

EXTERNAL INTEGRATED SUMMATIVE ASSESSMENT

CANDIDATE INFORMATION

SURNAME													
NAMES													
ID NUMBER													
EISA REGISTRATION NUMBER													
ASSESSMENT CENTRE													
ASSESSMENT CENTRE ACCREDITATION NUMBER													

QUALIFICATION INFORMATION

QUALIFICATION TITLE	Intermediate Occupational Certificate: Food and Beverage Process Machine Operator (EXEMPLAR)
SAQA ID	121149
NQF LEVEL	3
CREDITS	123
DURATION	2 hrs 00min
TOTAL MARKS	100
PASS MARK	50 Marks
DATE OF EISA	

--	--

GENERAL EISA RULES

- a) Candidates are **ONLY** allowed to use the supplied **EISA BOOKLETS**.
- b) Candidates can **ONLY** use a **BLACK PEN** for their answers.
- c) Candidates to ensure that their **NAMES, SURNAMES** and **EISA registration numbers** appear on the front of their EISA booklet.
- d) This is a closed-book examination. Therefore, no other materials or belongings are to be brought into the assessment centre. Should you bring any other materials or belongings into the assessment centre, you will be required to leave such at the front of the assessment centre examination room. The assessment centre will not be held liable for any loss or damage to property brought into the assessment centre examination room.
- e) All EISA booklets must be handed back to the invigilator intact. No paper may be torn off from the EISA booklet. The removal of EISA booklets from the examination room is prohibited.
- f) Candidates may use a calculator in this EISA.
- g) Unless this is an online examination where access to a computer will be made available to you, the use of any communication devices, including smart watches, cell phones, tablets, iPads, headphones and laptops, are prohibited.
- h) All cell phones are to be switched off for the duration of the EISA.
- i) The invigilator will not assist you with the explanation of questions related to the EISA.
- j) Candidates are prohibited from conversing in any manner with other students.
- k) Candidates may not leave the examination venue within one hour of the start of the examination and in the last 10 minutes of the allotted examination period.
- l) Candidates who are found to be disruptive and unruly in the assessment centre will be requested to leave the assessment centre by the invigilator.

I HEREBY CONFIRM THAT I HAVE READ THE ABOVE EISA RULES AND DECLARE THAT I UNDERSTAND AND ACCEPT THE RULES

CANDIDATE SIGNATURE

INSTRUCTIONS TO CANDIDATES

1. Candidates must complete ALL questions in this EISA.
2. Candidates must use only a **BLACK PEN** when completing this EISA.
3. Should you require additional space to complete your answer, please request additional paper from your invigilator. Ensure that you indicate your NAME, SURNAME, and EISA registration number.

QUESTION 1:

1.1

You are provided with the following Shift Production and Performance Report at the end of a shift:

SHIFT PRODUCTION AND PERFORMANCE REPORT

- **Shift:** Day Shift (06:00 - 14:00)
- **Line Location:** Blending and Pasteurization Block C
- **Lead Operator:** Shift Lead

Section A: Operational Yields	Target	Actual	Variance / Status
Total Processed Volume	64 000 L	60 000 L	−4 000 L (Target Shortfall)
Line Run Time	480 minutes	450 minutes	30 minutes Mechanical Downtime

Section B: Active Process Log	Critical Limit	Measured Core Reading	Status
Carbonator Dosing Pump	6.2 bar ±	0.0 bar (At 10:15)	Seal Failure / Line Stopped
Pasteurizer Temperature	> 72.0°C	66.5°C (At 12:30)	Temperature Drop Flagged

Section C: Supervisor Handover Notes

- At 10:15, a pneumatic seal failure on the carbonation dosing pump caused a 30-minute process interruption. Maintenance resolved this.
- At 12:30, a sudden temperature drop occurred on the pasteurizer, with liquid temperature falling to 66.5°C against the critical food safety limit of > 72.0°C . The automated

divert valve activated immediately to recirculate the under-processed liquid.

