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EXTERNAL INTEGRATED SUMMATIVE ASSESSMENT
CHEMICAL PLANT OPERATOR
EXEMPLAR 1A -MEMORANDUM

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_A	1A (there are 3 papers to be written 1A, 1B, 1C & practical assessment)
DATE OF EISA DD/MM/YYYY	DD/MM/YYYY
DURATION	03 HRS 15 MINS
TOTAL MARKS	230 MARKS

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

UNDERSTAND AND ACCEPT THE RULES.

_____

SIGNATURE OF STUDENT

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- **Candidates must ensure that they use only a black pen when completing this EISA.**
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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 these items. On completion, the maintenance department handed the equipment back to the production department for commissioning. The operator from the

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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	✓ Ensure that all work permit assigned to this pump is signed off.	1
2.	PPE	✓ Ensure that the proper protective equipment is worn before any equipment is started up	1
3.	Hazards (Chemical Oil Spills)	✓ Ensure that all hazards in and around the pump be removed e.g. ensure that there is no debris left behind as a result of maintenance activities or during installation	1
4.	Priming	✓ For reliable operation, pumps must first be primed; that is, air or gases expelled from the suction and impeller eye area and replaced with liquid.	1
5.	Drain Valve	✓ The drain valve is a very important valve in the process of starting up an equipment. Ensure that the pump drain valve is closed before opening the inlet valve of the pump.	2
6.	Suction Valve line-up	✓ Open suction valve of the pump slowly to bring fluid flow to the impeller and fill the volute of the centrifugal pump.	1
7.	Discharge Valve line-up	✓ Open discharge valve of the pump slowly and bring the pump under pressure.	1
8.	Lubricating Oil System	✓ The lubrication system of all bearing points must be check.	1
9.	Cooling water system	✓ Cooling water inlet and outlet must be opened to pump bearings	1
Total marks			10

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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?** ✓ to ensure that the raw material is of the right quality samples need to be taken as prescribed by the standard operating procedure and analysed. The results are then checked against minimum requirements. ✓ Since the material comes from tank farm it is the responsibility of the operator to communicate with the responsible person at tank farm to confirm the availability of raw material before starting the plant. The operator must communicate what quantity of raw material is required for the process. **(3 marks each)**	6
2.	**Before the transfer of product from tank farm, what are the necessary step to be taken by the operator.** ✓ Ensure that the plant is ready to receive the product. ✓ Ensure that the request for transfer of material has been completed/signed off. **(1 mark each)**	2
3.	**Since the separation unit depends on heat, what would be the consequence if the pressure of the steam drops below 5bars?** ✓ Since the products are separated by application of heat, Steam can be used to achieve separation. ✓ Some of the light components that are supposed to exit at the top outlet will revert back with the bottom flow output and more purity on the overhead stream will be achieved at the expense of low overhead stream production	2

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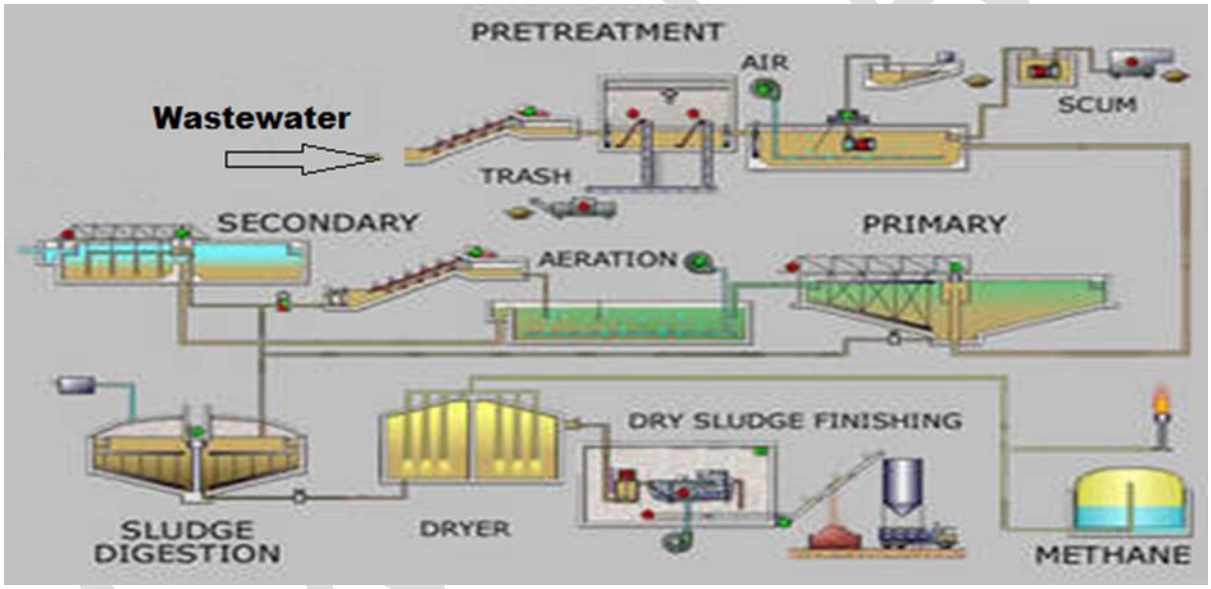
	Total Marks	**10**

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.



