

# Manufacturing of Butter

(OFO-code: 681301)

## EXTERNAL SUMMATIVE ASSESSMENT: THEORY

Learner name & surname: \_\_\_\_\_

Assessor name & surname: \_\_\_\_\_

Date: \_\_\_\_\_

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

### 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 butter manufacturing. Complete the following sentences that describe the reasons for the pasteurisation process: (2)

- To kill all \_\_\_\_\_ .
- To reduce the number of heat sensitive spoilage micro-organisms to such a level that the \_\_\_\_\_ of the pasteurised milk/cream and subsequent butter products, that are manufactured from that milk/cream, is extended.

2. What is the function of the raw materials listed below in manufacturing of butter? (3)

Raw material	Function
Cream	
Salt	
Colouring	

3. Why is cream pasteurised at a higher temperature than normal raw milk? (2)

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4. Why is cream neutralised prior to butter manufacturing? Give 2 reasons. (2)

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5. What is the purpose of deodorising? (2)

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6. Complete the following principles of the cream preparation procedures: (8)

**Neutralisation:** When \_\_\_\_\_ and an \_\_\_\_\_ are added together, a chemical neutralisation reaction takes place.

If the cream is too sour, it is neutralised by the addition of an \_\_\_\_\_, such as \_\_\_\_\_ (give one example).

**Deodorising:** A more recently developed method makes use of a plate heat exchanger coupled to a separate \_\_\_\_\_.

The vacuum treatment involves \_\_\_\_\_ the cream to the required temperature and then subjecting it to \_\_\_\_\_ and \_\_\_\_\_.

7. What causes a cooked flavour in cream? (2)

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8. What should be done to the cream to ensure proper mixing of neutraliser? (1)

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9. Name 2 disadvantages of over-neutralisation. (2)

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10. What is the purpose of crystallisation? (2)

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11. Complete the following for **crystallisation**: (5)

The final \_\_\_\_\_ and the \_\_\_\_\_ are more important than the cooling rate.

Nucleation is substantially complete within \_\_\_\_\_ min at \_\_\_\_\_ °C but a minimum of \_\_\_\_\_ holding is necessary for the development of an extensive network of stable fat crystals.

12. Name 3 things that will affect the amount and size of fat crystals. (3)

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13. What will the texture of butter be like if the cream is exposed to heat for an excessively long period and too slow cooling? (1)

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14. What is churning? (4)

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15. **Complete the following for batch churning:** (7)

The crystallised cream is pumped to the churn via a \_\_\_\_\_  
that brings it to the requisite churning temperature of \_\_\_\_\_ °C.

The churn is usually filled to \_\_\_\_\_ % of its volume to allow space  
for \_\_\_\_\_. The churn is set at a \_\_\_\_\_ that will ensure that the  
cream is beaten or whipped to an optimum.

The \_\_\_\_\_ and the \_\_\_\_\_ will  
determine the duration of the churning process.

16. What causes the temperature of the cream to rise with 1-3°C during batch churning?(1)

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17. What does “working of butter” mean? (3)

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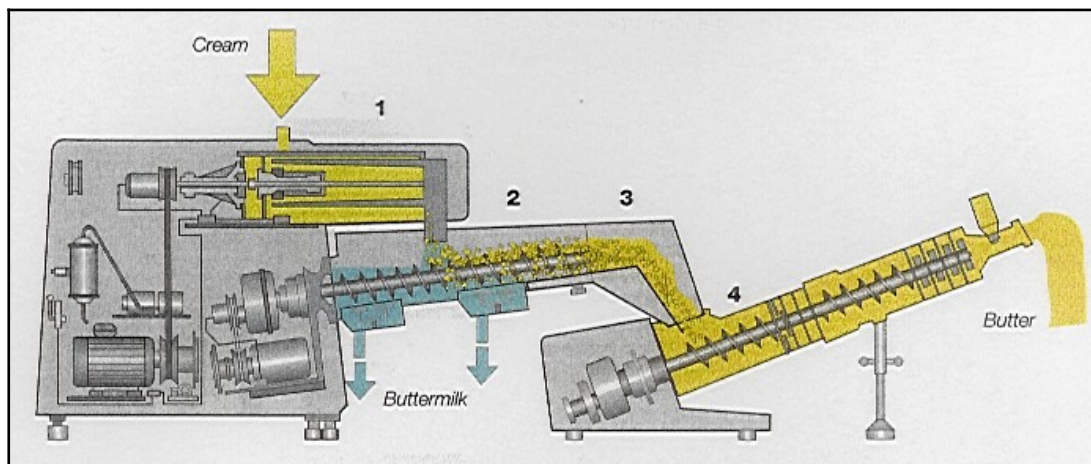
18. What will happen if the churning temperature of the cream during continuous churning is too high? (2)

