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EXTERNAL INTEGRATED SUMMATIVE ASSESSMENT
CHEMICAL PLANT OPERATOR
EXEMPLAR 1A

STUDENT NAME & SURNAME	
ID NUMBER	
EISA REGISTRATION NUMBER	
ASSESSMENT CENTRE	
ASSESSMENT CENTRE	
ACCREDITATION NUMBER	
QUALIFICATION	**CHEMICAL PLANT OPERATOR**
SAQA ID	**102156**
CREDITS	**487**
PAPER 1	**1A (there are 3 papers to be written 1A, 1B and 1C & practical assessment)**
DATE OF EISA DD/MM/YYYY	**DD/MM/YYYY**
DURATION	**03 HRS 15 MINS**
TOTAL MARKS	**230**

GENERAL EISA RULES

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2. Students are only allowed to use a black pen for their answers.
3. Students to ensure that their name, surname and EISA registration number appears on the front of your EISA booklet.
4. This is a closed book examination; therefore, no other material or belongings are to be brought into the assessment centre. Should you bring any other material 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 pages may be torn off from the EISA booklet. The removal of EISA booklets from the examination room is prohibited.
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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.

_____

SIGNATURE OF STUDENT

CANDIDATE INSTRUCTIONS

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- Candidates must ensure that they use only a black pen when completing this EISA.
- 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

1.1.1 Complete a pre-start-up checklist for specific equipment to be commissioned for production.

(10 Marks)

1.1.1 Constructive Response
Allocate one mark for all except for number 5 which is 2 marks adding up to a total of 10 marks.
Use discretion to allocate marks for any other relevant points that may be given by the students.

Company "A" had an explosion and a few of its units were destroyed by the fire. Equipment was identified and a maintenance plan was set up for the repair of

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these items. On completion, the maintenance department handed the equipment back to the production department for commissioning. The operator from the control room requested the outside plant operator to prepare Centrifugal Pump PC 101A for pre-start-up.

Below is a checklist of the pre-start-up checks. Complete the table with corrective actions you would take for the pre-start-up.

No	Pre-start-up Check List	Corrective Actions	Marks
1	Work Permit		1
2.	PPE		1
3.	Hazards (Chemical Oil Spills)		1
4.	Priming		1
5.	Drain Valve		2
6.	Suction Valve line-up		1
7.	Discharge Valve line-up		1
8.	Lubricating Oil System		1
9.	Cooling water system		1

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Total marks			**10**

1.1.2 Ensure correct and sufficient material are available according to production plans and complete a "Request for Transfer of chemicals" document from Tank Farm as needed
(10 Marks)

1.1.2 Case Study
Allocate six marks for number 1, two marks for number 2 and number 3 respectively. Marks totalling to 10.
Use discretion to allocate marks for any other relevant points that may be given by the students.

You are working in a processing plant that receives raw material from a tank farm, TK1 is the raw material storage tank. When the feed gets to your plant it is fed into a separator to separate the material into two products by the application of heat. Steam is supplied from steam plant at 5 bars. The final products are then transferred back to tank farm into TK 3 and TK4 for storage.

No	Corrective Actions	Marks
1.	How would you as a plant operator ensure that the plant has sufficient correct quality raw material to start the plant?	6
2.	Before the transfer of product from tank farm, what are the necessary step to be taken by the operator.	2

