203. Filling by metering is used in filling of:
(A) Thin liquids like milk
(B) More viscous products
(C) Thin liquids as well as more viscous products
(D) None of the above

204. Glass is susceptible of breakage from:
(A) Internal pressure only (B) Impact only
(C) Thermal shock only (D) All the above

205. The breakage properties of glass containers can be minimized by:
(A) Proper choice of container thickness (B) Coating treatments
(C) Both (A) and (B) above (D) None of the above

206. The chances of breakage of glass due to internal pressure will be reduced if:
(A) Heavier jar or bottle for a given volume is used
(B) Lighter jar or bottle for a given volume is used
(C) Either heavier or lighter jar or bottle for a given volume is used
(D) All the above

207. The heavier jar is more susceptible to:
(A) Internal pressure breakage only (B) Impact breakage only
(C) Thermal shock breakage only (D) Both thermal shock and impact breakage

208. To reduce breakage of glass due to thermal shock, it is recommended to:
(A) Maximize temperature differences between the inside and outside of glass containers
(B) Minimize temperature differences between the inside and outside of glass containers
(C) Keep constant temperature differences between the inside and outside of glass containers
(D) All the above

Fill up the Blanks

1. Bag storage structures are often used to store grains from_____ to_____ tonnes.
2. The equilibrium moisture properties of materials are important in_____ and _____.
3. Lateral pressure in deep bins is calculated from _____ equation.
4. Grain infesting insects cannot survive at temperatures above_____°C.
5. The optimum moisture content for paddy storage is_____.
6. Safe grain moisture content for storage is about _____percent.
7. The optimum moisture content for one year duration of groundnut storage is____.
8. The recommended safe moisture content for storage of oilseeds is _____ percent.
9. Angle of repose of granular materials in general is _____ than the angle of internal friction.
10. Stack to stack distance in a 500 ton grain warehouse should be _____ m.
11. Wall to stack distance in a 500 ton grain warehouse should be _____ m.

195. Heavier jar or bottle is more susceptible to:
(A) Internal pressure
(B) Internal pressure and thermal shocks
(C) Internal pressure and impact breakage
(D) Impact breakage and thermal shock

196. Heavier jar or bottle for a given volume capacity, it is less likely to break from:
(A) Impact
(B) Thermal shock
(C) Internal pressure
(D) All the above

197. Which statement is not true?
(A) Glass is chemically inert
(B) Glass is not fragile
(C) Glass is susceptible to breakage
(D) Glass is water-vapor resistant

198. Which statement is not true?
(A) To avoid damage of bottle due to thermal shock, slow warming of bottles before being used for a hot fill is recommended
(B) To avoid damage of bottle due to thermal shock, partial cooling of bottles is recommended before placing under refrigeration
(C) Temperature difference between inside and outside of bottle should not exceed 44°C
(D) Surface coating of glass increases the noise from glass to glass contact at filling lines

199. Which one is not the mechanical property of packaging films?
(A) Water vapor transmission rate
(B) Elongation
(C) Bursting strength
(D) Tearing strength

200. Shrink package:
(A) Protects the food against contamination
(B) Allows the customer to see the product
(C) Keeps moisture in the food from drying out
(D) All the above

201. The first operation in shrink packaging of meat is:
(A) Twisting the bag and tying a knot
(B) Passing the package through a mild heat tunnel
(C) To fit skin tight by drawing a vacuum on the bagged item
(D) None of the above.

202. Filling by gravity is used in filling of:
(A) Thin liquids like milk
(B) More viscous products
(C) Thin liquids as well as more viscous products
(D) None of the above

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181. Major _____ variables which cause various changes and deteriorations in food grains during storage are respiration and heating:
(A) Physical (B) Physiological (C) Chemical (D) Biological

182. Most of the storage _____ do not develop below 0°C:
(A) Temperature (B) Moisture (C) Fungi (D) Chemical

183. Storage _____ do not develop below 5°C:
(A) Mites (B) Moisture (C) Protein (D) All the above

184. The moulds etc. respire at much _____ rates compared to the grain:
(A) Lower (B) Higher (C) Equal (D) Same

185. Equilibrium moisture content is determined by _____ method:
(A) Cooling (B) Cyclic (C) Dynamic (D) Evaporation

186. In air tight grain storage, insects are killed when the O_2 level falls to about:
(A) 0% (B) 2% (C) 8% (D) 12%

187. Which seals in bottles have higher inside pressure?
(A) Normal (B) Pressure (C) Vacuum (D) All the above

188. For corrosive liquids, the material used as shipping container is:
(A) Metal (B) Glass (C) Plastic (D) All the above

189. Selection of strapping materials depends upon following properties:
(A) Tensile and compression (B) Compression and elongation
(C) Tensile and elongation (D) None of the above

190. To test the performance of fiber board, the following tests are performed:
(A) Stack and drop (B) Stack and tensile
(C) Tensile and drop (D) None of the above

191. Which statement is not true?
(A) Packaging can improve the quality of foods
(B) Packaging cannot improve the quality of foods
(C) Packaging should be compatible with the product
(D) Package should not be costly

192. Water vapor proof packaging material is:
(A) Paper (B) Glass (C) Plastic (D) None of the above

193. Type of steel base required for most highly corrosive foods which are generally acidic is:
(A) Type MR (B) Type L
(C) Type MC (D) Type MC and Type MR

194. For corrosive or non corrosive low acid foods and dry products, type of steel base required:
(A) Type L (B) Type MS
(C) Type L and Type MS (D) Type MR or MC

