Manufacturing of Ripened Cheese

(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. Milk is pasteurised prior to cheese manufacturing. Complete the following sentences that describe the reasons for the pasteurisation process: (3)

- To kill all _____ .
- To reduce the number of heat sensitive spoilage micro-organisms to such a level that the _____ of the pasteurised milk and subsequent cheese, that is manufactured from that milk, is extended.
- During cheese making, pasteurisation also aids in the denaturation of whey proteins on top of the casein so that less whey proteins are lost in the whey, thereby increasing the _____ .

2. Complete the following for the distribution of components between curd and whey during cheese manufacturing: (8)

- More than 90% of the cheese consists of water, _____ and _____.
- _____ and _____ are the main components of whey.
- Almost all the _____protein is lost in the whey.
- The _____ are evenly distributed between cheese and whey.
- A small quantity of _____ and _____ is lost in the whey.

3. Complete the following table to show the functions of casein and milk fat during cheese manufacturing (3 functions for each): (6)

Milk component	Functions during cheese manufacturing
Casein	1.
	2.
	3.
Milk fat	1.
	2.
	3.

4. What is the <u>main</u> function of lactose during cheese manufacturing? (2)

_____

_____

5. How will an increase in acidity affect the rate of syneresis? (1)

_____

6. **Complete the following**: (4)

At a constant pH, stirring the curd in the whey has a dramatic effect and almost _____ the rate of syneresis.

The subdivision of the curd into smaller particles _____ the surface area in relation to volume, resulting in a corresponding _____ in release of whey.

When whey is removed, partially or in total from the curd, the rate of syneresis will _____ .

7. Circle the 2 predominant minerals in cheese curd. (2)

Iron	Sodium	Calcium
Phosphorous	Nitrogen	Sulfur
Magnesium	Potassium	Iodine

8. What is the consequence of the fact that the moisture loss from the outer layer of the curd particle is faster than from the interior? (2)

_____

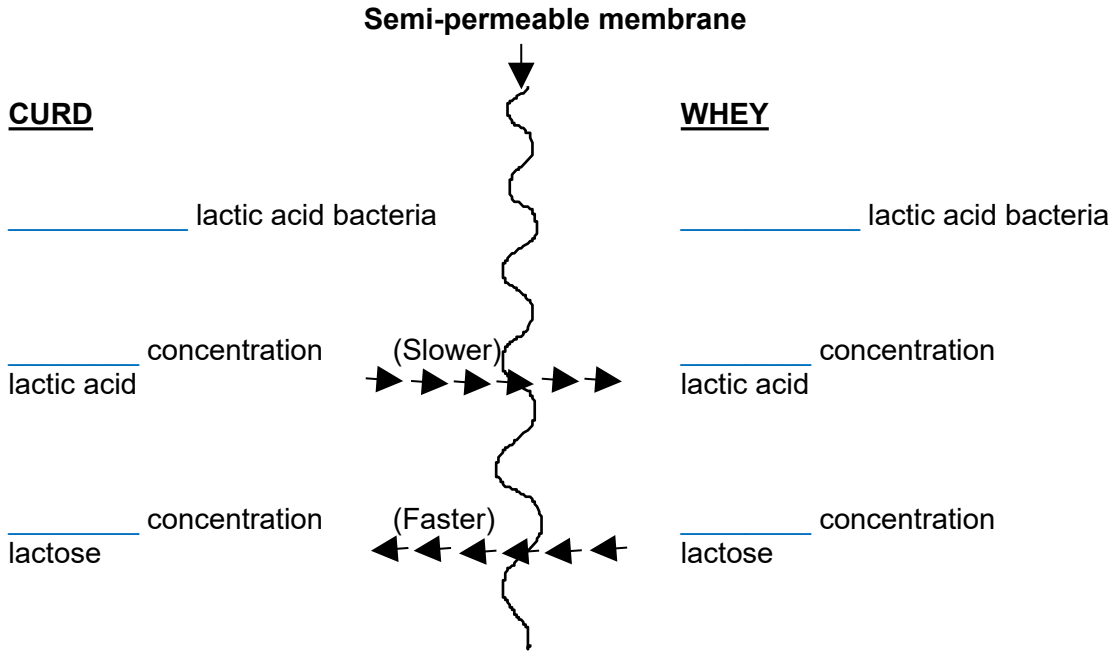
_____

9. What effect will faster and higher acid development have on cheese curd particles? (2)

_____

_____

10. Complete the following for the lactose-lactic acid equilibrium: (6)



11. Why is it important to control the moisture of cheese? (2)

_____

_____

12. Name 3 factors that influence the moisture content of cheese. (3)

_____

_____

_____

13. Why is milk standardised prior to cheese manufacturing? (1)

_____

_____

14. What is the function of the following raw materials in cheese making: (3)

Raw material	Function
Rennet	
Annatto	
Calcium chloride	

15. Why must the inoculum size not be too big or too small during inoculation of cheese milk? (4)

_____

_____

_____

_____

_____

16. Name the incubation time and temperature for the ripened cheese manufactured at your factory. (2)

_____

17. Explain the purpose of the cutting process during cheese manufacturing. (2)

_____

_____

_____

_____

18. Explain the purpose of the healing process during cheese manufacturing. (2)

_____

_____

_____

_____

19. (a) Explain the purpose of whey drainage during cheese manufacturing. (3)

_____

_____

_____

_____

(b) Why is the curd for Gouda cheese washed with water after the first whey draining step? (1)

_____

_____

20. Explain the purpose of heating the curd/whey mixture. (2)

_____

_____

_____

_____

21. (a) What is the effect of the curd/whey temperature on the starter bacteria? (2)

_____

_____

_____

(b) What is the effect of a faster rate of heating on the minerals content in the curd? (2)

_____

_____

_____

22. What is the purpose of moulding cheese curd? (1)

_____

_____

23. (a) Explain the purpose of the cheddaring process. (2)