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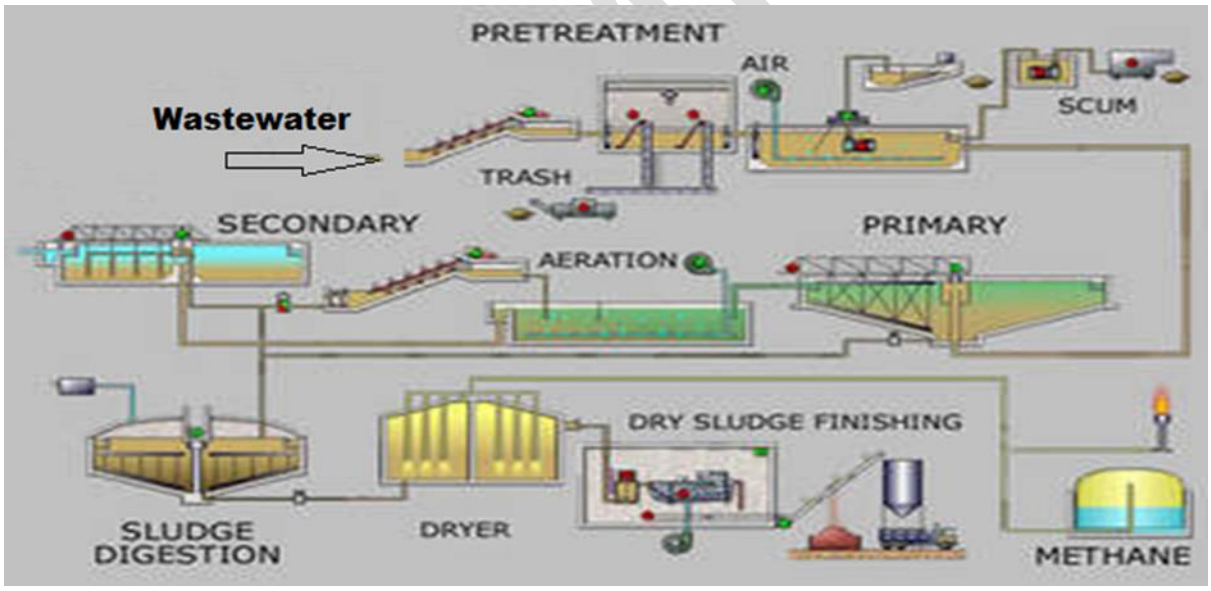
3.	**Since the separation unit depends on heat, what would be the consequence if the pressure of the steam drops below 5bars?**	**2**
	Total Marks	**10**

1.1.3 Predict upstream and downstream consequences of resource availability and mitigate negative consequences.

(10 Marks)

1.1.3 Case Study
Allocate five mark for Number 1 and 2. Marks adding up to 10.
Use discretion to allocate marks for any other relevant points that may be given by the students.



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Refer to the process flow diagram). You are working in a water recovery pant that purifies municipal wastewater (sewage). The influent goes to three different stages namely Pre-treatment, Primary and secondary. The wastewater first goes through the pre-treatment where large solid objects are removed by screens and taken out as trash. Then the water goes to the primary stage where further removal of fine solids is removed in a settling tank as sludge. The last stage is the secondary stage where the water is clarified with the aid of filtration.

Resources	Upstream Consequences	Downstream Consequences	Mitigation Actions	Marks
1. Wastewater • High flow of wastewater.				5
2. Power • No power				5

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Total Marks				**10**

1.1.4 Recognise/confirm product quality and determine production readiness.

(15 Marks)

Constructive Response
Allocate two marks for Number 1. Four marks for Number 2 and 3, and five marks for Number 4. Marks adding up to 15.
Use discretion to allocate marks for any other relevant points that may be given by the students.

No	Corrective Actions	Marks
1.	Define a quality product.	2
2.	How does sampling affect the quality of the product?	4
3.	How would you check the quality of a product in a process?	4

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4.	**What is the effect of processing a non-conforming product?**	**5**
Total Marks		**15**

1.1.5 Perform the start-up sequence using Standard operating procedures.

(30 Marks)

1.1.5 Case Study
Allocate thirty marks for Number 1. Mark adding up to 30.
Use discretion to allocate marks for any other relevant points that may be given by the students.

You are working in a water filtration plant that uses tap water as raw material. The water is first stored in a feed tank before it is pumped through the filters to remove impurities in the water. After the water is filtered it is then stored in a product tank.

