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EXTERNAL INTEGRATED SUMMATIVE ASSESSMENT

EXEMPLAR 1B

STUDENT INFORMATION

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

QUALIFICATION INFORMATION

QUALIFICATION TITLE	OCCUPATIONAL CERTIFICATE: CHEMICAL PLANT OPERATOR
SAQA ID	102156
NQF LEVEL	4
CREDITS	487
PAPER	1B (there are 3 papers to be written: 1A, 1B, 1C & practical assessment)
DURATION	02 HOURS: 30 MINUTES
TOTAL MARKS	220 MARKS
DATE OF EISA	

GENERAL EISA RULES

1. Students are ONLY allowed to use the supplied **EISA BOOKLETS.**
2. Students are ONLY allowed to use a **BLACK PEN** for their answers.
3. Students to ensure that their **NAMES, SURNAMES** and **EISA registration numbers** appears on the front on your EISA booklet.
4. 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.
5. 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.
6. Students may make use of a calculator in this EISA.
7. 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, i-Pads, head phones and laptops are prohibited.
8. All cell phones are to be switched off for the duration of the EISA.
9. The invigilator will not assist you with the explanation of questions related to the EISA.
10. Students are prohibited from conversing in any manner with other students.
11. Students 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.

12. Students 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

_____

STUDENT SIGNATURE

CANDIDATE INSTRUCTION

a) Candidates must complete ALL questions in this EISA.
b) Candidates must ensure that they use only a BLACK PEN when completing this EISA.
c) 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 at the top of the additional paper. Also ensure that the question number is clearly marked on your additional paper.

QUESTION 1

1.1 Shut down a Chemical Process in a Chemical Plant

1.1.1

Chemical process plant equipments are designed to be operated in a manner that should enable value addition to raw materials by converting them into quality semi-finished products and/or finished products.

Failure to operate any of the process equipments according to their required specifications will negatively impact on the entire production process and thus result to the production of non-conforming products.

Furthermore, for these process equipments to continue to operate efficiently until they reach their lifespan, these process equipments require servicing and maintenance, this therefore require the Chemical Plant Operator to be able to systematically start them up, shut them down and perform safe functions as stipulated in their SOP's.

1. Case Study of a Normal Shutdown

A normal equipment shut-down involves allowing the chemical plant operator adequate time to establish and verify the status of product quality in the equipment, and allowing such equipments to completely finish their operation cycles, and switching the equipment OFF from the OFF - SWITCH in their control panel.

Consider the example of a Centrifugal pump Normal Shutdown checklist below:

- Verify the level of the product being pumped
- Close the suction valve
- Switch the pump OFF using the switch button in the control panel
- Close the delivery valve
- Open the pump drain valve

2. Case Study of an Emergency Shutdown

An Emergency shutdown process is often applied when there process threatens the safety and health of the operator, or when the process threatens the safety of the environmental or when the process threatens the safety of the equipment or the quality status of the product being processed. Emergency shutdown activities differs from process equipments to process equipments, however for inter-connected equipments, emergency shutdown activity triggers the whole process equipments value chain to systematical shutdown. The emergency shutdown process is normally done by depressing the EMERGENCY SHUTDOWN button from the equipment control panel.

An example of the emergency shutdown of a Centrifugal pump checklist includes:

- Switching the emergency shutdown button on the pump control panel.
- Closing the suction valve
- Close the delivery valve
- Open the drain valve

3. Case Study on Repair and Maintenance Shutdown

Repair and Maintenance shutdown is performed when process plant equipments are due for repair or maintenance work. Chemical Plant Operator are normally trained to prepare such plant equipments and helps to make them safe for the mechanical fitters and or/ electricians to work on them.
A safe working environment has to be established first prior any repair or maintenance work is carried out.
The chemical plant operator should know how to prepare the environment under which the process equipment repair work is performed.