169. For a deep bin, the following data is given:
Grain bulk density = 700 kg/m^3
Hydraulic radius = 1.25 m
Coefficient of friction of the grain on the wall = 0.532
Depth of grain = 6 m
Constant K (ratio of horizontal and vertical pressure intensity) = 0.4
The lateral pressure intensity (using Janssen's theory) will be:
(A) 878 kg/m^2 (B) 960 kg/m^2 (C) 1052 kg/m^2 (D) 1200 kg/m^2

170. For an air flow rate of 2 cubic meters per minute, the linear air velocity in the inter-granular space in a circular storage bin having 2 m diameter and 0.4 void fractions will be:
(A) 1.59 m/s (B) 1.06 m/s (C) 0.0265 m/s (D) 0.0177 m/s

171. Moulds grow only in grains with moisture content over:
(A) 6 (B) 8 (C) 10 (D) 13

172. Most fruits and vegetables are stored at:
(A) Low temperature and low humidity (B) High temperature and low humidity
(C) Low temperature and high humidity (D) High temperature and high humidity

173. A minimum thickness of silos wall is kept:
(A) 10 cm (B) 15 cm (C) 20 cm (D) None of the above

174. Vertical grain silo may be:
(A) Circular (B) Square (C) Hexagonal (D) All the above

175. Bottom of a silo should have slope:
(A) Less than angle of repose of grain (B) More than angle of repose of grain
(C) Equal of angle of repose of grain (D) All the above

176. The cracked grains have _____ respiratory rates than whole grains under the same conditions:
(A) Lower (B) Higher (C) Equal (D) Same

177. _____ of grain sometimes is brought about by insects and pests infestation which ultimately causes serious grain damage:
(A) Loading (B) Cooling (C) Heating (D) Unloading

178. Moisture accumulated at the top or bottom of the bin is attributed to the _____ of convection air:
(A) Movement (B) Relative humidity (C) Moisture (D) Temperature

179. All cereal grains contain certain _____ that decompose their constituents such as starch, proteins and lipids:
(A) Enzymes (B) Ash (C) Ice (D) Moisture

180. The grain _____ is always to be considered in conjunction with its moisture:
(A) Temperature (B) Oil (C) Protein (D) Starch

162. The flux of nitrogen through polyethylene at steady state is:
(A) 2.58×10^{-13} kg mole m^{-2} s^{-1} (B) 5.78×10^{-12} kg mole m^{-2} s^{-1}
(C) 1.44×10^{-11} kg mole m^{-2} s^{-1} (D) 2.58×10^{-10} kg mole m^{-2} s^{-1}

163. A 50 m high silo is fully charged with 500 tonnes of grain. True density and bulk density of the grain are 1500 and 450 kg/m^3, respectively. The diameter D of the silo and void fraction v of grain present in the silo will be:
(A) D =1.45 m; v = 0.9 (B) D = 5.32 m; v = 0.9
(C) D =1.45 m; v = 0.7 (D) D = 5.32 m; v = 0.7 *(GATE 2006)*

164. Angle of internal friction for rice grain is 27°, bulk density of rice at 14% moisture content is 833 kg/m^3 and coefficient of friction between rice and concrete wall is 0.5. For a silo of 5 m diameter and 20 m height, the ratio between the lateral pressure at the bottom of the silo obtained by Rankine and Janssen formulae is:
(A) 1.63 (B) 3.16
(C) 6.13 (D) 9.47 *(GATE 2007)*

165. The diameter of a grain storage bin is 4 m and the depth is 16 m. It is completely filled with wheat having bulk density of 800 kg m^{-3}. The angle of friction between wheat and wall is 24°. The ratio of lateral and vertical pressure intensity is 0.4. The lateral pressure intensity of wheat in kPa on the bin wall at 2 m depth is:
(A) 2.85 (B) 5.28
(C) 8.25 (D) 8.52 *(GATE 2009)*

Common Data for Questions 166 and 167:

Apple is to be stored at 30°C in modified atmosphere package of laminated films made of 150 μm thick polyethylene and 100 μm thick nylon. The partial pressures of oxygen outside and inside of the package are 0.21 atm and 0.01 atm respectively. The permeability values of polyethylene and nylon in m^3 solute (STP) m^{-2} s^{-1} atm^{-1} per m thickness are 4.17×10^{-12} and 1.52×10^{-14} respectively:

166. Ratio of resistance between Nylon and Polyethylene films is:
(A) 138 (B) 183
(C) 381 (D) 813 *(GATE 2009)*

167. The molar flux of oxygen across the laminate in kg mole m^{-2} s^{-1} at steady state will be:
(A) 1.35×10^{-12} (B) 2.47×10^{-12}
(C) 3.59×10^{-12} (D) 5.41×10^{-12} *(GATE 2009)*

168. In a circular concrete silo of 2.5 m internal diameter and 8 m height, paddy weighing 800 kg/m^3 is loaded. The angle of internal friction of paddy is 28° and that for paddy and concrete is 25°. The maximum lateral pressure (kg/m^2) at the bottom of bin section (using Airy's theory) will be:
(A) 2428.5 (B) 2800.6 (C) 3200 (D) 3439.4

153. Composite packaging films are economical and serve as:
(A) Gas barrier (B) Water vapor barrier
(C) Aroma retention of foods (D) All the above

154. Controlled atmosphere storage is used for storage of:
(A) Jams (B) Juices
(C) Dried products (D) Fresh fruits & vegetables

155. Which of the following materials is the best for packaging of liquid food products?
(A) Glass (B) Plastic film (C) Steel (D) Wood