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No	Question and Answers	Marks
1.	**Use the standard operating procedure provided to perform a start-up sequence.**	30

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	Total Marks	**30**

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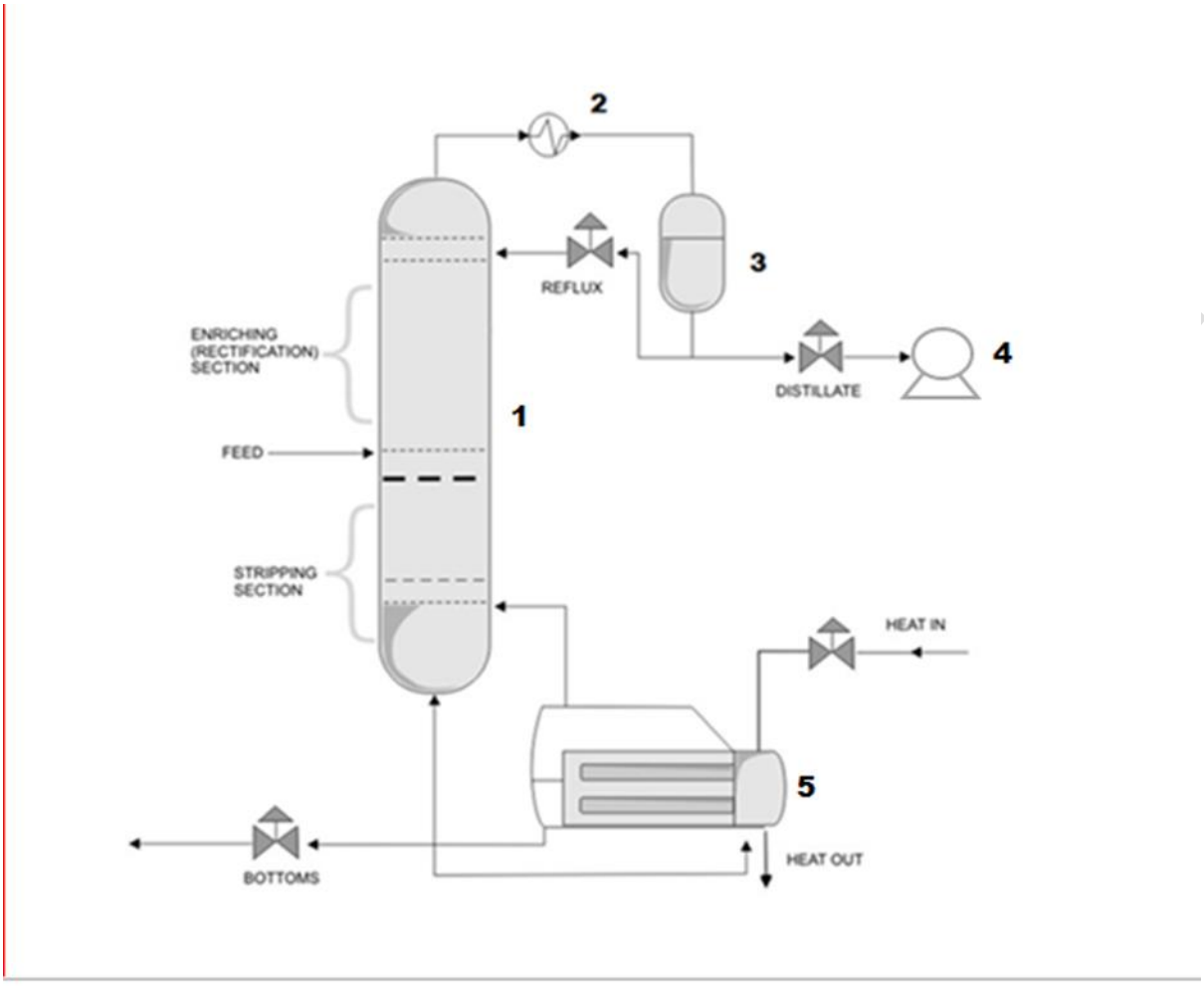
1.1.6 Identify plant equipment and its operational purpose.

(25 Marks)

1.1.6 Case Study
Allocate Five marks to Numbers 1,2,3, 4 and 5. Marks adding up to 25.
Use discretion to allocate marks for any other relevant points that may be given by the students.

Identify the equipments in the diagram below and give its operational purposes.

