

Name: _____ Student ID _____

**Prince of Songkla University
Faculty of Engineering**

**Exam: Mid Term, Semester I
Date: July 31, 2006
Subject: 230-591 - Special Topic
(Food Unit Operations)**

**Academic Year: 2006 – 2007
Time: 9:00 – 12:00 PM
Room: A301**

ทฤษฎีในการสอบโทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียน 1 ภาคการศึกษา

Instructions: This exam is divided into a Closed Book Section and an Open Book Section. Once you have completed the Closed Book Section, you can obtain the Open Book Section. The points for each problem are not distributed evenly. Place your name and the student ID number on every page. Students are allowed to use only a pen or pencil and a calculator. Students are allowed to use class notes, homework materials, and any references necessary in the Closed Book Section of the exam.

Points Distribution (For Grader Only)		
Part	Points Value	Score
1	20	
2	30	
3	20	
4	35	
5	10	
6	40	
7	20	
8	15	
9	25	
Total	225	

**Exam prepared by
Ram Yamsaengsung
July 24, 2006**

**PLEASE CHECK TO MAKE SURE THAT
YOU HAVE ALL 10 PAGES OF THE EXAM BEFORE BEGINNING.
GOOD LUCK!**

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CLOSED SECTION (125 points)

I. True and Faults (T/F) (If the statement is false, make it true.) (20 points)

- 1. Gel formation is the result of junction zone formation.
- 2. Proteins and starches are polymers, which will be in a rubbery state above T_g and glassy state below T_g .
- 3. Enzymes are responsible for the browning of bruised apples or cut raw potatoes.
- 4. Fats provide sensory characteristics of mouth feel, juiciness, and flavor.
- 5. Syneresis is the process in which water is squeezed from the gel as the starch begins to interact and the junction zone collapses.
- 6. Maltose has a sweetness value of 0.3 and glucose has a sweetness value of 0.5.
- 7. Sucrose is the reference point of sweetness and has a value of 1.0.
- 8. Lactose can be found in sugar beets and sugar cane.
- 9. Cornflakes, which have a water activity (a_w) of 0.10, will gain moisture in a 5% RH environment.
- 10. Water activity is the ratio P_s/P_v .
- 11. Potato chips are fried to low moisture content and packed in N_2 environment to preserve freshness and increase the shelf-life.
- 12. Amylopectin is in the form of linear chains and amylose is highly branched.
- 13. Tortilla chips are made from wheat flour and fried to produce a crispy snack product.
- 14. Corn starch can be converted into sucrose using acid, heat, and enzyme (producing corn syrup).
- 15. Amylose contributes to the high viscosity of the starch paste and amylopectin contributes to the gelling property.
- 16. Gelatinization temperature generally begins around 80°C .
- 17. Water is dipolar in nature and can form H-bond with carbohydrates and proteins.
- 18. Sugars form amorphous structures in confectionery products such as hard and soft candies.
- 19. Emulsion is gas dispersed in a liquid.
- 20. An increase in water content can change the T_g of the product.

II. Fill in the blanks (30 points)

1. The five basic components of food consist of: carbohydrates, _____, _____, _____, and _____.
2. Starch gelatinization takes place in the presence of _____, _____, and _____.
3. Plants store their surplus energy in two forms: _____ and _____.
4. _____ are used to stabilize oil and fat dispersions.
5. Sugars are _____ so sugary foods retain (hold) water and are difficult to evaporate them.
6. A solid dispersed in a liquid is called a _____ and gas dispersed in liquid is called a _____.
7. The _____ of sucrose is responsible for the texture in cookies and fudge.
8. During the _____ process, the viscosity of the starch paste decreases dramatically as the molecules begin to orient themselves in the direction that the system is being stirred.
9. _____ are responsible for the development of the final flavor and texture in fruits and vegetables
10. _____ pasteurization (72°C for 16 sec) is used in cheese and milk processing.
11. Cone/plate viscometer measures _____ when rotating at discrete speed and correlates the information to the shear stress.
12. _____, which is extensible, cohesive, and elastic, provides the key properties of dough for making bread.
13. The types of fluids that have yield stress are _____ and _____.
14. Toothpaste and tomato ketchup (paste) are examples of _____ fluids, while milk and honey are examples of _____ fluids.
15. Applesauce, banana puree, and orange juice are examples of _____ fluid.
16. Apparent viscosity is the _____ divided by the _____.
17. Shear-thickening fluid has a _____ greater than 1.
18. Irreversible thixotropy is called _____.
19. The two types of carbohydrates are _____ and _____.

