Manufacturing of Fresh Dairy Products

(OFO-code: 681301)

EXTERNAL SUMMATIVE ASSESSMENT: THEORY

Learner name & surname: _____

Assessor name & surname: _____

Date: _____

DECLARATION OF COMPETENCE	
To be completed by the External Assessor (tick the applicable block)	
Learner competent (C)	
Learner not yet competent (NYC)	

Instructions to the Learner:

1. Answer all of the following questions without referring to any notes.
2. No group work is allowed, i.e. complete the questionnaire on your own individual effort.
3. After completion, hand the questionnaire to the External Assessor for evaluation.
4. You need to obtain a minimum of 70% for this assessment in order to be found competent in the theory component.

1. What will happen if milk/cream/dairy mixture is pasteurised insufficiently prior to fresh dairy product manufacturing? (2)

_____

_____

_____

_____

_____

_____

2. Complete the table below by naming the 4 main sections of a plate pasteuriser and the function of each. (4)

Main section of plate pasteuriser	Function
1.	
2.	
3.	
4.	

3. (a) Name the specified minimum time-temperature combination for pasteurisation of milk with:

HTST method: _____ (2)

LTLT method: _____ (2)

(b) Name the specified minimum time-temperature combination for pasteurisation of cream with the HTST method. (2)

_____

(c) Why is cream pasteurised at this temperature? (2)

_____

_____

_____

4. (a) What is the purpose of the equipment in the picture shown below and why is this is critical control point during pasteurisation? (2)

_____

_____

_____

_____

(b) What will happen during pasteurisation if the milk temperature after the holding section is monitored as being below the required pasteurisation temperature? (2)

_____

_____

_____

_____

5. (a) In what 2 phases does milk divide during separation? (1)

_____

_____

(b) Which phase mentioned in question 5 (a) is heavier than the other? (1)

_____

_____

_____

6. Give the legends for numbers 1, 2 and 3 of Figure 1 below: (3)

1. _____

2. _____

3. _____

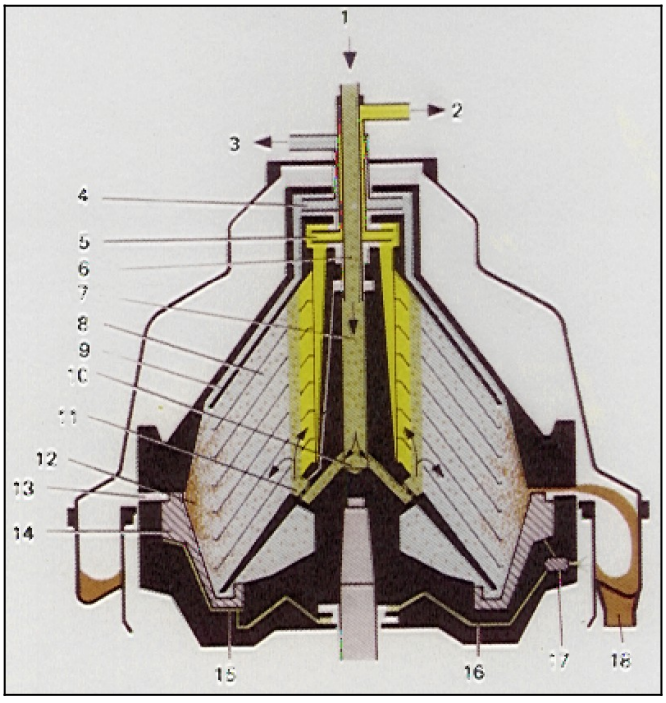


Figure 1: Centrifugal cream separator parts

7. Give the meanings of the arrows in Figure 2 below: (4)

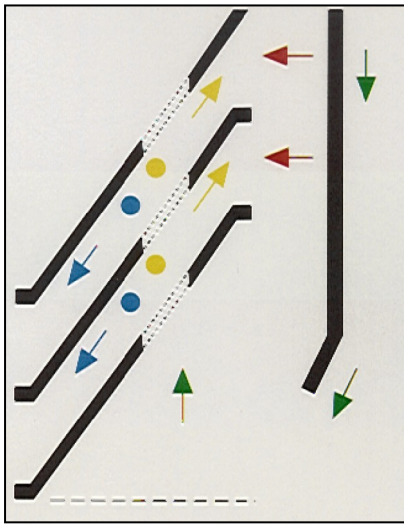


Figure 2: Centrifugal cream separator inside

→ _____

→ _____

→ _____

→ _____

8. According to our local law, what is the maximum amount (%) of butterfat that is allowed in skim milk? (1)

_____

9. What is the purpose of each of the following on the cream separator:

(a) Brake (1)

_____

_____

(b) Flow regulating valve (1)

_____

_____

_____

10. You have sufficient full cream milk (3,4% butterfat) and skim milk (0,1% butterfat) at your disposal. Determine, in litres, how much of each ingredient you will use to make 10 000 litres of milk that will have a butterfat content of 2,0%. Also do the necessary calculations to test your answers.

    Presume the following:

    S.G. of 3,4% milk = 1,030
    S.G. of 0,1% milk = 1,035
    S.G. of 2,0% milk = 1,032 (12)

    Calculations:

Calculations (continued):

11. What is standardisation? (2)

_____

_____

12. Why is it necessary that we standardise the fat content of milk?
Name 3 things (3)

_____

_____

_____

_____

13. Name 3 ways how % butterfat can be lowered. (3)

_____

_____

_____

_____

14. Why should raw milk and pasteurised milk never be mixed? (1)

_____

_____

15. Name 3 reasons why milk/dairy mixture is homogenised prior to the manufacturing of fresh dairy products. (3)

_____

_____

_____

_____

_____

16. What is the purpose of bactofugation? (1)

_____

_____

17. Why should milk be homogenised after regeneration and before the heating and holding sections of the pasteuriser? Give a reason for each. (2)

_____

_____

_____

_____

18. Complete the table below to show 3 raw materials that are used in the manufacturing of the fruit juice or fruit milk mixture at the organisation where you receive your training. Also give the function of each. (6)