(Marks 25)



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No	Questions and Answers	Marks
1.	**Column/ Distillation tower**	5
2.	**Reboiler**	5
3.	**Condenser**	5
4.	**Reflux drum**	5

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5.	**Pump**	5
Total Marks		25

Question 2.1

2.1.1 Adjust operating parameters to ensure plant efficiency and product quality is achieved.

(30 Marks)

2.1.1 Case Study
Allocate eight marks for Number 1, twelve marks for Number 2 and ten marks for Number 3. Marks adding up to 30.
Use discretion to allocate marks for any other relevant points that may be given by the students

The diagram below shows a separation unit (V_102), where a mixture of gas and liquid must be separated into 70% gas and 30% liquid at the Gas outlet and 30% gas and 70% liquid at the Liquid outlet. The feed to a separator is first passed through a shell and tube heat exchanger (X_101) to cool the feed down in order to be able to maintain the temperature in the separator at 35^0C. If the temperature increases or decreases the composition of the product is also affected. The pressure in the vessel can be controlled by varying the gas exit flow and the liquid exit. As the PC working in the plant you take a routine gas sample of the product and observe that the composition of top product is 60% gas and 40% liquid.

Assume you find the following
TI 30°C (normally 35°C)
PI 1.9 bar (normally 2.8 bar)

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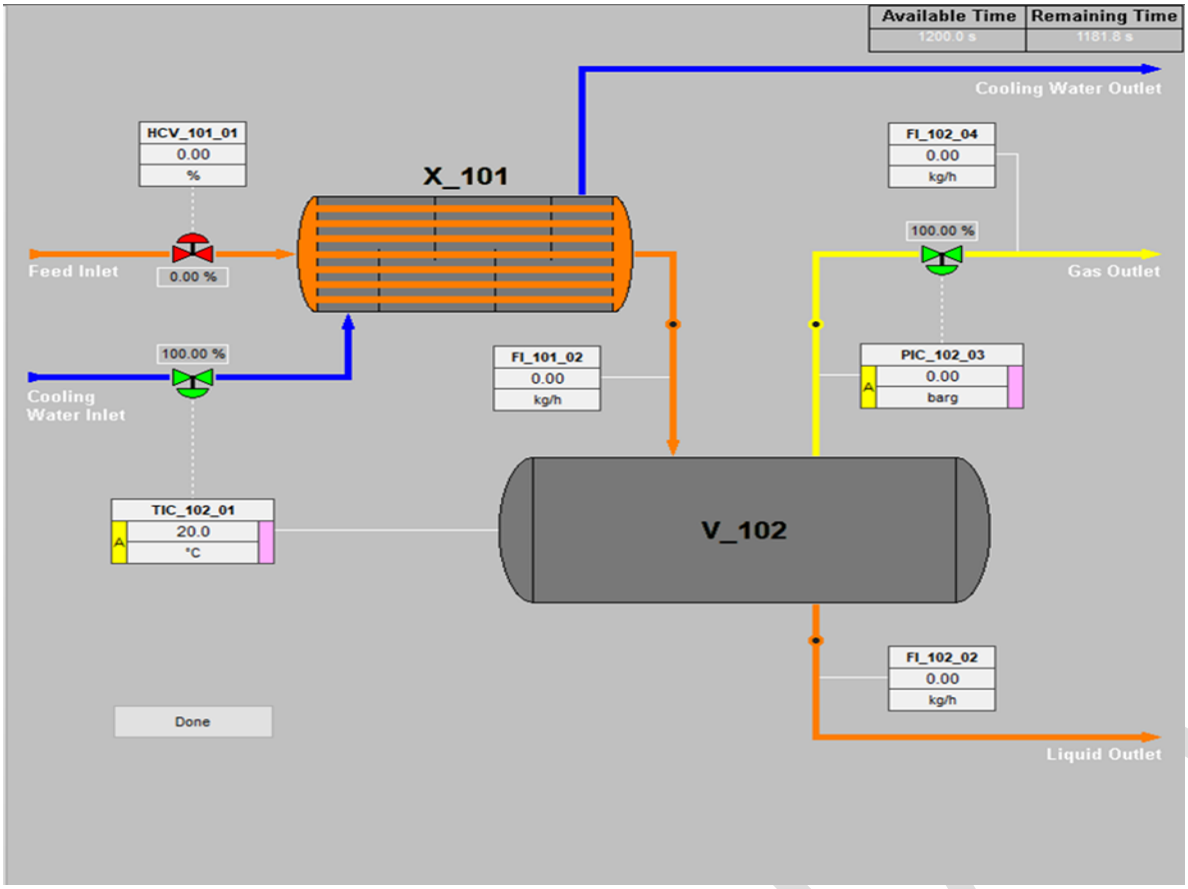