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.

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Resources	Upstream Consequences	Downstream Consequences	Mitigation Actions	Marks
1. Wastewater • **High flow of wastewater.**	When the flow is high on the pre-treatment stage (upstream) a). there will a high volumn of soli accumulating resulting in a quicker blockage of screens. b) odour nuisance will result in environmental pollution.	When the pre-treatment is overflowing, large solids will be carried over into the primary stage resulting in blockages and contamination of the sludge.	Redirect the excess flow into a reservoir for storage to be pumped on a later stage.	**5**
2. Power • **No power**	Power is lost during the running of the Water treatment Plant and this may cause powered equipment in the upstream will not to be functional. Therefore the screening process will not take place.	The secondary stage will not receive any water as a result of malfunctioning equipment from upstream, resulting in equipment damage or blockages	There should be stand by power supply generators/UPS to back up the plant.	**5**
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.** ✓ This is a product that meets specifications set out for it.	**2**

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2.	Explain what impacts an incorrect sampling technique can have on product quality"? ✓ Incorrect sampling techniques will yield incorrect undesired results. Based on these, wrong plant decisions will be undertaken resulting in production loss. ✓ When incorrect sampling technique is used, contamination will occur affecting the product quality. ✓ ✓ .	**4**
3.	**How would you check the quality of a product in a process?** ✓ Compare analysis results to the quality standard set out by the plant. ✓ To know if the product is produced according to specification, the analysis should be compared to the quality standards of the product. ✓ When some of the product specifications measured in the samples are not the same as the quality standards, non-conformance has occurred, and corrective action must be taken before the start of the process. ✓ **Aesthetic properties such as colour/smell can quickly pre-determine your product quality.**	**4**
4.	**What factors would contribute to the production of a non-conforming product and how can these factors be mitigated?** ✓ The quality of the raw materials and ingredients used in the manufacturing process has a major influence on the quality of the final product. If we are using poor quality raw materials or ingredients, we will never manufacture a good quality final product. Therefore, the raw materials and ingredients must always conform to quality specifications. This is ensured by testing and inspecting the raw materials and ingredients in accordance with quality control procedures	**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.

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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.

No	Question and Answers	Marks
1.	**Use the standard operating procedure provided to perform a start-up sequence.** ✓ Ensure that the proper PPE is used for the Start-up ✓ Ensure correct line up of valves ✓ POWER UP the plant via the key switch turn ON the plant LOCAL and REMOTE boxes and observe the System ON green light turn on. ✓ To operate the plant on local panel, select local operation in the control room ✓ Observe the RED light on the LOCAL control station coming on. ✓ For remote Control Station turn ON the computer via the Computer ON/OFF switch and observe the computer screen turning on. ✓ Start the compressor and allow pressure to build up to 2bar minimum in order to be able to supply all pneumatic equipment, this should take 4-6 min. ✓ Then switch on the pump that is in line with the valve line up. ✓ Check the pressure gauge on the discharge line it should read 3-4bars ✓ check the flow meter the flow rate should be 8-9l/min ✓ Check the pressure difference across the pressure filters it should be 1.5bar ✓ Close the by-pass valve on control valve CV1 ✓ There should be flow going through the cooling tower. ✓ Now close the by-pass valve for control valve CV2. ✓ There plant is now fully operation. **(Two marks each)**	30
	Total Marks	**30**