_____

_____

_____

_____

(b) Name any 2 chemical and/or physical changes that take place in the curd during the cheddaring process. (2)

_____

_____

_____

_____

24. Explain the purpose of the milling process for cheese curd. (2)

_____

_____

_____

_____

25. (a) Explain the purpose of the plasticising (stretching) process. (3)

_____

_____

_____

_____

(b) Name 1 chemical and 1 physical change that occur in the curd during plasticising. (2)

_____

_____

_____

_____

26. Give another name for Mozzarella cheese. (1)

_____

27. Name 2 reasons why Mozzarella cheese is cooled after moulding. (2)

_____

_____

_____

_____

28. (a) How is Cheddar cheese salted? (1)

_____

_____

(b) How is Gouda and Mozzarella cheese salted? (1)

_____

29. (a) What is the purpose of salting/brining cheese? Name 4 reasons. (4)

_____

_____

_____

_____

(b) Complete the following table by drawing arrows in the middle column to show the direction of diffusion during cheese brining. Also fill in the missing component. (5)

BRINE	**CHEESE RIND**	**CHEESE MOISTURE**
Component	**Direction of diffusion**	**Component**
Water		Water
_____	→	_____
Lactic Acid		Lactic Acid
Lactose		Lactose
Milk Salts		Milk Salts

30. (a) Explain the purpose of pressing the cheese. (3)

_____

_____

_____

_____

(b) Why is Gouda cheese pressed underneath the whey? (1)

_____

_____

_____

31. (a) What is the meaning of the term cheese yield? (1)

_____

_____

_____

_____

(b) Determine the theoretical yield of ripened cheese manufactured from milk with 3.8% fat and 3.4% protein by using the formula below. The aim is to obtain 34% moisture in the final cheese. Show your calculations clearly. (6)

$$Y = \frac{[(\%\ \text{fat} - 0.3) + (\%\ \text{casein} - 0.1)] \times 1.09}{1 - \%\ \text{moisture}}$$

_____

_____

_____

_____

_____

_____

_____

32. What is the contribution of protein, fat and water to cheese yield? (3)

_____

_____

_____

_____

33. Name any 3 different factors that have an effect on cheese ripening. (3)

_____

_____

_____

_____

_____

_____

34. Name 3 chemical reactions that take place in cheese during ripening. (3)

_____

_____

_____

TOTAL: (111)

Occupational Certificate: Ripened Cheesemaker

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	**146**
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 cheese milk**

Multiple Choice Questions

1.1.1.

- Production instructions state "Use raw milk." What does "raw milk" mean? (2)
  a) Milk that has been pasteurized.
  b) Milk that has not been heated or pasteurized.
  c) Milk that is powdered.
  d) Milk that is ultra-high temperature treated.

- The recipe calls for "Jersey cow milk, 4% fat content." Which of the following is MOST critical to verify? (2)
  a) The delivery truck's color.
  b) The breed of cow and fat percentage of the milk.
  c) The time of day the milk arrived.
  d) The quantity of milk.

- Production instructions state "Maintain milk temperature at 10°C ± 2°C for raw milk storage." What is the acceptable temperature range? (2)
  a) 6°C to 8°C.
  b) 8°C to 12°C.
  c) 9°C to 11°C.
  d) 10°C to 14°C.

- Production instructions specify "Utilize milk with a Somatic Cell Count (SCC) below 200,000 cells/mL." Which of the following is the MOST accurate interpretation of this requirement? (1)
  a) The milk must have exactly 200,000 cells/mL.
  b) The milk must have between 198,000 and 202,000 cells/mL.
  c) The milk must have less than 200,000 cells/mL.
  d) The milk must have more than 200,000 cells/mL.

1.1.2. Fill in the missing words (10)

- To make cheese, we add _____ to the milk to make it curdle.
- Salt is added to cheese for flavor and to help control _____ growth.
- Colouring agents are used to give the cheese its desired _____.
- The type of _____ culture used will determine the specific flavor and texture of the ripened cheese.

- Calcium _____ is often added to milk to improve curd formation, especially when using pasteurized milk.
- For mold-ripened cheeses, _____ cultures are sprayed or injected into the cheese.
- To control the pH of the cheese, food-grade _____ or bases are sometimes used.
- When using raw milk, it is very important to make sure that it is free of _____.
- The addition of specific _____ , such as enzymes, can accelerate the ripening process and enhance flavor development.
- The use of specific _____ materials, such as cheesecloth or moulds, influences the shape and drainage of the cheese curd.

2. QUESTION 2: Producing and managing curd, whey & Green cheese

2.1. Produce & Manipulate Coagulum

2.1.1.

- What is the FIRST step after the milk coagulates? (1)
  a) Salting the cheese.
  b) Cutting the coagulum.
  c) Pressing the curd.
  d) Adding cultures.

- Cutting the coagulum helps to: (1)
  a) Increase the cheese's flavor.
  b) Release whey from the curd.
  c) Add color to the cheese.
  d) Prevent mold growth.

- What is "whey"? (1)
  a) The solid part of the coagulated milk.
  b) The liquid part of the coagulated milk.
  c) The added cultures.
  d) The salt used in cheesemaking.

- Describe the process of cutting the coagulum, including: (2)
  The tools used.
  _____
  _____
  _____
  The desired size of the curd pieces for a semi-hard cheese. (2)
  _____
  _____
  _____
  Why the size of the curd pieces matters. (2)
  _____
  _____
  _____

- Explain the steps involved in draining the whey after cutting the coagulum, and describe two methods used to achieve this. (4)
  _____
  _____
  _____

- The rate of syneresis (whey expulsion) is MOST influenced by: (2)
  a) The color of the milk.
  b) The size of the cut curd and temperature.
  c) The type of salt added.
  d) The room's humidity.

2.1.2.