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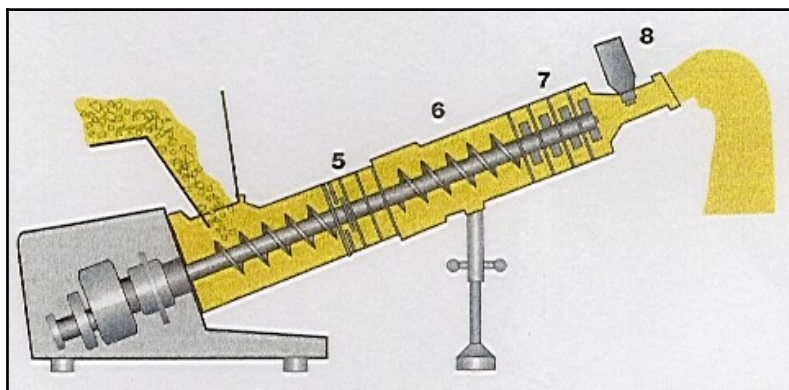
19. Look at the Figure 1 of the continuous butter churn below. Give the names of each numbered section and provide a short description of the purpose of each section. (8)



**Figure 1: Continuous butter churn**

Section name	Purpose (What happens in this section?)
1.	
2.	
3.	
4.	

20. Look at the second illustration (Figure 2) of the continuous butter churn below. Give the names of each numbered section and provide a short description of the purpose of each section. (8)



**Figure 2: Continuous butter churn (continued)**

Section name	Purpose (What happens in this section?)
5.	
6.	
7.	
8.	

21. Complete the following sentences: (4)

Large \_\_\_\_\_ of very small \_\_\_\_\_ are required to make butter of good quality.

Over-churning results in \_\_\_\_\_ with a lot of incorporated buttermilk. Too much buttermilk in the butter may impair the \_\_\_\_\_ of the butter.

22. Why is cooled buttermilk used instead of cold wash water during butter manufacturing? Give 2 reasons. (2)

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23. At what temperature is butter stored? (1)

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**TOTAL: (75)**

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## 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: (2)
  - 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/cream and subsequent butter products, that are manufactured from that milk/cream, is extended.

2. (3)

Raw material	Function
Cream	Main constituent of butter. Influences the %fat and subsequent yield of butter.
Salt	Adds flavour, acts as preservative against microbial spoilage, increases the overrun.
Colouring	Provides uniform coloured product throughout the year.