No	Questions and Answers	Marks
1.	**What is the relationship between temperature and pressure and how would you use that principle to ensure plant efficiency?**	8

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2.	**How would you adjust the following operating parameters to ensure plant efficiency?** **Assuming the following** **TI 30°C (normally 35°C)** **PI 1.9 bar (normally 2.8 bar)** **TOP Product Composition 60% (normally 70%,)**	12
3.	**Explain how the temperature in the vessel is monitored.**	10

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	Total Marks	**30**

2.1.2 Record and report on all operating information accurately and timeously as per plant requirements.

(20 Marks)

2.1.2 Case study
Allocate twenty marks for Number 1. Marks adding up to 20 Marks.
Use discretion to allocate marks for any other relevant points that may be given by the students.

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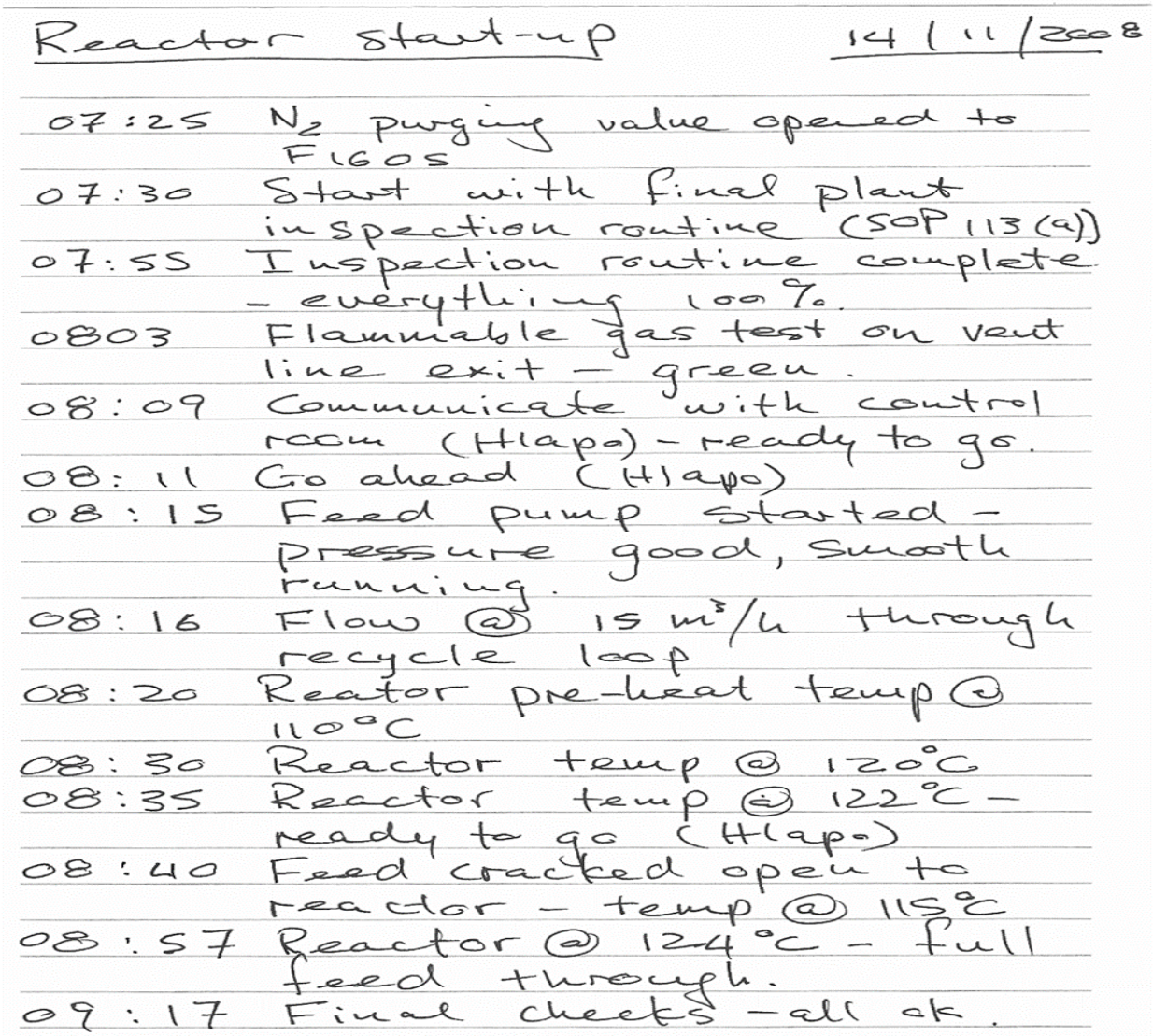
You are working in a processing plant, at the beginning of your morning shift the operator going out informs you about the reactor that must be commissioned for start-up. You carry out the task as instructed and wrote down everything down as performed together with the time it was done.
Start-up went smoothly and according to procedures. Reactor heating sequence was a bit slow (total of 7 hrs and 12 min to 122 deg C), but this can be expected because of the fouled condition of steam tubes. Normal running conditions were achieved 66 minutes after start-up go-ahead was received.