1.1.1

- **a)** List the **three (3) communication logs** used to report these two shift errors and name who receives each report. (3)

- **b)** Why is the pasteurizer temperature drop a **higher food safety priority** than the carbonation pump failure? (3)

1.1.2 Describe how you would resolve an interpersonal conflict between the raw blending operator and the pasteurization technician regarding who was responsible for the delay in reporting the temperature deviation. (2)

1.1.3 Explain why an operator must digitally log the batch numbers, raw material lot codes, exact blending tank volumes, and heat treatment chart temperatures into the plant's ERP database rather than simply relying on physical notebook entries. (3)

1.2 SCENARIO: QUALITY, HYGIENE, AND ALLERGEN CHANGEOVER CONTROLS

You are the operator preparing the line for a critical product changeover from a high-allergen strawberry-flavored concentrate to a standard clear apple juice blend. To ensure complete customer safety and product quality, your team must complete several tasks:

1. Inspect the raw materials in the storage bay to prevent spoilage.
2. Verify that the inline flowmeters are calibrated to keep mixing ratios consistent.
3. Monitor the pasteurizer's divert valve parameters.
4. Clean and sanitize the equipment to prevent cross-contamination. During the inspection, you notice some pump gaskets are beginning to wear, and overhead ventilation ducts are starting to accumulate condensation above open blending vessels. On the exterior walls of the mixing tanks, some sugary residue has dried into a hard, sticky layer.

1.2.1 Which of the following describes the correct regulatory food safety parameter and storage limit for raw, concentrated fruit pulp/purees to prevent micro-spoilage or natural fermentation prior to the active blending process? (2)

- A.** Store in open, non-refrigerated mixing vessels next to steam headers at 38.0°C to maintain viscosity.
- B.** Keep in a cool, dry area at a temperature range of 4.0°C to 15.0°C with relative humidity maintained below 65% .
- C.** Deep freeze at -18.0°C with liquid nitrogen spraying to preserve metabolic sugars.
- D.** Store in sealed aseptic bags on pallets inside deep refrigeration at $2.0^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$ with continuous batch traceability logging.

Write your selected option (A, B, C, or D) in the block below:

ANSWER:

1.2.2

- a)** Identify **two (2) physical quality parameters** that must be measured and recorded on the blended juice intake quality log. (2)

b) Explain how calibrating the inline electromagnetic flowmeter helps the operator maintain exact ingredient dosing ratios. (2)

c) Analyze the consequence to the liquid blend's biological stability if the divert valve on the pasteurizer fails to activate during a temperature deviation below **72.0°C** . (1)

1.2.3 List 3 acts of Good Manufacturing Practice (GMP) in a food and beverage processing environment to prevent cross contamination (3)

1.2.4 Identify **two (2) distinct physical or biological pathogens** that could compromise product safety if the primary pump gaskets deteriorate or if the overhead ventilation ducts accumulate condensation above open blending vessels. (2)

1.2.5 Provide a reason why using high-pressure water to flush dried sugar syrupy residues off exterior tank walls before applying an alkaline foaming detergent is incorrect and state the physical consequence. (2)

QUESTION 2:

2.1 Scenario: You are operating a multi-stage continuous beverage blending and pasteurization block configured to produce premium fruit juice mixtures at a target rate of **8 000 litres per hour** . To ensure consistent brix levels and microbiological stability, you must verify raw input characteristics, control ingredient ratios, and manage thermal transformations within the continuous process.

2.1.1

a) Identify **two (2) primary input materials** required for a fruit juice blend. Describe the visual and physical properties that must be checked at the receiving bay. (4)

b) list 2 reasons why executing a physical sensory inspection on incoming liquid sweetening agents prevents downstream processing and machine failures. (4)

2.1.2

a) State the chemical characteristics of fructose/sucrose sugars and food-grade citric acid as constituents of a juice blend. Define how these chemical levels dictate the target Brix and acid ratio of the final beverage. (4)

b) Give 2 factors of how structural physical variables impact the mixing rates and power draws of mechanical agitators inside raw blending vessels. (4)

2.1.3 Mention 2 sequential processing steps required to transform raw liquid inputs into a finished, homogenized, and pasteurized beverage ready for aseptic filling. (4)

2.1.4 Mention 2 characteristics of how the physical variables of holding-tube length and flow velocity (m/s) are mathematically adjusted to ensure that liquid Food & Beverage products receive the exact required pasteurization value (PU) without over-processing. (4)

QUESTION 3:

3.1 Scenario: You have been assigned to prepare and mix a 5 000-litre batch of flavored isotonic beverage. You must prepare the workstation, clean and inspect the blending vessels, receive and measure out bulk dry sugar and liquid flavor concentrates, verify inline process parameters, and manage raw ingredient waste according to South African food safety standards.

