邢◀唷?>└? -|?╪┐┌?　　?????

n　痞u?賹　2cmd＞??塒NG　IHDR　^　欈?┌sRGB　└ pHYs.%.% {瀧IDATx^鞲|`¶G　蝁躚　佮→荏袑↑葱鈔(敹8　h　创@憱B「换粄涅糋濑?粄{┤讳$w?蔑oo嬙戡踩藜塵　/6:驕紝?　韰HqI垙KNN瓮蜕侍释蓣?↕彷瀰?楏LLx<>_　　磎Z驺鎳V諙?...戢蠢柧m鄱澠　┴y　　h?<　Ｚa?匸妁├?Ｑ　巢瞝糧E″S　[籾　季索袟pptr捕?377　?餽弗◘鄨馫♬9篌e2槨"◀嬇iii?　缮I饬'┬☼垆◀钵ㄔd玟xzy桓篹[?`誂●↕挑?┘F　ě　　2扫>{赎?▼▼?盬┤77gg　s　懇　?€?　　-,-　笑?壬汀^?yy　┗y?>?綣(凪IN抏?5e腢*KOKk　性亿羺檬狟8`? 0j　]　?.6种晤怍?潩??3　?　鳺$嬬傈榊<嬬┐1友↕闟,-凪II?頡@j　WW　口-?R　?面佈蜢▼?麾賁剥霍　遢?厴H预?諉Q蓬?├皤/%屢`J　YY　cG　档稹　叭'╕　潭M　?面甙玏憑w镏ビ?　綒?{弸D″砻|裔蝬Cj怳(¶　汔薀?芙#3=Qs倓┐酅E佈蜷賟W蠨粗c?{碭<嫝Z?H峓v,]?*罿┬?R?　?　F衰7迩帳叙鶘炙洞匆:M@??芙sG霐　A聧姽┌ｅ貶絃☼▼盾捻宋挝?ML鸄雡:　?♬↑;●◘窶0　6　#蠗I?-┬煓檯逭　I汆裒熩M雂　A聧姽┌ｅ訌瘼钤簠诓?7　Y譑菴捋瞎€纇吠窦?　?0　→↕!?●*┻●◘孷榮　RBoM??`梓&¶H^聧势┌?で殴管w椭|涙?~橿G2VN　??k　溪眩?-;G夒h賗GrUZ　5　囡?:　刋.?C廴~?0崮╪　0j?　/'　T??.　}梂y　?聲?┤IO8P?@`謍{▼烛?iTLI Tu★R?bGA困Re!?　*9　窶↑佳/G 5　蹚箈坋嗥┼▲0　A願}　ebR胐!　蠶C4ī鵲摂?F?　ｅ舵?鞣stm郅m俊└b?J[　示!?┘遛)閆?‥綄胐‼摀└?Fv柁询f齌鞘鑕5YH扷:♬┼↑-?钒矐c9|　⌣J?|?8　?3　銘A蜾絖→U筍鑌榽　溢臄悢　斮←☼熩y　颁?-垓|　c　)棳类9@`??_&你犄└<|　?_隙q敶←┬q矜轀賺oO忯屘倳c}熨　埃☼●?集r　廅?胆枝う?　贵鳰d|　挖尘[p牷砸W　诖Ys懇E鄖☼迳&R6醼as€　″Rn?　骊Q胀　J　禪So\?　趄瘢敏d　+KWg'/O/o//[[　?　~舆　|6b8齤|K?　N???? @jrRRtlll|<蒮?　：乩k弒s攵m玏?H'.鎥Jb磧砢??L8`? 0Z>?　灬]?啰?+++6&　蒽/?☼　?▼▼gnnno　榠miaac　/　w飛樨廖?<鎯G<　?絛2??盹23砢rs　b　=}V　顶?8　陨俟f　?●4h厝疰5u?　杉渍ie疾b扼p狉p€括钧→Vq?5蔓pzZZLLLtTd,郑TTRbbjj*爣nN　&X?`　(　h　'/仝佟覢┗潩lm?　??絲{zy999榓t　K采?痎玆俨揆?┻?┘F踮瑦q　蝞>%　?帴　b舁们JOjN?厡??羼|?Nh　　垮I　]　?齴(4　蝬>p湄狛}@D閶　}　┐唋nW霐　A?c慒跹k　RX藍U---徛鏀↑6h圉　v?U隕?▼[纱N笵俌├9孜酒?巾萁↔芙↔A吞b朴●▲A聇脹唱?‼帗盟授堙　H　暪N　鬘Ptd　rL　a?　?煋?淺醣???↔緑?8茂┤M峈晲sL偷☼优?>*yD???各├T　€　敹c鷒vq洱u?]癇☼4;7鋍?h　跨?疬蠽evo构u用　狙┬I?陁郗◀★?C　祸↔?　鸄0]4蛰?0　靄?`″蛁S?　僖裂晟迂3G_K?h0v澩h?蕆　c&tl迆rM儐　0閌墝″t?　:　b?|肱偻隰絜A├6　磉咧瑨篾U?蘧→◘尔飂T貣Z嗢歞鵬A　┻繌<|鵹慔€瞴詰|德?\€蕞蛹塚　o舅H%　祫帗?7'+　溙杓pQt)抛遰丹?m:助　A;嶮←2?$強N.菴??¶绋┬??窑&edg?阒|?A　?　€]%6　bu袎瓮蜬巏+?4　E氯%0?　侮`勸霏?陁″　啀?垷帼??!‼　C　?　?　i箭诨纲A殈竾?16衽磊臉?{▼?炉?n鹬巽霾_醳哟{盾┘-┌$胙b　坚怄??/G 纵?循?p　XS?　份Ai瞩i获?[??鳥詷┌[弗窴)羨　熄▽\　蒮楳@呎㈤G竭婜x?緪　″倔5N　E　?u钭~S?k?#-←hBq*则r?B鈅]　钮n訣q{　┘?€f up鸽.)D裔繸`┐?　♬w.績V　▼LclJ剃?灟s%P钒?*?}┐$栎嫦!=　])?涸)懤?₩*]→X让?C　BU杲忡U?\竀镽橡　jh24\　;G镞寧J罗~>橏呜装捋頭　齾e　鰩仆?oz　傀s桍8s{薘├¶吙7軜:货yS　M　?軠馦[根?U?　芨?H刘→鷗頠?;W　簷炸鬣栻炸}箕~0c^　?<灄B蹲馹眐脤^聑4LA?={?\€z攎　质V?　U顰嬉袟└鴦?↔7莽J琎↕溢M>　讽▼y檠?螏st秈??瞫Y篛芊SS岚qm貨?慎‼☼};{?]?4鱷?~覕凅g烸├8　鑫↔?謝鼛n泳?鍣-_t笨　|9　?:俑D駝　蠝追U鱺旡b駢┼N?怮KH`T浮-縷q濭,?m丶厠^絲q庳Qm6次　恢I薾犗怞ruT　楈舛□砌f芊?W　歍　碉┻铘磆笈嗹?刍k稍舁?Vo　:　Tgd洚?　-☼?hL蜜嵼?NOQ　??V应f?{'　?　竞餪a恛崑*嫜|m　錥C　y??h啅ぐ　走'$?炒w?>y?4箂銚{7?　XN樥┌?扬寿☼Py袟淄3o　_络麩¶?楈蚬o+4墀枸@(.盒甈鴐铡Q写B+嫈▲5懍?岥+hf???{o伶=‼v燏　阌ml 9鑵辒*%?钳}7k~?sz?3蟪　蕇i?　→R偍}馁蠡　ㄖ　M??軠?醢▲蹄i?0ZZ??59柷‼鳷5爣|　?鬗哪?箕飶?┼倉砸憟x　?珠肫?o^Fz{[t魕　┼Aガ庇¶BS裾挹*↑7滭傲?汚賊?P　閱W　|俑?指)]趙 > 掣X毊點　S酘　啖　●;Gk乐　?_e镲　??2　_郯?衹　染1屠Z 絨　椄┌裙骟　]q嬥s?=Z碁?●歟H9r\s?　摽刖箐$曄◘鑰眍　'痰F}芳┤妝　┘L?婇諞曝;X鈐┘答└??h(n蹜#`盍柯坠K　??鱱|▼e濒　~t稞=　苣o　[sH　佩唆瓊/?鄯┐?睭?aA　↔輯Y?　耿M礹?迅　C\?淊註Q?遇u3?J4樣?"┤▼谈駣&?鴞踌┘fTv?　:臧匪C`碩?$1權殴?埙)-C'|9d雍A_孛1?阆??g鎔?灩{?PS傰?◀D　U嘖EρT　　5币?&Y&r犮　華?e″G>Fr?S?　?垏j　荎隸沆　V汪|擁　吗●☼☼?芜?清+G　歐←?h$　?r掖→篾* 彿枳┌┌嵼V/=薇幄&具♬腭?O　/→w頒`渊翰?[　fX┳X垹F-逋↑? ?,班　┌??)峓w3喱yK?[检　?3哲绿L莱[□└訐枧?寶翑@^%p蘆F綆-U　闷-h靜←●磍醑藕蟛_z　y榓Z岼?″崠奭ZH靇334?,D鐸S~娓<*┐澡鱹跼?棚_鏬:●nL?裗?.爓　?膿菟LN2宋敦縻扱S抏齡fm???齱URp5-詼%辩?F　V癇?~蒙M(鈸o8J迫bu鍍Yx2?　甍`T沃齬碄羝揋麥uM蚤酳b? 0　瘢└→傞掩　OS0殯+?_zT?饈鰓?&<　(仴　?┌i?;蹣领狩棑　?gna绸窄€榦_巛筷w瘳鋍?=岷p弭温?耒铐踶　OK妄襲　?m　;?K瘟　H??*忘恣┬??濼*&0　溘?'♬┼↑?愜U蘁?}x'琏K?葦Y栝m譶1划皚|?　KO睠镓藝?懭噹??→哉?.F　″癮.琯?裙$<旂W緲嘎?222b蝤駁N?m?　{　?饸/栻/}┼緤錕髖◀┌┼鶒┞?┬詳,?g<　┘└ 0　N25索驏剑乩W貶V?o衣v鳩*Z香鶹跃@▲邆g箐a　?桻谪靨┼→潋[?2″/<攤Q擢　◘搳0€Q諛鞿1舅,^　弸?▲;鯖I擫1?椢?M??O虙.:cr猰┼忸4筸醅|畫`h?iT婕@H　6　窶C　太?-FV{?綢KO?屭螣嬨悚{督党3崛锐¯¯▲┣.-↑璟]桡藦　垔襤5潓?!练o?>xH贶M　-₩?.┻J〆`珏IL?涇　└鑭??型$:↔　净-e?　?>槝L? 芊♬?E　铇└┘Fu锑氯　汰Q嫋▼　◘c　篛M　儮恿◀6損镓ゥI黠x眧　厉i資2J　?0*茕z恢肂　揊?Y簑?M涘4　鼕?瑟ｒ攒寵G篕{,愴　←yZ嶝　┴┤'灣└?1　枴?S　佈r　]　齗€括聿n忤$sp　‼?#└麩昤豉?S3辆↔/?蚶en.鷇x輂3　O歊钳篝┻?蟀惣骸節=咦?伶血貉?y　[服癙?鷺　鶅牰[　x甬梓彿[??*暉?鴆‼€|j.銲d|闟蒘鄒<‼◘□ojJ`?F　)R　└ 0??J屻　閉`jWR掀媛^?O黿训旆祺??,Z大欈]搚f无U,狌袑p'莽　?b锢氍嗮?☼O?昱yb　q　??餪创椪?v　餯?_●洠-鵙f|q纠炮D　g關0j　0　1达6　?　摞4酏食←H暉└歲€括f　,穿　殈搽棓鈽櫃　?瑆莪A?啡乩晓