An example of the repair/ maintenance shutdown of a Centrifugal pump checklist includes:

- Switching the pump OFF from the control panel.
- Putting the caliper on the pump control panel
- Locking the padlock in the caliper on the pump control panel
- Close both the suction and delivery valves and put the valves lock cover or chains around the valves
- Open the drain valve
- Putting a "Do NOT OPERATE' sign on the pump
- Clean the place around the pump and remove excess products around the pump location.

a.	List TWO (2) purposes of a Normal Equipment shutdown.	(2)
b.	Discuss TWO (2) situations where process equipments Emergency Shutdown may be required.	(2)

c.	List two (2) process documents that will outline the process plant Emergency Shutdown procedures to the Chemical Plant Operator. (2)
d	In your production environment, I want you to generate a checklist that is associated with **the NORMAL SHUTDOWN** activities of at least **THREE (3) Process Equipments**, your checklists should include 1. Names of process equipments that are SHUTDOWN during a NORMAL SHUTDWN 2. Conditions that each equipments has to meet for it to be SHUTDOWN 3. NORMAL SHUTDOWN activities of each equipment. (30)

Name of Equipment - 1

CONDITIONS that should be met before SHUTDOWN

NORMAL SHUTDOWN activities

Name of the Equipment – 2

CONDITIONS that should be met before SHUTDOWN

NORMAL SHUTDOWN activities

Name of Equipment – 3

CONDITIONS that should be met before SHUTDOWN

NORMAL SHUTDOWN activities

e	In your production environment, I want you to generate a checklist that is associated with the **EMERGENCY SHUTDOWN** activities of at least **THREE (3) Process Equipments you LISTED in the previous section**, your checklists should include 1. Names of process equipments that are SHUTDOWN during an EMERGENCY SHUTDOWN 2. EMERGENCY SHUTDOWN activities of each equipment. (18)

Name of Equipment – 1

EMERGENCY SHUTDOWN activities

Name of Equipment – 2

EMERGENCY SHUTDOWN activities

Name of Equipment – 3

EMERGENCY SHUTDOWN activities

f	In your production environment, I want you to generate a checklist that is associated with the **REPAIR / MAINTENANCE SHUTDOWN** activities of at least **THREE (3) Process Equipments you LISTED in the previous sections**, your checklists should include 3. Names of process equipments that are SHUTDOWN during an REPAIR / MAINTENANCE SHUTDOWN 4. REPAIR / MAINTENANCE SHUTDOWN activities of each equipment. (18)

Name of Equipment – 1

REPAIR / MAINTENANCE SHUTDOWN activities

Name of Equipment – 2

REPAIR / MAINTENANCE SHUTDOWN activities

Name of Equipment – 3

REPAIR / MAINTENANCE SHUTDOWN activities

g	List at least THREE (3) impacts of FAILURE to perform the correct NORMAL SHUTDOWN activities in the equipments you LISTED in QUESTION **d** above. (6)

h	List at least THREE (3) impacts of FAILURE to perform the correct EMERGENCY SHUTDOWN activities in the equipments you LISTED in QUESTION **e** above. (6)
i.	List at least THREE (3) impacts of FAILURE to perform the correct RAPAIR / MAINTENANCE SHUTDOWN activities in the equipments you LISTED in QUESTION f above. (6)

1.1.2	Open and Close relevant valves for "Plant Safe making" during a Normal Shut Down
a.	Match Column A and Column B on the types of valves below and write your answer on the Answer column provided (5)

	Column A	Column B	Answer Column
1		Butterfly valve	
2		Swing Check valve	

	Column A	Column B	Answer Column
3		Gate valve	

4		Ball Valve	
5		Globe Valve	

b	List where applicable **THE AREAS** in your process plant where each of the above valve are used and explain the purposes for which each of the valves is used for, also list the equipments to which each of the valves is attached to. (15)

Valve Type	Purpose	Equipment attached to
1:_____		
2:_____		

Valve Type	Purpose	Equipment attached to
3:_____		
4:_____		

5:_____		

c	Explain THREE (3) of the valves you listed in question c above are Opened and Closed for "Safe Plant making" as applicable in your workplace and why they are used for "Safe Plant Making" (6)