3. 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. Any 2 of the following: (2)
- To ensure a more **uniform product** from day to day i.e. one that tastes and looks the same.
  - To **avoid excessive losses of fat** during churning.
  - To **prevent the burn-on** of protein during pasteurisation.
  - To **increase the keeping quality** of butter in cold storage. Butter made from sour cream has a short shelf life.
  - To ensure butter with a **good texture**.
5. The purpose of deodorising cream is to **remove undesirable volatile off-flavours and odours** (1) and thereby prevent the final product from having an **inferior quality** (1). (2)
6. **Neutralisation:** When lactic acid and an alkali are added together, a chemical neutralisation reaction takes place. (2)
- If the cream is too sour, it is neutralised by the addition of an alkaline compound such as sodium bicarbonate, hydroxide, lime, magnesium oxide or a mixture of these compounds (any one example). (2)
- Deodorising:** A more recently developed method makes use of a plate heat exchanger coupled to a separate vacuum chamber. (2)  
The vacuum treatment involves preheating the cream to the required temperature and then subjecting it to expansion and cooling. (2)
7. At **very high temperature (80°C or higher)** (1), **sulphydryl groups** will be formed from the milk protein (1) which will result in a cooked flavour in the cream and in the final butter. (2)
8. The cream should be **heated to 30-40°C**. (1)
9. Any 2 of the following: (2)
- **Neutraliser flavour** and **soapiness** (this chemical flavour cannot be diluted even with fresh, untreated cream).
  - **Excessive fat losses** in the buttermilk.
  - **A longer churning time**.

10. During crystallisation the cream is **cooled under controlled temperatures** and the milk fat changes from a completely **liquid state** to a **small crystal state**. Crystallisation plays a major part in the **consistency** and **spread ability** of the final product (1). **Stable fat globules** also **minimise fat losses** during butter production and **increase the churning ability** of the fat (1). (2)
11. The final temperature and the length of holding are more important than the cooling rate. (2)
- Nucleation is substantially complete within 60 min at 5°C but a minimum of 4h holding is necessary for the development of an extensive network of stable fat crystals. (3)
12. Any 3 of the following: (3)
- **Rate of cooling** the cream.
  - **Lowest temperature** to which the cream is cooled.
  - **Temperature** of cream **after cooling**.
  - **Time period** that the cream is held at this temperature.
  - **Stirring** of cream during crystallisation.
13. The butter will have a **mealy texture**. (1)
14. Churning is the process where **cream is violently agitated** (1) to **break down the fat globules** (1), causing them to **coagulate** (1) and **form butter grains** (1). (4)
15. The crystallised cream is pumped to the churn via a heat exchanger that brings it to the requisite churning temperature of 9-12°C. (2)
- The churn is usually filled to 40-50% of its volume to allow space for foaming. The churn is set at a speed that will ensure that the cream is beaten or whipped to an optimum. (3)
- The type of churn and the condition of the cream will determine the duration of the churning process. (2)
16. **Friction** caused by agitation and concussion. (1)
17. Working is the term used for the **even dispersion** (1) of the **moisture droplets throughout the butter** (1), **under pressure** (1). (3)

18. If the churning temperature is too high the **protective fat globule membrane will easily be removed** resulting in **high fat losses**. (2)

19. One mark for each section and one mark for each correct purpose of a section. (8)

Section name	Purpose (What happens in this section?)
1. Churning cylinder	Cream is beaten to break down the fat globules so that butter grains are formed.
2. Separation section	Butter grains and buttermilk are separated from each other (buttermilk is drained).
3. Squeeze dry section	Any remaining buttermilk is removed through perforated plates.
4. Second working section	Final expulsion of buttermilk and fusion of butter grains.

20. One mark for each section and one mark for each correct purpose of a section. (8)

Section name	Purpose (What happens in this section?)
5. Injection section	Salt is added in slurry form.
6. Vacuum working section	Further working of butter (texturising) under vacuum to remove extra air.
7. Final working section	Butter grains are worked (texturised) into heterogeneous mass and further buttermilk is expelled (moisture control).
8. Moisture control unit (transmitter)	This unit is fitted to the butter-making machine for control over e.g. moisture content, salt content, density and temperature.

21. (4)  
Large numbers of very small fat crystals are required to make butter of good quality.  
Over-churning results in abnormal large granules with a lot of incorporated buttermilk. Too much buttermilk in the butter may impair the keeping quality of the butter.
22. Any 2 of the following: (2)
- Washing with water can lead to possible microbial contamination.
  - Washing water increases the water content in the butter.
  - Difficulty exists in disposing the wash water.
23. Butter is stored at temperatures between **-20°C and -15°C**. (1)

**TOTAL: (75)**