- List the basic steps for cleaning a cheese vat after draining the whey. Medium-Level (5):

  _____
  _____
  _____

- Mention the process of calibrating a pH meter used to measure the acidity of cheese curd. Include two reasons why accurate pH readings are important. (5)

  _____
  _____
  _____

- Describe two potential issues that could arise from improper operation of a cheese press, and explain how these issues could affect the final cheese product. (2)

  _____
  _____
  _____

2.1.3

- What is one way to check if the cheese curd has reached the correct firmness before pressing?(3)

  _____
  _____
  _____

- Describe the process of controlling the ripening environment for a hard cheese like cheddar, including:
  - Temperature control and its importance. (3)

    _____
    _____
    _____
    ___

  - Humidity control and its importance.(3)

    _____
    _____

_____
___

- Air circulation and its importance. (3)

_____
_____
_____
___

■ How you would monitor these parameters.
What two potential defects* could occur if the ripening environment is not properly controlled? (7)

_____
_____
_____

- Explain the importance of turning cheese during the ripening process and describe how often a large format hard cheese should be turned. (3)

_____
_____
_____

- List 2 variations in raw milk composition that can affect the final characteristics of a ripened cheese.(2)

_____
_____
_____

2.1.4. True or False (12)

A. Green cheese is ready to eat immediately after pressing.
B. Cheese can be ripened at room temperature.
C. Salt helps to preserve cheese during ripening.
D. All cheeses require the same ripening temperature.
E. The humidity in the ripening room does not affect mold growth.
F. Turning cheese during ripening helps to distribute moisture evenly.
G. Waxing cheese is a method of packaging that prevents moisture loss.
H. The type of packaging material used has no effect on the ripening process.
I. A cheese with a bloomy rind should be wrapped tightly in plastic wrap.
J. Washing the rind of a cheese during ripening can help control mold growth.
K. The development of specific microbial communities during ripening is solely dependent on initial starter cultures.

L. Ripening time is a fixed parameter and cannot be adjusted based on environmental conditions.

2.1.5.

A. List three basic hygiene practices you should follow when handling cheese to prevent contamination. (3)

_____
_____
_____

B. Explain the relationship between temperature control and food safety in a cheese ripening facility. Describe two potential hazards that can arise from improper temperature control and how to mitigate them. (5)

_____
_____
_____

C. Describe the process of cleaning and sanitizing equipment used in cheese production, including:

- The steps involved. (3)

  _____
  _____
  _____
  ___

- The types of cleaning and sanitizing agents used. (2)

  _____
  _____
  _____
  ___

- The importance of verifying cleanliness. (5)

  _____
  _____
  _____
  ___

D. List 2 risk assessment principles that can be applied to both food safety and OHS in a cheese ripening environment. (2)

_____
_____
_____

2.1.6.

A. Match the term in Column A with its description in Column B:(6)

Column A	Column B
A. Rennet	1. Liquid removed from curd
B. Whey	2. Substance that coagulates milk
C. Salt	3. Preserves Cheese

B. Match the ripening defect in Column A with its likely cause in Column B:(10)

Column A	Column B
A) Cracking	1. Excessive surface moisture
B) Uneven mold growth	2. Inconsistent temperature
C) Slimy rind	3. Low humidity
D) Off flavors	4. Poor air circulation
E) Bloating	5. Contamination or improper cultures

C. Describe the process of salting a hard cheese, including:
The methods used.(2)

_____
_____
_____

The purpose of salting. (2)

_____
_____
_____

How the salt concentration affects the cheese. (2)

_____
_____
__

D. List 2 factors that influence the development of a specific flavor profile in a long-ripened cheese, and explain how these factors can be manipulated to achieve desired results.(4)

_____
_____
_____

2.1.7.
Fill-in-the-blanks (6)

A. A physical analysis of cheese includes checking its _____ and texture.
B. A sensory analysis uses our sense of taste and _____ to evaluate cheese.
C. To measure the acidity of cheese, we use a _____ meter.
D. The moisture content of cheese can be determined using a _____ balance.
E. During sensory analysis, we assess the cheese's aroma, flavor, and _____.

F. Describe the process of conducting a sensory evaluation of a ripened cheese, including:
   - The key sensory attributes to assess. (2)

     _____
     _____
     _____
   - The importance of using a standardized scoring system. (2)

     _____
     _____
     _____
   - How to minimize bias during the evaluation.(2)

     _____
     _____
     _____

2.1.8.

A. Name one thing you should always write down when you make cheese.(2)

   _____
   _____
   _____

B. List three types of information that should be recorded during the ripening process of a cheddar cheese.(3)

   _____
   _____
   _____

3. **QUESTION 3:**

3.1. Case Study:

"A small, artisanal cheese producer, 'Mountain View Dairy,' specializes in a semi-hard, natural rind cheese. They've recently had several batches with inconsistent texture and flavor. One batch, in particular, exhibited excessive moisture and a bitter aftertaste. The production records show the following:

- Milk: Raw cow's milk, sourced from a local farm.
- Cultures: A mesophilic starter culture and a surface mold culture.
- Coagulation: Rennet added at 32°C, with a coagulation time of 45 minutes.
- Cutting: Curd cut into 2cm cubes.
- Whey Drainage: Gravity drainage for 2 hours.
- Salting: Dry salting, 2% of curd weight.
- Pressing: 6 hours at moderate pressure.
- Ripening: 12°C, 90% humidity, 6 weeks.
- Deviation: During the pressing stage, the press malfunctioned, resulting in inconsistent pressure for the first 2 hours."

3.1.1.

A. Based on the case study, name two steps in the cheese-making process. (2)

_____
_____
_____

B. Identify three potential causes for the excessive moisture and bitter aftertaste in the problematic batch.(3)

_____
_____
_____

Manufacturing of Ripened Cheese

(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. Completion of sentences as follows: (3)
   - To kill all **pathogenic (disease-causing) micro-organisms**.
   - To reduce the number of heat sensitive spoilage micro-organisms to such a level that the **shelf life** of the pasteurised milk and subsequent cheese, that is manufactured from that milk, is extended.
   - During cheese making, pasteurisation also aids in the denaturation of whey proteins on top of the casein so that less whey proteins are lost in the whey, thereby increasing the **cheese yield**.