156. A cylindrical silo of 3.0 m diameter and 20 m in height is filled with wheat. The hydraulic radius of the silo will be:
(A) 0.75 m (B) 1.50 m (C) 0.15 m (D) 60 m

157. If 'H' is depth of grain and 'R' is hydraulic radius, the relationship for shallow bin will be:
(A) $H < 4R$ (B) $H > 4R$ (C) $H = 4R$ (D) $H = 2R$

158. For an air flow rate of 2 m^3/min, the linear air velocity in the inter-granular space in a circular storage bin having 2 m diameter and 0.4 void fractions will be:
(A) 1.59 m/s (B) 1.06 m/s
(C) 0.0265 m/s (D) 0.0177 m/s *(GATE 2001)*

159. A silo, 15.24 m high and 1.83 m diameter, is filled with grain having a bulk density of 635 kg m^{-3}. The pressure ratio and coefficient of friction between grain and wall of the bin are 0.333 and 0.5, respectively. Vertical pressure developed at the base of the silo is:
(A) 32.09 kPa (B) 1.738 kPa
(C) 17.05 kPa (D) 3.27 kPa *(GATE 2003)*

160. One tonne of grain stored in a bin is cooled by aeration with ambient air at 20° C (density 1.15 kg m^{-3}) at a flow rate of 0.11 m^3 min^{-1} $tonne^{-1}$. The heat capacities of the grain and the air are 1.67 kJ kg^{-1} K^{-1} and 1.00 kJ kg^{-1} K^{-1}, respectively. The time required for cooling the grain in the bin is:
(A) 104 h (B) 110 h
(C) 214 h (D) 220 h *(GATE 2004)*

Data for Q. 161-162 are Given Below. Solve the Problems and Choose the Correct Answers.

A polyethylene film of 200 μm thickness is to be used for wrapping banana at 30°C temperature. The partial pressures of oxygen outside and inside the wrapper are 21.30 kPa and 1.01 kPa respectively. The partial pressures of nitrogen outside and inside of the wrapper are 78.02 kPa and 1.01 kPa respectively. Permeability of oxygen and nitrogen at 30° C temperature through polyethylene are 4.12×10^{-16} m^3 solute at STP m^{-1} s^{-1} kPa^{-1} and 1.50×10^{-14} m^3 solute at STP m^{-1} s^{-1} kPa^{-1}, respectively. *(GATE 2004)*

161. The flux of oxygen through polyethylene at steady state is:
(A) 1.86×10^{-12} kg mole m^{-2} s^{-1} (B) 2.78×10^{-13} kg mole m^{-2} s^{-1}
(C) 4.18×10^{-14} kg mole m^{-2} s^{-1} (D) 1.86×10^{-15} kg mole m^{-2} s^{-1}

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143. Fresh fruits weighing W kg and having surface area A_a (m^2) are packed inside a polymeric film. The surface area of the film is A_f (m^2) and its O_2 permeability is K [cm^3/h-m^2-concentration difference of O_2 in fraction]. Void space inside the package is V cm^3. If the concentration of O_2 as fraction in the atmosphere is Y_a and R_y [cm^3 oxygen/kg fruit-h] is the respiration rate for oxygen consumption by the fruit, the rate of change of oxygen concentration with time dY/dθ inside the void space of the package can be expressed by the following equation:

(A) $-\frac{A_f K(Y_a - Y)}{V} + \frac{WR_y}{V}$ (B) $\frac{A_f K(Y_a - Y)}{V} - \frac{WR_y}{V}$

(C) $\frac{A_a K(Y_a - Y)}{V} - \frac{WR_y}{V}$ (D) $-\frac{A_a K(Y_a - Y)}{V} + \frac{WR_y}{V}$ *(GATE 2006)*

144. Constant levels of oxygen and carbon dioxide are maintained in
(A) Controlled atmospheric storage (B) Modified atmosphere storage
(C) Hypobaric storage (D) Cold storage

145. Hypobaric storage is also known as:
(A) MA storage (B) Low pressure storage
(C) CA storage (D) All the above

146. Which of the following is the suitable packaging material for dried milk products?
(A) Carton lined with aluminum foil (B) Bags of plastic coated paper
(C) Aluminum polyethylene foil bags (D) All the above

147. MAP refers to:
(A) Modified Aseptic Packaging (B) Modern Aseptic Packaging
(C) Minimized Atmospheric Packaging (D) Modified Atmosphere Packaging

148. The composition of following gases is kept control in CA storage:
(A) O_2 & N_2 (B) O_2 & CO_2 (C) O_2 & H (D) O_2, N_2 & CO_2

149. Which packaging material is used for packaging of wheat in grain markets?
(A) Plastic bags (B) Jute bags (C) Paper bags (D) Cloth bags

150. Which type of package is best suited for packaging of fresh grapes?
(A) Bamboo baskets (B) CFB box (C) Jute bags (D) Paper bags

151. The permeability of a polymeric film is affected by:
(A) Temperature (B) Thickness of film
(C) Pressure difference across the film (D) All the above

152. The working pressure for pneumatic sealing machine is:
(A) 2 to 4 bar (B) 4 to 6 bar (C) 6 to 8 bar (D) 8 to 10 bar

133. The most widespread consumer package for aseptic products is:
(A) Can (B) Paper based carton
(C) Sachet and pouch (D) Bottle (*ASRB*)

134. Which is one of the best packaging materials to inhibit moisture migration from the packaged products?
(A) Laminated foil (B) Steel (C) CFB (D) HDPE (*ASRB*)

