

3.1 Physiology and chemistry of skin

The skin is the largest organ of the body and the surface every product in this subject except the oral and nail classes is made for, so its structure is examined in detail. In section from outside inward, the skin has three principal layers. The epidermis is the thin outer layer, itself layered, whose deepest basal layer continuously produces new cells that move outward, flatten, fill with the protein keratin and die, forming at the surface the stratum corneum: a wall of flattened corneocytes held in a mortar of skin lipids, ceramides, cholesterol and fatty acids. This brick and mortar wall is the skin barrier. It keeps water in and the world out, and nearly every cosmetic action in this subject happens in it, on it, or against its resistance. Beneath it the dermis carries the strength of the skin: the proteins collagen and elastin in a ground substance, with blood vessels, nerves, sweat glands, sebaceous glands and the hair follicles passing through it. Cosmetics in the legal sense do not act in the dermis; a product that did would be claiming drug action. Beneath the dermis the hypodermis, subcutaneous fat, insulates and cushions.

The chemistry teaching of the syllabus head follows from the structure. The skin surface carries a mixed film of sebum from the sebaceous glands and sweat, mildly acidic in health, the acid mantle of the textbooks, which is why product pH matters and why harsh alkaline cleansing disturbs the surface. Sebum output, sweat rate, surface lipid composition and the water content of the stratum corneum together define the working skin types of cosmetic practice, dry, oily, normal and combination, and the sensitive state in which barrier damage makes the skin react to materials it once tolerated. Appendages complete the picture: eccrine sweat glands for cooling, apocrine glands in limited sites whose secretions feed the body odour chemistry of Unit 4, sebaceous glands opening into hair follicles, and the nails and hair of the next sections. The cosmetic consequences should be drawn explicitly in an examination answer: cleansing removes surface soil and excess sebum and must stop there; moisturizing raises or protects stratum corneum water; colour sits on the surface film; and penetration beyond the barrier is, for a cosmetic, a safety question and not a selling point.

Structure of the skin

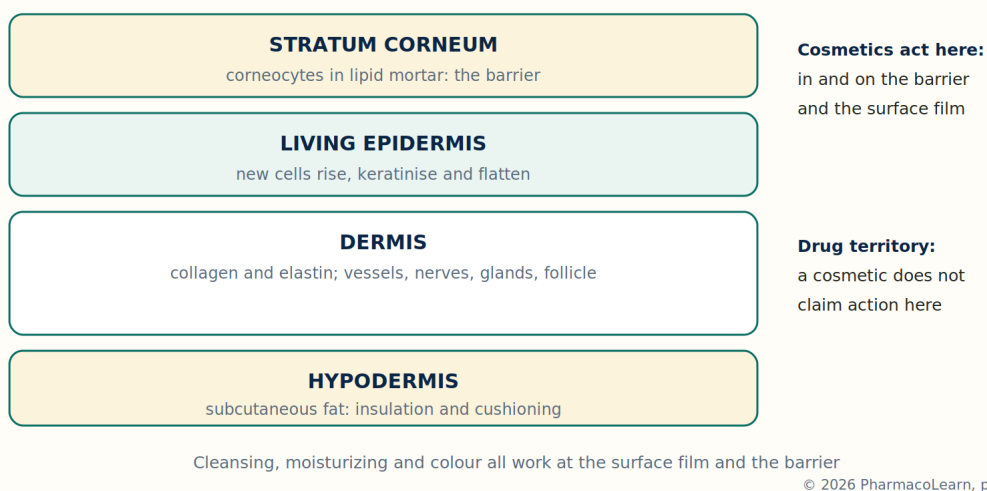


Figure: The skin in section. The stratum corneum barrier is where cosmetics act; the dermis below it is drug territory, not cosmetic territory.