2.
   - More than 90% of the cheese consists of water, **fat** and **casein**. (2)
   - **Water** and **lactose** are the main components of whey. (2)
   - Almost all the **whey** protein is lost in the whey. (1)
   - The **mineral salts** are evenly distributed between cheese and whey. (1)
   - A small quantity of **casein** and **fat** is lost in the whey. (2)

3. For <u>casein</u>, any 3 of the following: (3)

- It **entraps** the **fat** and other **insoluble substances** during curd formation.
- It **holds** the **whey** and its **soluble constituents**, namely **lactose**, **soluble salts** and **whey proteins**.
- Through its **water binding capacity**, casein controls the **firmness**, **consistency** and **elasticity** of the cheese.
- The degradation products of casein contribute to the **flavour** of the cheese.
- The casein content of the milk is directly related to the **yield of cheese** – the higher the casein content of the milk, the higher the cheese yield.

For <u>milk fat</u>, any 3 of the following: (3)

- Milk fat imparts a **pleasant, rich and full flavour** to cheese.
- It adds **smoothness, mellowness and softness** to the body of the cheese.
- When milk fat is degraded by **enzyme** action, the **free fatty acids** make a valuable contribution to the flavour of some cheese varieties, e.g. **Roquefort and some Italian cheeses**.
- Milk fat adds **colour** to the cheese.
- Because milk fat is incorporated into the curd matrix, it **restricts** to a certain degree the **loss of moisture** from the curd.
- Milk fat makes an extremely important contribution to the **yield** of cheese.

4. To be **converted to lactic acid** during fermentation and thus to **increase the acidity** in the cheese milk, which will **facilitate coagulation**. (2)

5. It will **increase** the rate of syneresis. (1)

6. At a constant pH stirring the curd in the whey, has a dramatic effect and almost **doubles** the rate of syneresis. (1)

The subdivision of the curd into smaller particles **increases** the surface area in relation to volume, resulting in a corresponding **increase** in release of whey. (2)

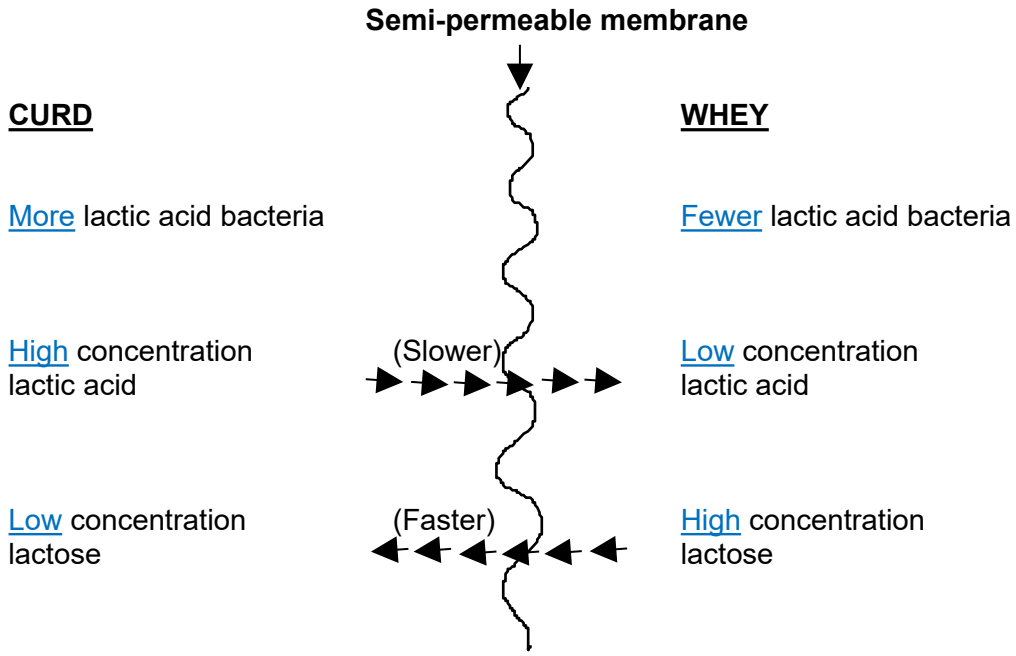
When whey is removed partially or in total from the curd the rate of syneresis will **increase**. (1)

7. **Calcium** and **phosphorous** (2)

8. The **outer layer shrinks** and forms a **semi - permeable membrane** across which **chemical compounds can diffuse** between the curd and whey. (2)

9. Greater **loss** in **minerals** and **moisture**. (2)

10. (6)



11. For every cheese variety, a **maximum level of moisture** exists which is governed by the law. By proper **control** of the **moisture content**, the balance is kept and a product obtained with the **desired characteristics**. A **uniform product** is manufactured throughout the year which will **comply** with the **legislation**. (2)

12. Any 3 factors: (3)
- Milk composition
- Coagulation of milk
- Cutting the curd
- Heating, stirring and pH
- Whey draining
- External pressure
- Dry stirring of curd

13. To rectify the casein to fat ratio in the milk for cheese making. (1)

14. (3)

Raw material	Function
Rennet	Rennet is an enzyme that breaks the casein at a certain bond and thus **facilitates coagulation**.
Annatto	Annatto is added to the milk to give it a **yellowish creamy colour** and thus produce with a standard colour throughout the year.
Calcium chloride	Calcium chloride **facilitates cross-linking** between proteins, thereby **promoting coagulation**.