Raw material	Function

19. Why must fruit juice concentrate be stored in a frozen form if unpreserved? (1)

_____

_____

20. Why is sweet de-flavoured apple juice or grape juice sometimes added to orange juice? (2)

_____

_____

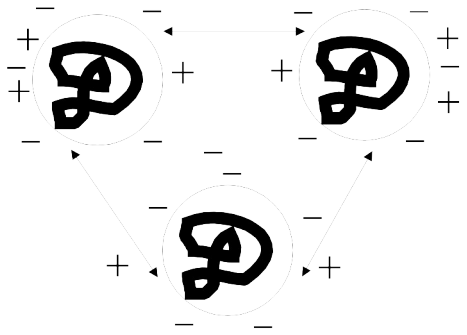
21. Circle 2 preservatives that are permitted for use in sweetened fruit juice. (2)

Pimarisin	Salt
Tartrazine	Sulfur dioxide
Carbon dioxide	Tartaric acid

22. How can the °Brix reading be lowered? (1)

_____

23. Look at the pictures below and write down a very short description of what happens with milk proteins at each pH.



pH 6,7

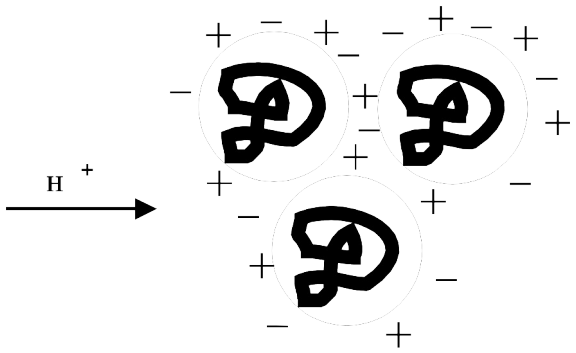
_____

_____

_____

_____

_____ (2)



pH 4,6

Isoelectric point

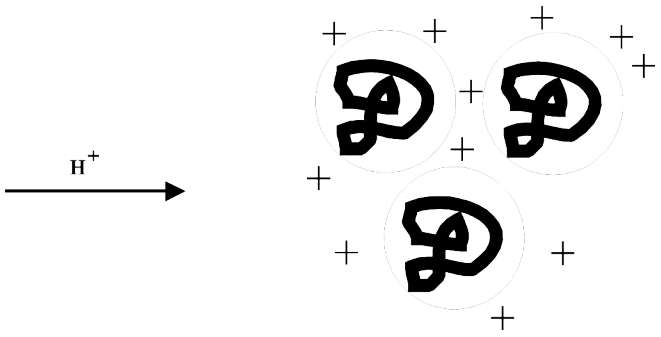
_____

_____

_____

_____

_____ (2)



pH <4,6

_____

_____

_____

_____

_____ (2)

24. (a) What is the net charge on stabiliser molecules? (1)

_____

(b) Circle <u>one</u> of the 3 pictures in question 23 where stabilisers will most certainly attach to milk proteins to stabilise the mixture. (1)

25. Why must the mixture be stirred continuously during manufacturing of fruit milk mixtures? (1)

_____

_____

26. Why must the pasteurisation temperature for fruit milk mixtures not be too high? (2)

_____

_____

_____

_____

TOTAL: (80)

FRESH DAIRY PRODUCTS MAKER

EXTERNAL SUMMATIVE ASSESSMENT

LEARNER NAME & SURNAME_____

ASSESSOR NAME & SURNAME: _____

LEARNER ID NUMBER_____

DATE:_____

DECLARATION OF COMPETENCE	
To be completed by external assessor (Tick applicable box)	
Learner Competent (C)	
Learner not yet Competent (NYC)	

Instructions to the Learner:

1. Answer all of the following questions without referring to any notes.

2. No group work is allowed, i.e. complete the questionnaire on your own individual effort.

3. After completion, hand the script to the invigilator
4. You need to obtain a minimum of 50% in both theory and application sections for this assessment in order to be found competent.

TOTAL MARKS	**168**
LEARNER MARK	

Duration: 4 ½ Hours

SECTION A (THEORY)

1. **QUESTION 1**: Prepare raw milk and make additions for the manufacturing of ripened cheese

1.1. **Interpreting production instructions, obtain milk or cream**

1.1.1. Complete the table below by naming the 4 main sections of a pasteurizer and the function of each. (4)

Section	**Function**

1.1.2. Raw milk contains microorganisms which are both good and bad and are subject to a heat treatment method called _____, which requires you to heat raw milk to _____ degrees Celsius for _____ seconds (3)

1.1.3. From your answer above, what would be the cause leading to the following results? (2)

Milk has a burnt taste:

_____

High bacterial load after heat treatment:

_____

1.2. Obtain other raw materials required for fresh dairy products manufacturing, standardize and homogenize milk

1.2.1. Name the specified minimum time-temperature combination for pasteurization of cream with the HTST method. (1)

_____

_____

1.2.2. In which section of the plate pasteurizer will the milk or product be kept at the required pasteurization temperature for the required time period? (1)

_____

_____

1.2.3. In which section of the plate pasteurizer will the milk or product get heated by hot water to the required pasteurization temperature? (1)

_____

_____

1.2.4. Name 3 reasons why milk/dairy mixture is homogenized prior to manufacturing fresh dairy products. (3)

_____

_____

_____

_____

1.2.5. What is standardization? (2)

_____

_____

_____

_____

1.2.6. Why is it necessary that we standardize the fat content of milk? Name 3 things (3)

_____

_____

_____

_____

2. QUESTION 2:

2.1. Producing Fruit Juice/Fruit-milk mixture

2.1.1. List 5 pieces of equipment required for the production of fruit milk mixtures along with their functions. (10)

_____

_____

_____

_____

_____

2.1.2. Why is sweet de-flavoured apple juice or grape juice sometimes added to orange juice? (2)

_____

_____

_____

_____

_____

2.1.3. Name 2 preservatives that are permitted for use in sweetened fruit juice. (2)

_____

_____

_____

2.1.4. What must be done when the °Brix reading is too low? (1)

_____

_____

_____

2.1.5. What must be done when the °Brix reading is too high? (1)

_____

_____

_____

2.1.6. Name the specified minimum time-temperature combination for pasteurization of milk with:

HTST method: _____ (2)

LTLT method: _____ (2)

Name the specified minimum time-temperature combination for pasteurization of cream with the HTST method and why is it done this way? (3)

_____

_____

_____

2.2.