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The Contain Function

The product s nature: corrosive corrodible flammable volatile perishable fragile aseptic toxic abrasive odorous subject to odor transfer easily marked sticky hygroscopic under pressure irregular in shape

The Protect/Preserve Function

1. Considerations related to the protect/preserve function Protect refers to the prevention of physical damage. Specifics on what will cause loss of value (damage) must be known. Preserve refers to stopping or inhibiting chemical and biological change and to the extension of food shelf life beyond the product s natural life or the maintenance of sterility in food or medical products.

The Protect/Preserve Function

2. Examples of protective packaging problems Table 2.1 Examples of protective packaging problems and concerns

Condition	Quantification or Design Requirement
Vibration	Determine resonant frequencies
Mechanical shock	Determine fragility factor (drop height)
Abrasion	Eliminate or isolate relative movement
Deformation	Determine safe compressive load
Temperature	Determine critical values
Relative humidity	Determine critical values
Water	Design liquid barrier
Tampering	Design appropriate systems

The Protect/Preserve Function

3. Examples of preservation packaging problems Table 2.2 Typical preservation packaging problems and concerns

Condition	Quantification or Design Requirement
Oxygen	Determine required barrier level
Carbon dioxide	Determine required barrier level
Other volatiles	Determine nature and barrier level
Light	Design opaque package
Spoilage	Determine nature/chemistry
Incompatibility	Determine material incompatibilities
Loss of sterility	Determine mechanism
Biological deterioration	Determine nature
Deterioration over time	Determine required shelf life

Food Preservation

The Nature of Food 1. The nature of food Food is derived from animal or vegetable sources. Its organic nature makes it an unstable commodity in its natural form. Various means can increase the natural shelf life of foods, thus reducing dependence on season and location.

Food Preservation

2. Spoilage mechanisms Food spoilage can occur by three means: a) Internal biological deterioration b) External biological deterioration c) Abiotic deterioration Taste refers only to the sweet, sour, salty, and bitter sensations by the taste sensors located on our tongue Essential oils or sensory active agents and sense of smell by sensors

located in our nasal passages What we perceive as a food product s flavor is a combination of what we detect with our sense of taste combined with what we detect with our sense of smell. Preservation of essential oils retains the food s full flavor at retail.? P(Pp P? P (N ? ? ?? ? ? Food Preservation? ? ? Essential oils are volatile.Volatiles can permeate packaging materials and making the problem of contamination or isolation even more difficult. Water vapor is similar to an essential oil in that it readily permeates many packaging materials. The creation of high-barrier packaging systems is partly in response to the need for packaging that will either hold desirable gases and volatiles in the package or prevent undesirable volatiles from entering the package. Temperature can promote undesirable changes that are abiotic in nature. ? Z ?, ? ? ? ? Food Preservation? ? ??Meat products - Meats are an ideal medium for microorganisms because they contain all the necessary nutrients to sustain growth. In addition to biological action, fatty tissue is susceptible to oxidation, and the entire mass can lose water. - Reduced temperature retards microorganism activity, slows evaporation and slows chemical reactions such as those associated with oxidation. ? H x @ < ? ? ? Food Preservation? ? ??Fish - The preservation of fish is a difficult challenge because of three main factors: 佛 Psychrophilic bacteria may be present. 佛 Many fish oils are unsaturated and are easily oxidized. 佛 Typical fish proteins are not as stable as red meat proteins. - Chilling does not affect the activity of psychrophilic bacteria. Frozen fish is typically kept at much lower temperatures (-300C/) than other frozen foods in order to ensure the control of psychrophilic bacteria.?X Z Z Z Z 1 B ? ?>a ? ? ? Food Preservation? ? ??Produce - Harvested fruits and vegetables continue to respire and mature. - They contain large amounts of water and will wither if water loss is excessive. - Peas, green beans, and leafy vegetables have high respiration rates compared with those of apples oranges, and pears. - Potatoes, turnips and pumpkins respire slowly and are easy to store. Moisture loss is more rapid with lettuce than with a turnip because of the large available surface area. ?. Z? Z ? ? ? ? Food Preservation? ? ?? - Most fruits have an optimum ripening temperature, usually about 200C. Few fruits will ripen below 50C. - Freezing of many produce items will damage cell structure, and breakdown is very rapid after thawing. - Modified atmosphere packaging used(CO2, O2) - Bananas can remain in a mature but green state for up to six months in atmospheres of 92% nitrogen, 5% oxygen, 3% carbon dioxide and no ethylene. ?X? P P ? ? ? ? ? Food Preservation? ? ?v - Atmosphere and temperature control are key requirements for extending the shelf life of fresh produce. Trade-offs for many produce items: 90%RH+perforated plastic wrap; or Selecting packaging films with high gas-transmission rates. i.e. precut salad bags(the shelf life of about ten days): excellent moisture barrier and very low oxygen barrier. ?6j P P Pw ? Y? ? ? Food Preservation? ? ? Barrier Packaging ?2 ? ? ? ? Food Preservation? ? ?c - Stopping the movement of a gas requires barrier packaging. - This packaging construction either retains desirable gases and volatiles inside the package or prevents undesirable gases and volatiles from entering the package. - Of the materials a packager can choose from, only glass and metal provide absolute barriers to all gases and volatiles. ?6b a ? c ? ? ? Food Preservation? ? ??- The term "high barrier" plastic is a relative, nonspecific term and should not be taken to mean "absolute" barrier. - Barrier packaging can harm some products. Fresh produce, for example, continues to respire after harvesting and would shortly consume all the oxygen in an oxygen-barrier package. This would lead to reduced shelf life. Plastic bags for produce commonly have vent holes punched in them to allow for a free exchange of atmospheric gases. ?$? P P? ? ? ? Food Preservation? ? ?N 3. Microorganisms and their preferred environments for propagation Microorganisms - A large part of food preservation depends on the control of microorganisms. - Bacteria or microbes are unicellular microscopic organisms that reproduce by binary fission. - Certain bacterial species can form spores that are highly resistant to killing. - Molds or fungi are multicellular and unicellular plantlike organisms. - Yeasts are similar organisms that reproduce by budding. The propagation and spread of molds and yeasts is typically slower than for bacteria because of the reproduction method.?TC P P? PC ? ? h ? ? ? Food Preservation? ? ?N Microorganisms preferred environments for propagation - By manipulating the four principal environmental factors that regulate microorganism growth, microorganisms can be controlled or eliminated: temperature moisture acidity (pH) nutrient source?H b 6 b ? ? ? Food Preservation? ? ?? Microorganisms are often classified by their preferred reproduction environment: Mesophyllic: Prefer ambient conditions, 20-450C Psychrophilic: Prefer cool conditions, 10-250C Thermophilic: tolerate heat; will propagate at 30 to 750C Aerobic: need oxygen to