3.2 Pigmentation

Skin colour is produced principally by melanin, the pigment made by melanocytes in the basal layer of the epidermis and transferred in melanosomes to the surrounding keratinocytes, where it absorbs ultraviolet radiation and gives the skin its tone. Two pigment families are distinguished in standard teaching: the brown black eumelanin and the red yellow pheomelanin, their proportion contributing to the range of human skin and hair colour, with haemoglobin in the dermal blood and carotene in the surface layers adding their tints. Melanin production responds to ultraviolet exposure, which is the physiology behind tanning, and its disorders give the pigmentation problems cosmetic practice meets: excess and uneven production in patches, loss of pigment in defined areas, and the post inflammatory darkening that follows skin injury or inflammation. For this subject the doctrine is narrow and firm. Cosmetics in the fairness class of Unit 4 work on the surface: they cleanse, moisturize, protect against sun exposure and even the appearance of tone by film and colour. The chemistry of melanin formation, a tyrosine derived pathway in the melanocyte, belongs to the student's knowledge of pigmentation, and products are described in these notes by their surface functions, with no depigmenting efficacy claims stated for any ingredient or product.

3.3 Hair and scalp: physiology and chemistry

Hair is a keratin fibre produced by the hair follicle, a pocket of epidermis sunk into the dermis with a bulb at its base where living cells divide, keratinise and die into the shaft. The shaft in section has three layers: the outer cuticle of overlapping scales that gives smoothness and shine when it lies flat and roughness when it is raised or damaged; the cortex beneath it, the bulk of the fibre, carrying the melanin that colours the hair and the protein structure that gives strength and elasticity; and the medulla, a central core present in coarse hairs. Chemically hair is keratin, a protein rich in the amino acid cystine, whose disulphide bonds cross link the structure and give hair its strength and its settable character: wetting and heat temporarily rearrange its hydrogen bonds, which is styling, while chemical breaking and remaking of disulphide bonds is the permanent waving and straightening chemistry of the wider trade. Hair grows in a cycle of growth, transition and rest phases, sheds continuously in small numbers, and is judged cosmetically by cleanliness, shine, manageability and colour, all properties of the dead shaft and its surface, since the shaft itself cannot be repaired, only conditioned, coated and protected.

The scalp is skin with a dense population of follicles and sebaceous glands, and its cosmetic problems are skin problems in a hairy site: excess sebum and loose surface scale in the condition called dandruff, dryness and itching, and the soiling of the hair itself by sebum, sweat, dust and applied products. Every hair product of Units 3 and 4 is aimed at one side of this pair: shampoos at the scalp and shaft soil, conditioners at the shaft surface, oils at scalp and shaft feel, colorants at the cortex pigment, and hair growth formulations at the follicle environment, stated in the careful terms of Section 4.2.