2.2.1. Name 3 ways how % butterfat can be lowered. (3)

_____

_____

_____

2.2.2. How does the stabilizing effect in fruit milk mixtures work? (8)

_____

_____

_____

_____

_____

_____

2.2.3. According to our local law, what is the maximum amount (%) of butterfat that is allowed in skim milk? (2)

_____

_____

_____

2.2.4. Complete the table below to show 3 raw materials that are used in the manufacturing of the fruit juice or fruit milk mixture at the organization where you receive your training. Also give the function of each. (8)

Raw Material	Function

2.2.5. _____ is when milk is put under pressure through fine openings, which evenly disperses _____. This stops the cream from separating and rising to the top, allowing a more consistent texture and taste. Some manufacturers produce _____ milk for people who prefer the _____to separate and rise to the top of the bottle. (8)

2.3.

What is the function of the following steps in dairy processing: (10)

2.3.1. Centrifugal separation

_____

_____

_____

_____

2.3.2. Ultrafiltration

_____

_____

_____

_____

2.3.3. Reverse osmosis

_____

_____

_____

_____

2.3.4. Homogenisation

_____

_____

_____

_____

2.4. Perform food safety practices.

2.4.1. List 3 of the most common pathogens found in raw milk from riskiest to least riskiest: (6)

1_____

2_____

3_____

2.4.2. Explain the meaning of the abbreviation H.A.C.C.P, and why it is important in the dairy products manufacturing process. (7)

_____

_____

_____

_____

_____

_____

2.4.3. List the steps required to produce fresh cream, as well as the necessary control measures at "Critical Control Points" to ensure food safety: (12)

Production step	Control Point

2.5.

2.5.1. List 4 major observations to be recorded during Fresh dairy products manufacturing (4)

_____

_____

_____

_____

2.5.2. Name at least 3 raw materials that are used in the manufacturing of the fruit juice or fruit milk mixture. (4)

_____

_____

_____

_____

_____

3. QUESTION 3:

3.1.

3.1.1. Discuss the following statements:

Describe the functional components of a centrifugal separator.
(3)

_____

_____

_____

_____

_____

_____

Why must the pasteurization temperature for fruit milk mixtures not be too high? (2)

_____

_____

_____

_____

3.1.2. What else can be done in order to prevent yeast and mold growth in unpreserved fruit juice concentrate when preservatives are not allowed? (1)

_____

_____

_____

3.2.

Correct the below statements

3.2.1. (4)

STATEMENT	CORRECTIVE ACTION
_____ are agents that cause illness or injury from the consumption of food	Cross-contamination Food Safety Flow diagram Citric acid Beta Carotene Hazards
_____ is the movement of harmful microorganisms and other pathogens that are spread unintentionally from the service area or equipment to the food being prepared.	
A _____ provides a good overview of all the steps in the production process.	
_____ is a preservative used in the preservation of fruit juices	

3.2.2. Discuss the disadvantages associated with long term cold storage of milk and the effect it has on the final fresh dairy product (3)

_____

_____

_____

_____

_____

_____

3.3. Sampling final products

3.3.1. List 3 different tools used for testing the quality of fresh dairy products: (3)

_____

_____

_____

_____

_____

_____

SECTION B (APPLICATION)

1. QUESTION 1:

As a receiving supervisor you have just received a batch of milk that you suspect may have been diluted with water to increase volume and the milk received is scheduled to be used in the production of dairy fruit juice blends, fresh cream as well as fresh milk production.

As you prepare to standardize the raw milk consignment you can't help but wonder how the steps to ensure the consistency of milk will affect the final yield of products as well as the overall quality. How do you ensure that production goes ahead without any problems that will compromise the quality and yield of the final products?

1.1. Interpret production instructions.

1.1.1. List any 2 steps that you are required to perform in the preparation of raw milk for standardization (2)

_____

_____

_____

1.1.2. Describe the actions that can be taken to ensure that the milk received is within specification (4)

_____

_____

_____

_____

_____

_____

1.1.3. Are you going to let the milk through even though you can spot the physical difference? What can you do to verify that the milk will not ruin the final product, out of the steps mentioned above, which one (s) would you employ to ensure you get the best result? (2)

_____

_____

_____

_____

_____

1.2.

Fill in the missing words

1.2.1. When milk is pasteurized, it is heated to _____degrees, for _____, once the milk is within production specifications, some of the other processes that are employed to produce other fresh dairy products include_____, _____ and _____ (4)

1.2.2. Is it possible to amend the consistency of milk once it has been pasteurized, please support your answer (3)

_____

_____

_____

_____

_____

2. Question 2:

You have sufficient full cream milk (3,4% butterfat) and skim milk (0,1% butterfat) at your disposal. Determine, in liters, how much of each ingredient you will use to make 10 000 liters of milk that will have a butterfat content of 2,0%. Also do the necessary calculations to test your answers. Presume the following:

S.G. of 3,4% milk = 1,030
S.G. of 0,1% milk = 1,035
S.G. of 2,0% milk = 1,032 (12)

2.1.1. Calculations

_____

_____

_____

_____

_____

2.1.2. Milk has a pH of between _____ - _____ and fresh cream has a pH of between _____ - _____ (2)

2.1.3. How can the % of butterfat be lowered (3)

_____

_____

_____

_____

_____

_____

2.2.

Define the following terms (2)

2.2.1. HACCP -

_____

_____

2.2.2. GMP -

_____

_____

2.2.3. List and describe a high-level HACCP plan for a juice manufacturing operation. (10)

_____

_____

_____

_____

_____

_____

_____

_____

_____

3. **Question 3:**

3.1.