propagate Anaerobic: propagate only in the absence of oxygen ?S S ″
,) ?>V + & ? ? ? Food Preservation? ? ??-
Some microorganisms act only on the food. They do little harm when ingested - Pathogenic organisms can cause sickness or death, falling into basic classes: 佛 Those that produce harmful toxins as by-products in the food they infest. 佛 Those that infest the food and then grow in the human body to produce illnesses.?j € L R ? ? ? Food Preservation? ?
?X 4. Six basic methods, which are used alone or in combination, can extend the normal biological shelf life of food: 佛 Reduced temperatures 佛 Thermal processing 佛 Water reduction 佛 Chemical preservation 佛 Modified atmospheres 佛 Irradiation - Each method can slow the natural biological maturation and spoilage of a food product, reduce biological activity or inhibit the chemical activity that leads to abiotic spoilage. - Each method requires its own unique blend of packaging materials and technology.?% P Pr
″ ? ? ˆ? ? ?
Food Preservation? ? ?@ Reduced Temperature and Freezing - Reducing temperatures below the ambient temperature has many beneficial effects that will lead to a longer shelf life. Doing so 佛 Slows chemical activity 佛 Slows loss of volatiles 佛 Reduces or stops biological activity - Bacteria and molds stop developing at about -80C, and by -180C, chemical and microorganism activity stops for most practical purposes. ? n & ?
? ? Food Preservation? ? ? - Freezing kills some microorganisms, but not to the extent of commercial usefulness. - Ice crystal formation is greatest between 0 and -5 !. Ice crystals can pierce cell walls, destroying the texture of many fruits and vegetables. Rapid freezing reduces this damage. - Freezer conditions will cause ice to sublimate, and serious food dehydration(freezer burn) will occur. Snug, good moisture-barrier packaging with a minimum of free air space will reduce freezer dehydration. Complete filling of the package is desirable. ?F P P P P ? ?
! ? ? Food Preservation? ? ?? - Frozen food packages materials must remain flexible at freezer temperatures, provide a good moisture barrier and conform closely to the product. - When paperboard is used as part of the package, it should be heavily waxed or coated with polyethylene to give protection against the inevitable moisture present in the freezing process. - Poultry packaging in high-barrier PVDC bags is an excellent example of an ideal freezer pack. Prepared birds, placed into bags, pass through a vacuum machine that draws the bag around the bird like a second skin. The tight barrier prevents water loss and freezer burn for extended periods, as well as preventing passage of oxygen that would oxidize fats and oils.? ? P? ? ?? ″ ? ? Food Preservation? ? ?
N Thermal Processing - Heat can destroy microorganisms. The degree of treatment depends on the: 佛 Nature of the microorganism to be destroyed 佛 Acidity (pH) of the food 佛 Physical nature of the food 佛 Heat tolerance of the food 佛 Container type and dimensions?
_ K 5 ″ % $? # ? ? Food Preservation? ? ?? - Pasteurization, a mild heat treatment of 60 to 700C, kill most, but not all, microorganisms present. Pasteurization is used when 佛 More severe heating would harm the product 佛 Dangerous organisms are not very heat resistant (such as some yeasts) 佛 Surviving organisms can be controlled by other means 佛 Surviving organisms do not pose a health threat?
3 N = 1 ? { ? $? ? Food Preservation?
? ?B Aseptic packaging - ∟Hot filling refers to product filling at elevated temperatures up to 100 !, used to maintain sterility in products such as jams, syrups and juices. - Some products can tolerate high temperatures for short time periods. - UHT processing of milk and fruit juices uses temperatures in the range of 135 to 150 !, but for a few seconds or less. The high temperature is enough to kill most pathogens. ?6 ? ? ? % ? ? Food Preservation? ? ?z -
UHT is the basis of most flexible aseptic drink packaging. The term aseptic as applied to packaging refers to any system wherein the product and container are sterilized separately and then combined and sealed under aseptic conditions. In the 1940s, metal cans were sterilized and filled with puddings, sauces, and soups (the Dole Process). In the 1970s, aseptic packaging was adapted to institutional bag-in-box systems. - Advantages: eliminating the need for the elevated temperatures and pressures used in conventional canning methods; Eliminating the need for extreme sterilizing conditions allows aseptic packaging materials to have lower physical strengths and lower temperature tolerance. ?D?
PG H ? & ! ? ? Food Preservation? ? ? - Commercial systems, such as Tetra Pak, Combibloc, and Bosch, use hydrogen peroxide to sterilize simple paper, foil and polyethylene laminates, and then fill the formed package with UHT-treated product. - Normal canning: Only maintains nominal cleanliness in the food and the container, Subjected to temperatures (110 to 130 !) high enough to kill pathogens and achieve commercial sterility. ?&? P ?) Y ?

’ ″ ? ? Food Preservation? ? ??Generally, the less acid the food, the longer the cook times needed to ensure destruction of Clostridium botulinum. Foods with acidities high enough to prevent harmful pathogens from propagating can be heat-processed by immersion in boiling water. Overcooking gives some foods their canned taste or texture. - The retortable pouch is a laminate of polyester (for toughness), foil (for an oxygen barrier) and a heat-sealable polyolefin. Its largest customer is the military.? ?,i ? (# ? ? Food Preservation? ? ?` Water Reduction - Drying is an old and well-established method of preserving food. - The essential feature of drying is that moisture content is reduced below that required for the support of microorganisms. - An added advantage is reduced bulk and reduction of other chemical activity. - Methods: by simple heat drying or by the addition of salt or sugar. 00i.e., Concentrated salt and sugar solutions tie up free water and make it unavailable to microorganisms. Jams and marmalades having high sugar contents do not require refrigeration for this reason.?4i P P ″ ? i ?) $? ? Food Preservation? ? ?F - Equilibrium relative humidity (E.R.H) is the atmospheric humidity condition under which a food will neither gain nor lose moisture to the air. - Aw, the water activity. A food with an Aw of 0.5 is at an equilibrium relative humidity of 50%. Table 2.3 lists the moisture content and the desired E.R.H for some common foods.? G G ? * % ? ? Food Preservation? ? ??Table 2.3 Typical moisture content and E.R.H ranges 0Product 00000Typical Moisture(%) E.R.H Potato chips, instant coffee0003% or less 000000010 to 20% Crackers, breakfast cereals0003 to 7% 00020 to 30% Cereal grains, nuts, dried fruit 007 to 20% 00030 to 60% Salt 0 0075% Sugar 000000000000000000 0085% ?RY 3 8 ?4 A % + ? + & ? ? Food Preservation? ? ?? - Very low-E.R.H. foods are hygroscopic and will draw available moisture from the air. These foods require a barrier package that will not permit the entry of atmospheric moisture. 1. Dried foods such as potato chips and instant coffee require packaging materials with high moisture-barrier properties. Potato chips are also rich in oil (about 30%), so that they also need a high oxygen barrier. In-package desiccants and oxygen scavengers are sometimes used to increase the shelf life of very sensitive products. 2. Dried foods with E.R.H. values of 20 to 30% have less stringent moisture-barrier requirements and are easier to package. Depending on the food, oxygen or other barriers may still be needed. ?0? P ? ?? , ’ ? ? Food Preservation? ? ? 3. Foods with an E.R.H. of 30 to 60% can often be stored for long periods with little or no barrier packaging since their E.R.H. corresponds to typical atmospheric conditions. If the food has a high oil content, oxygen barriers may be needed. Bacteriological activity is rarely a problem with low- or reduced-moisture foods since one of the essentials of bacterial growth has been removed. 4. High E.R.H. foods lose moisture under typical atmospheric conditions. A cake with an E.R.H. of 90% would soon establish a relative humidity of 90% inside a sealed package, creating ideal conditions for mold growth. The packaging challenge is to control moisture loss, retarding it as much as possible, but not to the extent that a high humidity is established within the package.? & P ? ? ¬┐(┌?┘?◀Food Preservation? ? ? Chemical Preservatives - Various natural and synthetic chemicals and antioxidants are used - They are used in conjunction with other preservation methods. - The use of most of them is strictly controlled by law. - Chemical preservatives work in various ways: ?, ? .) ? ? Food Preservation? ? ?l 1.Some, such as lactic, acetic, propionic, sorbic and benzoic acids, produce acid environments. 2. Others, such as alcohol, are specific bacteriostats. Carbon dioxide, found in beers and carbonated beverages creates an acid environment and is also a bacteriostat. 3. Smoking and curing of meat and fish is partly a drying process and partly chemical preservation. 4. Aliphatic and aromatic wood distillation products (many related to creosote) are acidic and have variable bacteriostatic effects. Varying amounts of salt pretreatment accompanies most smoking. 5. Antioxidants and oxygen absorbers can reduce oxidation.? m Pm ?b Y d ? / * ? ? Food Preservation? ? ??Modified Atmosphere Packaging - MAP recognizes that many food degradation processes have a relationship with the surrounding atmosphere. - MAP involves the introduction of a gas mixture other than air into a package - CAP is used in storage and warehousing where the atmosphere can be monitored and adjusted. - Vacuum packaging is one type of MAP. It has the effect of eliminating some or all oxygen that might contribute to degradation. ?.? Z ? ? 0 + ? ? Food Preservation? ? ? 00Disadvantages: fruits and vegetables have respiratory functions that must be continued; red meat will turn brown or purple without oxygen; pressures created by the external atmosphere surrounding a vacuum-packaged product can physically crush delicate products or squeeze water out of moist products. - Ambient air is about 20% oxygen and 80% nitrogen, with a trace of carbon dioxide. ?60 U . U ? ?? 1 , ? ? Food Preservation? ? ??0Table 2.4 Typical modified atmospheres for selected food products 0Product 000xygen Carbon Dioxide Nitrogen 0Red meat 00040% 000020% 40% 0White meats/pasta ---- 000050% 50% 00Fish 20% 000080% ---- 0Produce 00005%

