

1. Please define free water and bound water. How is bound water content of foods determined? What is the formula for calculating  $a_w$ ? (10%)
2. Name the type of heat transfer that occurs (a) in an electric/gas oven when baking, (b) in a sauce pan to boil water (c) in a thick stew in a pan on the stove. (6%)
3. What determines the rate of dehydration of a food? Please describe the constant rate drying period and falling rate period of a drying curve. Which process would you use for the dehydration of egg white (need maintain the functionality of the egg white) – spray drying or drum drying? Why? (10%)
4. Following are the compositions of one commercial brand of improver for bakery products. Please indicate the functions of each component. Which type of bakery products may use this improver? (6%)

Ingredient	Starch	Calcium carbonate	Ammonium chloride	Ascorbic acid
percentage	46%	25%	16%	5%

5. What is glass transition temperature ( $T_g$ )? How does water or solutes (e.g. sugars, polyols) affecting  $T_g$ ? Please give two examples of the importance of glass transitions in food products? (8%)
6. Explain why some kernels or parts of cereal grains (e.g. wheat, corn) appear opaque or floury when a cut surface is viewed, whereas others appear glassy or vitreous. How are opacity and vitreousness related to hardness in cereals? What effects of grain hardness on the wheat flour milling? (10%)
7. Draw and explain the characteristic curve of time-temperature data during food freezing (monitoring at the thermal center of food). (6%)
8. Give the definition of recrystallization in foods. How many types of recrystallization are known in foods? Describe the effects of recrystallization on frozen storage of foods (9%)
9. Give the principle of the following terms. (20%)
  - (a) microwave heating
  - (b) lyophilization
  - (c) food irradiation
  - (d) membrane concentration
  - (e) cryogenic chilling
10. Give a diagram of brewing (the production of beer) and explain in words the objective of each step. (5%)
11. Explain the following glossaries used in food processing. (10%)
  - (a) refrigerant
  - (b) bleaching
  - (c) low acid food
  - (d) hydrophile-lipophile balance
  - (e) critical control point