Valve Type	Reason for Opening and Closing

d	List TWO (2) common problems that are associate with the valves you mentioned in question c above and list the most common solutions used to solve those respective problems. (4)

Valve Types	Common Problems	Common Solutions

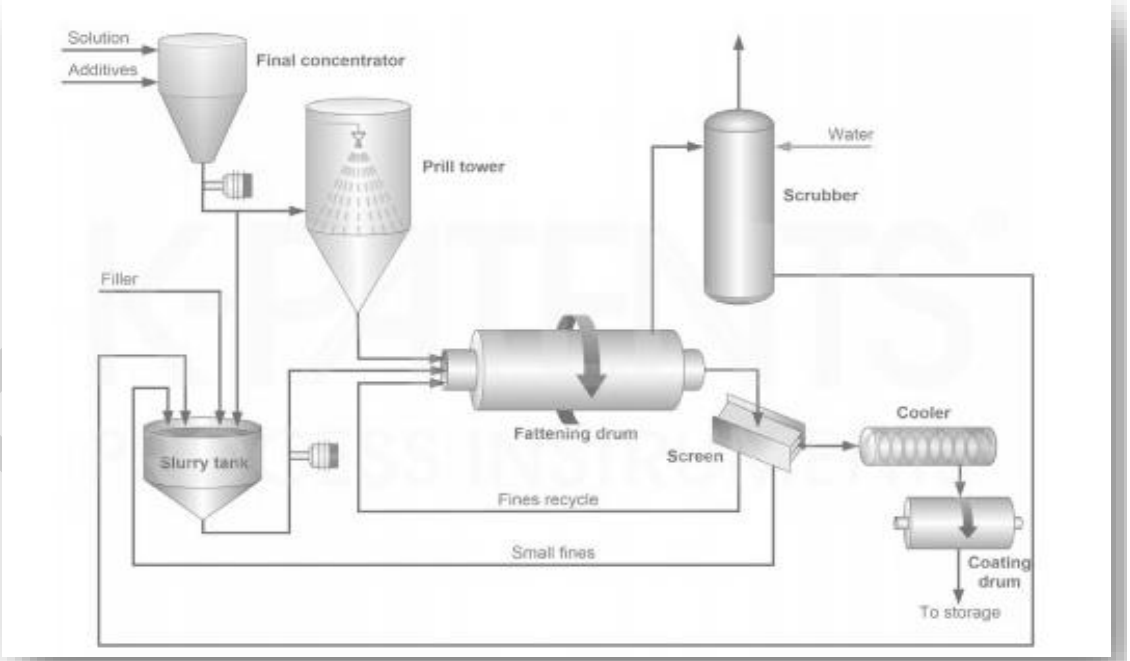
1.1.3	Communicate with the Chemical Plant Controller and Line Manager.
a.	List FIVE (5) functions of a Chemical Plant Controller as applicable to your own workplace (5)

b.	List THREE (3) functions of a Line Manger as applicable in your own workplace.	(3)
c.	List TWO (2) communication channels that are used for communication between the Chemical Plant Operator and Chemical Plant Controller .	(2)
d	List FIVE (5) plant conditions and status of actions that are communicated to the Chemical Plant Controller and the Line Manager during the Plant Shutdowns activities.	(10)

1.1.4	Identify correct equipment/ systems/ processes for decommission of the equipment during Planned Maintenance Shutdown

Workplace production equipments are engineered to withstand punitive process conditions and still be able to function producing quality products as per their pre-empted lifespans.
However, for these process equipments to succeed in yielding the desired quality products, they have to be periodically maintained and serviced.
Organisational Planning departments are therefore responsible for the development and implementation of Planned Equipment Maintenance Schedule.
Moreover, Chemical Plant Operators are responsible in ensuring that the respective process equipments are decommissioned in a correct sequential order to prevent further mechanical integrity compromise or damage to such equipments.