0000---- 000095% 0Baked goods 001% 0060% 39%?ZK B = ? 2 B + ? 2 -┌?┘?◀Food Preservation? ? ?~ - O2 is biologically active, and for most products, is associated with respiration and oxidation. - Co2 in high concentrations is a natural bacteriostat. Levels of 20% and higher are used to create conditions unfavorable to most microorganisms. - N2 is biologically inert, filler gas or to displace oxygen. - Most packaging materials used in MAP for everything other than produce must have good gas-barrier properties to all three gases. ?? Z ? a ? ? ?$ & ? 3 . ? ? Food Preservation? ? ? - A package containing only carbon dioxide and nitrogen is a system where atmospheric oxygen is trying to penetrate the package and establish an equilibrium partial pressure. The integrity of all seals is of paramount importance. - The natural respiration of a fruit or vegetable consumes oxygen and produces carbon dioxide and moisture. Ventilated or low-barrier packaging is needed to ensure a supply of oxygen and to rid the package of excess moisture. - MAP has increased natural shelf life by 2 to 10 times. ? Z ? 4 / ? ? Food Preservation? ? ?$ Irradiation - Radiation is energy categorized by wavelength and includes radio waves, microwaves, infrared radiation, visible light, ultraviolet light and X rays. - These types of radiation increase in energy from radio to X rays; the shorter the wavelength, the greater the energy. - Given sufficient energy, waves can penetrate substances. With more energy still, they will interact with the molecules of the penetrated substance. - Short-wavelength radiations have enough energy to cause energy to ionization of molecules, mainly water. ?H! P P ? 5 0 ? ? Food Preservation? ? ?N - Ionization can disrupt complex molecules and leads to the death of living organisms. - Irradiation has been used to increase the keeping quality of various foods. Cobalt 60, a radioactive isotope, is the principal source of ionizing radiation (gamma rays). - All safety precautions pertaining to radioactive hazards must be observed. It should be noted that while the energy source is radioactive, gamma rays cannot make other substances radioactive. - Irradiation is a unique process in that it is carried out at ambient temperatures and can penetrate packaging material or products.? 0 P0 ? 6 1 ? ? Food Preservation? ? ?< - Irradiation of consumable food is an issue that is not fully resolved, and the process is carefully controlled in most countries. - Food irradiation is prohibited in some countries and highly regulated in most. However, the use of irradiation to achieve sterility for medical devices, packaging materials and personal care products does not present a problem and is a useful technology. - Labeling is another contentious issue. The irradiation symbol must be accompanied by a statement such as treated by irradiation or irradiated . ? P ? 7 2 ? ? Food Preservation? ? ? ? 8 3 ? ? The Transport Function? ? ? The transport function and examples of transport modes - The transport function entails the effective movement of goods from the point of production to the point of final consumption. - This involves various transport modes, handling techniques and storage conditions. - In addition to the general physical rigors of distribution, there are a number of carrier rules that will influence package design. Examples of some of the information required to design successful distribution packaging appear in Table 2.5.? 0 P6 ? ? 9 4 ? ? The Transport Function? ? ?? Table 2.5 Typical transport handling and storage information truck rail aircraft cargo ship storage duration storage conditions handling methods unitizing methods specific shipping unit weight considerations stock-picking dimension limits carrier rules environmentally controlled storage?6? < Z ? : 5 ? ? The Transport Function? ? ?{ - Transportation and distribution is generally regarded as an activity that is hazardous to the product being moved. - Packaging contributes to the safe, economical, and efficient storage of a product. Good package design take into account the implications of transport and warehousing, not just for the distribution package and unitized load, but for every level of packaging.? | { ? { ? < 7 ? ? The Transport Function? ? ? F 2. Persona - A good package is said to have a persona , or personality. If the designer has done an effective job, that persona will appeal to the targeted audience. - The targeted audience itself needs to be identified and studied. This is the realm of demographics and psychographics.?H ? ; 6 ? ? The Inform/Sell Function ? & ? ??1. Package communication roles - The communication role of packaging is perhaps the most complex of the packaging functions to understand, measure and implement because of the many levels at which this communication must work. - Law or customs dictate certain messages without much leeway in their presentation. Examples of such message are: 佛 Specific name of the product (what is this?) 佛 Quantity contained 佛 Address of the responsible body? Z8 Z Z 8 6 ! ? = 8 ? ? The Inform/Sell Function ? & ? ?H 3. How a package communicates 佛 Selected material 佛 Shape

and size 佛 Color 佛 Predominant typography 佛 Recognizable symbols or icons 佛 Illustrations?

″ ? > 9 ? ? The Inform/Sell Function ? & ? ?x - All of the communication channels must be balanced and supportive of one another to produce a persona with appeal and instant recognition. - All supporting material, such as promotions and advertisements, must agree with the image projected by the package. - Producing a well-balanced package persona requires an intimate familiarity with not just the structural qualities of packaging materials, but also the emotional qualities that they project. - A thorough understanding of the various printing processes and the specialized decorating techniques used to create particular effects or decorate unusual surfaces is essential.

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? ? ? ? ┌◘┌┐◘┼?P ` X 痤?┘┘?Figure 2.2 A barrier packaging material is one that slows down or stops the movement of selected gaseous substances into or out of a package?. V N 餒↨ ?┌h ?? ? ?師?藿h? ┌◘┘└ ?└┌┌┼? f櫃 櫥 櫃 櫧 fff ?8 ?0? ___PPT10? ? 佻┌`_燔☼?$┐┐?↑┌♬┌€ ?☼┐饘┌?◘?└└l ? ? ? ?l 餽↨ ?┐l S ? € 湅S ? ┌┌┌└┴┼?{4 ? ?? S ?? 餽↨ ?└l S ? €复S ? ┌┌┌└●┴┼??€ ?☼◀??◘┌♬S ?? 餒↨ ?┌l ?? ? ?師?藿h? ┌◘┘└ ?└┌┌┼? f櫃 櫥 櫃 櫧fff ?8 ?0? ___PPT10? ? 佻┌p哭9 ? $? € ?☼┐饘┌?◘?└└p ? ? ? ?p 餽↨ ?┐p S ? €鬃S ? ┌┌┌└┴┼?{4 ? ?? S ?? 餽↨ ?└p S ? €h岁 ?┌ ┌┌┌└●┴┼??€ ??☼◀??◘┌♬S ?? 餒↨ ?┌p ?? ? ?師?藿h? ┌◘┘└ ?
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鬞 ?″1 Z , ?4 # ? ? : ? ? content? ? ?Introduction The Contain Function The Protect/Preserve Function Food Preservation The Transport Function The Inform/Sell Function ? ? ? ? ? Introduction? ? ?1. The four main functions of a package Contain Protect/Preserve Transport Inform/Sell?H) [([? ? ? Introduction? ? ?

2. Definitions of different packaging levels Primary package: The first wrap or containment of the product that directly holds the product for sale. Secondary package: A wrap or containment of the primary package. Distribution package(shipper): A wrap or containment whose prime purpose is to protect the product during distribution and to provide for efficient handling. Unit load: A number of distribution packages bound together and unitized into a single entity for purposes of mechanical handling, storage, and shipping.?-┌↑♬└Z? Z, W . ? ? ? ? Introduction? ? ? ? ? ? Introduction? ?

?g 3. Packages are often defined by their intended destination Consumer package: A package that will ultimately reach the consumer as a unit of sale from a merchandising outlet. Industrial package: A package for delivering goods from manufacturer to manufacturer. Industrial packaging usually, but not always, contains goods or materials for further processing.?

r= + < a ? ? ? The Contain Function? ? ??

Considerations pertaining to thecontain function of packaging The product s physical form: mobile fluid viscous fluid solid/fluid mixture gas/fluid mixture granular material paste free-flowing non-free-flowing powder solid unit discrete items multicomponent mix?XA > ?4 ? ? ? The Contain Function? ? ??The product s nature: corrosive corrodible flammable volatile perishable fragile aseptic toxic abrasive odorous subject to odor transfer easily marked sticky hygroscopic under pressure irregular in shape?

D e ˆ ? ? ? The Protect/Preserve Function? ? ? 1.

Considerations related to the protect/preserve function Protect refers to the prevention of physical damage. Specifics on what will cause loss of value (damage) must be known. Preserve refers to stopping or inhibiting chemical and biological change and to the extension of food shelf life beyond the product s natural life or the maintenance of sterility in food or medical products.?

4= M < M ? ? ? The Protect/Preserve Function? ? ?0 2. Examples of protective packaging problems Table 2.1 Examples of protective packaging problems and concerns Condition Quantification or DesignRequirement Vibration Determine resonant frequencies Mechanical shock Determine fragility factor (drop height) Abrasion Eliminate or isolate relative movement Deformation Determine safe compressive load Temperature Determine critical values Relative humidity Determine critical values Water Design liquid barrier Tampering Design appropriate systems?P P-┌┐┌└-┌┐┌
┌┐┌↑┌┐↑6 2 ? ? ?? ? ? The Protect/Preserve Function? ? ??3. Examples of preservation packaging problems Table 2.2 Typical preservation packaging problems and concerns Condition Quantification or Design Requirement Oxygen Determine required barrier level Carbon dioxide Determine required barrier level Other volatiles Determine nature and barrier

level Light Design opaque package Spoilage Determine nature/chemistry Incompatibility Determine material incompatibilities Loss of sterility Determine mechanism Biological deterioration Determine nature Deterioration over time Determine required shelf life?d?

P/ B 0 ? ? ? ? Food Preservation? ? ? The Nature of Food 1. The nature of food Food is derived from animal or vegetable sources. Its organic nature makes it an unstable commodity in its natural form. Various means can increase the natural shelf life of foods, thus reducing dependence on season and location. ?X ?