135. Modified atmosphere packaging is used in the storage of fresh _____, the term refers to their storage in plastic films which restrict the transmission of respiratory gases:
(A) Cereal and pulses (B) Oilseeds
(C) Fruits and vegetables (D) Fodder and fiber seeds (*ASRB*)

136. Permeability of gases and vapor through a packaging film depends on:
(A) Concentration difference between the two sides of the film
(B) Thickness of the film
(C) Thermal conductivity of film
(D) Area of the film surface (*ASRB*)

137. The conditions that extend the shelf life of horticultural products or of packaged products can be optimized by maintaining the internal levels of:
(A) Oxygen (B) Carbon dioxide (C) Water activity (D) All the above (*ASRB*)

138. Which of the following materials is not used for aseptic packaging?
(A) Plastics (B) Stainless steel (C) Aluminum (D) Glass (*ASRB*)

139. Which of the following does not affect the quality of food properly packed?
(A) Moisture (B) Ingredients (C) Oxygen (D) Light transfer (*ASRB*)

140. Aseptic processing and packaging encompasses the filling of _____ food into _____ containers followed by hermetic sealing with a pre-sterilized enclosure in pre-sterilized and continuously decontaminated tunnel or aseptic zone:
(A) Sterilized and cooled, pre-sterilized
(B) Raw, cooled
(C) Preserved, hot
(D) Sterilized, hot (*ASRB*)

141. The units employed for expressing permeability are:
(A) cm^3-cm/m^2–day–atmosphere (B) mg/m^2–day-bar
(C) mg/m^2 (D) ml m^2 MPa^{-1} day^{-1}

142. Ideal storage temperature for potato is:
(A) 0°C (B) 4°C (C) 8°C (D) –2°C

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120. During storage at higher temperature, spoilage reaction occurs at a:
(A) Faster rate (B) Slower rate
(C) Constant rate (D) None of the above

121. Hermetically sealed containers are essential for:
(A) Vacuum and pressure packaging (B) Aseptic packaging
(C) Flexible packaging (D) Controlled atmosphere packaging

122. In modified atmosphere packaging:
(A) CO_2 and O_2 levels increase
(B) CO_2 level increases and O_2 level decreases
(C) CO_2 level decreases and O_2 level increases
(D) CO_2 and O_2 levels remain constant

123. Hermetic containers are:
(A) Cans (B) Bottles (C) Flexible packages (D) Cans and bottles

124. Tensile strength of annealed aluminum foil increases in strength as gauge or thickness is:
(A) Decreased (B) Increased (C) Equalizes (D) None of the above

125. Sealing of polyethylene and other thermoplastic materials are usually done by applying heat to the film for a given time in the temperature range of:
(A) 60–75°C (B) 76–93°C (C) 94–204°C (D) 205–304°C

126. The controlled atmosphere storage applied to:
(A) Low Oxygen (B) High CO_2 atmosphere
(C) Burner gas (D) All the above

127. Modified humidity packaging (MHP) systems are designed to control:
(A) CO_2 and N_2 (B) Oxygen
(C) Dehydration and Condensation (D) All the above

128. In general, insects are killed when oxygen level in the inter-granular air falls to about:
(A) 0.1% (B) 4% (C) 2% (D) 6%

129. High density polyethylene (HDPE) is manufactured by:
(A) Low pressure process (B) High pressure process
(C) None of these (D) Both

130. Polyethylene films are good barrier of:
(A) Water vapor (B) Oxygen (C) Aroma (D) All the above

131. Packaging film, which is used for better MAP is:
(A) LDPE (B) HDPE (C) Polyproplene (D) LLDP

132. The sorption of key aroma and flavor compounds by the plastic packaging material in contact with the juice is:
(A) Absorption (B) Adsorption (C) Penetration (D) Scalping *(ASRB)*

106. Refrigerated storage temperature means storing below a temperature of:
(A) 16°C (B) 25°C (C) –2.2°C (D) None of the abov

107. The quick freezing of food products is done by
(A) Immersion freezing (B) Indirect contact freezing
(C) Air blast freezing (D) All the above

108. Addition of salt to ice will:
(A) Increase the temperature of the mixture
(B) Decrease the temperature of the mixture
(C) Not alter the temperature of the mixture
(D) Increase or decrease the temperature of the mixture

109. The recommended relative humidity for safe storage of potato is:
(A) 40 to 50% (B) 50 to 60% (C) 60 to 70% (D) 85 to 90%

110. On tonne of refrigeration is equivalent to:
(A) 50 kcal/min (B) 100 kcal/min (C) 60 kcal/min (D) 110 kcal/min

111. One tonne of refrigeration is the amount of heat required to melt 1 tonne of ice at 0°C
(A) 6 hour (B) 12 hour (C) 24 hour (D) 48 hour

112. One tonne of refrigeration is equal to:
(A) 4000 kcal/hour (B) 3000 kcal/hour (C) 2500 kcal/hour (D) 3500 kcal/hour

113. To inhibit the growth of bacteria in the milk, the storage temperature should not exceed
(A) 1°C (B) 2°C (C) 3°C (D) 4°C

114. The recommended temperature for safe storage of grapes is:
(A) –1 to 10°C (B) –5 to 0°C (C) 10 to 15°C (D) 15 to 20°C

115. The shelf life of food material is increased by reducing:
(A) Spoilage causing microorganisms (B) Chemical changes
(C) Biochemical reactions (D) All the above

116. Mature green tomato may be kept green for 5 to 6 weeks at 13°C in an atmosphere havi O_2 content of:
(A) 1% (B) 3% (C) 5% (D) 7%