15. If the inoculum size is **too big** the **culture** will **grow too fast** and will result in a **poor product (over acid)**. (2)
If the inoculum size is **too small** the **culture** will **grow too slow** and **other unwanted fermentations can take place** that will also produce a **poor product**. The cheese will also be to **dry**. (2)

16. Incubation **time** and **temperature** as applied at the specific manufacturing facility.(2)

17. Cutting the coagulum into **smaller pieces** to **increases the effective draining area** and thus **assists in draining (syneresis)** of the whey from the coagulum. (2)

18. During healing, the cut surface is allowed to **form a semi permeable membrane** through which the **osmotic processes (lactose into the curd and moisture and lactic acid out of the curd)** can take place. In this manner **fat loss and subsequent decrease in cheese yield are also minimised**. (2)

19. (a) Whey drainage during cheese curd manufacturing is important because it is a tool for the cheese maker to help him **control the syneresis of the curd**. The amount of **whey** above (on top) of the curd particle exerts a **pressure** on the curd particle and forces the whey back into the curd particle. This **slows down the syneresis process**. When some of the **whey is removed** (drained) the **pressure** on the curd particle **decreases** and **syneresis can take place at a faster rate**. (3)

(b) Because a **lower acid content is preferred** (lower than Cheddar). By **diluting the whey** (addition of water) the **lactose content** of the **whey** is also **diluted** and this **slows down the movement of lactose to the curd and subsequent acid development**. (1)

20. With heating the curd/whey mixture the cheese maker can **control the syneresis of the curd** as well as the **growth of the starter bacteria** and therefore the **production of lactic acid**. (2)

21. (a) The **higher the temperature** (above optimum) the **slower the growth** of the bacteria till the bacteria dies off at temperatures above the maximum growth rate. (2)

(b) A **faster rate of heating** will **slow down** the **growth of the bacteria**, **less lactic acid** will be produced and **less calcium and phosphate will be lost** in the whey. (2)

22. To give solid **shape/form** to the cheese curd so that it can be pressed (where applicable). Also to **help develop a cheese rind**. (1)

23. (a) The cheddaring process is **aimed at producing the characteristic flavour, body and texture**, as well as **controlling the moisture content of the cheese**. (2)

(b) Any 2 of the following: (2)

- Lactic acid bacteria increase considerably
- Lactic acid production increases rapidly
- Reduction in moisture content of the curd
- Undesirable bacteria like spore-formers are totally inhibited
- Chemical reactions between the lactic acid and casein compounds occur which influence the texture of the curd
- The casein micelles thicken and become more elongated and the bonding sites of the curd particles change.

24. Any 2 of the following: (2)

- To obtain an even distribution of salt.
- To increase the absorption of salt.
- To make the curd easier to handle when moulding into cheese.
- To ensure that the cheese will eventually have a closed body.
- To regulate the final moisture content of the curd. By milling the curd, the surface area is increased enormously and a considerable amount of moisture can escape.

25. (a) During the setting of the cheese with rennet a smooth, whitish, water-holding gel is produced **entrapping fat, insoluble salts and lactose**. During the plasticising stage (57°C and higher) **para-caseinate curd becomes smooth, pliable and stringy and retains fat**, which is very important for the manufacturing of e.g. pizzas. (3)

(b) Any 1 chemical and 1 physical reaction: During the setting of the cheese with rennet the **protein micelles aggregate through cross-links involving calcium bridges**. The so formed para-caseinate curd does not produce a smooth, plastic mass when exposed to hot water or steam during cheese manufacture. With additional **acid** produced by the starter bacteria some of the **calcium and phosphorous** bound to the para-caseinate is **solubilised by the decrease in the pH** caused by the acid. In the pH range of 5.2 to 5.4 the para-caseinate curd possesses unique properties. **When heated** to 57°C or higher, para-caseinate curd **becomes smooth, pliable and stringy and retains fat**. (2)

26. Pasta Filata cheese or pizza cheese (any 1). (1)

27. Any 2 reasons: Since the curd enters the moulds at temperatures up to 65-70ºC, it must be cooled in order to **stabilise the shape of the cheese** and to **facilitate the emptying of the moulds**. Another reason for cooling the cheese is to **limit undesirable microbial growth**. (2)

28. (a) Cheddar cheese is **dry-salted**, meaning that the pressed blocks are not exposed to brine in brine dams like Gouda for gradual take-up, but the **milled curd pieces are manually or mechanically salted**. (1)

(b) Gouda and Mozzarella cheese is **brine-salted**, i.e. it is soaked in a brine solution for a certain amount of time. (1)

29. (a) Any 4 of the following reasons: (4)

- Salt adds **flavour/taste** to the cheese.
- **Restricts further acid development** by lactic acid bacteria, thereby **preventing a too acid curd**.
- Because salt affects the lactic acid bacteria, it also **influences the ripening of the cheese**.
- It **aids the removal of whey** and is therefore an additional method of **moisture control**.
- Influences the **body and texture** of the cheese (e.g. **increases the pliability of cheese**).
- Assists in **prolonging the shelf-life** of cheese.
- During brining, salt is responsible for the **formation of the cheese rind**.

(b) (5)

BRINE	CHEESE RIND	CHEESE MOISTURE
Component	**Direction of diffusion**	**Component**
Water	←	Water
Salt	→	Salt
Lactic Acid	←	Lactic Acid
Lactose	←	Lactose
Milk Salts	←	Milk Salts

30. (a) All of the following: (3)
- To remove more moisture from the cheese
- To obtain a close–knitted rind
- To bind the curd particles completely to ensure a close-textured cheese.