3.1.1. Elaborate on the methods you can put in place to ensure that you are constantly monitoring the production process, list possible control points and their functions. (7)

_____

_____

3.2. Elaborate on the steps the team would have to take in the event that they need to perform corrective actions on the batch in order to ensure a high-quality final product (6)

_____

_____

_____

_____

_____

_____

_____

_____

Manufacturing of Fresh Dairy Products

(OFO-code: 681301)

MODEL ANSWERS FOR EXTERNAL SUMMATIVE THEORY ASSESSMENT

Instructions to the External Assessor:

1. Evaluate each learner's answers at the hand of the model answers provided below.
2. Learners must answer all questions, without referring to any notes. No group work is allowed, i.e. each learner's questionnaire must be completed on own individual effort.
3. The learner must achieve a minimum of 70% for this assessment in order to be found competent in the theory component.
4. After evaluation, complete the Declaration of Competence on the first page of the learner's knowledge questionnaire, as well as the Summative Declaration in **Section 8** of the Assessment Guide.

1. Insufficiently pasteurised milk will: (2)
   - Pose a risk to the health of the consumer, and
   - Reduce the shelf life of the milk or dairy products that are manufactured from that milk.

2. (4)

Main section of plate pasteuriser	Function
1. Regeneration section	Milk or product enters the pasteuriser from the front of the regeneration section, where it is **partially heated by the milk that is returning from the heating and holding sections**. At the same time, the **returning milk or product**, which has already been pasteurised, is **partially cooled off**.
2. Heating section	Here the milk or product is finally **heated to the required pasteurisation temperature by hot water**.
3. Holding section	Milk or product flows through the length of this section **at the required holding temperature** (no heating takes place here) **for the required holding period**. In the case of milk, for example, it is 15 seconds.
4. Cooling section	Here the pasteurised milk or **product** is finally **cooled down to approximately 4°C or lower by ice water** flowing in an opposite direction to the milk or product that is being pumped through the section.

3. (a) HTST method: 72°C for 5 seconds (2)
LTLT method: 62°C for 30 minutes (2)

(b) 80-90°C for 15 seconds (2)

(c) Because cream is a **viscous** product with a **high total solids** content. The total solids will **protect the micro-organisms** and therefore a **higher pasteurisation temperature** is necessary. (2)

4. (a) Temperature control chart (1) to monitor the pasteurisation temperature in order to ensure that it does not fall below the requirement and thus pose a risk to the health of consumers (1). (2)

(b) If the milk or product that leaves the holding section is below the required minimum pasteurisation temperature, the **flow diversion valve closes off** (1) the supply to the regenerating and cooling sections and **makes the milk flow back to the balancing tank to be re-pasteurised** (1). (2)

5. (a) In skim milk and cream. (1)

(b) The skim milk phase. (1)

6. 1. Product (liquid) feed/inlet (1)
2. Cream or light phase outlet (1)
3. Skim milk or heavy-phase outlet (1)

7.
- Milk supply (1)
- Horizontal (centrifugal) force (1)
- Cream (1)
- Skim milk (1)

8. Not more than 0,5% (1)

9. (a) Brake: Brings the separator bowl to a stop more quickly. (1)

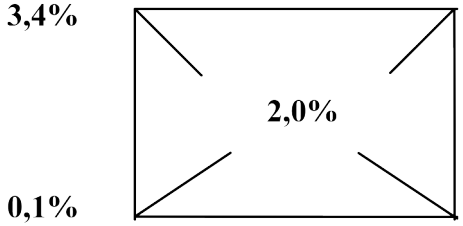
(b) Flow regulating valve: Controls the product supply so that the capacity of the separator is not exceeded. (1)

10.

- Firstly, you must convert 10 000 litres to kilograms:

  10 000 litres X 1,032 = 10 320 kg (1)

- Draw a Pearson square.



1,9 parts of the 3,4% milk

1,4 parts of the 0,1% milk

3,3 total parts of the 2,0% milk

(3)

- Quantity of 3,4% milk = $\frac{1,9}{3,3}$ x 10 320
  = 5 941,8 kg
  = 5 942 kg (rounded off) (1)

  How many litres of 3,4% milk will this be?

  $\frac{5\ 942 \text{ kg}}{1,030}$ = 5 769 litres (1)

- Quantity of 0,1% skim milk = $\frac{1,4}{3,3}$ x 10 320
  = 4 378 kg (1)

  How many litres of 0,1% skim milk will this be?

  $\frac{4\ 378 \text{ kg}}{1,035}$ = 4 230 litres (1)

You thus mix 5 769 litres of milk, that has a butterfat content of 3,4%, and 4 230 litres of skim milk to get 10 000 litres of milk that has a butterfat content of 2,0%.

- **Now test your answer:**

kg of fat in 3,4% milk = 5 942 kg x $\frac{3,4}{100}$

= 202 kg (1)

kg of fat in 0,1% milk = 4 378 kg x $\frac{0,1}{100}$

= 4,38 kg (1)

Total kg of fat in the ingredients = 202 + 4,38

= 206,38 kg (= 206 kg rounded off) (1)

kg of fat in 2,0% milk = 10 320 kg x $\frac{2,0}{100}$

(The final product) = 206,40 kg (= 206 kg rounded off) (1)

Thus:
Because 206 kg of 2,0% milk = 206 kg of fat in the ingredients, the calculation is correct.

11. Standardisation is to **change** or **adapt** the **% butterfat** of milk or other liquid dairy mixtures to a **specific or prescribed value**. (2)

12. Al 3 of the following: (3)
    - From a **quality** point of view it is very important to market products that have a **constant composition**. This is why the butterfat level of fresh milk and other dairy products must be standardised. It is also the **consumer's right to get what he/she pays for.**
    - On the other hand, **butterfat is an expensive ingredient** of milk and the company is not prepared to give more butterfat than the consumer has paid for. If this happened, the **company would lose money**.
    - Another reason for standardisation is that there are **legal standards** for the fat content of most dairy products to which the company must adhere.

13. All 3 of the following: (3)
    - Use a cream separator to remove almost all the fat.
    - Use a cream separator to remove only part of the butterfat.
    - Add skim milk to the full cream milk.