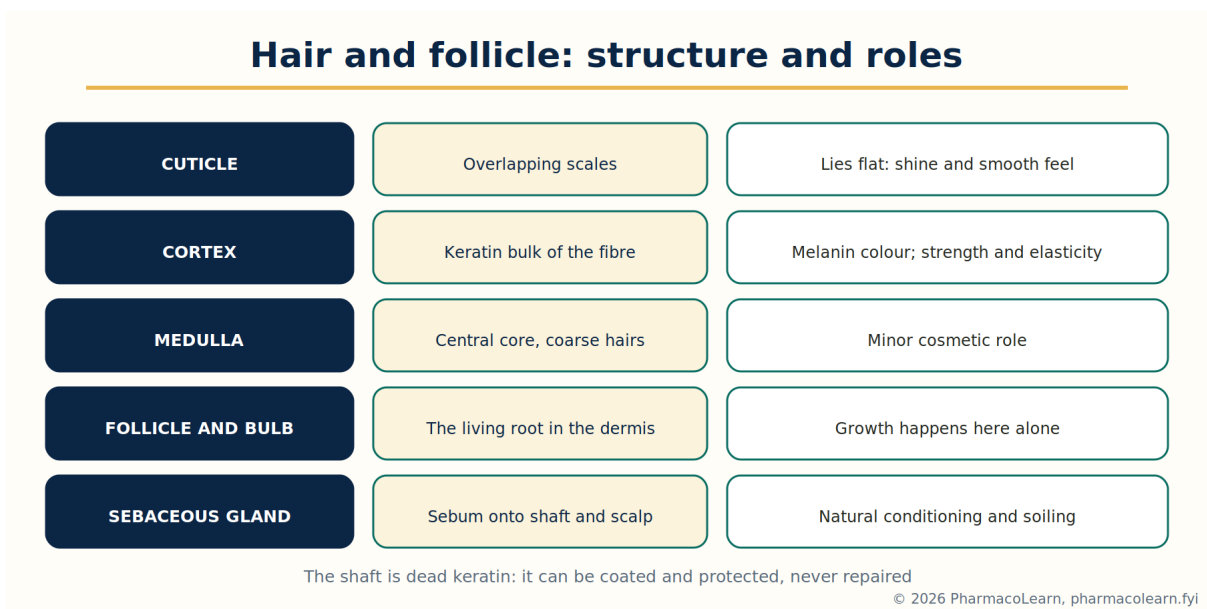


Figure: Hair in section. The cuticle decides shine and feel, the cortex carries colour and strength, and the living part of the system is the follicle bulb alone.

3.4 Lips and nails

The lips are a transition surface between skin and mucous membrane: their covering is thin, with a very thin stratum corneum, no sweat glands and few sebaceous glands, a rich blood supply close to the surface that gives the lips their colour, and a high rate of water loss that makes them dry and crack in a way ordinary skin does not. Cosmetically this predicts the whole lip product class: lipsticks and lip preparations must deposit colour in a fatty film that also protects against water loss, must be made of materials acceptable for a surface from which product is inevitably ingested in small amounts, and are therefore held to the strictest colour and ingredient discipline in the subject.

The nail is a plate of hard keratin produced by the nail matrix under the proximal nail fold, growing forward over the nail bed, with the cuticle sealing its base. Nail cosmetics work on a dead, dense, poorly permeable plate: lacquers deposit a coloured film that must adhere, flex and resist chipping; removers dissolve that film; and creams and oils condition the surrounding skin and the plate surface. Nail health teaching is simple and belongs in the answer: the plate is damaged by harsh solvents, by water and detergent exposure without protection, and by infection entering a broken cuticle seal, and cosmetic care is film, protection and hygiene.

3.5 The product classes of Unit 3 in outline

The remainder of this unit takes the product classes in the syllabus order. Each class is taught in the same pattern, and the student should be able to reproduce the pattern for any class in the examination: the tissue and task, the physical form and how it works on the surface, the ingredient families it draws from Unit 2, the herbal character of the class, and the preparation and standardisation points the syllabus names for the oral and nail classes and by extension the quality points for all of them. Preparation is taught throughout at the level of principle and operation, the emulsification, mixing, milling, moulding and filling operations of

cosmetic manufacture in general terms, and never as a worked recipe.

The Unit 3 product classes by tissue

SKIN	FACE, LIPS AND BODY	HAIR, MOUTH AND NAILS
Cleansing creams and lotions Face powders Face packs Tonics and bleaches Baby products	Lipsticks Bath products Soaps Face powders and foundations in Unit 4	Hair and scalp care in Units 3 and 4 Dentifrices and tooth pastes Mouth washes Cosmetics for nails

One pattern teaches every class: tissue, form, families, preparation, standardisation

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Figure: The Unit 3 classes by tissue. One pattern teaches them all: tissue and task, form, ingredient families, preparation in principle, standardisation.

3.6 Cleansing creams and lotions

Cleansing creams and lotions remove surface soil, sebum, sweat residue and applied colour cosmetics without the water and surfactant washing of a soap or shampoo. Their mechanism is solvent and emulsion action at the surface: the fatty phase of the cream dissolves oily soil and makeup, the product is spread, worked gently and wiped or rinsed away carrying the soil with it, and a thin conditioning film is left behind. In form they divide between the heavier cleansing creams, commonly water in oil in character, rich and thorough for dry skin and heavy makeup, and the lighter cleansing lotions and milks, commonly oil in water, fluid, quick to use and suited to lighter cleansing. The ingredient families are those of Unit 2 in cleansing proportion: lipid phase for soil dissolving, emulsifiers to hold the system and to help removal, humectants against tightness after cleansing, preservative for the aqueous phase, and fragrance and functional herbs for identity. Herbal cleansing products carry plant oils and extracts suited to the cleansing task in traditional use, and their standard is the class standard: the product must cleanse in use, remain a stable emulsion on the shelf, and leave the barrier undisturbed, claims that Unit 5 tests rather than labels assert.