Below is the schematic diagram of the **Ammonium Nitrate Prilling Process** and its associated processing equipments



Major Chemical Equipments:

1. Final Concentrator
2. Slurry Tank
3. Prill Tower
4. Fattening Drum
5. Scrubber
6. Screen
7. Cooler and
8. Coating Drum.

From the equipment list above it is evident that for the Chemical Plant Operator to successfully decommissioned this process, the following sequence will have to be followed:

1. 1st (***first)*** equipment to decommission will be the ***Final Concentrator*** by making sure that products (Solution and Additives) going into it are isolated. Also allow the solution in the Final Concentrator to completely deplete.
1. 2nd ***(second)*** equipment to decommission will be the ***Prill tower***, by also allowing all the solution from the Final Concentrator to completely deplete
2. 3rd ***(third***) equipment to decommission is the ***Fattening Drum*** after all the prills in it have exited the equipment
3. 4th ***(fourth)*** equipment to decommission is the **Screen** after all prills have been screened and exited it.
4. 5th ***(fifth***) equipment to decommission is the ***Cooler*** after all screened prills have exited the equipment.
5. 6th ***(sixth)*** equipment to decommission will be the ***Coating Drum*** after all prills have been coated and sent to storage.
6. 7th ***(seventh)*** equipment to decommission will be the ***Slurry Tank*** which serves as a product reworking tank.

a.	List at least five (5) process plant equipments associated with your own workplace	(5)

b. Explain at least one (1) purpose of each of the equipments you mentioned in question a above. (5)

Equipment	Purpose of the equipment
1	
2	

3	
4	
5	

c.	Discuss the correct sequential decommissioning order of the process equipments as it pertain to your own workplace and also explain the impacts on each equipment of the failure to decommission the equipments in a recommended sequential order.	(10)

CASE STUDY of the SAFE MAKING PROCESS of the AMMONIUM NITRATE PRILLING PROCESS

The Major Equipments of the Ammonium Nitrate Prilling Process as listed below have to be safely decommissioned during the Planned Maintenance Schedule. Chemical Plant Operators are usually trained at ensuring that the Safe Making Activities are properly done prior Process Plant decommissioning.

Below are the Ammonium Nitrate Prilling Process.

1. Final Concentrator
2. Slurry Tank
3. Prill Tower
4. Fattening Drum
5. Scrubber
6. Screen
7. Cooler and
8. Coating Drum.

SAFE MAKING PROCESS of at least FOUR (4) Ammonium Nitrate Prilling Process equipments.

Equipment	Safe Making Processes/ Procedures
1. Final Concentrator	1. Solution & Additives delivery valve should be CLOSED and ISOLATED/ FLANGED OFF 2. Solution & Additives pump has to be SWITCHED – OFF and LOCKED OUT 3. Solution & Additives suction valve should be CLOSED and ISOLATED/ FLANGED OFF 4. Final Concentrator stirrer has to SWITCHED – OFF and LOCKED OUT 5. Final Concentrator steam inlet has to be CLOSED and ISOLATED/ FLANGED OFF 6. Final Concentrator delivery valve has to be CLOSED and ISOLATED/FLANGED OFF 7. Final Concentrator delivery pump has to be SWITCHED – OFF and LOCKED OUT 8. OPEN drain valve of the Final Concentrator
2. Prill Tower	1. Inlet valve to be CLOSED and ISOLATED/ FLANGED OFF 2. Prill Tower Spray Head ISOLATED/ FLANGED OFF 3. Prill Tower Cooling Air supply has to be SWITCHED – OFF and LOCKED OUT 4. Open DRAIN valve of the PRILL TOWER
3. Fattening Drum	1. Fattening Drum Inlet CLOSED and ISOLATED 2. Fattening Drum Electrical Motor SWITCHED – OFF and LOCKED OUT
4. Scrubber	1. Water Inlet valve CLOSED and ISOLATED/ FLANGED OFF 2. Water Inlet pump SWITCHED OFF and LOCKED OUT 3. Fattening Drum dust outlet CLOSED and ISOLATED/ FLANGED OFF 4. Open DRAIN valve of the SCRUBBER

Above are some of the SAFE MAKING PROCESS activities as applicable to the AMMONIUM NITRATE PRILLING PROCESS.