III. Give a brief explanation of the following reactions and give one example of a food product in which this reaction takes place. (20 points)

1. Maillard Browning -

2. Caramelization -

3. Gelatinization -

4. Lipid Oxidation -

5. Retrogradation -

IV. Answer the following questions based on your trip to Tesco Lotus, Hat Yai, and the cooking demonstrations that took place in class. (35 points)

(1) Name 4 brands of salty snacks. (2 points)

(2) Name 2 examples dessert snacks and 2 of its major ingredients. (2 points)

(3) Name 4 brands of ice cream. What is its most important ingredient? A super premium ice cream must contain at least how much of this ingredient. (4 points)

(4) Name 3 brands of soft drinks and what makes it sweet (do not use sugar). (2 points)

(5) Name 4 types (plants) of cooking oil. (2 points)

(6) List 4 types of fresh fruits in their English names. (2 points)

(7) Name the 4 types of product that are found in the Lotus Bakery. (4 points)

(8) Name 8 products that were presented by you and your classmates in the Food Processes Presentation. (8 points)

(9) During the study of starch gelatinization, what were the 3 products that you and your classmates make? (3 points)

(10) Name the 4 ingredients that were used to make Pancake during class and the 3 ingredients used to make its topping. What chemical reactions took place during the cooking process of pancake and its topping? (6 points)

- V. Beginning with the relationship between shear stress and shear rate, derive the velocity profile for a Power Law fluid flowing through a tube viscometer. Please, show all your work. (10 points)

$$u(r) = \left[\frac{\Delta P}{2LK} \right]^{1/n} \left[\frac{n}{n+1} \right] \left[R^{\frac{(n+1)}{n}} - r^{\frac{(n+1)}{n}} \right] \quad (1)$$

**Prince of Songkla University
Faculty of Engineering**

**Exam: Mid Term, Semester I
Date: August 9, 2005
Subject: 230-591 - Special Topic
(Food Unit Operations)**

**Academic Year: 2005 – 2006
Time: 2:00 – 5:00 PM
Room: A205**

OPEN BOOK - (100 points)

VI. Select one of the 6 products listed below. Give their main ingredients, the function of each ingredient, and its production process. Draw a Flow Chart if necessary. (40 points)

**(1) Bread, (2) Beer, (3) Fruit Juice, (4) Ice Cream, (5) Potato Chips, (6) Milk
1.**

VII. Answer the following questions. (20 points)

- (1) What type of heat exchange is used to make ice cream? What refrigerant is typically used as the heat transfer medium? What type of freezer is used to make "soft serve"? What temperature is used during hardening? (5 points)

- (2) What type of grain is used to make beer and what is added to give beer its bitter taste? What is wort? For the making of Benromach, how long does fermentation last? (5 points)

- (3) What plant is chocolate made from? Name 3 main ingredients that are added in the making of chocolate. What is the result of incorrect tempering? (5 points)

- (4) What is used to extract sugar from sugar beets? What are the thin slices of sugar beets called? What processing conditions are used in the crystallization of sugar? What are molasses? What is the final moisture content of sugar? (5 points)

VIII. Match the following process or description with the following product. Note, some process may apply to more than one product. (15 points)

- | | |
|-------------------------|----------------|
| _____ 1. Fermentation | a. Ice Cream |
| _____ 2. Liming | b. Sugar |
| _____ 3. Washing | c. Bread |
| _____ 4. Pressing | d. Fruit Juice |
| _____ 5. Forming | e. Milk |
| _____ 6. Ageing | f. Chocolate |
| _____ 7. Pasteurization | g. Hot Dogs |
| _____ 8. Curing | h. Whisky |
| _____ 9. Homogenization | |
| _____ 10. Proofing | |

IX. Experimental results with a concentric cylinder viscometer used for banana puree at 340 K were as followed:

Shear Rate [$10^{-3} \times 1/s$]	Shear Stress [$10^{-4} \times Pa$]
1.0	2.40
1.5	3.20
2.0	3.50
3.0	4.50
4.0	4.60
5.0	4.90
6.0	5.20
7.0	5.30

Assuming Power-Law behavior: (25 points)

- (1) Determine the rheological parameters required to describe the product. (10 points)
- (2) If the pressure drop in a 40 m long straight pipe is 15,000 KPa and the diameter of the pipe is 5 in., what is the volumetric flow rate in gal/min.? (15 points)

Given: $\rho = 1,400 \text{ kg/m}^3$ and $1 \text{ m}^3 = 264.17 \text{ gallons}$