3.7 Face powders and face packs

Face powders are finely divided solid preparations applied to the face to absorb surface oil and moisture shine, to even appearance, to give smoothness and a matte finish, and in their tinted forms to add colour. Their working materials are the powder shelf of cosmetic science: absorbent and covering powders, white pigments for opacity, clays and siliceous materials for oil absorption, talc type materials for slip and spread, small proportions of colours, binders in the pressed forms, and fragrance. Judgement is by fineness and uniformity of particle size, covering power without chalkiness, adhesion to the skin, absorbency, and freedom from grit and from microbial and heavy contamination, since a powder is inhaled in small amounts in use and its purity discipline follows from that. Loose and pressed or compact forms divide the class by manufacture: simple blending and sieving against compression into cakes with binder.

Face packs are the mask class: pastes or powders mixed to pastes, applied in a layer to the face, allowed to dry or set, and then removed, carrying surface oil, loose scale and soil away with them and leaving the surface feeling tightened and refreshed. Traditional Indian packs of plant powders, clays and grain flours are the herbal heart of this subject, and the class is taught by its mechanism: the wet layer hydrates the surface briefly, the drying layer absorbs and contracts, and removal exfoliates the loosest surface cells.

Standard points are fineness, freedom from grit that would scratch, even drying, ease of removal, and the raw material purity of the plant and clay materials, which varies widely in commerce and is controlled exactly as MPG202T taught for any crude drug.

3.8 Lipsticks

The lipstick is a moulded stick of a coloured fatty base: waxes give the stick its structure and melting behaviour, oils and fats give spread and gloss, and pigments and lakes give the colour, dispersed through the mass by milling so the stick lays colour evenly. Manufacture in principle is melt, disperse the colour in the fatty phase, pour into moulds, cool, and finish, each operation controlled because the product's faults are all visible: streaking and sweating from a badly built base, graininess from undispersed pigment, breakage from a weak structure, and rancidity from an oxidised oil. Because the product is used on the lips and partly ingested, its colours must come from the permitted lip list, its fatty materials must be of cosmetic purity, and its standardisation covers colour match, melting and softening behaviour, breaking strength, and stability of colour and odour. Herbal lipsticks substitute plant colours and plant butters and waxes within the same structure, and inherit the same tests: the herbal origin of a colour does not relax its permission or its purity.

3.9 Bath products, soaps and baby products

Bath products cleanse and condition the whole body surface in water: bath salts and powders that soften or scent the water, bath oils that disperse to leave a conditioning film, foam baths built on surfactant systems, and shower preparations of the surfactant class. Their teaching points are solubility and dispersion in the bath, skin feel during and after, fragrance behaviour in warm water, and the mildness discipline that a whole body, prolonged contact product demands.

Soap is the oldest cleansing product and chemically the most definite: the alkali salt of fatty acids, made by saponification of fats and oils, cleansing because the soap molecule is itself a surfactant, lifting oily soil into micelles for rinsing. Its character follows from its chemistry and the student should state both the virtues and the faults: effective and inexpensive cleansing, an alkaline reaction in use that can disturb the acid mantle and dry the surface, and poor behaviour in hard water, where calcium and magnesium soaps precipitate as scum. Toilet soaps are the milled, perfumed, coloured descendants of the basic cake, with superfatting and added humectants softening the alkaline character, while herbal soaps carry plant oils in the fat charge and plant materials for identity and traditional roles, judged by the standard soap points: total fatty matter in the trade sense, moisture, lather, hardness and wear, and freedom from excess free alkali.

Baby products are not a chemistry of their own but a discipline applied to every class: cleansing, oiling, powdering and creaming products for infant skin, whose barrier is thinner, whose surface area to weight ratio is high, and whose user cannot report irritation. The discipline is mildness above all: gentle surfactant systems at controlled pH, minimal fragrance, conservative preservation proven by test, fine and non dusty powders used with care, and packaging and labelling that direct safe use. A herbal claim adds nothing to a baby product's safety; the standard is met by formulation restraint and by the testing of Unit 5.