Reactor start-up 14 / 11 / 2008

07:25 N_2 purging value opened to F1605
07:30 Start with final plant inspection routine (SOP 113(a))
07:55 Inspection routine complete - everything 100%.
0803 Flammable gas test on vent line exit — green.
08:09 Communicate with control room (Hlapa) - ready to go.
08:11 Go ahead (Hlapa)
08:15 Feed pump started - pressure good, smooth running.
08:16 Flow @ 15 m^3/h through recycle loop
08:20 Reator pre-heat temp @ 110°C
08:30 Reactor temp @ 120°C
08:35 Reactor temp @ 122°C - ready to go (Hlapa)
08:40 Feed cracked open to reactor - temp @ 115°C
08:57 Reactor @ 124°C - full feed through.
09:17 Final checks - all ok.

1. **Complete the table below on recording and reporting on all operating information accurately and timeously as per plant requirements.**

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Time	Equipment	Condition	Action

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Comments:

2.1.3 Implement corrective actions for non-conforming conditions and predict process effects.

(40 Marks)

2.1.3 Case Study
Allocate ten marks from Number 1 and ten marks for Number 2, twelve marks for Number 3 and Eight marks for number 4. Marks adding up to 40.
Use discretion to allocate marks for any other relevant points that may be given by the students.

On Monday morning the 9th November 2020 at a Chemical Plant Z, the operator Pieter discovered a leak on the seal of Pump PC101. He reported it to John the control room process operator. Upon investigation Thabo the outside senior process operator acknowledged that it was no concern for emergency prioritization. At the end of the shift, Pieter handed over the shift to Moses (night shift) and he emphasized the defect on Pump PC 101.
Lucas the Foreman was also relieved seeing that the maintenance department was running on short staff personnel.
On the morning of 10th November 2020 at 02h00 the inside panel operator Ryan noticed that he was losing the flow from Pump PC101. He called Moses to quickly investigate. Even before Moses could arrive, a massive explosion took place around Pump PC 101. Moses report the incident to the control room process operator and the whole system was brought under control and safely shutdown. The fire department was called out to extinguish the fire.
After the investigation it was found that the explosion started at a centrifugal pump PC101 which pumps Phenol to Tank Tk101.
Upon further investigation it was found that this pump PC101 was recently on maintenance for pump seal leakage.