? ? Food Preservation? ? ??2. Spoilage mechanisms Food spoilage can occur by three means: a) Internal biological deterioration b) External biological deterioration c) Abiotic deterioration Taste refers only to the sweet, sour, salty, and bitter sensations by the taste sensors located on our tongue Essential oils or sensory active agents and sense of smell by s

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located in our nasal passages What we perceive as a food product s flavor is a combination of what we detect with our sense of taste combined with what we detect with our sense of smell. Preservation of essential oils retains the food s full flavor at retail.? P(Pp P? P (N ? ? ?? ? ? Food Preservation? ? ? Essential oils are volatile.Volatiles can permeate packaging materials and making the problem of contamination or isolation even more difficult. Water vapor is similar to an essential oil in that it readily permeates many packaging materials. The creation of high-barrier packaging systems is partly in response to the need for packaging that will either hold desirable gases and volatiles in the package or prevent undesirable volatiles from entering the package. Temperature can promote undesirable changes that are abiotic in nature. ? Z ?, ? ? ? ? Food Preservation? ? ??Meat products - Meats are an ideal medium for microorganisms because they contain all the necessary nutrients to sustain growth. In addition to biological action, fatty tissue is susceptible to oxidation, and the entire mass can lose water. - Reduced temperature retards microorganism activity, slows evaporation and slows chemical reactions such as those associated with oxidation. ? H x @ < ? ? ? Food Preservation? ? ??Fish - The preservation of fish is a difficult challenge because of three main factors: 佛 Psychrophilic bacteria may be present. 佛 Many fish oils are unsaturated and are easily oxidized. 佛 Typical fish proteins are not as stable as red meat proteins. - Chilling does not affect the activity of psychrophilic bacteria. Frozen fish is typically kept at much lower temperatures (-300C/) than other frozen foods in order to ensure the control of psychrophilic bacteria.?X Z Z Z Z 1 B ? ?>a ? ? ? Food Preservation? ? ??Produce - Harvested fruits and vegetables continue to respire and mature. - They contain large amounts of water and will wither if water loss is excessive. - Peas, green beans, and leafy vegetables have high respiration rates compared with those of apples oranges, and pears. - Potatoes, turnips and pumpkins respire slowly and are easy to store. Moisture loss is more rapid with lettuce than with a turnip because of the large available surface area. ?. Z? Z ? ? ? ? Food Preservation? ? ?? - Most fruits have an optimum ripening temperature, usually about 200C. Few fruits will ripen below 50C. - Freezing of many produce items will damage cell structure, and breakdown is very rapid after thawing. - Modified atmosphere packaging used(CO2, O2) - Bananas can remain in a mature but green state for up to six months in atmospheres of 92% nitrogen, 5% oxygen, 3% carbon dioxide and no ethylene. ?X? P P ? ? ? ? ? Food Preservation? ? ?v - Atmosphere and temperature control are key requirements for extending the shelf life of fresh produce. Trade-offs for many produce items: 90%RH+perforated plastic wrap; or Selecting packaging films with high gas-transmission rates. i.e. precut salad bags(the shelf life of about ten days): excellent moisture barrier and very low oxygen barrier. ?6j P P Pw ? Y? ? ? Food Preservation? ? ? Barrier Packaging ?2 ? ? ? ? Food Preservation? ? ?c - Stopping the movement of a gas requires barrier packaging. - This packaging construction either retains desirable gases and volatiles inside the package or prevents undesirable gases and volatiles from entering the package. - Of the materials a packager can choose from, only glass and metal provide absolute barriers to all gases and volatiles. ?6b a ? c ? ? ? Food Preservation? ? ??- The term "high barrier" plastic is a relative, nonspecific term and should not be taken to mean "absolute" barrier. - Barrier packaging can harm some products. Fresh produce, for example, continues to respire after harvesting and would shortly consume all the oxygen in an oxygen-barrier package. This would lead to reduced shelf life. Plastic bags for produce commonly have vent holes punched in them to allow for a free exchange of atmospheric gases. ?$? P P? ? ? ? Food Preservation? ? ?N 3. Microorganisms and their preferred environments for propagation Microorganisms - A large part of food preservation depends on the control of microorganisms. - Bacteria or microbes are unicellular microscopic organisms that reproduce by binary fission. - Certain bacterial species can form spores that are highly resistant to killing. - Molds or fungi are multicellular and unicellular plantlike organisms. - Yeasts are similar organisms that reproduce by budding. The propagation and spread of molds and yeasts is typically slower than for bacteria because of the reproduction method.?TC P P? PC ? ? h ? ? ? Food Preservation? ? ?N Microorganisms preferred environments for propagation - By manipulating the four principal environmental factors that regulate microorganism growth, microorganisms can be controlled or eliminated: temperature moisture acidity (pH) nutrient source?H b 6 b ? ? ? Food Preservation? ? ?? Microorganisms are often classified by their preferred reproduction environment: Mesophyllic: Prefer ambient conditions, 20-450C Psychrophilic: Prefer cool conditions, 10-250C Thermophilic: tolerate heat; will propagate at 30 to 750C Aerobic: need oxygen to

propagate Anaerobic: propagate only in the absence of oxygen ?S S ″
,) ?>V + & ? ? ? Food Preservation? ? ??-
Some microorganisms act only on the food. They do little harm when ingested - Pathogenic organisms can cause sickness or death, falling into basic classes: 佛 Those that produce harmful toxins as by-products in the food they infest. 佛 Those that infest the food and then grow in the human body to produce illnesses.?j € L R ? ? ? Food Preservation? ?
?X 4. Six basic methods, which are used alone or in combination, can extend the normal biological shelf life of food: 佛 Reduced temperatures 佛 Thermal processing 佛 Water reduction 佛 Chemical preservation 佛 Modified atmospheres 佛 Irradiation - Each method can slow the natural biological maturation and spoilage of a food product, reduce biological activity or inhibit the chemical activity that leads to abiotic spoilage. - Each method requires its own unique blend of packaging materials and technology.?% P Pr
″ ? ? ˆ? ? ?
Food Preservation? ? ?@ Reduced Temperature and Freezing - Reducing temperatures below the ambient temperature has many beneficial effects that will lead to a longer shelf life. Doing so 佛 Slows chemical activity 佛 Slows loss of volatiles 佛 Reduces or stops biological activity - Bacteria and molds stop developing at about -80C, and by -180C, chemical and microorganism activity stops for most practical purposes. ? n & ?
? ? Food Preservation? ? ? - Freezing kills some microorganisms, but not to the extent of commercial usefulness. - Ice crystal formation is greatest between 0 and -5 !. Ice crystals can pierce cell walls, destroying the texture of many fruits and vegetables. Rapid freezing reduces this damage. - Freezer conditions will cause ice to sublimate, and serious food dehydration(freezer burn) will occur. Snug, good moisture-barrier packaging with a minimum of free air space will reduce freezer dehydration. Complete filling of the package is desirable. ?F P P P P ? ?
! ? ? Food Preservation? ? ?? - Frozen food packages materials must remain flexible at freezer temperatures, provide a good moisture barrier and conform closely to the product. - When paperboard is used as part of the package, it should be heavily waxed or coated with polyethylene to give protection against the inevitable moisture present in the freezing process. - Poultry packaging in high-barrier PVDC bags is an excellent example of an ideal freezer pack. Prepared birds, placed into bags, pass through a vacuum machine that draws the bag around the bird like a second skin. The tight barrier prevents water loss and freezer burn for extended periods, as well as preventing passage of oxygen that would oxidize fats and oils.? ? P? ? ?? ″ ? ? Food Preservation? ? ?
N Thermal Processing - Heat can destroy microorganisms. The degree of treatment depends on the: 佛 Nature of the microorganism to be destroyed 佛 Acidity (pH) of the food 佛 Physical nature of the food 佛 Heat tolerance of the food 佛 Container type and dimensions?
_ K 5 ″ % $? # ? ? Food Preservation? ? ?? - Pasteurization, a mild heat treatment of 60 to 700C, kill most, but not all, microorganisms present. Pasteurization is used when 佛 More severe heating would harm the product 佛 Dangerous organisms are not very heat resistant (such as some yeasts) 佛 Surviving organisms can be controlled by other means 佛 Surviving organisms do not pose a health threat?
3 N = 1 ? { ? $? ? Food Preservation?
? ?B Aseptic packaging - ∟Hot filling refers to product filling at elevated temperatures up to 100 !, used to maintain sterility in products such as jams, syrups and juices. - Some products can tolerate high temperatures for short time periods. - UHT processing of milk and fruit juices uses temperatures in the range of 135 to 150 !, but for a few seconds or less. The high temperature is enough to kill most pathogens. ?6 ? ? ? % ? ? Food Preservation? ? ?z -
UHT is the basis of most flexible aseptic drink packaging. The term aseptic as applied to packaging refers to any system wherein the product and container are sterilized separately and then combined and sealed under aseptic conditions. In the 1940s, metal cans were sterilized and filled with puddings, sauces, and soups (the Dole Process). In the 1970s, aseptic packaging was adapted to institutional bag-in-box systems. - Advantages: eliminating the need for the elevated temperatures and pressures used in conventional canning methods; Eliminating the need for extreme sterilizing conditions allows aseptic packaging materials to have lower physical strengths and lower temperature tolerance. ?D?
PG H ? & ! ? ? Food Preservation? ? ? - Commercial systems, such as Tetra Pak, Combibloc, and Bosch, use hydrogen peroxide to sterilize simple paper, foil and polyethylene laminates, and then fill the formed package with UHT-treated product. - Normal canning: Only maintains nominal cleanliness in the food and the container, Subjected to temperatures (110 to 130 !) high enough to kill pathogens and achieve commercial sterility. ?&? P ?) Y ?