3.1.1 List 3 Food & Beverage preparation protocols to outline the steps to inspect, prepare, and verify the mechanical and sanitation readiness of an industrial blending vessel, its agitator

blade, and discharge valve before commencing blending. (3)

3.1.2 List 3 mandatory physical inspections and administrative checks that must be executed when receiving and transferring bulk liquid sugar and concentrated flavor canisters from the raw material storage warehouse to the blending deck. (3)

3.1.3 List 3 physical steps required to prepare, pre-dilute, and hydrate raw citric acid crystals and dry salt-mineral powder in treated water prior to dosing them into the main product blending tank. (3)

3.1.4 List 2 process control checks are completed during blending. (4)

3.1.5 Mention 3 steps in the procedure for handling, identifying, and physically isolating spilled

raw dry materials, damaged concentrate canisters, or out-of-specification blended batches. (3)

3.1.6 List 3 sequential steps that are part of an automated five-phase Clean-in-Place (CIP) loop that is conducted on a product blending vessel and product transfer lines. (3)

3.1.7 Mention 2 physical or technical steps required to formally release a completed 5 000-litre flavored isotonic batch from the blending department and transfer it safely to the pasteurization buffer tanks. (4)

3.1.8 Provide 3 technical or regulatory reasons why operators must maintain complete records of raw ingredient lot numbers, scale calibration weights, blend timestamps, and laboratory "Brix-pH pass" certificates for every completed batch. (3)

Add

sub total

QUESTION 4:

4.1 Scenario: You are the Lead Operator assigned to configure, run, and shut down a high-capacity industrial Plate Heat Exchanger (PHE) Pasteurizer block. To ensure product safety and protect equipment longevity, you must execute the entire equipment lifecycle in accordance with strict Standard Operating Procedures (SOPs).

4.1.1

a) Describe how heat is transferred between hot utility water and the raw liquid product across the corrugated plate channels. (7)

b) Describe 3 mechanical or food safety consequences of a failure in the plate seal gaskets. (3)

4.1.2

a) List six (6) sequential mechanical and electrical steps required to execute a controlled operational shutdown of the PHE Pasteurizer after processing the final beverage volume.

(6)

b) Mention 2 factors of how the system handles hot-water loop deceleration and thermal pressure relief.

(4)

4.1.3

a) State the mandatory safety Lockout/Tagout (LOTO) steps that must be executed on the pasteurizer's electrical panel and steam inlet valves prior to commencing any physical inspections or cleaning activities.

(3)

b) List 2 physical actions to visually inspect the external plate pack compression bolts for alignment.

(2)

END OF EXAM PAPER

QUESTIONS	MARKS
Question 1	25
Question 2	24
Question 3	26
Question 4	25
TOTAL	100

EXTERNAL INTEGRATED SUMMATIVE ASSESSMENT

CANDIDATE INFORMATION

SURNAME													
NAMES													
ID NUMBER													
EISA REGISTRATION NUMBER													
ASSESSMENT CENTRE													
ASSESSMENT CENTRE ACCREDITATION NUMBER													

QUALIFICATION INFORMATION

QUALIFICATION TITLE	INTERMEDIATE OCCUPATIONAL CERTIFICATE: MEAT PROCESSING OPERATOR
SAQA ID	121153
NQF LEVEL	3
CREDITS	123

DURATION	2 hours
TOTAL MARKS	100
PASS MARK	50 Marks
DATE OF EISA	

GENERAL EISA RULES

- a) Candidates are **ONLY** allowed to use the supplied **EISA BOOKLETS**.
- b) Candidates can **ONLY** use a **BLACK PEN** for their answers.
- c) Candidates to ensure that their **NAMES, SURNAMES** and **EISA registration numbers** appear on the front of their EISA booklet.
- d) This is a closed-book examination. Therefore, no other materials or belongings are to be brought into the assessment centre. Should you bring any other materials or belongings into the assessment centre, you will be required to leave such at the front of the assessment centre examination room. The assessment centre will not be held liable for any loss or damage to property brought into the assessment centre examination room.
- e) All EISA booklets must be handed back to the invigilator intact. No paper may be torn off from the EISA booklet. The removal of EISA booklets from the examination room is prohibited.
- f) Candidates may use a calculator in this EISA.