No	Question and Answer	Marks

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1.	**Give a short summary of the sequence of events taking into consideration:** **a) Shift handover** **b) Shift Logs** **c) Shift Inspections** **d) Communications with Panel SPC** e) **Determine if Standard Operating Procedure was followed.**	10
2.	**Main causes for this incident** **a) What was the cause of the explosion e.g. utility failure?** **b) Determine the extent of the explosion**	10

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3.	**Monitor the effectiveness of the action and correct if necessary** **a) Approval for shutdown** **b) Shut down system as per SAFE OPERATING PROCEDURE.** **c) Maintenance plan for systems shut down for repairs**	12
4.	**Restore the system to normal conditions** **a) Obtain clearance from relevant disciplines and align system for start-up.** b) **Safe operating start-up procedure.**	8

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Total Marks		40

2.1.4 Perform plant walk about.

(20 Marks)

2.1.4 Constructed response.
Allocate Twenty marks from Number 1. Marks adding up to 20.
Use discretion to allocate marks for any other relevant points that may be given by the students.

No	Question and Answer	Marks
1.	**Once normal operating conditions have been achieved, why is it important to conduct a plant walk about?**	**20**

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Total Marks		**20**

2.1.5 Monitor, maintain and replenish stock according to production plans using various methods and techniques (calculations).

(20 Marks)

2.1.5 Constructive Response
Allocate ten marks each (Number 1 and Number 2) adding up to 20 Marks.
Use discretion to allocate marks for any other relevant points that may be given by the students.

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<table>
<tr><th>No</th><th>Question and Answer</th><th>Marks</th></tr>
<tr><td>1.</td><td>
Calculate the mean and range of the data in the table below.
<table>
<tr><th colspan="2">Chemicals</th><th colspan="4">Observations made</th><th>Means</th><th>Range</th></tr>
<tr><td>Chlorine</td><td>Kg</td><td>49</td><td>50</td><td>51</td><td>49</td><td></td><td></td></tr>
<tr><td>Bromine</td><td>Kg</td><td>47</td><td>47</td><td>50</td><td>48</td><td></td><td></td></tr>
<tr><td>Sulfur</td><td>Kg</td><td>52</td><td>50</td><td>49</td><td>51</td><td></td><td></td></tr>
<tr><td>Caustic</td><td>Kg</td><td>48</td><td>49</td><td>50</td><td>50</td><td></td><td></td></tr>
<tr><td>Salt</td><td>Kg</td><td>51</td><td>50</td><td>50</td><td>52</td><td></td><td></td></tr>
</table>
</td><td>10</td></tr>
<tr><td>2.</td><td>Given data containing the values: 44, 48, 44, 38, 50, 37, 45, 46, 39 and 44.
Calculate the mean, mode, median and range</td><td>10</td></tr>
<tr><td colspan="2">Total Marks</td><td>20</td></tr>
</table>

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MARK ALLOCATION GRID (For use by the Assessor only)

QUESTION	MARK	MARKS AWARDED
1.1.1	10	
1.1.2	10	
1.1.3	10	
1.1.4	15	
1.1.5	30	
1.1.6	25	
TOTAL QUESTION 1.1	100	
2.1		
2.1.1.1	8	
2.1.1.2	12	
2.1.1.3	10	
TOTAL QUESTION 2.1.1	30	
2.1.2		
TOTAL QUESTION 2.1.2	20	
2.1.3		
2.1.3.1	10	
2.1.3.2	10	
2.1.3.3	12	
2.1.3.4	8	
TOTAL QUESTION 2.1.3	40	
2.1.4		
TOTAL QUESTION 2.1.4	20	
2.1.5		
2.1.5.1	10	
2.1.5.2	6	
2.1.5.3	4	
TOTAL QUESTION 2.1.5	20	
GRAND TOTAL	230	

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ASSESORS DETAILS

ASSESSOR NAME & SURNAME	
REGISTRATION NUMBER	
SIGNATURE	
DATE	

INTERNAL MODERATOR DETAIL

MODERATOR NAME & SURNAME	
REGISTRATION NUMBER	
SIGNATURE	
DATE	

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