117. The distance between the stacks in bag storage is kept as:
(A) 1 m (B) 2 m (C) 1.5 m (D) 3 m

118. Cooling system common in meat packing plant is:
(A) Brine system (B) Forced air circulation
(C) Chilled water system (D) Ammonia compression

119. During storage of foods, water will be evaporated from the surface of food to the su rounding air and water content of the food will be reduced. This is known as:
(A) Evaporation (B) Squeezing (C) Vaporizing (D) Desiccation

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92. Low irradiation range is:
(A) Below 1 Gy
(B) Below 10 Gy
(C) Below 100 Gy
(D) Below 1000 Gy (AS

93. Safe storage temperature for apple is:
(A) 2 to 3°C (B) –1 to 4°C (C) –2 to –1°C (D) –3 to –2°C

94. Optimum temperature and relative humidity for storage of tomatoes is:
(A) 2°C and 90 %
(B) 2°C and 100 %
(C) 8°C and 90 to 95 %
(D) 8°C and 95 to 100 %

95. Optimum conditions for onion storage are:
(A) 0 to 1 °C, 65 to 70 % RH
(B) 0 to 2 °C, 75 to 85 % RH
(C) –1 to 0 °C, 85 to 90 % RH
(D) –1 to 1 °C, 85 to 90 % RH

96. For ripe tomatoes, the maximum storage period for long term storage ranges from:
(A) 2 to 3 days (B) 7 to 10 days (C) 15 days (D) 30 days

97. Which of the followings can be stored at low temperature and low RH?
(A) Onions (B) Potatoes (C) Carrots (D) All the above

98. Which of the followings cannot be stored at temperature below 10°C?
(A) Apples (B) Mangoes (C) Pears (D) Grapes

99. Which of the followings is maximum perishable?
(A) Carrots (B) Onions (C) Spinach (D) Potatoes

100. Which of the followings is sensitive to low temperature storage?
(A) Mango (B) Pear (C) Apple (D) Grapes

101. Which of the followings cannot be stored safely in high humidity environment?
(A) Onion (B) Garlic (C) Potatoes (D) Onion and Garlic

102. In evaporative cooled storage structures, the potatoes may be stored for 3 to 4 months, if the environmental temperature and relative humidity are maintained at about:
(A) 40°C, 60% (B) 35°C, 70% (C) 25°C, 90% (D) None of the above

103. For onion storage, the relative humidity in the store should not be more than:
(A) 25% (B) 70% (C) 90% (D) 95%

104. Vapor barrier on an insulated wall should be provided on:
(A) Both sides of the wall
(B) Colder sides of the wall
(C) Warmer sides of the wall
(D) Neither sides of the wall

105. Cold chain transport, where the crop is pre-cooled directly after harvest and kept at a constant _____ throughout the marketing chain, is being increasingly practiced in both industrial and non-industrial countries:
(A) Pressure (B) Temperature (C) Humidity (D) Moisture (ASRB)

79. A grain bed is referred to as shallow bin, when the depth of the grain is _____ to equivalent diameter:
(A) Equal (B) Greater (C) Less (D) Less or equal

80. For safe storage of vegetable and oilseeds, moisture level should be:
(A) 2–3% (B) 4–6% (C) 8–9% (D) 10–11%

81. In a deep bin, depth of grain is _____ than equivalent diameter:
(A) Equal (B) Greater (C) Less (D) Less or equal

82. Short term storage of seed under dry condition retains good quality in:
(A) Tin containers (B) Plastic containers
(C) Porous paper (D) Metal containers

83. Concentration of CO_2 & O_2 in CA storage for apple should be maintained at:
(A) 1.5 to 10%, 2.5% (B) 5 to 10%, 3%
(C) 5 to 10%, 5% (D) None of the above

84. Wax coating is done on fruits and vegetables to retard:
(A) Retard respiration (B) Retard dehydration
(C) Enhance appearance (D) All the above

85. The evaporative cooling system is very much effective for storage of fruits and vegetal in the regions where:
(A) High temperature and high relative humidity
(B) Low temperature and low relative humidity
(C) Low temperature and high relative humidity
(D) High temperature and low relative humidity

86. To prevent the potato from sprouting, it is stored in the temperature and humidity range
(A) 10–12°C & 70–75% (B) 18–20°C & 75–80%
(C) 4–6°C & 85–90% (D) 24–26°C & 85–90%

87. Optimum storage condition for onion without any warming period during storage is:
(A) 4°C (B) 0°C (C) –4°C (D) –18°C

88. Garlic bulbs, before storing them in an ordinary room are used in shady places for:
(A) 3–4 days (B) 4–8 days (C) 7 days (D) 15 days

89. Sprouting of potato stored at 10°C can be prevented by application of:
(A) Ethylene (B) Natural gas (C) Oxygen (D) Carbon dioxide

90. Hypobaric storage is mostly used in storage of:
(A) Fruits & Vegetables (B) Fish
(C) Egg (D) Flowers

91. If RH is not controlled in cold storage of fruits/vegetables, they undergo following:
(A) Desiccation (B) Swelling
(C) Rot (D) None of the above (AS

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In an axial fan:

(A) Horse power requirement decreases with increase in discharge rate
(B) Horse power requirement decreases with decrease in discharge rate
(C) Horse power requirement decreases with increase in static pressure
(D) Horse power requirement is not affected either by discharge rate or by static pressure (*ASRB*)

_____ is used both as contact chemical as well as a fumigant?

(A) Phostoxin (B) Detia
(C) Ethylene dichloride (D) Dichlorvos (*ASRB*)

Air is flowing through a bed of grain stored in a silo. If 'V' is the superficial velocity and 'ε' is the void fraction, then the velocity of air through the bed is:

(A) V/ε (B) $1/\varepsilon$
(C) $V(1-\varepsilon)$ (D) $V(1-\varepsilon)$ (*GATE 1997*)

Process of moving atmospheric air through stored grain for its preservation without drying is known as:

(A) Aeration (B) Drying (C) Cooling (D) None of the above

The perforation in duct for aeration should be uniformly spaced with minimum area of:

(A) 5% (B) 10% (C) 15% (D) 20%

Which of the following is not a solid fumigant?