(b) In order to remove trapped air from the inside of the curd. (1)

31. (a) Cheese yield is the **mass of the cheese manufactured** expressed as a **percentage of the mass of milk** processed. (1)

(b) $Y = \dfrac{[(\%\ \text{fat} - 0.3) + (\%\ \text{casein} - 0.1)] \times 1.09}{1 - \%\ \text{moisture}}$

$Y = \dfrac{[(3.8 - 0.3) + (80\%\ \text{of}\ 3.4 - 0.1)] \times 1.09}{1 - 0.34}$ (2)

$= \dfrac{(3.5 + 2.62) \times 1.09}{0.66}$ (2)

$= \dfrac{6.6708}{0.66}$ (1)

$= 10.11 \approx 10.0\%$ (1)

32. **Protein** is the main moisture-binding constituent in cheese and is therefore the main component which determines cheese yield. **Fat** and **water** are the second most important contributors to cheese yield. Therefore, the higher the protein, fat and water content in cheese, the higher the yield will be. (3)

33. Any 3 of the following: (3)
- Salt content of the cheese
- Moisture content of the cheese
- pH of the cheese
- Amount of coagulant used
- Heat treatment of milk during cheese manufacturing
- Ripening temperature
- Extent of casein degradation
- Relative humidity
- Air circulation
- Moulds
- Cheese mites
- Pests

34. All 3 of the following: (3)
- **Fermentation** (glycolysis): Break down of lactose
- **Lipolysis**: break-down of milk fat
- **Proteolysis**: Break-down of milk proteins

TOTAL: (111)

Occupational Certificate: Ripened Cheesemaker

Manufacturing Ripened Cheese

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 50% 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.

SECTION A (THEORY)

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

1.1. **Interpreting production instructions, obtaining cheese milk**

Multiple Choice

1.1.1. Production instructions state "Use raw milk." What does "raw milk" mean? (2)

b) Milk that has not been heated or pasteurized.

- The recipe calls for "Jersey cow milk, 4% fat content." Which of the following is MOST critical to verify? (2)
  b) The breed of cow and fat percentage of the milk.

- Production instructions state "Maintain milk temperature at 10°C ± 2°C for raw milk storage." What is the acceptable temperature range? (2)
- b) 8°C to 12°C.

- Production instructions specify "Utilize milk with a Somatic Cell Count (SCC) below 200,000 cells/mL." Which of the following is the MOST accurate interpretation of this requirement? (1)
  c) The milk must have less than 200,000 cells/mL.

1.1.2.

- To make cheese, we add **rennet** to the milk to make it curdle.
- Salt is added to cheese for flavor and to help control **bacterial** growth.
- Colouring agents are used to give the cheese its desired **colour**.
- The type of starter culture used will determine the specific flavor and texture of the ripened cheese.
- Calcium chloride is often added to milk to improve curd formation, especially when using pasteurized milk.
- For mold-ripened cheeses, mold cultures are sprayed or injected into the cheese.
- To control the pH of the cheese, food-grade acids or bases are sometimes used.

- When using raw milk, it is very important to make sure that it is free of pathogens.
- The addition of specific enzymes, such as lipases or proteases, can accelerate the ripening process and enhance flavor development.
- The use of specific forming materials, such as cheesecloth or moulds, influences the shape and drainage of the cheese curd.

QUESTION 2: Producing and managing curd, whey & Green cheese

Produce & Manipulate coagulum

2.1.1.

(Multiple Choice)

What is the FIRST step after the milk coagulates?

b) Cutting the coagulum.

Cutting the coagulum helps to:

b) Release whey from the curd.

What is "whey"?

b) The liquid part of the coagulated milk.

Describe the process of cutting the coagulum, including:

The tools used: Cheese knives or cheese harps are used. These tools have long blades or wires that can cut through the coagulum cleanly.

The desired size of the curd pieces for a semi-hard cheese: For a semi-hard cheese, the curd pieces are typically cut into cubes around 1-2 cm in size.

Why the size of the curd pieces matters: The size of the curd pieces affects the moisture content of the final cheese. Smaller curd pieces release more whey, resulting in a drier, harder cheese. Larger curd pieces retain more moisture, leading to a softer, moister cheese. (6 marks)

List the steps involved in draining the whey after cutting the coagulum, and describe two methods used to achieve this.

After cutting, the curd and whey mixture is allowed to rest, allowing the curd to firm up slightly. Then, the whey is gradually removed.

Methods:

Gravity Drainage: The curd and whey are poured into a cheesecloth-lined container or a perforated vat, allowing the whey to drain naturally through gravity.
Mechanical Drainage: A cheese press or a draining table with a vacuum system can be used to apply pressure and accelerate whey removal. (4 marks)

(Multiple Choice)
The rate of syneresis (whey expulsion) is MOST influenced by:
b) The size of the cut curd and temperature.

2.1.2.

Describe the basic steps for cleaning a cheese vat after draining the whey.
Answer:
First, remove any remaining curd pieces from the vat.
Rinse the vat with warm water to remove any residual whey.
Wash the vat with a food-grade detergent and scrub thoroughly.
Rinse the vat again with clean, warm water.
Sanitize the vat with a food-grade sanitizer.
Allow the vat to air dry or dry with a clean, sanitized cloth.

Explain the process of calibrating a pH meter used to measure the acidity of cheese curd. Include two reasons why accurate pH readings are important.
Answer:
Calibration Process:
Rinse the pH probe with distilled or deionized water.
Place the probe in a buffer solution with a known pH (e.g., pH 7.0).
Adjust the pH meter using the calibration knob until the reading matches the buffer solution's pH.
Rinse the probe again and place it in a second buffer solution with a different known pH (e.g., pH 4.0 or 10.0).
Adjust the meter again if necessary to match the second buffer's pH.
Rinse the probe and test with a third buffer to verify calibration.

Reasons for Accuracy:

Accurate pH readings are essential for monitoring the acidification process, which is crucial for curd formation and cheese ripening. Incorrect pH can lead to undesirable flavors, textures, or even food safety issues.
pH readings are used to determine the optimal time for cutting the coagulum and pressing the curd. Precise pH control helps ensure consistent cheese quality and prevents bacterial spoilage.

Describe two potential issues that could arise from improper operation of a cheese press, and explain how these issues could affect the final cheese product.
Answer:
Uneven Pressure Distribution:
If the cheese press applies uneven pressure, the cheese will have inconsistent moisture content. Areas with higher pressure will be drier, while areas with lower pressure will be moister. This can result in uneven texture, inconsistent ripening, and potential mold growth in the moister areas.
Excessive Pressure:
Applying too much pressure can expel too much moisture from the cheese, resulting in a very hard, dry, and crumbly product. It may also damage the cheese's structure, leading to cracks or fissures. Additionally, excessive pressure can hinder the development of desired flavor profiles by inhibiting enzymatic activity.