’ ″ ? ? Food Preservation? ? ??Generally, the less acid the food, the longer the cook times needed to ensure destruction of Clostridium botulinum. Foods with acidities high enough to prevent harmful pathogens from propagating can be heat-processed by immersion in boiling water. Overcooking gives some foods their canned taste or texture. - The retortable pouch is a laminate of polyester (for toughness), foil (for an oxygen barrier) and a heat-sealable polyolefin. Its largest customer is the military.? ?,i ? (# ? ? Food Preservation? ? ?` Water Reduction - Drying is an old and well-established method of preserving food. - The essential feature of drying is that moisture content is reduced below that required for the support of microorganisms. - An added advantage is reduced bulk and reduction of other chemical activity. - Methods: by simple heat drying or by the addition of salt or sugar. 00i.e., Concentrated salt and sugar solutions tie up free water and make it unavailable to microorganisms. Jams and marmalades having high sugar contents do not require refrigeration for this reason.?4i P P ″ ? i ?) $? ? Food Preservation? ? ?F - Equilibrium relative humidity (E.R.H) is the atmospheric humidity condition under which a food will neither gain nor lose moisture to the air. - Aw, the water activity. A food with an Aw of 0.5 is at an equilibrium relative humidity of 50%. Table 2.3 lists the moisture content and the desired E.R.H for some common foods.? G G ? * % ? ? Food Preservation? ? ??Table 2.3 Typical moisture content and E.R.H ranges 0Product 00000Typical Moisture(%) E.R.H Potato chips, instant coffee0003% or less 000000010 to 20% Crackers, breakfast cereals0003 to 7% 00020 to 30% Cereal grains, nuts, dried fruit 007 to 20% 00030 to 60% Salt 0 0075% Sugar 000000000000000000 0085% ?RY 3 8 ?4 A % + ? + & ? ? Food Preservation? ? ?? - Very low-E.R.H. foods are hygroscopic and will draw available moisture from the air. These foods require a barrier package that will not permit the entry of atmospheric moisture. 1. Dried foods such as potato chips and instant coffee require packaging materials with high moisture-barrier properties. Potato chips are also rich in oil (about 30%), so that they also need a high oxygen barrier. In-package desiccants and oxygen scavengers are sometimes used to increase the shelf life of very sensitive products. 2. Dried foods with E.R.H. values of 20 to 30% have less stringent moisture-barrier requirements and are easier to package. Depending on the food, oxygen or other barriers may still be needed. ?0? P ? ?? , ’ ? ? Food Preservation? ? ? 3. Foods with an E.R.H. of 30 to 60% can often be stored for long periods with little or no barrier packaging since their E.R.H. corresponds to typical atmospheric conditions. If the food has a high oil content, oxygen barriers may be needed. Bacteriological activity is rarely a problem with low- or reduced-moisture foods since one of the essentials of bacterial growth has been removed. 4. High E.R.H. foods lose moisture under typical atmospheric conditions. A cake with an E.R.H. of 90% would soon establish a relative humidity of 90% inside a sealed package, creating ideal conditions for mold growth. The packaging challenge is to control moisture loss, retarding it as much as possible, but not to the extent that a high humidity is established within the package.? & P ? ? ¬┐(┌?┘?◀Food Preservation? ? ? Chemical Preservatives - Various natural and synthetic chemicals and antioxidants are used - They are used in conjunction with other preservation methods. - The use of most of them is strictly controlled by law. - Chemical preservatives work in various ways: ?, ? .) ? ? Food Preservation? ? ?l 1.Some, such as lactic, acetic, propionic, sorbic and benzoic acids, produce acid environments. 2. Others, such as alcohol, are specific bacteriostats. Carbon dioxide, found in beers and carbonated beverages creates an acid environment and is also a bacteriostat. 3. Smoking and curing of meat and fish is partly a drying process and partly chemical preservation. 4. Aliphatic and aromatic wood distillation products (many related to creosote) are acidic and have variable bacteriostatic effects. Varying amounts of salt pretreatment accompanies most smoking. 5. Antioxidants and oxygen absorbers can reduce oxidation.? m Pm ?b Y d ? / * ? ? Food Preservation? ? ??Modified Atmosphere Packaging - MAP recognizes that many food degradation processes have a relationship with the surrounding atmosphere. - MAP involves the introduction of a gas mixture other than air into a package - CAP is used in storage and warehousing where the atmosphere can be monitored and adjusted. - Vacuum packaging is one type of MAP. It has the effect of eliminating some or all oxygen that might contribute to degradation. ?.? Z ? ? 0 + ? ? Food Preservation? ? ? 00Disadvantages: fruits and vegetables have respiratory functions that must be continued; red meat will turn brown or purple without oxygen; pressures created by the external atmosphere surrounding a vacuum-packaged product can physically crush delicate products or squeeze water out of moist products. - Ambient air is about 20% oxygen and 80% nitrogen, with a trace of carbon dioxide. ?60 U . U ? ?? 1 , ? ? Food Preservation? ? ??0Table 2.4 Typical modified atmospheres for selected food products 0Product 000xygen Carbon Dioxide Nitrogen 0Red meat 00040% 000020% 40% 0White meats/pasta ---- 000050% 50% 00Fish 20% 000080% ---- 0Produce 00005%

0000---- 000095% 0Baked goods 001% 0060% 39%?ZK B = ?
2 B + ? 2 -┌?┘?◀Food
Preservation? ? ?˜ - 02 is biologically active, and for
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most
products, is associated with respiration and oxidation. - Co2 in high concentrations is a natural bacteriostat. Levels of 20% and higher are used to create conditions unfavorable to most microorganisms. - N2 is biologically inert, filler gas or to displace oxygen. - Most packaging materials used in MAP for everything other than produce must have good gas-barrier properties to all three gases. ?? Z ?a ? ? ?$
& ? 3 . ? ? Food Preservation? ? ? - A package containing only carbon dioxide and nitrogen is a system where atmospheric oxygen is trying to penetrate the package and establish an equilibrium partial pressure. The integrity of all seals is of paramount importance. - The natural respiration of a fruit or vegetable consumes oxygen and produces carbon dioxide and moisture. Ventilated or low-barrier packaging is needed to ensure a supply of oxygen and to rid the package of excess moisture. - MAP has increased natural shelf life by 2 to 10 times. ? Z ? 4 / ? ?
Food Preservation? ? ?$ Irradiation - Radiation is energy categorized by wavelength and includes radio waves, microwaves, infrared radiation, visible light, ultraviolet light and X rays. - These types of radiation increase in energy from radio to X rays; the shorter the wavelength, the greater the energy. - Given sufficient energy, waves can penetrate substances. With more energy still, they will interact with the molecules of the penetrated substance. - Short-wavelength radiations have enough energy to cause energy to ionization of molecules, mainly water. ?H! P P
? 5 0 ? ? Food Preservation? ? ?N - Ionization can disrupt complex molecules and leads to the death of living organisms. - Irradiation has been used to increase the keeping quality of various foods. Cobalt 60, a radioactive isotope, is the principal source of ionizing radiation (gamma rays). - All safety precautions pertaining to radioactive hazards must be observed. It should be noted that while the energy source is radioactive, gamma rays cannot make other substances radioactive. - Irradiation is a unique process in that it is carried out at ambient temperatures and can penetrate packaging material or products.? 0 P0 ? 6 1 ? ? Food Preservation? ?
?< - Irradiation of consumable food is an issue that is not fully resolved, and the process is carefully controlled in most countries. - Food irradiation is prohibited in some countries and highly regulated in most. However, the use of irradiation to achieve sterility for medical devices, packaging materials and personal care products does not present a problem and is a useful technology. - Labeling is another contentious issue. The irradiation symbol must be accompanied by a statement such as treated by irradiation or irradiated . ? P ? 7 2 ? ? Food Preservation? ?
? ? 8 3 ? ? The Transport Function? ? ? The transport function and examples of transport modes - The transport function entails the effective movement of goods from the point of production to the point of final consumption. - This involves various transport modes, handling techniques and storage conditions. - In addition to the general physical rigors of distribution, there are a number of carrier rules that will influence package design. Examples of some of the information required to design successful distribution packaging appear in Table 2.5.?0 P6 ? ?
9 4 ? ? The Transport Function? ? ?? Table 2.5 Typical transport handling and storage information truck rail aircraft cargo ship storage duration storage conditions handling methods unitizing methods specific shipping unit weight considerations stock-picking dimension limits carrier rules environmentally controlled storage?6? < Z ? : 5 ? ? The Transport Function?
? ?{ - Transportation and distribution is generally regarded as an activity that is hazardous to the product being moved. - Packaging contributes to the safe, economical, and efficient storage of a product. Good package design take into account the implications of transport and warehousing, not just for the distribution package and unitized load, but for every level of packaging.? | { ? { ? < 7 ? ? The Transport Function? ? ?F 2. Persona - A good package is said to have a persona , or personality. If the designer has done an effective job, that persona will appeal to the targeted audience. - The targeted audience itself needs to be identified and studied. This is the realm of demographics and psychographics.?H
? ; 6 ? ? The Inform/Sell Function ? & ? ??1. Package communication roles - The communication role of packaging is perhaps the most complex of the packaging functions to

understand, measure and implement because of the many levels at which this communication must work. - Law or customs dictate certain messages without much leeway in their presentation. Examples of such message are: 佛 Specific name of the product (what is this?) 佛 Quantity contained 佛 Address of the responsible body? Z8 Z Z 8 6 ! ? = 8 ? ? The Inform/Sell Function ? & ? ?H 3. How a package communicates 佛 Selected material 佛 Shape and size 佛 Color 佛 Predominant typography 佛 Recognizable symbols or icons 佛 Illustrations? ″ ? > 9 ? ? The Inform/Sell Function ? & ? ?x - All of the communication channels must be balanced and supportive of one another to produce a persona with appeal and instant recognition. - All supporting material, such as promotions and advertisements, must agree with the image projected by the package. - Producing a well-balanced package persona requires an intimate familiarity with not just the structural qualities of packaging materials, but also the emotional qualities that they project. - A thorough understanding of the various printing processes and the specialized decorating techniques used to create particular effects or decorate unusual surfaces is essential.? y Py ? ?0 ? € ?✲┐饵┌0 ? ? ? ? ? 饃↕ ?┐¶ ┐c ? €@ ??┌ ┌┌┌└● ┼??p y ?? ? ?? 饃↕ ?└¶ c ? € ??┌ ┌┌┌└■ ┼?x ??? ?? ? ?? 餒↕ ?┌¶ ??■?|■?師?藿h? ┌■┘└ ?└┌┌┼? €€€秽 33櫃櫙✲?8 ?0? ___PPT10? ? 畝??遠r jc V* ? ? Fc ? ? x ?扒┌?(€ ??€ r ?^? ? ≧;u ?>../jiaoxueluxiang/flash/2-1.EXE ??/? 0? ???DAriallac甫‼甫‼(+8? ? ?0 8?z[00? ?D婘SOal !? #$%&'()*+,-./0123456789:;<=>?@B? C?