14. The raw milk can contaminate the pasteurised milk with unwanted bacteria. (1)

15. All of the following: (3)
- Fat is dispersed evenly through the milk, in other words, a **layer of cream does not form** on the surface.
- **Milk** has a **creamier taste**. For **dairy mixtures**, **hydration of dry ingredients is enhanced**, which reduces syneresis and **positively influences the texture** of the liquid long life dairy product.
- A **homogenous blend** is accomplished in the case of dairy mixtures.

16. Bactofugation is a centrifugal process where a specially designed centrifuge, a bactofuge s**eparates micro-organisms (e.g. bacteria) and their spores from liquid food**. (1)

17. After regeneration, the milk fat globules are in **liquid** form and will be **more easily stretched** out than if it is in solid (cold) form (1). Homogenisation before the heating and holding sections of the pasteuriser line is necessary in order to **prevent post pasteurisation contamination** (1). (2)

18. Any 3 of the following, with a corresponding function: (6)

Raw material	Function
Fruit juice or fruit milk mixture concentrate	Forms the fruit base of the product
Skimmed milk/milk powder	Forms the dairy base of the product
Sugar	Acts as sweetener
Water	Used to dilute the concentrate
Stabiliser	Prevents the milk from coagulating and precipitating when fruit juice is added
Citric acid	Added to correct the final pH-value
Flavouring	Added for flavour
Colouring	Added for colour
Preservative	Added to prevent the growth of yeasts and moulds

19. To prevent yeast and mould growth. (1)

20. It is added in cases when the orange juice has a high acid content. The purpose is to increases the °Brix-acid ratio and therefore to improve the flavour profile of the product. (2)

21. Both of the following to be circled by the learner: (2)
- Pimarisin
- Sulfur dioxide

22. Add more water. (1)

23. pH 6,7: At the normal pH of milk (pH 6,7), protein molecules has a net negative charge. The protein molecules remain separated because identical charges repel each other. (2)

pH 4,6: If H + ions are added they are absorbed by the protein molecules. At a pH value where the positive charge of the protein is equal to the negative charge, i.e. where the numbers of the NH_3^+ and COO^- groups are equal, the net total charge of the protein is zero. The protein molecules no longer repel each other, but the positive charges on one molecule links up with negative charges on the neighboring molecules and large protein clusters are formed. The protein is then precipitated from the solution. The pH where this happens is pH 4,6 and is called the **iso-electric point** of the protein. (2)

pH < 4,6: As the pH of milk drops below 4,6 the protein cluster begins to obtain a net positive charge. (2)

24. (a) Negative (1)

(b) Third picture (pH < 4,6) (1)

25. It is important to continuously stir the mixture to ensure that the sugar stays in suspension. (1)

26. If pasteurisation temperature is too high for the specific stabiliser, the stable suspension of casein and stabiliser will be broken. The contact surface of casein enlarges as a result more stabiliser is needed to prevent precipitation. (2)

TOTAL: (80)

Occupational Certificate: Fresh Dairy Products Maker

MODEL ANSWERS

FOR EXTERNAL SUMMATIVE THEORY ASSESSMENT

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SECTION A (THEORY)

1. **QUESTION 1**: Prepare raw milk and make additions for the manufacturing of ripened cheese

1.1. **Interpreting production instructions, obtain milk or cream**

1.1.1. Complete the table below by naming the 3 main sections of a plate pasteuriser and the function of each. (6)

Section	**Function**
Pre-warming sub section	**Incoming cold milk or product enters**
Heat harvesting sub-Section	**For milk or product coming from the separator**
Homogeniser	**Mixing of fat and water particles in milk.**

1.1.2. Raw milk contains microorganisms which are both good and bad and are subject to heat treatment method called **Pasteurization**, which requires you to heat raw milk to **72** degrees Celsius for **16** seconds (2)

1.1.3. From your answer above, what would be the cause of milk having a burnt smell and taste, but the bacterial load is still high, please indicate if that milk can still be used or not? (3)

Overheating

Initial bacterial load

The milk can still be used but will have to be processed again or make use of an alternative to heat treatment

1.2.

1.2.1. Name the specified minimum time-temperature combination for pasteurization of cream with the HTST method. (1)

82°C for 15 seconds

1.2.2. In which section of the plate pasteuriser will the milk or product be kept at the required pasteurization temperature for the required time period? (1)

Holding section

1.2.3. In which section of the plate pasteuriser will the milk or product get heated by hot water to the required pasteurization temperature? (1)

Heating Section

1.2.4. Name 3 reasons why milk/dairy mixture is homogenized prior to the manufacturing of fresh dairy products. (3)

Prevents separation of the fat

Aids in the rich white color

Helps improve texture of the milk

1.2.5. What is standardization? (2)

Standardization is to change or adapt the % butterfat of milk or other liquid dairy mixtures to a specific or prescribed value.

1.2.6. Why is it necessary that we standardize the fat content of milk? Name 3 things (3)

From a quality point of view it is very important to market products that have a constant composition. This is why the butterfat level of fresh milk and other dairy products must be standardised. It is also the consumer's right to get what he/she pays for.

On the other hand, butterfat is an expensive ingredient of milk and the company is not prepared to give more butterfat than the consumer has paid for. If this happened, the company would lose money.

Another reason for standardisation is that there are legal standards for the fat content of most dairy products to which the company must adhere.

2. QUESTION 2:

2.1. Producing Fruit Juice/Fruit-milk mixture

2.1.1. Why is sweet de-flavoured apple juice or grape juice sometimes added to orange juice? (2)

The addition of grape or pear juice can have either a Brix lowering or Brix increasing affect, but is rather used for flavour advantage, as it masks excess acidity with sweetness..

2.1.2. Name 2 preservatives that are permitted for use in sweetened fruit juice. (2)

Benzoic acid

Sorbic acid e.g.

potassium sorbate

Sulfur dioxide

Pimarisin

2.1.3. What must be done when the °Brix reading is too low? (1)

Add more fruit juice/fruit milk mixture concentrate.