- g) Unless this is an online examination where access to a computer will be made available to you, the use of any communication devices, including smart watches, cell phones, tablets, iPads, headphones and laptops, are prohibited.
- h) All cell phones are to be switched off for the duration of the EISA.
- i) The invigilator will not assist you with the explanation of questions related to the EISA.
- j) Candidates are prohibited from conversing in any manner with other students.
- k) Candidates may not leave the examination venue within one hour of the start of the examination and in the last 10 minutes of the allotted examination period.
- l) Candidates who are found to be disruptive and unruly in the assessment centre will be requested to leave the assessment centre by the invigilator.

I HEREBY CONFIRM THAT I HAVE READ THE ABOVE EISA RULES AND DECLARE THAT I UNDERSTAND AND ACCEPT THE RULES

CANDIDATE SIGNATURE

INSTRUCTIONS TO CANDIDATES

1. Candidates must complete ALL questions in this EISA.
2. Candidates must use only a **BLACK PEN** when completing this EISA.
3. Should you require additional space to complete your answer, please request additional paper from your invigilator. Ensure that you indicate your NAME, SURNAME, and EISA registration number.

QUESTION 1: COMMUNICATION, QUALITY AND FOOD SAFETY (25 Marks)

1.1 Shift Handover, Business Communication and Administration (11 Marks)

1.1.1 Business Communication (6 Marks) [Split Cognitive Category: Med L2 (3 Marks) / High L3 (3 Marks)]

- **a) Communication Channels & Receivers (3 Marks) [Medium Order - L2]:**

Award 1 mark per correct target communication channel and receiver described:

1. **Maintenance Supervisor (Job Card/Log):** Request a physical seal replacement for the carbonation pump, detailing the ^{30-minute} mechanical breakdown. (1 Mark)
2. **Quality Control Manager (QC Deviation Register):** Log the pasteurizer temperature drop to ^{66.5°C}, confirming that the automated divert valve activated immediately. (1 Mark)
3. **Incoming Shift Operator (Verbal Handover & Logbook):** Conduct a face-to-face handover at Block C, indicating the seal repair location and verifying that the pasteurizer has stabilized. (1 Mark)

- **b) Failure Priority and Risk Analysis (3 Marks) [High Order - L3]:**

Award 3 marks for a complete biochemical and safety explanation:

- The carbonator pump seal failure is a **mechanical downtime issue** that stops production but does not represent an immediate food safety risk to processed products. (1 Mark)
- The pasteurizer temperature drop is a **high-risk biological hazard**. Below ^{72.0°C}, pasteurization fails to kill pathogenic microbes (like *Salmonella* or *E. coli*), which can lead to severe food poisoning. Therefore, it must be reported to Quality Control first to ensure the failed product is safely diverted and quarantined. (2 Marks)

1.1.2 Interpersonal Relationships (2 Marks) [Cognitive Category: Medium Order - L2]

Award 1 mark per application step of resolution concepts:

- **Accountability:** Refer to the supervisor notes in **Section C** of the shift report. Focus on

objective log sheets. Clarify that the raw blending operator is responsible for raw materials and the pasteurization technician for verifying temperatures. This avoids personal blame-shifting. (1 Mark)

- **Team Trust:** Sit down together to agree on a fast communication path (e.g., direct radio alert) if a parameter drifts again, rebuilding mutual trust. (1 Mark)

1.1.3 Business Administration (3 Marks) [Cognitive Category: Low Order - L1]

Award 1 mark per valid administrative rationale:

- **Traceability:** Keeps a record of supplier origin and delivery dates for Department of Health or ISO 22000 audits. (1 Mark)
- **Shrinkage Tracking:** Allows management to match raw ingredients received against packaged volume to calculate material losses. (1 Mark)
- **Unalterable Logs:** Prevents operators from erasing or hiding shift errors or temperature failures. (1 Mark)

1.2 Food Safety, GMP and Quality Systems (14 Marks)

1.2.1 Food Safety Standards (2 Marks) [Cognitive Category: Low Order - L1]

Award 2 marks for Option D. Award 0 marks for any other option:

- **Correct Answer: D** (Store in sealed aseptic bags on pallets inside deep refrigeration at $2.0^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$ with continuous batch traceability logging.)
- **Technical Explanation:** Keeping pulp under tight cold-chain storage suppresses psychrotrophic growth and prevents natural yeast fermentation, maintaining product safety. (2 Marks)

1.2.2 Quality Control Systems (5 Marks)

-

Split Cognitive Category : LowL1(2Marks)/MedL2(2Marks)/HighL3(1Mark)

a) Physical parameters (2 Marks) [Low L1]:

- *Award 1 mark per correct parameter listed (Maximum 2 Marks):*
- Refractometric Brix value (to verify sugar density %). (1 Mark)
- Liquid mixture pH (to verify active acidity). (1 Mark)

- **b) Flowmeter Calibration (2 Marks) [Med L2]:**

- Award 2 marks for explaining how calibration maintains exact ratios:
- The inline flowmeter measures raw concentrate and water volumes. Calibrating it ensures that the PLC receives correct data to adjust the control valves, keeping syrup-to-water ratios steady. (2 Marks)

- **c) Temperature Deviation Impact (1 Mark) [High L3]:**

- Award 1 mark for the biological consequence:
- If the divert valve fails below 72.0°C , pathogens (e.g., *E. coli*, *Salmonella*) survive. This causes biological contamination, public health risks, and rapid product spoilage. (1 Mark)

1.2.3 Good Manufacturing Practice (GMP) (3 Marks) [Cognitive Category: Medium Order - L2]

Award 1 mark per valid GMP rule described (Maximum 3 Marks):

- **Uniforms:** Operators must wear clean uniforms, hairnets, and safety boots, and sanitize hands before entering the processing room. (1 Mark)
- **Footwear Sanitation:** Operators must pass through a sanitizing footwear bath at zoning gates to prevent importing floor pathogens. (1 Mark)
- **Allergen Control:** Execute a complete wet-wash CIP on lines during changeovers to remove any strawberry proteins, preventing cross-contact. (1 Mark)

1.2.4 Food Contamination Hazards (2 Marks) [Cognitive Category: Low Order - L1]

Award 0.5 marks per correctly listed hazard (Maximum 2 Marks):

- **Physical Objects:** Gasket rubber fragments or plastic pieces from damaged pump parts, or rust flakes. (1 Mark)
- **Biological Hazards:** Spores of *Bacillus cereus* or *Listeria monocytogenes* from condensation carryover. (1 Mark)

1.2.5 Plant Cleaning and Sanitation (2 Marks) [Cognitive Category: Medium Order - L2]

Award 1 mark for the chemical mistake, and 1 mark for the result:

- **Chemical Mistake:** High-pressure hot water ($> 60.0^{\circ}\text{C}$) caramelizes/bakes the sugar proteins directly onto the stainless steel. (1 Mark)

- **Physical Result:** This forms a hard, sticky scale that resists cleaning and breeds bacterial biofilms. (1 Mark)

QUESTION 2: F&B PROCESSING PRINCIPLES AND TECHNOLOGY (24 Marks)

2.1 Raw Material Input, Constituents and Transformations (24 Marks)

2.1.1 Food & Beverage Raw Input Materials (8 Marks) [Split Cognitive Category: Low L1 (4) / Med L2 (4)]

- **a) Input Materials & Receiving Checks (4 Marks) [Low L1]:**
 - *Concentrated pulp:* Verify that aseptic seals are intact, look for leaks, check batch certificates, and measure temperature. (2 Marks)
 - *Reverse Osmosis Water:* Check clarity/turbidity, perform odor check, and check water pressure. (2 Marks)
- **b) Sensory Inspection on Sweeteners (4 Marks) [Med L2]:**
 - *Sensory Check:* Check color, odor, and clarity of liquid sugar. (2 Marks)
 - *Machine Benefit:* Identifying clumps or foreign debris prevents blockages in the inline strainers and dosing valves, avoiding motor strain. (2 Marks)

2.1.2 Raw Material Constituents (8 Marks) [Split Cognitive Category: Low L1 (4 Marks) / Med L2 (4 Marks)]

- **a) Chemical Characteristics (4 Marks) [Low L1]:**
 - State that citric acid provides sourness (lowers pH) and fructose/sucrose provides sweetness. (2 Marks)
 - Explain that their relative levels must be balanced to achieve the target Brix-to-acid ratio, which is the key driver of flavor consistency. (2 Marks)
- **b) Physical Variables (4 Marks) [Med L2]:**
 - High-viscosity liquids or dense pulp fibers require higher mechanical torque and power draw from mixing agitators. (2 Marks)
 - The operator must adjust agitation speed (RPM) to prevent motor overload or shear damage to the pulp fibers. (2 Marks)

2.1.3 Transformation Process Elements (4 Marks) [Cognitive Category: Medium Order - L2]

Award 1 mark per sequential step correctly described (Maximum 4 Marks):

