ribbons of warm gelatin move between rotating dies; the liquid fill is injected between them, and the dies press and seal the ribbons into one-piece capsules, which are then dried. Think of it as a *puri*-press that seals oil inside dough — except the "dough" is gelatin and the machine is continuous.

11.5 Easy Analogy

- A hard capsule is like a tiny **tiffin box**: the body holds the food (drug), the cap is the lid. A softgel is like a **water balloon** — one sealed piece with liquid inside.
- Capsule sizes are like **shoe sizes in reverse**: size 5 shoe is bigger than size 1, but capsule size 5 is *smaller* than size 1. Remember: bigger number = smaller capsule.

11.6 Diagram — Hard vs Soft Capsule

Draw side by side: (a) hard capsule pulled apart showing cap, body, and powder fill; (b) softgel as a sealed oval with liquid fill inside, labelled "one-piece, sealed".

> **AI Image Prompt:** "Clean educational textbook diagram, white background, two labelled capsule cross-sections side by side: left, a hard gelatin capsule pulled apart into cap and body with powder fill visible; right, a soft gelatin capsule as a sealed oval with liquid oil fill inside; eight capsule sizes 000 to 5 drawn in descending size order beneath, clear black labels, minimal decoration, professional pharmacy textbook style."

11.7 Flowchart — Filling of Hard Capsules (Machine)

Empty capsules fed in
↓
Cap separated from body (vacuum)
↓
Body filled with powder/granules/pellets
↓
Cap replaced and locked
↓
Polished, inspected, packed

11.8 Examples

- **Amoxicillin capsules** — hard gelatin, antibiotic powder.
- **Omeprazole capsules** — hard gelatin containing enteric-coated pellets.
- **Vitamin E softgels** — oil in a soft shell.
- **Cod liver oil capsules** — classic softgel masking fishy taste.

11.9 Pharmacy Relevance

- **Counselling:** "Swallow whole with water; do not open unless the doctor says so" (some pellets lose their coating if crushed).
- **Storage:** keep capsules in a cool, dry place — heat makes them sticky, moisture makes them soft.
- **Special populations:** for patients who cannot swallow capsules, ask the doctor about a liquid alternative — do not advise opening capsules routinely.

11.10 India Context

Capsules are hugely popular in India for antibiotics and vitamins; vegetarian (HPMC) capsules are increasingly available for patients who avoid animal-derived gelatin. The Indian Pharmacopoeia prescribes disintegration and dissolution tests for capsules.

11.11 High-Yield Points

1. **Remember:** Capsule = drug enclosed in a (usually gelatin) shell.
2. **Exam Pearl:** Hard = two-piece (cap + body), dry fills; Soft = one-piece sealed, liquid/oil fills.
3. **Exam Pearl:** Sizes 000 (largest) → 5 (smallest); bigger number = smaller capsule.
4. Common human sizes: **0, 1, 2**.
5. Softgel shell needs **plasticizers** (glycerin, sorbitol).
6. Softgel manufacture = **rotary die process**.
7. Advantages: masks taste, easy to swallow, flexible fills; disadvantages: moisture sensitivity, cost, can't split dose.

11.12 Common Confusions & Common Mistakes

Do not confuse:

- **Hard ≠ Soft:** hard = two-piece, powders; soft = one-piece sealed, oils/liquids.
- **Capsule size numbers:** 000 is biggest, 5 is smallest — the reverse of what most students guess.
- **Caplet ≠ Capsule:** a caplet is a capsule-*shaped tablet* (no shell); a capsule has a real shell.

> **Common mistakes:** storing capsules in humid bathrooms (they soften and stick); advising patients to open capsules routinely; thinking softgels can be pulled apart like hard capsules.

11.13 Memory Tricks

- "**H**ard = **H**alves (two pieces); **S**oft = **S**ealed (one piece)."
- Sizes: "**0**-**1**-**2** for **y**ou and me (humans); **000** is **O**versized."

11.14 Exam-Oriented Summary

Capsules enclose the drug in a gelatin shell. Hard capsules are two-piece (cap + body) filled with powders/granules/pellets; soft capsules are one-piece sealed shells filled with liquids/oils (plasticizers keep them flexible). Sizes run 000 (largest) to 5 (smallest); 0–2 are common for humans. Advantages: taste masking, easy swallowing, flexible fills; disadvantages: moisture sensitivity, cost, fixed dose. Shells are made by dipping pins in gelatin; filling is by hand, semi-automatic or automatic machines; softgels by the rotary die process.