3.10 Tonics and bleaches: preparation and standardisation

Tonics, in the cosmetic sense of this syllabus, are the liquid skin tonics and the hair and scalp tonics of traditional practice: aqueous or hydroalcoholic liquids applied to refresh, to remove the last traces of cleanser, to give an astringent and toned feel to skin, or to carry functional herbs to the scalp. Their preparation in principle is solution and extraction work: the vehicle is built, the herbal material is extracted into it or its standardised extract dissolved, astringent and humectant components are added by class, the product is clarified, preserved and packed. Standardisation is the syllabus word and should be answered

directly: identity and strength of the herbal content by its marker or fingerprint where established, alcohol content where the vehicle carries it, pH, clarity and freedom from sediment beyond specification, microbial quality, and stability of colour and odour.

Bleaches in cosmetic use are preparations applied to lighten the appearance of facial hair and surface tone temporarily, of two families in standard teaching: the powder and cream bleaches based on oxidising action, and the milder herbal and pack type preparations sold for brightening. The teaching duty is candour: oxidising bleaches are chemically active products with real irritation and sensitisation potential, they are used strictly by their directions and patch test discipline, and their standardisation covers strength of the active system, pH, and stability in the pack. Herbal brightening preparations work at the surface by cleansing, pack action and film, and are described by those functions without lightening claims beyond appearance.

3.11 Dentifrices, tooth pastes and mouth washes

Dentifrices are the preparations for cleaning the teeth, in powder, paste and gel forms, and tooth paste is their dominant modern form. A tooth paste is a structured suspension: a mild abrasive system that polishes away surface film and stain without damaging enamel, humectants that keep the paste moist and give body, binders and thickeners that hold the structure and give the ribbon its stand up character, surfactant for foam and soil dispersion, flavour and sweetener for acceptance, water as vehicle, preservative, and in the medicated and herbal variants the functional materials of the product. Preparation in principle is controlled dispersion: the powders are wetted and dispersed without grit or air, the structure is built under vacuum mixing in modern manufacture, flavour and surfactant enter late, and the paste is filled while its consistency is in specification. Standardisation, expressly named in the syllabus, covers abrasiveness within safe limits, consistency and extrudability, pH, foam, flavour stability, fluoride content where a fluoride paste declares it, microbial quality, and stability without separation or drying in the tube. Herbal dentifrices carry plant materials of traditional oral use, including the chewing stick tradition materials of Indian practice, astringent barks and powders and aromatic oils, and they meet the same standardisation list: traditional use does not measure abrasiveness, the test does.

Mouth washes are the liquid companions: aqueous or hydroalcoholic solutions for rinsing the mouth, for freshness, cleansing of loose debris and delivery of aromatic and astringent materials to the oral surfaces. Their formulation families are vehicle, flavour and aromatic oils solubilised into the system, humectant and sweetener for feel, colour, and preservative, and their standards are clarity, alcohol content where present, pH, microbial quality and flavour stability. The boundary discipline of Section 1.1 applies with force in the mouth: a mouth wash is a cosmetic while it freshens and cleanses, and therapeutic claims for gum disease or infection move a product toward drug judgement.

3.12 Cosmetics for nails

The nail class completes the unit: nail lacquers or polishes, lacquer removers, and nail creams and oils. A lacquer is a film forming system: a film former of the nitrocellulose family in standard practice, resins for adhesion and gloss, plasticisers for flexibility, solvents that evaporate in the order that lets the film level and set, and pigments dispersed in the system for colour. Its standard points are viscosity and application, drying time, gloss, adhesion and chip resistance, colour uniformity, and stability without thickening or pigment settling beyond recovery. Removers are solvent systems matched to the film, judged by removal speed and by their harshness to plate and surrounding skin. Nail creams and oils are conditioning emulsions and oils for the cuticle and surrounding skin, judged as their parent classes are judged. Herbal nail products carry plant oils and colours within the same film and solvent logic, and the discipline of the class is unchanged: a coloured film on a keratin plate, made to a specification and tested against it.

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