(A) Methyl bromide (B) Celphos (C) Detia (D) Phostoxin

Which of the following is not a liquid fumigant?

(A) Carbon tetrachloride (B) Phostoxin
(C) Ethylene dichloride (D) Ethylene dibromide

Which of the following statement is false about stored grain aeration?

(A) It prolongs effectiveness of pesticides
(B) It increases moisture accumulation at the bottom of grain storage structure
(C) It slows down insect activity
(D) Application of fumigants through an aeration system is an easy and practical method for controlling insects in stored grains

The process of moving air at low flow rate through stored grain to maintain its quality is known as:

(A) Respiration (B) Curing (C) Aeration (D) Sublimation

Design velocity for cross-section of aeration duct is generally:

(A) 5 m/s (B) 10 m/s (C) 20 m/s (D) 30 m/s

The sorghum seeds in sealed metal can had an initial moisture content that did not damage with:

(A) High temperature (B) Low temperature
(C) Low relative humidity (D) Time

57. Asbestos sheets of bag storage godown are applied _____ to prevent mould grov
(A) Sodium sulphate (B) Magnesium sulphate
(C) Zinc sulphate (D) Copper sulphate (

58. Rolling structures of the _____size are found to be more suitable type doors for g used for storage of agricultural produce:
(A) 2.44 m × 2.44 m (B) 4.22 m × 4.22 m
(C) 1.44 m × 2.44 m (D) 2.24 m × 2.24 m (

59. In a godown extra space for alleys for inspection and disinfecting of stacks is pr which is generally about:
(A) 30% (B) 20% (C) 5% (D) 1% (*GATE*

60. Storage of grain that requires protection from solar heat should use the following as ing material:
(A) Galvanized iron (B) Asphalt
(C) Aluminum (D) Asbestos sheet (*GATE*

61. Ventilation is done in seed storage when:
(A) Outside temperature is less and relative humidity is more
(B) Outside temperature is more and relative humidity is less
(C) Both outside temperature and relative humidity are high
(D) Both outside temperature and relative humidity are low

62. Good sanitation in seed store is necessary for protection from:
(A) Insects and rodents (B) Yeast and molds
(C) Bacteria and viruses (D) All the above

63. Cross section of the trench silo depends upon:
(A) Number of days silage is fed (B) Size of the herd
(C) Size of animals (D) All the above (A

64. To prevent spoilage, silage should be removed at the rate of:
(A) 5 cm/day (B) 10 cm/day
(C) 15 cm/day (D) 20 cm/day (A

65. Pit silos have
(A) Rectangular cross-section (B) Trapezoidal cross-section
(C) Circular cross-section (D) None of the above

66. An example of solid fumigant is:
(A) Ethylene dibromide (B) Methyl bromide
(C) Malathion (D) Aluminum phosphide

67. The most common fumigant for storage of cereals is:
(A) Zinc phosphide (B) Ethylene dibromide
(C) Aluminium phosphide (D) DDT

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48. The pressure of moving grains on the walls the bin is:
(A) Slightly greater than that of stationary grain
(B) Slightly less than that of stationary grains
(C) Same as that of stationary grains
(D) None of the above

49. To determine lateral pressure in a deep bin, Janssen assumed that the ratio of lateral pressure to vertical pressure is:
(A) Constant
(B) Increases during loading and unloading
(C) Varying
(D) Decreases during loading and unloading

50. Rankine formula is used to determine pressure in a:
(A) Shallow bin
(B) Deep bin
(C) Shallow bin and deep bin
(D) None of the above

51. If dried grain are stored in a silo for a long period of time and the bottom layer of the grain is spoilt due to accumulation of moisture, then the reason for this spoilage is that the grain, in comparison to outside air, is:
(A) Cooler (B) Warmer (C) More wet (D) Drier *(GATE 1987)*

52. Damp heating of stored food grains refers to:
(A) High temperature zone created in the grain bulk as a result of mold's activity
(B) High temperature zone created in the grain bulk as a result of insect's activity
(C) Physical effect of high humidity and high temperature of storage environment
(D) None of the above *(ASRB)*

53. The moisture migration in stored grains results from:
(A) Temperature changes
(B) Pressure changes
(C) Changes in hydraulic conductivity
(D) None of the above

54. Moisture migration in stored grains can be checked by:
(A) Air circulation
(B) Stirring the contents
(C) Surface covering of the structure
(D) All the above

55. During the winter season, if the grains are stored in cylindrical bin, the moisture condenses on the:
(A) Top (B) Bottom (C) Center (D) None of the above

56. Choose the correct statements:
(I) Moisture migration takes place in bin when grains are stored at moisture content above safe for storage
(II) Moisture migration does not take place in bin when grains are at a moisture level generally considered safe for storage
(III) Moisture migration takes place in bin when grains are at a moisture level generally considered safe for storage
(A) I, II & III
(B) I & II
(C) II & III
(D) I & III