Addition of sugar

2.1.4. What must be done when the °Brix reading is too high? (1)

Add more water

2.1.5. Name the specified minimum time-temperature combination for pasteurization of milk with:

HTST method: **72°C for 15 seconds** (2)

LTLT method: **62°C for 30 minutes**(2)

Name the specified minimum time-temperature combination for pasteurization of cream with the HTST method and why is it done this way? (3)

80-90°C for 15 seconds

2.2.

2.2.1. Name 3 ways how % butterfat can be lowered. (3)

Use a cream separator to remove almost all the fat.

Use a cream separator to remove only part of the butterfat.

Add skim milk to the full cream milk.

2.2.2. How does the stabilizing effect in fruit milk mixtures work? (8)

At the normal pH of milk 6,6, the protein molecules have a net negative charge. The protein molecules remain separated because identical charges repel each other. (2)

As soon as the pH drops the amount of hydrogen ions (H+) will increase and will be absorbed by the protein molecules. At a pH value where the positive charge of the protein is equal to the negative charge, i.e. where the numbers of the OH- and H+ groups are equal, the net total charge of the protein is zero. The protein molecules no longer repel each other,

but the positive charges on one molecule link up with the negative charges on the neighbouring molecules and large protein clusters are formed. The protein is then precipitated from the solution. (3)

As the pH of milk drops below 4,6 the protein cluster begins to obtain a net positive charge. (1)

On the other hand, the stabiliser has a negative charge. The negative and positive charges attract one another and a stable casein-stabiliser complex is formed. The efficiency of the stabiliser depends on the degree of interaction between the stabiliser and casein (2)

2.2.3. According to our local law, what is the maximum amount (%) of butterfat that is allowed in skim milk? (2)

Not more than 0.5%

2.2.4. Complete the table below to show 3 raw materials that are used in the manufacturing of the fruit juice or fruit milk mixture at the organization where you receive your training. Also give the function of each. (8)

Any 3 of these

Raw material	Function
Fruit juice or fruit milk mixture concentrate	Forms the fruit base of the product
Skimmed milk/milk powder	Forms the dairy base of the product
Sugar	Acts as sweetener
Water	Used to dilute the concentrate
Stabiliser	Prevents the milk from coagulating and precipitating when fruit juice is added
Citric acid	Added to correct the final pH-value
Flavouring	Added for flavour
Colouring	Added for colour
Preservative	Added to prevent the growth of yeasts and moulds

2.2.5. **Homogenization** is when milk is put under pressure through fine openings, which evenly disperses **Fat Globules**. This stops the cream from separating and rising to the top, allowing a more consistent texture and taste. Some manufacturers produce **unhomogenised** milk for people who prefer the **Cream** to separate and rise to the top of the bottle.

(8)

2.3.

What is the function of the following steps in dairy processing: (10)

2.3.1. Centrifugal separation

This process separates milk into skim milk and cream

_____

2.3.2. Ultrafiltration

The ultrafiltration (UF) membrane separates the feed (e.g. skim milk) into two streams, allowing water, dissolved salts, lactose, and acids to pass through it in either direction, while retaining (and thereby concentrating) proteins and fat.

_____

2.3.3. Reverse osmosis

is used for the concentration of milk to reduce shipping volumes and transport costs.

_____

_____

2.3.4. Homogenisation

Milk homogenization is a process that mixes and disperses that milkfat by using a high-pressure procedure to break it down into smaller particles

2.4. Perform food safety practices.

2.4.1. List 3 of the most common pathogens found in raw milk from most riskiest to least riskiest: (6)

1. Mycobacterium tuberculosis
2. Coxiella burnetti
3. Brucella abortus..

2.4.2. Explain the meaning of the abbreviation H.A.C.C.P, and why is it important in the dairy products manufacturing process. (5)

H.A.C.C.P. stands for Hazard Analysis and Critical Control Points. It's a system used in the food industry to identify and control food safety hazards. In cheese making, H.A.C.C.P. is important because it helps to ensure that the cheese is safe to eat. The system involves identifying potential hazards, such as bacteria or other contaminants, and then putting in place controls to prevent them from causing illness. H.A.C.C.P. is an important part of food safety, and it's required by law in many countries.

'Prerequisite programmes' including (specifications, cleaning and sanitization)

personal hygiene,

training

'Food processing' (e.g. heating, cooling, moisture control, oxygen control, preservatives, etc).

2.4.3. List the steps required to produce fresh cream, as well as the necessary control measures at "Critical Control Points" to ensure food safety: (12)

Producing fresh cream involves separating the cream from milk, and ensuring food safety throughout the process is paramount. Here's a breakdown of the steps and critical control points (CCPs):

Steps in Fresh Cream Production:

1. Milk Reception and Quality Control:

Raw milk is received and tested for quality (e.g., bacteria count, antibiotics).

2. Separation:

The milk is processed in a separator, which uses centrifugal force to separate the lighter cream from the heavier skim milk.

3. Pasteurization:

The cream is heated to a specific temperature for a set time to kill harmful bacteria.

4. Cooling:

The pasteurized cream is rapidly cooled to prevent bacterial growth.

5. Packaging:

The cooled cream is packaged in sterile containers.

6. Storage and Distribution:

The packaged cream is stored at refrigerated temperatures and distributed.

Critical Control Points (CCPs) and Control Measures:

1. Milk Reception and Quality Control:

CCP: Raw milk quality.

Control Measures:

Regular testing for bacteria, antibiotics, and other contaminants.

Maintaining strict hygiene during milk collection and transport.

Only accepting milk from approved suppliers.

2. Separation:

This step itself is less of a CCP, but the cleanliness of the separator is.

Control Measures:

Ensuring the separator is cleaned and sanitized regularly.

3. Pasteurization:

CCP: Inadequate pasteurization.

Control Measures:

Accurate temperature and time control during pasteurization.

Regular calibration of pasteurization equipment.

Monitoring and recording pasteurization parameters.

4. Cooling:

CCP: Slow or inadequate cooling.

Control Measures:

Rapidly cooling the cream to the required temperature.

Monitoring and recording cooling temperatures.

Ensuring that cooling equipment is functioning correctly.

5. Packaging:

CCP: Contamination during packaging.