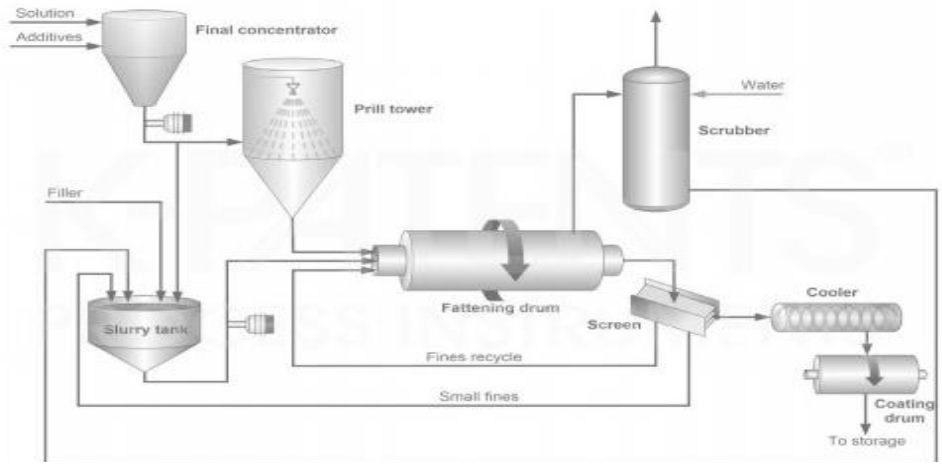
1.1.5		
a	Explain the FIVE (5) purposes of SAFE MAKING PROCESS activities.	(5)

b	List and describe the SAFE MAKING ACTIVITIES of process equipments applicable to OWN WORKPLACE (25)

Equipment	SAFE MAKING PROCESS ACTIVITIES
1.....	
2.....	
3.....	
4.....	
5.....	

1.1.6	Upstream and Downstream consequences of Shutting Down

Consequences of shutting down the process without following the proper shut down procedures will adversely impact on the entire process and its equipments. Upstream and Downstream impacts of failure to shut down the process correctly and mitigating efforts are discussed below.



Equipment	Downstream Effect	Upstream Effect	Mitigating efforts
1. Final Concentrator	1. Improperly shutting down will result to the solution and additives interlocked pumps to trip. 2. Solutions and Additives left in the pipelines may hardened	1. Impact of improper shutting down will cause the Prill Head to choke because of inadequate product going into it and because of negative air pressure. 2. Air pressure build up in the Prill Tower can cause unnecessary products to adhere to Tower walls and hence compromise the tower capacity	**On Down-Stream Process** 1. Stop the Solution and Additives pumps prior to shutting down the Final Concentrator 2. After shutting the solution and additives pumps down, drain the pumps and the delivery lines. **On Upstream Process** 1. Allow the product in the Prill Head to completely drain through the Prill Head 2. Allow the product to completely clear the tower before shutting down the Prill tower.
1. Prill Tower			**On Down-Stream Process**

	1. Improperly shutting down will trip the Concentrator pump. 2. Solution in the pump will harden if not drain.	1. Fattening Drum will be processing products from the Slurry Tank and Reworks from the Screen only 2. Fattening Drum will continue to process poor quality products and consume expensive electricity	1. Ensure that the Concentrator pump is switched off first before 2. Drain the solution in d the Concentrator Pump after shutting down the pump **On Upstream Process** 1. Switch off the Slurry Tank Pump, Screen and Prill Tower simultaneously to prevent the Fattening Drum from processing. 2. Switch off the Fattening Drum to prevent Prill Dust from being scrubbed by the scrubber.

a List a tleast FIVE (5) process equipments as they apply in your work environment, Discuss the impacts of failure to shut down the production equipment on both the Upstream and Downstream processes, also discuss the correct mitigating efforts for each discussed impact.