38. Jenssen formula is used to determine the pressure in a:
(A) Shallow bin (B) Deep bin
(C) Both types of bins (D) Neither shallow nor deep bin

39. Which among the following grain pressure theories takes into account the friction betwe grains and bin wall?
(A) Hydrostatic pressure theory (B) Rankine's pressure theory
(C) Janssen's theory (D) None of the above (ASR

40. If 'φ' is the angle of repose of material, then the angle of rupture with the horizontal may taken as:
(A) $\frac{90+\phi}{2}$ (B) $\frac{90-\phi}{2}$ (C) $\frac{\phi}{2}$ (D) $90-\frac{\phi}{2}$ (ASR

41. The ratio of lateral pressure to vertical pressure in the design of storage structures is equ to:
(A) $\frac{1-\sin\phi}{1+\sin\phi}$ (B) $\frac{1+\sin\phi}{1-\sin\phi}$ (C) $\frac{1-\cos\phi}{1+\cos\phi}$ (D) $\frac{1+\cos\phi}{1-\cos\phi}$ (ASR

42. The benefits of aeration are:
(A) Reduces moisture accumulation (B) Prevents storage odour
(C) Application of fumigation (D) All the above

43. Jenssen equation is related to:
(A) Storage silo design (B) Size reduction of particles
(C) Grain transportation system (D) Size separation of grains (GATE 200

44. Pressure drop in fluid flow through granular materials is best estimated by:
(A) Blake - Kozney equation (B) Burke-Plummer equation
(C) Ergun equation (D) Fourier equation (GATE 200

45. Pressure in shallow bins is determined by:
(A) Fick's law (B) Janssen's formula
(C) Rankine formula (D) Fourier law

46. Theory used for determination of pressure induced by granular materials in deep bins is:
(A) Airy's theory (B) Janssen's theory
(C) Rankine's theory (D) None of the above

47. If 'L' and 'h' be the breadth and depth of the storage bin and ϕ be the angle of repose o material stored in it, then the bin can be taken as shallow bin if:
(A) $h = L \tan\left(\frac{90+\phi}{2}\right)$ (B) $h > L \tan\left(\frac{90+\phi}{2}\right)$
(C) $h < L \tan\left(\frac{90+\phi}{2}\right)$ (D) $h = L \tan\left(\frac{90-\phi}{2}\right)$

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26. *Pusa* bin is a storage structure, which is:
(A) Made of plastic
(B) Made of cow dung
(C) Made of cement
(D) Made of katcha brick with moisture proof film

27. In which regions of India, Morai type storage structures are used?
(A) Eastern and Southern (B) Western and Northern
(C) Eastern and Western (D) Southern and Northern

28. In which region of the country, Kothar type structures are used?
(A) Eastern region (B) Western region (C) Northern region (D) Southern region

29. Rat proofing cones are provided in grain storage structure at a height of:
(A) 0.90 m (B) 1.20m (C) 1.50 m (D) 1.80m

30. A type of modern permanent storage structure is:
(A) Squat silo (B) Mud kothi
(C) Kothar type structure (D) Pusa bin

31. Bag storage structures are used to store grains:
(A) Less than 25 tonnes (B) 25 to 100 tonnes
(C) 25 to 500 tonnes (D) More than 500 tonnes

32. Which of the following storage structure(s) has/have storage capacitry of 3.5 to 18 tonnes?
(I) Bukhari (II) Kothar (III) Morai
(A) I & II (B) I & III (C) II & III (D) I, II & III

33. For smooth floor surfaces, in vertical silos the slope angles should be:
(A) 20-30° (B) 30-35° (C) 40-45° (D) More than 45°

34. A bin whose relative dimensions are such that the plane of rupture meets the grain surface before it strikes the opposite side is called:
(A) Pusa Bin (B) Shallow Bin (C) Vertical Bin (D) Deep Bin

35. Airy's theory is applicable in design of:
(A) Cleaners (B) Dryers
(C) Screw conveyors (D) Silo

36. In case of a deep bin, the ratio of lateral pressure to vertical pressure (k) is:
(A) $(1 + \sin \varphi)/(1-\sin \varphi)$ (B) $(\sin \varphi + 1)/(\sin \varphi - 1)$
(C) $(\sin \varphi - 1)/(\sin \varphi + 1)$ (D) $(1 - \sin \varphi)/(1+\sin \varphi)$

37. Airy's theory is used to calculate lateral pressure exerted by grain in a:
(A) Deep bin (B) Shallow bin
(C) Deep & shallow bin (D) Medium bin

15. Paddy is normally stored at:
(A) 12 per cent moisture content on dry basis
(B) 12 per cent moisture content on wet basis
(C) 15 per cent moisture content on wet basis
(D) 15 per cent moisture content on dry basis *(GATE 1999)*

16. The higher values of angle of internal friction indicate that the material is:
(A) Cohesive (B) Easy flowing
(C) Normal flowing (D) No indication of flow

17. Mites grow in seed grain only at temperatures over:
(A) –5°C (B) 2°C (C) 5°C (D) 0°C

18. In equilibrium moisture content during the seed storage, vapor pressure of the grain is:
(A) > atm (B) < atm (C) = atm (D) None of the above

19. The safe moisture content for safe storage of corn is:
(A) 13% (B) 15% (C) 16% (D) 18%

20. The EMC gives an idea about
(A) Critical MC of the material
(B) Initial MC of the material
(C) Final MC of the material
(D) Whether the material will loose or gain the moisture at a particular atmospheric conditions

21. Two most important features governing storage life of food grains are
(A) Moisture and temperature (B) Humidity and density
(C) Foreign matter and size (D) None of the above