One-Minute Revision: Hard = 2-piece, dry fill; soft = 1-piece, oil fill. Sizes 000→5, bigger number smaller. 0,1,2 common. Plasticizer for softgels. Rotary die process. Store cool and dry.

11.15 Questions

Very Short Answer (1–2 marks)

1. Define a capsule. 2. What are the two parts of a hard gelatin capsule? 3. Which is the largest capsule size? 4. Name one plasticizer used in soft capsules. 5. What is filled in soft gelatin capsules? 6. Name the process used to make soft gelatin capsules.

Short Answer (3–5 marks)

1. Distinguish between hard and soft gelatin capsules.
2. Write the advantages and disadvantages of capsules.
3. Describe the capsule sizes with their approximate fill weights.
4. Name the excipients used in hard and soft capsules.

Long Answer (5–10 marks)

1. Define capsules. Classify them with examples and describe the general methods of preparation.
2. Write short notes on: (a) capsule sizes, (b) soft gelatin capsules.

MCQs

1. The two parts of a hard gelatin capsule are: (a) shell and coat (b) cap and body (c) top and base (d) lid and seal — **Ans: (b)**.
2. Which capsule size is the smallest? (a) 000 (b) 0 (c) 2 (d) 5 — **Ans: (d)**. Bigger number = smaller capsule.
3. Plasticizers are added to: (a) hard capsule fill (b) soft capsule shells (c) tablet coating (d) powder diluents — **Ans: (b)**. Glycerin/sorbitol keep softgels flexible.
4. Soft gelatin capsules are manufactured by: (a) compression (b) rotary die process (c) slugging (d) trituration — **Ans: (b)**.
5. Which is commonly filled in soft gelatin capsules? (a) Dry powder (b) Granules (c) Oils/liquids (d) Pellets — **Ans: (c)**. E.g., vitamin E oil.

Viva: Why can't soft capsules be pulled apart? Which capsule sizes are most common for humans? Why must capsules be stored in a dry place? What is the difference between a caplet and a capsule? Name one vegetarian alternative to gelatin capsules.

Application-based: 1. *A patient finds capsules difficult to swallow and asks if she can open her antibiotic capsule and take the powder with water. What do you advise? (Ans: Advise against routine opening — dose accuracy is lost, taste is exposed, and some fills (e.g., coated pellets) are designed not to be disturbed; suggest asking the doctor for a liquid or dispersible alternative.)* 2. *Capsules stored in a humid kitchen have become soft and stuck together. Explain and counsel. (Ans: Gelatin absorbs moisture; advise cool, dry storage in the original pack and to discard damaged capsules.)*

UNIT III INFOGRAPHIC — Solid Dosage Forms at a Glance

Concept box for the PDF designer: One-page visual panel titled "Solid Dosage Forms — One Page". Three columns: **Powders** (bulk/divided icons; special types with mini-icons: fizzing glass for effervescent, melting pair for eutectic, water drop for hygroscopic; key line "Mix by geometric dilution"); **Tablets** (tablet press icon with die + punches; type badges: chewable, effervescent, sublingual, enteric, SR; key line "DBDLG excipients; never crush SR/enteric"); **Capsules** (cap + body icon and softgel icon; size bar 000→5; key line "bigger number = smaller capsule"). Footer strip: "Pills & Python · pillsandpython.com".

COMBINED REFERENCES — Units III, IV, V

1. Ansel, H.C., Allen, L.V. & Popovich, N.G. *Pharmaceutical Dosage Forms and Drug Delivery Systems.* (Standard textbook for dosage forms.)
2. Cooper & Gunn's *Dispensing for Pharmaceutical Students.* (Classic dispensing textbook — powders, liquids, semisolids.)
3. Bentley's *Textbook of Pharmaceutics.* (Covers all dosage forms in the syllabus.)
4. Indian Pharmacopoeia. (Official standards for dosage-form preparations.)
5. Remington: *The Science and Practice of Pharmacy.* (Background reference on dosage-form science.)