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to store. Moisture loss is more rapid with lettuce than with a turnip because of the large available surface area. ?. Z? Z ? ? ? ? Food Preservation? ? ?? - Most fruits have an optimum ripening temperature, usually about 200C. Few fruits will ripen below 50C. - Freezing of many produce items will damage cell structure, and breakdown is very rapid after thawing. - Modified atmosphere packaging used(CO2, O2) - Bananas can remain in a mature but green state for up to six months in atmospheres of 92% nitrogen, 5% oxygen, 3% carbon dioxide and no ethylene. ?X? P P ? ? ? ? ? Food Preservation? ? ?v - Atmosphere and temperature control are key requirements for extending the shelf life of fresh produce. Trade-offs for many produce items: 90%RH+perforated plastic wrap; or Selecting packaging films with high gas-transmission rates. i.e. precut salad bags(the shelf life of about ten days): excellent moisture barrier and very low oxygen barrier. ?6j P P Pw ? Y? ? ? Food Preservation? ? ? Barrier Packaging ?2 ? ? ? ? Food Preservation? ? ?c - Stopping the movement of a gas requires barrier packaging. - This packaging construction either retains desirable gases and volatiles inside the package or prevents undesirable gases and volatiles from entering the package. - Of the materials a packager can choose from, only glass and metal provide absolute barriers to all gases and volatiles. ? 6b a ? c ? ? ? Food Preservation? ? ??- The term "high barrier" plastic is a relative, nonspecific term and should not be taken to mean "absolute" barrier. - Barrier packaging can harm some products. Fresh produce, for example, continues to respire after harvesting and would shortly consume all the oxygen in an oxygen-barrier package. This would lead to reduced shelf life. Plastic bags for produce commonly have vent holes punched in them to allow for a free exchange of atmospheric gases. ?$? P P? ? ? ? Food Preservation? ? ?N 3. Microorganisms and their preferred environments for propagation Microorganisms - A large part of food preservation depends on the control of microorganisms. - Bacteria or microbes are unicellular microscopic organisms that reproduce by binary fission. - Certain bacterial species can form spores that are highly resistant to killing. - Molds or fungi are multicellular and unicellular plantlike organisms. - Yeasts are similar organisms that reproduce by budding. The propagation and spread of molds and yeasts is typically slower than for bacteria because of the reproduction method.? TC P P? PC ? ? h ? ? ? Food Preservation? ? ? N Microorganisms preferred environments for propagation - By manipulating the four principal environmental factors that regulate microorganism growth, microorganisms can be controlled or eliminated: temperature moisture acidity (pH) nutrient source?H b 6 b ? ? ? Food Preservation? ? ?? Microorganisms are often classified by their preferred reproduction environment: Mesophyllic: Prefer ambient conditions, 20-450C Psychrophilic: Prefer cool conditions, 10-250C Thermophilic: tolerate heat; will propagate at 30 to 750C Aerobic: need oxygen to propagate Anaerobic: propagate only in the absence of oxygen ?S S ″ ,) ?>V + & ? ? ? Food Preservation? ? ??- Some microorganisms act only on the food. They do little harm when ingested - Pathogenic organisms can cause sickness or death, falling into basic classes: 佛 Those that produce harmful toxins as by-products in the food they infest. 佛 Those that infest the food and then grow in the human body to produce illnesses.?j € L R ? ? ? Food Preservation? ? ?X 4. Six basic methods, which are used alone or in combination, can extend the normal biological shelf life of food: 佛 Reduced temperatures 佛 Thermal processing 佛 Water reduction 佛 Chemical preservation 佛 Modified atmospheres 佛 Irradiation - Each method can slow the natural biological maturation and spoilage of a food product, reduce biological activity or inhibit the chemical activity that leads to abiotic spoilage. - Each method requires its own unique blend of packaging materials and technology.?% P Pr ″ ? ? ^? ? ? Food Preservation? ? ?@ Reduced Temperature and Freezing - Reducing temperatures below the ambient temperature has many beneficial effects that will lead to a longer shelf life. Doing so 佛 Slows chemical activity 佛 Slows loss of volatiles 佛 Reduces or stops biological activity - Bacteria and molds stop developing at about -80C, and by -180C, chemical and microorganism activity stops for most practical purposes. ? n & ? ? ? Food Preservation? ? ? - Freezing kills some microorganisms, but not to the extent of commercial usefulness. - Ice crystal formation is greatest between 0 and -5 !. Ice crystals can pierce cell walls, destroying the texture of many fruits and vegetables. Rapid freezing reduces this damage. - Freezer conditions will cause ice to sublimate, and serious food dehydration(freezer burn) will occur. Snug, good moisture-barrier packaging with a minimum of free air space will reduce freezer

dehydration. Complete filling of the package is desirable. ?F P P P P ? ? ! ? ? Food Preservation? ? ?? - Frozen food packages materials must remain flexible at freezer temperatures, provide a good moisture barrier and conform closely to the product. - When paperboard is used as part of the package, it should be heavily waxed or coated with polyethylene to give protection against the inevitable moisture present in the freezing process. - Poultry packaging in high-barrier PVDC bags is an excellent example of an ideal freezer pack. Prepared birds, placed into bags, pass through a vacuum machine that draws the bag around the bird like a second skin. The tight barrier prevents water loss and freezer burn for extended periods, as well as preventing passage of oxygen that would oxidize fats and oils.? ? P? ? ?? ″ ? ? Food Preservation? ? ? N Thermal Processing - Heat can destroy microorganisms. The degree of treatment depends on the: 佛 Nature of the microorganism to be destroyed 佛 Acidity (pH) of the food 佛 Physical nature of the food 佛 Heat tolerance of the food 佛 Container type and dimensions?
_ K 5 ″ % $? # ? ? Food Preservation? ? ?? - Pasteurization, a mild heat treatment of 60 to 700C, kill most, but not all, microorganisms present. Pasteurization is used when 佛 More severe heating would harm the product 佛 Dangerous organisms are not very heat resistant (such as some yeasts) 佛 Surviving organisms can be controlled by other means 佛 Surviving organisms do not pose a health threat?
3 N = 1 ? { ? $? ? Food Preservation? ? ?B Aseptic packaging - ㄴHot filling refers to product filling at elevated temperatures up to 100 !, used to maintain sterility in products such as jams, syrups and juices. - Some products can tolerate high temperatures for short time periods. - UHT processing of milk and fruit juices uses temperatures in the range of 135 to 150 !, but for a few seconds or less. The high temperature is enough to kill most pathogens. ?6 ? ? ? % ? ? Food Preservation? ? ?z - UHT is the basis of most flexible aseptic drink packaging. The term aseptic as applied to packaging refers to any system wherein the product and container are sterilized separately and then combined and sealed under aseptic conditions. In the 1940s, metal cans were sterilized and filled with puddings, sauces, and soups (the Dole Process). In the 1970s, aseptic packaging was adapted to institutional bag-in-box systems. - Advantages: eliminating the need for the elevated temperatures and pressures used in conventional canning methods; Eliminating the need for extreme sterilizing conditions allows aseptic packaging materials to have lower physical strengths and lower temperature tolerance. ?D?
PG H ? & ! ? ? Food Preservation? ? ? - Commercial systems, such as Tetra Pak, Combibloc, and Bosch, use hydrogen peroxide to sterilize simple paper, foil and polyethylene laminates, and then fill the formed package with UHT-treated product. - Normal canning: Only maintains nominal cleanliness in the food and the container, Subjected to temperatures (110 to 130 !) high enough to kill pathogens and achieve commercial sterility. ?&? P ?) Y ? ’ ″ ? ? Food Preservation? ? ??Generally, the less acid the food, the longer the cook times needed to ensure destruction of Clostridium botulinum. Foods with acidities high enough to prevent harmful pathogens from propagating can be heat-processed by immersion in boiling water. Overcooking gives some foods their canned taste or texture. - The retortable pouch is a laminate of polyester (for toughness), foil (for an oxygen barrier) and a heat-sealable polyolefin. Its largest customer is the military.? ?,i ? (# ? ? Food Preservation? ? ?` Water Reduction - Drying is an old and well-established method of preserving food. - The essential feature of drying is that moisture content is reduced below that required for the support of microorganisms. - An added advantage is reduced bulk and reduction of other chemical activity. - Methods: by simple heat drying or by the addition of salt or sugar. 00i.e., Concentrated salt and sugar solutions tie up free water and make it unavailable to microorganisms. Jams and marmalades having high sugar contents do not require refrigeration for this reason.?4i P P ″ ? i ?) $? ? Food Preservation? ? ?F - Equilibrium relative humidity (E.R.H) is the atmospheric humidity condition under which a food will neither gain nor lose moisture to the air. - Aw, the water activity. A food with an Aw of 0.5 is at an equilibrium relative humidity of 50%. Table 2.3 lists the moisture content and the desired E.R.H for some common foods.? G G ? * % ? ? Food Preservation? ? ??Table 2.3 Typical moisture content and E.R.H ranges 0Product 00000Typical Moisture(%) E.R.H Potato chips, instant coffee0003% or less 000000010 to 20% Crackers, breakfast cereals0003 to 7% 00020 to 30% Cereal grains, nuts, dried fruit 007 to 20% 00030 to 60% Salt 0 0075% Sugar 000000000000000000 0085% ?RY 3 8 ?4 A % + ? + & ? ? Food Preservation? ? ?? - Very low-E.R.H. foods are hygroscopic and will draw available moisture from the air. These foods require a barrier package that will not permit the entry of atmospheric moisture. 1. Dried foods such as potato chips and instant coffee require