Control Measures:

Using sterile packaging materials.

Maintaining a hygienic packaging environment.

Implementing clean-in-place (CIP) systems for packaging equipment.

6. Storage and Distribution:

CCP: Temperature abuse during storage and distribution.

Control Measures:

Maintaining refrigerated temperatures throughout the supply chain.

Monitoring and recording storage and transportation temperatures.

Implementing a "first-in, first-out" (FIFO) stock rotation system.

2.5.

2.5.1. List 4 major observations to be recorded during Fresh dairy products manufacturing (4)

Four key observations that should be recorded during fresh dairy production :

A. Animal Health and Treatment:

This includes records of any illnesses, injuries, or treatments administered to the dairy cows.

Specifically, records of mastitis occurrences, which are common in dairy cows, are extremely important.

Additionally, records of vaccinations, parasite control, and any medications given, along with withdrawal periods, are essential for ensuring milk safety.

B. Milk Production and Quality:

Detailed records of milk yield from individual cows or the herd as a whole.

Regular testing results for milk composition, including fat content, protein content, and somatic cell count (SCC). SCC is a key indicator of milk quality and udder health.

Observations of milk appearance, odor, and any abnormalities.

recording of the temperature of the milk at various stages of the process.

C. Hygiene and Sanitation:

Records of cleaning and sanitizing procedures for milking equipment, storage tanks, and processing areas.

Observations of general cleanliness and hygiene practices during milking and handling.

records of water quality testing.

D. Feed and Nutrition:

Records of the type and quantity of feed provided to the dairy cows.

Observations of feed quality and any changes in feeding practices.

Records of any changes in the quality of the pasture, or feed that the cows are consuming.

2.5.2. Name at least 3 raw materials that are used in the manufacturing of the fruit juice or fruit milk mixture. (4)

Fruit juice or fruit milk mixture concentrate

Skimmed milk/milk powder

Sugar

Water

Stabiliser

Citric acid

Flavouring

Colouring

Preservative

3. QUESTION 3:

3.1.

3.1.1. Discuss the following statements:

Describe the inside of a centrifugal separator. (3)

A centrifugal separator features a feed pipe, a rotor, a drive mechanism, a bowl, a separation chamber, an outlet pipe, and a control panel

Why must the pasteurization temperature for milk not be too high? (2)

If pasteurisation temperature is too high for the specific stabiliser, the stable suspension of casein and stabiliser will be broken. The contact surface of casein enlarges as a result more stabiliser is needed to prevent precipitation

3.1.2. What should be done in order to prevent yeast and mould growth in unpreserved fruit juice concentrate when preservatives are not allowed? (1)

The way to preserve juice concentrate without preservatives is to freeze it prior to delivery to the factory

3.2.

Correct the below statements

3.2.1. (4)

STATEMENT	CORRECTIVE ACTION
Hazards are agents that cause illness or injury from the consumption of food	Cross-contamination Food Safety Flow diagram Citric acid Beta Carotene Hazards
Cross-contamination is the movement of harmful microorganisms and other pathogens that are spread unintentionally from the service area or equipment to the food being prepared.	
A **Flow Diagram** provides a good overview of all the steps in the production process.	
Citric Acid is a preservative used in the preservation of fruit juices	

3.2.2. Discuss the disadvantages associated with long term cold storage of milk and the effect it has on the final fresh dairy product (3)

A. Lipolysis:

*** Even at refrigerated temperatures, enzymes present in milk, particularly lipase, can slowly break down milk fat. This process, known as lipolysis, results in the release of free fatty acids, leading to off-flavors and odors, often described as rancid.**

B. Protein Changes:

*** Prolonged cold storage can cause changes in milk proteins. Casein, the main protein in milk, can undergo alterations that affect its stability. This can lead to issues with coagulation during**

processing, impacting the texture of products like cheese or yogurt.

C. Vitamin Degradation:

*** Certain vitamins in milk, such as vitamins C and some B vitamins, are susceptible to degradation during extended storage, even at cold temperatures. This reduces the nutritional value of the final product.**

D. Bacterial Growth (Psychrotrophs):

While cold storage slows bacterial growth, it doesn't eliminate it entirely. Psychrotrophic bacteria, which thrive at low temperatures, can still multiply, producing enzymes that degrade milk components and cause spoilage. This can impact the flavor, odor, and shelf life of the final product.

E. Sedimentation:

*** Over long periods of storage, sedimentation can occur. This is where solids within the milk will begin to settle at the bottom of the storage container. This can change the consistancy of the milk.**

F. Flavor changes:

*** Milk is very good at absorbing odors from its surrounding enviroment. Therefore, if milk is stored for long periods of time, it is at a higher risk of taking on undesirable flavors.**

3.3. Sampling final products

3.3.1. List 3 different tools used for sampling the quality of fresh dairy products: (3)

Scoops

Agitators

Sample taps

SECTION B (APPLICATION)

1. QUESTION 1:

As a receiving supervisor you have just received a batch of milk that you suspect may have been diluted with water to increase volume and the milk received is scheduled to be used in the production of dairy fruit juice blends, fresh cream as well as fresh milk production.

As you prepare to standardize the raw milk consignment you can't help but wonder how the steps to ensure the consistency of milk will affect the final yield of products as well as the overall quality. How do you ensure that production goes ahead without any problems that will compromise the quality and yield of the final products?

1.1. Interpret production instructions.

1.1.1. List any 2 steps that you are required to perform in the preparation of raw milk for standardization (2)

Pasteurization of skim milk

Pass milk through a centrifugal separator to separate cream and skim milk

1.1.2. Describe the actions that can be taken to ensure that the milk received is within specification (4)

Addition of cream
Addition of skim milk

1.1.3. Are you going to let the milk through even though you can spot the physical difference? What can you do to verify that the milk will not ruin the final product, out of the steps mentioned above, which one (s) would you employ to ensure you get the best result? (2)

Yes - Milk will be let through only once it has been tested to be within specification as per production requirements

1.2.