(20)

Equipment	Downstream Effect	Upstream Effect	Mitigating efforts
1.			**On Down-Stream Process** **On Upstream Process**

2.			**On Down-Stream Process** **On Upstream Process**

3.			**On Down-Stream Process** **On Upstream Process**

4.			**On Down-stream Process**

			On Upstream Process
5.			**On Down-stream Process**

			On Upstream Process

1.1.7	**Shift Hand Over Document** a. Complete the Shift Hand-Over document as it apply to your own workplace, also list the information communicated during the shift-handover. (10)

Format Number: VPK oo76 | **Form / Document #** | **Form / Document Date**

SHIFT HANDOVER FORM

Revision Number: oo2/2o21
Revision Date: o5 February 2021

Equipment Name	Production Line	Production Code	Department	Product Running	Shift Hand Over	Shift Hand Over BY
					☐ 1st to 2nd ☐ 2nd to 1st	

Shift Hand Over Time	Running Job Product	Running Product Qty	Job Quantity Inserted	Remarks (about the Job)

Total manpower Used & Available	# of Electrical Breakdown Noted	# of Machine Breakdown Noted	Reasons for Breakdown Identified/ Not Identified	General conditions of Shift

INITIATIVE DETAILS (as per Production Schedule)

#	Job Order #	Product	General Processes	Scheduled (As per Production Planning)					
				Time	Machine #	Quantity Planned	Product Specification	Actual Quantity Produced	Remarks

Handover running job to shift

#	Job Order #	Required Processes	Product	Quantity	Instructions

List of Isolated Machines / Equipments		**Identified High Risks**	**Supervisor Notes**		
M/C Name	Short Description				
				Shift Handover by – Sign	Shift Handover to – sign

Total: 220 Marks

FOR ASSESSOR USE ONLY

MARKS ALLOCATION GRID

QUESTION 1			
SECTION 1.1		(220)	
	1.1.1	Marks Allocation	Marks Awarded
Subsection	a	2	
	b	2	
	c	2	
	d	30	
	e	18	
	f	18	
	g	6	
	h	6	
	i	6	
	Subtotal	**90**	
	1.1.2	Marks Allocation	Marks Awarded
Subsection	a	5	
	b	15	
	c	6	
	d	4	
	Subtotal	**30**	
	1.1.3	Marks Allocation	Marks Awarded
Subsection	a	5	
	b	3	
	c	2	
	d	10	
	Subtotal	**20**	
	1.1.4	Marks Allocation	Marks Awarded
Subtotal	a	5	
	b	5	
	c	10	
	Subtotal	**20**	

QUESTION 1			
SECTION 1.1 continue…			
	1.1.5	Marks Allocation	Marks Awarded
Subsection	a	5	
	b	25	
	Subtotal	**30**	
	1.1.6	Marks Allocation	Marks Awarded
Subsection	a	20	
	Subtotal	**20**	
	1.1.7	Marks Allocation	Marks Awarded
Subsection	a	10	
	Subtotal	**10**	
	QUESTION 1 SECTION 1.1 GRAND TOTAL	**220**	

ASSESSMENT OUTCOME			
	MARKS ALLOCATED	MARK AWARDED	% SCORED
QUESTION 1	220		
GRAND TOTAL	220		
PERCENTAGE SCORED			
Assessor Signature			
Date			

ASSESSOR DETAILS	
Assessor Names	
Assessor Surname	
Assessor Registration Number	**Assessor Signature**
Assessment Date	

INTERNAL MODERATOR DETAILS	
Moderator Names	
Moderator Surname	
Moderator Registration Number	**Moderator Signature**
Moderation Date	

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