packaging materials with high moisture-barrier properties. Potato chips are also rich in oil (about 30%), so that they also need a high oxygen barrier. In-package desiccants and oxygen scavengers are sometimes used to increase the shelf life of very sensitive products. 2. Dried foods with E.R.H. values of 20 to 30% have less stringent moisture-barrier requirements and are easier to package. Depending on the food, oxygen or other barriers may still be needed. ?0? P ? ?? , ' ? ? Food Preservation? ? ? 3. Foods with an E.R.H. of 30 to 60% can often be stored for long periods with little or no barrier packaging since their E.R.H. corresponds to typical atmospheric conditions. If the food has a high oil content, oxygen barriers may be needed. Bacteriological activity is rarely a problem with low- or reduced-moisture foods since one of the essentials of bacterial growth has been removed. 4. High E.R.H. foods lose moisture under typical atmospheric conditions. A cake with an E.R.H. of 90% would soon establish a relative humidity of 90% inside a sealed package, creating ideal conditions for mold growth. The packaging challenge is to control moisture loss, retarding it as much as possible, but not to the extent that a high humidity is established within the package.? & P ? ? ¬(┌?┘?◀Food Preservation? ? ? Chemical Preservatives - Various natural and synthetic chemicals and antioxidants are used - They are used in conjunction with other preservation methods. - The use of most of them is strictly controlled by law. - Chemical preservatives work in various ways: ?, ? .) ? ? Food Preservation? ?

?1 1.Some, such as lactic, acetic, propionic, sorbic and benzoic acids, produce acid environments. 2. Others, such as alcohol, are specific bacteriostats. Carbon dioxide, found in beers and carbonated beverages creates an acid environment and is also a bacteriostat. 3. Smoking and curing of meat and fish is partly a drying process and partly chemical preservation. 4. Aliphatic and aromatic wood distillation products (many related to creosote) are acidic and have variable bacteriostatic effects. Varying amounts of salt pretreatment accompanies most smoking. 5. Antioxidants and oxygen absorbers can reduce oxidation.? m Pm ?b Y d ? / * ? ? Food Preservation? ?

??Modified Atmosphere Packaging - MAP recognizes that many food degradation processes have a relationship with the surrounding atmosphere. - MAP involves the introduction of a gas mixture other than air into a package - CAP is used in storage and warehousing where the atmosphere can be monitored and adjusted. - Vacuum packaging is one type of MAP. It has the effect of eliminating some or all oxygen that might contribute to degradation. ?.? Z ? ? 0 + ? ? Food Preservation? ? ? 00Disadvantages: fruits and vegetables have respiratory functions that must be continued; red meat will turn brown or purple without oxygen; pressures created by the external atmosphere surrounding a vacuum-packaged product can physically crush delicate products or squeeze water out of moist products. - Ambient air is about 20% oxygen and 80% nitrogen, with a trace of carbon dioxide. ?60 U . U ? ?? 1 , ? ? Food Preservation? ? ??0Table 2.4 Typical modified atmospheres for selected food products 0Product 000xygen Carbon Dioxide Nitrogen 0Red meat 00040% 000020% 40% 0White meats/pasta ---- 000050% 50% 00Fish 20% 000080% ---- 0Produce 00005% 0000---- 000095% 0Baked goods 001% 0060% 39%?ZK B = ? 2 B + ? 2 -┌?┘?◀Food Preservation? ? ?~ - O2 is biologically active, and for most products, is associated with respiration and oxidation. - Co2 in high concentrations is a natural bacteriostat. Levels of 20% and higher are used to create conditions unfavorable to most microorganisms. - N2 is biologically inert, filler gas or to displace oxygen. - Most packaging materials used in MAP for everything other than produce must have good gas-barrier properties to all three gases. ?? Z ? a ? ? ?$ & ? 3 . ? ? Food Preservation? ? ? - A package containing only carbon dioxide and nitrogen is a system where atmospheric oxygen is trying to penetrate the package and establish an equilibrium partial pressure. The integrity of all seals is of paramount importance. - The natural respiration of a fruit or vegetable consumes oxygen and produces carbon dioxide and moisture. Ventilated or low-barrier packaging is needed to ensure a supply of oxygen and to rid the package of excess moisture. - MAP has increased natural shelf life by 2 to 10 times. ? Z ? 4 / ? ? Food Preservation? ? ?$ Irradiation - Radiation is energy categorized by wavelength and includes radio waves, microwaves, infrared radiation, visible light, ultraviolet light and X rays. - These types of radiation increase in energy from radio to X rays; the shorter the wavelength, the greater the energy. - Given sufficient energy, waves can penetrate substances. With more energy still, they will interact with the molecules of the penetrated substance. - Short-wavelength radiations have enough energy to cause energy to ionization of molecules, mainly water. ?H! P P ? 5 0 ? ? Food Preservation? ? ?N - Ionization can disrupt complex molecules and leads to the death of living organisms. - Irradiation has been used to increase the keeping quality of various foods. Cobalt 60, a radioactive isotope, is the

principal source of ionizing radiation (gamma rays). - All safety precautions pertaining to radioactive hazards must be observed. It should be noted that while the energy source is radioactive, gamma rays cannot make other substances radioactive. - Irradiation is a unique process in that it is carried out at ambient temperatures and can penetrate packaging material or products.? 0 P0 ? 6 1 ? ? Food Preservation? ? ?< - Irradiation of consumable food is an issue that is not fully resolved, and the process is carefully controlled in most countries. - Food irradiation is prohibited in some countries and highly regulated in most. However, the use of irradiation to achieve sterility for medical devices, packaging materials and personal care products does not present a problem and is a useful technology. - Labeling is another contentious issue. The irradiation symbol must be accompanied by a statement such as treated by irradiation or irradiated . ? P ? 7 2 ? ? Food Preservation? ? ? ? 8 3 ? ? The Transport Function? ? ? The transport function and examples of transport modes - The transport function entails the effective movement of goods from the point of production to the point of final consumption. - This involves various transport modes, handling techniques and storage conditions. - In addition to the general physical rigors of distribution, there are a number of carrier rules that will influence package design. Examples of some of the information required to design successful distribution packaging appear in Table 2.5.? 0 P6 ? ? 9 4 ? ? The Transport Function? ? ?? Table 2.5 Typical transport handling and storage information truck rail aircraft cargo ship storage duration storage conditions handling methods unitizing methods specific shipping unit weight considerations stock-picking dimension limits carrier rules environmentally controlled storage?6? < Z ? : 5 ? ? The Transport Function? ? ?{ - Transportation and distribution is generally regarded as an activity that is hazardous to the product being moved. - Packaging contributes to the safe, economical, and efficient storage of a product. Good package design take into account the implications of transport and warehousing, not just for the distribution package and unitized load, but for every level of packaging.? | { ? { ? < 7 ? ? The Transport Function? ? ? F 2. Persona - A good package is said to have a persona , or personality. If the designer has done an effective job, that persona will appeal to the targeted audience. - The targeted audience itself needs to be identified and studied. This is the realm of demographics and psychographics.?H ? ; 6 ? ? The Inform/Sell Function ? & ? ??1. Package communication roles - The communication role of packaging is perhaps the most complex of the packaging functions to understand, measure and implement because of the many levels at which this communication must work. - Law or customs dictate certain messages without much leeway in their presentation. Examples of such message are: 佛 Specific name of the product (what is this?) 佛 Quantity contained 佛 Address of the responsible body? Z8 Z Z 8 6 ! ? = 8 ? ? The Inform/Sell Function ? & ? ?H 3. How a package communicates 佛 Selected material 佛 Shape and size 佛 Color 佛 Predominant typography 佛 Recognizable symbols or icons 佛 Illustrations? ″ ? > 9 ? ? The Inform/Sell Function ? & ? ?x - All of the communication channels must be balanced and supportive of one another to produce a persona with appeal and instant recognition. - All supporting material, such as promotions and advertisements, must agree with the image projected by the package. - Producing a well-balanced package persona requires an intimate familiarity with not just the structural qualities of packaging materials, but also the emotional qualities that they project. - A thorough understanding of the various printing processes and the specialized decorating techniques used to create particular effects or decorate unusual surfaces is essential.? y Py ? ?N ? € ?⛭┐鴒└◘?|-,⛭└餘└⛭┘?┌ ?┐ ?,|⛭┘餽↕ ?┐, ┐S ? €藜?┌ ┌┌┌└┗┼?{4 ? ?? ?? 皎? ?┘, 餳┘◘┘|┘A ?? ? ?┌? ┌┌┌€€€ ?└┼┼??◘侈b_2-17 鱞↔┼? ┘?€ o ?? 痿↕ ?|, ?◘┘€獬q ? ? ? ? ┌◘┌┐◘┼??? P . 饒?┘┘?VFigure 2.1 Packaging can have many levels. All levels of the system must work together? WW 痱? ?-, ?€?┐ ┐¬┐?┘◘?◘?┼?┌◘ ┌◘┌┐◘┼??6 ?? 饎?┘┘?┘≧;u? f? ? ? U 0? 餒↕ ?┌, ??◘?|◘?師?藿h? ┌◘┘└ ?└┌┌┼? f櫃 櫥 櫃 櫟fff ?8 ?0? ___PPT10? ? 瘈?饎類r ? 傯┐?┗└┌? └?┐伉┐┌?┌