2.1.3

What is one way to check if the cheese curd has reached the correct firmness before pressing?
Answer: You can press a finger lightly into the curd. If it springs back slowly, it's likely ready.

Describe the process of controlling the ripening environment for a hard cheese like cheddar, including:
Temperature control and its importance: Maintain a consistent temperature (e.g., 10-13°C) to control enzymatic activity and bacterial growth, ensuring proper ripening.
Humidity control and its importance: Maintain a high humidity (e.g., 80-85%) to prevent excessive moisture loss and cracking.
Air circulation and its importance: Ensure gentle, even air circulation to prevent mold growth and maintain uniform ripening.
How you would monitor these parameters: Use calibrated thermometers and hygrometers to monitor temperature and humidity. Regularly observe air circulation patterns.

Two potential defects:
Cracking due to low humidity.
Excessive mold growth due to poor air circulation or high humidity. (7)

Explain the importance of turning cheese during the ripening process and describe how often a large format hard cheese should be turned.

* Answer: Turning cheese ensures even moisture distribution and prevents the cheese from becoming misshapen due to gravity. A large format hard cheese should be turned at least once or twice a week, or more often in the early stages of ripening. (3)

Discuss how variations in raw milk composition can affect the final characteristics of a ripened cheese.
Answer:
Higher fat content leads to a richer, creamier cheese, while lower fat content results in a drier, firmer cheese. Higher protein content yields a firmer curd and potentially a harder, denser cheese.
To compensate, adjust the following:
Rennet amount: Adjust rennet dosage based on protein content to achieve desired coagulation.

* Cutting size: Cut curd into smaller pieces for higher fat content milk to expel more whey. Cut larger pieces for lower fat milk.

* Cooking time and temperature: Adjust cooking parameters to control moisture content based on milk composition.

* Ripening time and conditions: Adjust ripening parameters to account for variations in moisture and texture.

* Standardize the milk: Blending milk from different sources to achieve a more consistent compositigon.

2.1.4. True or False (12)

Green cheese is ready to eat immediately after pressing.
* False
Cheese can be ripened at room temperature.

* False (Generally, ripening requires controlled temperatures)

Salt helps to preserve cheese during ripening.

* True

All cheeses require the same ripening temperature.

* False

The humidity in the ripening room does not affect mold growth.

* False

Turning cheese during ripening helps to distribute moisture evenly.

* True

Waxing cheese is a method of packaging that prevents moisture loss.

* True

The type of packaging material used has no effect on the ripening process.

* False

A cheese with a bloomy rind should be wrapped tightly in plastic wrap.

* False (Bloomy rinds need to breathe)

Washing the rind of a cheese during ripening can help control mold growth.

* True

The development of specific microbial communities during ripening is solely dependent on initial starter cultures.

* False (Environmental factors and secondary cultures play a role)

Ripening time is a fixed parameter and cannot be adjusted based on environmental conditions.

* False (Ripening time can be adjusted based on temperature and humidity)

2.1.5.

Describe three basic hygiene practices you should follow when handling cheese to prevent contamination.

* Answer:

Wash your hands thoroughly with soap and water before handling cheese.

Wear clean gloves when handling cheese.

Avoid touching your face, hair, or other potentially contaminated surfaces while handling cheese.

Explain the relationship between temperature control and food safety in a cheese ripening facility. Describe two potential hazards that can arise from improper temperature control and how to mitigate them. (5 marks)

* Answer:

Temperature control is crucial for inhibiting the growth of harmful bacteria in cheese. Proper temperature management ensures that the cheese ripens correctly and remains safe for consumption.

*Hazards:

Bacterial growth: If temperatures are too high, pathogenic bacteria can multiply rapidly, leading to foodborne illnesses. Mitigation: Maintain accurate temperature records, use calibrated thermometers, and ensure proper airflow in ripening rooms.

* Mold growth: If temperatures are too low or humidity is too high, unwanted mold can develop on the cheese. Mitigation: Control humidity levels, ensure adequate air circulation, and regularly inspect cheeses for mold.

Describe the process of cleaning and sanitizing equipment used in cheese production, including:

* Answer:

* Steps:

Pre-rinse equipment to remove large debris.

Wash with a detergent solution to remove grease and residues.

Rinse thoroughly with clean water to remove detergent.

Apply a sanitizing solution to kill remaining microorganisms.

Allow equipment to air dry or use a clean, sanitized cloth.

* Agents:

Food-grade detergents.

Chlorine-based sanitizers.

Quaternary ammonium compounds (quats).

Peracetic acid based sanitizers

* Importance of Verification: Verifying cleanliness ensures that all harmful microorganisms have been eliminated, preventing contamination of the cheese. This can be done through visual inspection, ATP testing, or microbial swabbing.

Discuss how risk assessment principles can be applied to both food safety and OHS in a cheese ripening environment, and provide an example of a situation where these principles overlap.

* Answer:

Risk assessment involves identifying potential hazards, evaluating their likelihood and severity, and implementing control measures. In a cheese ripening environment, this applies to both food safety (e.g., microbial contamination) and OHS (e.g., chemical handling, slip hazards).

* Example:

Cleaning chemicals are used to sanitize equipment (food safety), but they also pose a chemical hazard to workers (OHS). A risk assessment would involve evaluating the toxicity of the chemicals, the potential for exposure, and the effectiveness of PPE. Control measures would include providing proper ventilation, requiring the use of gloves and eye protection, and ensuring proper storage and labeling of chemicals. This shows the overlap, because the same chemicals are used for food safety, and worker safety.

2.1.6.