Fill in the missing words

1.2.1. When milk is pasteurized, it is heated to **72** degrees, for **15 seconds**, once the milk is within production specifications, some of the other processes that are employed to produce other fresh dairy products include **Filtration**, **Pre-heating** and **Separation**

Optional answer: Mixing and blending in a prescribed standard operating procedure, including sequence, rate, pre-mixing of stabiliser with a portion of sugar. (4)

1.2.2. Is it possible to amend the consistency of milk once it has been pasteurized, please support your answer (3)

Yes it is through the addition of cream or skim milk in order to achieve the correct specification

2. Question 2:

You have sufficient full cream milk (3,4% butterfat) and skim milk (0,1% butterfat) at your disposal. Determine, in liters, how much of each ingredient you will use to make 10 000 liters of milk that will have a butterfat content of 2,0%. Also do the necessary calculations to test your answers. Presume the following:

S.G. of 3,4% milk = 1,030

S.G. of 0,1% milk = 1,035

S.G. of 2,0% milk = 1,032 (12)

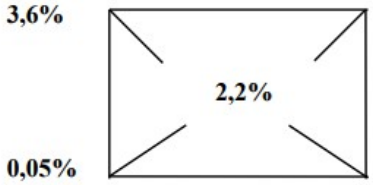
:

2.1.1. Calculations

- Firstly, you must convert 15 000 litres to kilograms:

  15 000 litres X 1,033 = 15 495 kg (1)

- Draw a Pearson square.



2,15 parts of the 3,6% milk

1,4 parts of the 0,05% milk

3,55 total parts of the 2,2% milk

(3)

- Quantity of 3,6% milk = $\frac{2,15}{3,55}$ x 15 495
  = 9 384,3 kg
  = 9 384 kg (rounded off) (1)

  How many litres of 3,6% milk will this be?

  $\frac{9\ 384 \text{ kg}}{1,030}$ = 9 111 litres (1)

- Quantity of 0,05% skim milk = $\frac{1,4}{3,55}$ x 15 495
  = 6 111 kg (1)

  How many litres of 0,05% skim milk will this be?

  $\frac{6\ 111 \text{ kg}}{1,034}$ = 5 910 litres (1)

You thus mix 9 111 litres of milk, that has a butterfat content of 3,6%, and 5 910 litres of skim milk to get 15 000 litres of milk that has a butterfat content of 2,2%.

2.1.2. Milk has a pH of between **6.5** - **6.85,** and fresh cream has a pH above **6.3**. (2)

2.1.3. How can the % of butterfat be lowered (3)

Use a cream separator to remove almost all the fat.
Use a cream separator to remove only part of the butterfat.
Add skim milk to the full cream milk.

2.2.

Define the following terms (2)

2.2.1. HACCP - **HAZARD ANALYSIS & CRITICAL CONTROL POINTS**

2.2.2. GMP - **GOOD MANUFACTURING PRACTICES**

2.2.3. List and describe a HACCP plan for a juice manufacturing operation. (10)

· Sample and test at the identified critical control points (or record an observation if a sample is not taken

Conduct Hazard Analysis
Implement Critical Control Points
Set Critical Limits
Set Critical Monitoring Expectations
Create rules for corrective actions
Develop procedures
Maintain records

3. **Question 3:**

3.1.

3.1.1. Kindly elaborate on the methods you can put in place to ensure that you are constantly monitoring the dairy production process, list possible control points and their functions. (7)

Methods for Constant Monitoring:

A. Real-time Data Acquisition:

Using quality controllers, sensors and automated systems to continuously measure critical parameters like temperature, pH, flow rate, and bacterial counts.

Utilizing data loggers to record and track these parameters over time.

Employing online monitoring systems that provide immediate feedback and alerts for deviations.

B. Regular Inspections and Audits:

Conducting routine visual inspections of equipment, facilities, and personnel hygiene.

Performing regular audits of sanitation procedures and record-keeping practices. Implementing internal and external quality control audits.

C. Laboratory Testing:

Regularly testing raw milk and finished products for bacterial counts, somatic cell counts, antibiotic residues, and other quality indicators.

Utilizing rapid testing methods for quick detection of potential contaminants.

Performing shelf-life testing to assess product stability.

D. Employee Training and Observation:

Providing thorough training to employees on proper hygiene, sanitation, and quality control procedures.

Implementing a system for observing and documenting employee practices.

Report any deviations or potential problems.

E. Traceability Systems:

Implementing a robust traceability system to track the movement of milk and dairy products from farm to consumer.

Utilizing barcode or RFID technology to identify and track individual batches.

Maintaining detailed records of all processing steps and ingredients.

Possible Control Points and Their Functions:

1. Raw Milk Reception:

Function: To ensure the quality and safety of incoming raw milk.

Control Points:

Temperature monitoring.

Antibiotic residue testing.

Bacterial count analysis.

Visual inspection for abnormalites.

2. Pasteurization:

Function: To eliminate pathogenic bacteria.

Control Points:

Temperature and time monitoring.

Flow rate control.

Equipment calibration.

3. Separation:

Function: To separate cream from skim milk.

Control Points:

Proper cleaning and sanitation of the seperator.

Monitoring of the fat content of the output streams.

4. Cooling:

Function: To rapidly cool milk and cream to prevent bacterial growth.

Control Points:

Temperature monitoring.

Cooling rate control.

5. Packaging:

Function: To protect the product from contamination.

Control Points:

Sterile packaging materials.

Hygienic packaging environment.

Seal integrity checks.

6. Storage and Distribution:

Function: To maintain product quality and safety during storage and transport.

Control Points:

Temperature monitoring.

Inventory control.

Vehicle hygiene.

7. Cleaning and Sanitation (CIP):

Function: To remove residues and eliminate bacteria from equipment and facilities.

Control Points:

Temperature and concentration of cleaning solutions.

Flow rate and contact time.

Verification of cleaning effectiveness.

3.2. Elaborate on the steps the team would have to take in the event that they need to perform corrective actions on the batch in order to ensure a high quality final product (6)

Define the problem
Establish scope of the problem
Take containment actions
Do root cause analysis
Plan corrective actions
Implement corrective actions
Follow up to ensure plan worked