1. **Dosing & Blending:** Metering exact ratios of water, sugars, concentrates, and citric acid in mixing tanks. (1 Mark)
2. **Homogenization:** Pushing the mixture through high-pressure nozzles to break down pulp fibers and stabilize the emulsion. (1 Mark)
3. **Flash Pasteurization:** Heating the liquid to $> 72.0^{\circ}\text{C}$ inside a PHE block to pasteurize pathogens. (1 Mark)
4. **Cooling & Transfer:** Rapidly cooling the pasteurized beverage to transfer it safely to the aseptic filling line buffer tanks. (1 Mark)

2.1.4 Key Principles of Food & Beverage Preparation (4 Marks) [Cognitive Category: Medium Order - L2]

Award 2 marks for pasteurization chemistry, and 2 marks for flow dynamics:

- **Pasteurization Chemistry:** The pasteurization value (PU) is a function of hot-holding temperature and time. (2 Marks)
- **Flow Dynamics:** The holding-tube length and product flow rate (m/s) are calculated to ensure that every drop of liquid stays at $> 72.0^{\circ}\text{C}$ for at least 15 seconds to achieve pasteurization without burning the product. (2 Marks)

QUESTION 3: PRODUCT PREPARATION AND WORK AREA SANITATION (26 Marks)

3.1 Product Staging, Preparation and Process Validation (26 Marks)

3.1.1 Blending Equipment Preparation (3 Marks) [Cognitive Category: Low Order - L1]

Award 1 mark per valid preparation step:

- Check that the tank is clean and free of physical debris or water residues. (1 Mark)
- Inspect the agitator shaft and blades for mechanical secureness and damage. (1 Mark)
- Verify that the physical discharge valve is closed, seals are intact, and no leaks exist. (1 Mark)

3.1.2 Raw Material Receiving (3 Marks) [Cognitive Category: Low Order - L1]

Award 1 mark per receiving audit step:

- Inspect concentrated flavor canisters for intact safety seals and zero dents. (1 Mark)
- Verify supplier lot codes against the batch dispatch sheet. (1 Mark)
- Check that liquid sugar tankers contain clean transfer hose connections. (1 Mark)

3.1.3 Raw Material Preparation (3 Marks) [Cognitive Category: Low Order - L1]

Award 1 mark per hydration step:

- Weigh out dry citric acid crystals on a calibrated platform scale. (1 Mark)
- Mix the dry powder into a clean, small vessel filled with warm reverse osmosis water. (1 Mark)
- Stir until completely dissolved, then pump the solution into the main blending tank. (1 Mark)

3.1.4 Physical, Sensory, and Process Control Checks (4 Marks) [Cognitive Category: Medium Order - L2]

Award 2 marks for Brix check, and 2 marks for pH check:

- **Refractometric Brix Check:** Dry the refractometer prism, place a drop of juice, close the lid, and read Brix percentage to check sugar density. (2 Marks)
- **pH Check:** Calibrate the glass-electrode pH meter using pH 4.0 and 7.0 buffer solutions, submerge the probe in a juice sample, and read active pH. (2 Marks)

3.1.5 Waste and Substandard Product Removal (3 Marks) [Cognitive Category: Low Order - L1]

Award 1 mark per isolation step:

- **Identify & Tag:** Put a physical red "Quarantine" tag on any damaged concentrate canister. (1 Mark)
- **Move:** Transfer the out-of-spec batches to the designated isolation zone. (1 Mark)
- **Log:** Log the quantities and batch codes in the waste registry sheet. (1 Mark)

3.1.6 Equipment Cleaning and Sanitizing (3 Marks) [Cognitive Category: Low Order - L1]

Award 0.6 marks per sequential cycle correctly listed (Maximum 3 Marks):

1. **Pre-Rinse:** Ambient water wash to flush out loose sugars.
2. **Caustic Wash:** Hot caustic circulation (1.5% – 2.5% , 80.0°C) to dissolve proteins.