22. Which one is not a permanent grain storage structure?
(A) CAP (B) Shed (C) Squat silo (D) Vertical silo

23. Food spoilage occurs due to:
(A) Bacteria (B) Molds (C) Yeast (D) All the above

24. When a granular material is permitted to flow from a point into a pile, the angle which the side of the pile makes with horizontal is called:
(A) Critical angle (B) Scant modulus (C) Angle of repose (D) Tangent modulus

25. The correct relationship of angle of repose is:
(A) $\phi = \tan^{-1}\left[\frac{2(H_a - H_b)}{D_b}\right]$ (B) $\phi = \cos^{-1}\left[\frac{2(H_a - H_b)}{D_b}\right]$
(C) $\phi = \sin^{-1}\left[\frac{2(H_a - H_b)}{D_b}\right]$ (D) $\phi = \cot^{-1}\left[\frac{2(H_a - H_b)}{D_b}\right]$

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Choose the Correct Answer from the Multiple Choices (A, B, C & D)

1. Deterioration of food during storage is caused by:
   (A) Micro-organism (B) Rodents
   (C) Environmental factors (D) All the above

2. Angle made by material with respect to horizontal when piled is:
   (A) Angle of friction (B) Angle of repose
   (C) Angle of rotation (D) Dynamic angle of friction

3. Suitable moisture content for storage of paddy is in the range of:
   (A) 4-6% (B) 16-18% (C) 22-24% (D) 10-12%

4. What is the safe moisture content (%) for storage of grains?
   (A) 8-10 (B) 10-12 (C) 14-16 (D) 12-14

5. Hukill's model is used for:
   (A) E.M.C. prediction (B) Thin layer drying
   (C) Psychrometric modelling (D) None of the above

6. Food grain silos are used to store the grain in:
   (A) Bags (B) Crates (C) Bulk (D) Both bags and bulk

7. Angle of repose of wheat grain falls in the range of:
   (A) 20–25 (B) 23–28 (C) 30–40 (D) 31–44

8. Which nutrient remains unchanged during storage?
   (A) Carbohydrate (B) Total Protein (C) Vitamins (D) Total Fat

9. The process of moving air through stored grain at low flow rates to maintain or improve its quality is called:
   (A) Aeration (B) Fumigation (C) Ventilation (D) Infilitration

10. The rate of respiration of paddy increases with increase in:
    (A) Moisture content (B) Volume (C) Mass (D) Place of storage

11. In the food plant operation and management dealing with four foods namely potato, fish, milk and orange, the temperature yielding maximum storage life of four materials decreases in the order:
    (A) Potato < Fish < Milk < Orange (B) Milk < Fish < Orange < Potato
    (C) Fish < Milk < Orange < Potato (D) Fish<Potato<Orange<Milk *(GATE 1991)*

12. Spoilage of stored food grains due to fungal and mold activity starts generally at following relative humidity of storage environment when its temperature is in the normal range:
    (A) 95% (B) 80% (C) 65% (D) 50% *(ASRB)*

13. Safe moisture content of paddy (wb) for storage over one year is:
    (A) 10% (B) 11% (C) 12% (D) 13%

14. The relationship between EMC and RH for biological materials has been given by:
    (A) Perry (B) Rankine (C) Janssen (D) Henderson

ANSWERS

Multiple Choice Questions

1. D	2. B	3. D	4. B	5. D	6. C	7. B	
9. A	10. A	11. B	12. C	13. C	14. D	15. B	
17. C	18. C	19. A	20. D	21. A	22. A	23. D	
25. A	26. D	27. A	28. C	29. B	30. A	31. C	
33. B	34. B	35. D	36. D	37. C	38. B	39. C	
41. A	42. D	43. A	44. C	45. C	46. B	47. C	
49. A	50. A	51. A	52. B	53. A	54. D	55. B	
57. D	58. A	59. A	60. D	61. D	62. D	63. D	
65. C	66. D	67. C	68. B	69. D	70. A	71. A	
73. A	74. B	75. B	76. C	77. B	78. D	79. D	
81. B	82. C	83. A	84. D	85. D	86. C	87. B	
89. A	90. D	91. A	92. D	93. B	94. C	95. A	
97. A	98. B	99. C	100. A	101. D	102. C	103. B	
105. B	106. A	107. D	108. B	109. D	110. A	111. C	
113. D	114. A	115. D	116. B	117. B	118. B	119. D	
121. A	122. B	123. D	124. A	125. C	126. D	127. C	
129. A	130. A	131. C	132. B	133. A	134. A	135. C	
137. D	138. B	139. B	140. A	141. A	142. B	143. B	
145. B	146. D	147. D	148. D	149. B	150. B	151. D	
153. D	154. D	155. A	156. A	157. A	158. A	159. C	
161. A	162. D	163. D	164. B	165. B	166. B	167. A	
169. C	170. C	171. D	172. C	173. B	174. D	175. B	
177. C	178. A	179. A	180. A	181. B	182. C	183. A	
185. C	186. B	187. B	188. B	189. C	190. A	191. A	
193. B	194. D	195. D	196. C	197. B	198. D	199. A	
201. C	202. A	203. C	204. D	205. C	206. A	207. D	

Correction: 51: B, 55: A

5. 12%
6. 12
7. 7%
8. 6 to 8
9. more
10. 2
11. 1
12. 30
13. 18
14. more
15. tan (45 + φ/2)
16. physical, aerodynamic, magnetic
17. drying, dehydration, dried
18. grain surface, shallow bin
19. reduced
20. environment

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