Match the term in Column A with its description in Column B:

* a) Rennet - 2. Substance that coagulates milk
* b) Whey - 1. Liquid removed from curd
* c) Salt - 3. Preserves cheese

Match the ripening defect in Column A with its likely cause in Column B:

a) Cracking - 3. Low humidity

b) Uneven mold growth - 4. Poor air circulation

c) Slimy rind - 1. Excessive surface moisture

d) Off-flavors - 5. Contamination or improper cultures

e) Bloating - 2. Inconsistent temperature

Describe the process of salting a hard cheese, including:

The methods used:

Dry salting: Rubbing salt directly onto the surface of the cheese.

Brine salting: Soaking the cheese in a salt brine solution.

* The purpose of salting:

Flavor enhancement.

Moisture control (drawing out whey).

Preservation (inhibiting bacterial growth).

Rind formation.

* How the salt concentration affects the cheese:

Higher salt concentrations lead to a drier, firmer cheese with a more pronounced salty flavor.

Lower salt concentrations result in a moister, softer cheese with a milder flavor.

Excessive salt can inhibit proper ripening.

Discuss the factors that influence the development of a specific flavor profile in a long-ripened cheese, and explain how these factors can be manipulated to achieve desired results.

* Answer:

Milk Composition: The type of milk (cow, goat, sheep), its fat and protein content, and the animal's diet all contribute to the base flavor. Manipulation: Use milk from specific breeds or adjust the animal's feed.

Starter Cultures: Different starter cultures produce distinct flavor compounds. Manipulation: Select specific cultures or combinations of cultures.

Enzymatic Activity: Enzymes from the milk, starter cultures, and secondary cultures break down proteins and fats, releasing flavor compounds. Manipulation: Control temperature and humidity to influence enzyme activity, or add enzymes.

Ripening Environment: Temperature, humidity, and air circulation affect microbial growth and enzymatic activity. Manipulation: Adjust these parameters to favor specific microbial populations or enzymatic reactions.

Ripening Time: Longer ripening times allow for more complex flavor development. Manipulation: Extend or shorten the ripening period to achieve desired flavor intensity.

Secondary Cultures: The addition of molds, or other bacteria, during the ripening process greatly effects the final flavor. Manipulation, introduce different secondary cultures, or change the application methods.

Washing or Smearing: The washing or smearing of the rind allows for the growth of specific bacteria or yeasts, that greatly effect the final flavour. Manipulation, choose different washes, or smearing agents.

2.1.7.

Fill-in-the-blanks (6):

A physical analysis of cheese includes checking its appearance and texture.

A sensory analysis uses our sense of taste and smell to evaluate cheese.
To measure the acidity of cheese, we use a pH meter.
The moisture content of cheese can be determined using a moisture balance.
During sensory analysis, we assess the cheese's aroma, flavor, and texture.

Describe the process of conducting a sensory evaluation of a ripened cheese, including:
The key sensory attributes to assess. (2)
* Appearance (color, rind, texture, visual defects).
* Aroma (intensity, specific odors).
* Flavor (intensity, specific tastes, aftertaste).
* Texture (mouthfeel, consistency, firmness).
The importance of using a standardized scoring system. (2)
* Ensures consistency and objectivity in evaluations.
* Allows for comparison of results across different evaluators and time periods.
* Provides a numerical or descriptive representation of sensory attributes for data analysis and quality control.
* Reduces subjective interpretations.
How to minimize bias during the evaluation. (2)
* Conduct evaluations in a controlled environment (neutral lighting, odor-free).
* Use a random or coded sample presentation to avoid preconceived notions.
* Train evaluators to recognize and avoid personal preferences or biases.
* Have evaluators evaluate samples independently.
* Use palate cleansers between samples.

2.1.8.

Name one thing you should always write down when you make cheese. (2)
* Answer: The date the cheese was made.
* Note: Other acceptable answers include the batch number, the type of milk used, or the cultures added.
List three types of information that should be recorded during the ripening process of a cheddar cheese. (3)
* Answer:

* Temperature and humidity of the ripening room.
* Turning schedule (dates and times the cheese was turned).
* Visual inspections (notes on appearance, mold growth, or any defects).

QUESTION 3:

3.1. Case Study:

"A small, artisanal cheese producer, 'Mountain View Dairy,' specializes in a semi-hard, natural rind cheese. They've recently had several batches with inconsistent texture and flavor. One batch, in particular, exhibited excessive moisture and a bitter aftertaste. The production records show the following:

Milk: Raw cow's milk, sourced from a local farm.
Cultures: A mesophilic starter culture and a surface mold culture.
Coagulation: Rennet added at 32°C, with a coagulation time of 45 minutes.
Cutting: Curd cut into 2cm cubes.
Whey Drainage: Gravity drainage for 2 hours.
Salting: Dry salting, 2% of curd weight.
Pressing: 6 hours at moderate pressure.
Ripening: 12°C, 90% humidity, 6 weeks.
Deviation: During the pressing stage, the press malfunctioned, resulting in inconsistent pressure for the first 2 hours."

3.1.1.

Based on the case study, name two steps in the cheese-making process.

* Answer
    * Coagulation
    * Cutting
    * Whey Drainage
    * Salting
    * Pressing
    * Ripening (any two of these)

Identify three potential causes for the excessive moisture and bitter aftertaste in the problematic batch. For each cause, explain how it could have affected the cheese.

* Answer:

* Inconsistent Pressure During Pressing:

* The malfunctioning press resulted in inadequate whey expulsion during the first 2 hours. This led to higher moisture content in the cheese, making it softer and more prone to bacterial activity.

* High Humidity During Ripening:

* While 90% humidity is typical for some cheeses, if the initial pressing was insufficient, this high humidity exacerbated the moisture problem, potentially leading to unwanted microbial growth and off-flavors

* Raw Milk Variability:

* Raw milk composition can vary significantly depending on the season, cow feed, and other factors. If the milk had a higher than usual moisture content or different microbial load, it could contribute to the excessive moisture and bitter aftertaste.

* Culture Imbalance/Contamination:

* Though they used mesophilic and surface mold cultures, if there was a contamination, or imbalance in the cultures, this could cause off flavours, and improper ripening.