3. **Inter-Rinse:** Clean water flush.
4. **Acid Wash:** Dilute nitric/phosphoric acid rinse to neutralize caustic scale.
5. **Final Rinse / Sanitize:** Fresh water flush and chemical sanitizer spray. (3 Marks)

3.1.7 Prepared Product Release Protocol (4 Marks) [Cognitive Category: Medium Order - L2]

Award 1 mark per sequential release step:

- Check that Brix, pH, and sensory checks have passed. (1 Mark)
- Verify that the transfer pipes and hoses are linked to the correct recipient lines. (1 Mark)
- Check that positive pressure transfer systems are set to prevent external vacuum collapse. (1 Mark)
- Electronically sign the batch release form on the HMI control board. (1 Mark)

3.1.8 Prepared Product Record-Keeping (3 Marks) [Cognitive Category: Low Order - L1]

Award 1 mark per valid record-keeping rationale:

- **Traceability:** Ensures the factory can trace ingredients back to the supplier if a quality recall occurs. (1 Mark)
- **Audit Compliance:** Provides unalterable records for national health and safety audits. (1 Mark)
- **Process Quality Control:** Proves the raw materials were validated and verified to meet recipe standards before final processing. (1 Mark)

QUESTION 4: OPERATING STAND-ALONE F&B MACHINERY (25 Marks)

4.1 Equipment Lifecycle, Thermal Operational Controls, and Safety (25 Marks)

4.1.1 Operating Principles of Stand-Alone F&B Machinery (10 Marks) [Split Cognitive Category: Med L2 (7 Marks) / High L3 (3 Marks)]

- **a) PHE Principles and Divert Valve Mechanics (7 Marks) [Medium Order - L2]:**
 - *PHE Heat Transfer:* Warm water and cold raw product flow in alternating channels

separated by thin corrugated steel plates, transferring heat. (3 Marks)

- *Divert Valve Role:* The automated divert valve is a pneumatic three-way valve at the holding-tube output. (2 Marks)
- *Triggering Mechanism:* If the product temperature drops below the setpoint (72.0°C), the valve diverts the under-pasteurized liquid back to the raw balance tank, avoiding contamination. (2 Marks)
- **b) Gasket Failures and Pressure Differential (3 Marks) [High Order - L3]:**
 - *Failure Consequence:* Worn gaskets allow raw liquid to mix with pasteurized product, bypassing pasteurization. (1.5 Marks)
 - *Pressure Differential Dynamics:* Keeping the pressure on the pasteurized side higher (e.g., 2.5 bar) than the raw side (1.5 bar) ensures that if a gasket leak occurs, pasteurized product leaks into raw, preventing raw juice from contaminating pasteurized stocks. (1.5 Marks)

4.1.2 Equipment Shutdown Procedures (10 Marks) [Split Cognitive Category: Low L1 (6 Marks) / Med L2 (4 Marks)]

- **a) Six Shutdown Steps (6 Marks) [Low L1]:**
 - *Award 1 mark per step listed in correct order (Maximum 6 Marks):*
 1. Close the primary liquid product feed valve to isolate the pasteurizer.
 2. Turn off the steam supply line to the hot-water heating loop.
 3. Run reverse osmosis flush water through the product side to clear remaining product.
 4. Shut down the product booster pump and water circulating pump.
 5. Allow the plate pack temperatures to cool below 40.0°C .
 6. Isolate the main electrical power switches on the local breaker panel.
- **b) Deceleration and Flushing Rationale (4 Marks) [Medium Order - L2]:**
 - *Deceleration:* Cooling slowly prevents mechanical stress and warping from sudden shrinkage of the steel plates. (2 Marks)
 - *Flushing Rationale:* Flushing with water removes residual sugars and acids before they dry. This stops sugars from baking-on or burning onto the plate surfaces during shutdown, preventing biofilm buildup. (2 Marks)

4.1.3 Post-Shutdown, LOTO and Cleaning Preparations (5 Marks) [Split Cognitive Category: Low L1 (3 Marks) / Med L2 (2 Marks)]

- **a) Pasteurizer LOTO Steps (3 Marks) [Low L1]:**
 - Isolate the main electrical switch and apply a personal lock and danger tag. *(1 Mark)*
 - Close the manual steam isolation valve and lock it with a chain blockout. *(1 Mark)*
 - Vent any remaining pneumatic pressure from the air supply lines. *(1 Mark)*
- **b) Physical and Digital Isolation Checks (2 Marks) [Medium Order - L2]:**
 - *Physical Check:* Check the plate pack alignment lines and bolts for wear. *(1 Mark)*
 - *Digital Check:* Confirm and sign the logbook to verify the machine has been safely isolated before handing over. *(1 Mark)*

END OF MARKING MEMORANDUM