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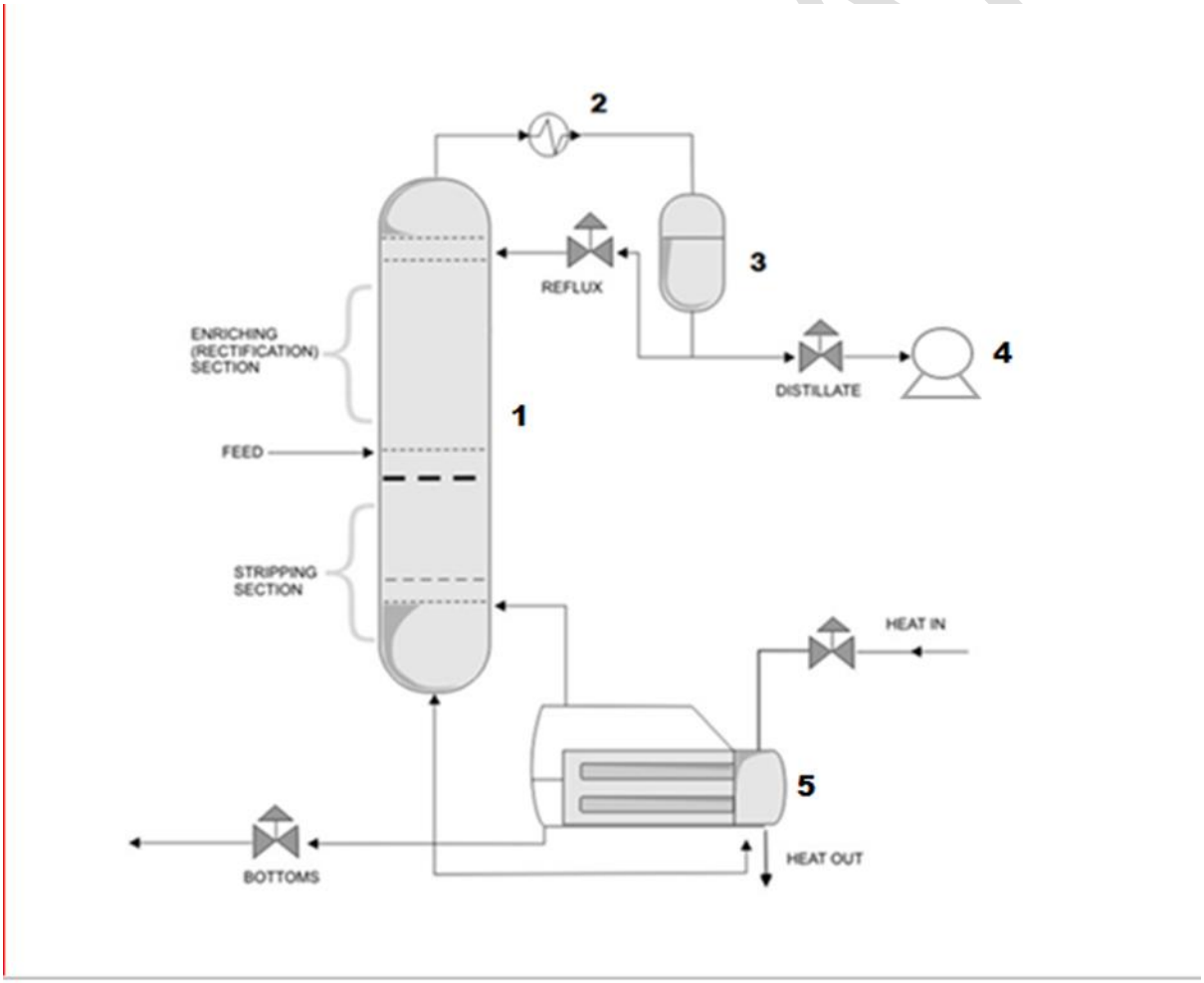
1.1.6 Identify plant equipment and its operational purpose.

(25 Marks)

1.1.6 Case Study
Allocate Five marks to Numbers 1,2,3, 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 equipment in the diagram below and give the operational purpose of each. (Marks 25)



No	Questions and Answers	Marks

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1.	**Column/ Distillation tower** The column is known as the distillation tower. Separation of the various products is achieved in this section. Distillation is a separation of two chemical with different initial boiling point through the application of heat. This tower is made up of two Section namely: ✓ **Enriching Section** The section of the column above the feed point is known as the enriching section **Stripping Section** ✓ the section below the feed is known as the stripping section	5
2.	**Reboiler** The reboiler heats the liquid product that is taken out at the bottom section of the tower to the desired temperature and then vapourises part of it to be returned as boil up. The heating medium in the reboiler may be steam or fuel.	5
3.	**Condenser** The overhead vapour from a distillation column usually must be cooled and condensed so that the product can be drawn off as liquid. Most importantly the reflux into the column should also be liquid. The condenser is a necessary component in distillation processes to help achieve this goal.	5
4.	**Reflux drum** Product that has been cooled down in the condenser is collected in this drum. From here a certain part is redirected as reflux to the top of the tower, while the rest is run-off (the final product). The reflux drum is important for storing a certain amount of distillate. This helps to	5
5.	**Pump** The pump is an auxiliary piece of equipment necessary for transportation of liquid from one location to another, especially the bottoms and the condensate. In large commercial columns, the accumulator cannot be fixed on the column next to the overhead outlet because this would prove uneconomical and difficult to support the tank. Instead the liquid must be pumped up to the reflux feed point at the top of the column.	5
Total Marks		25

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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 Plant operator 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
Temperature Indicator – TI_102 30°C (normally 35°C)
Pressure Indicator – PI_102 1.9 bar (normally 2.8 bar)

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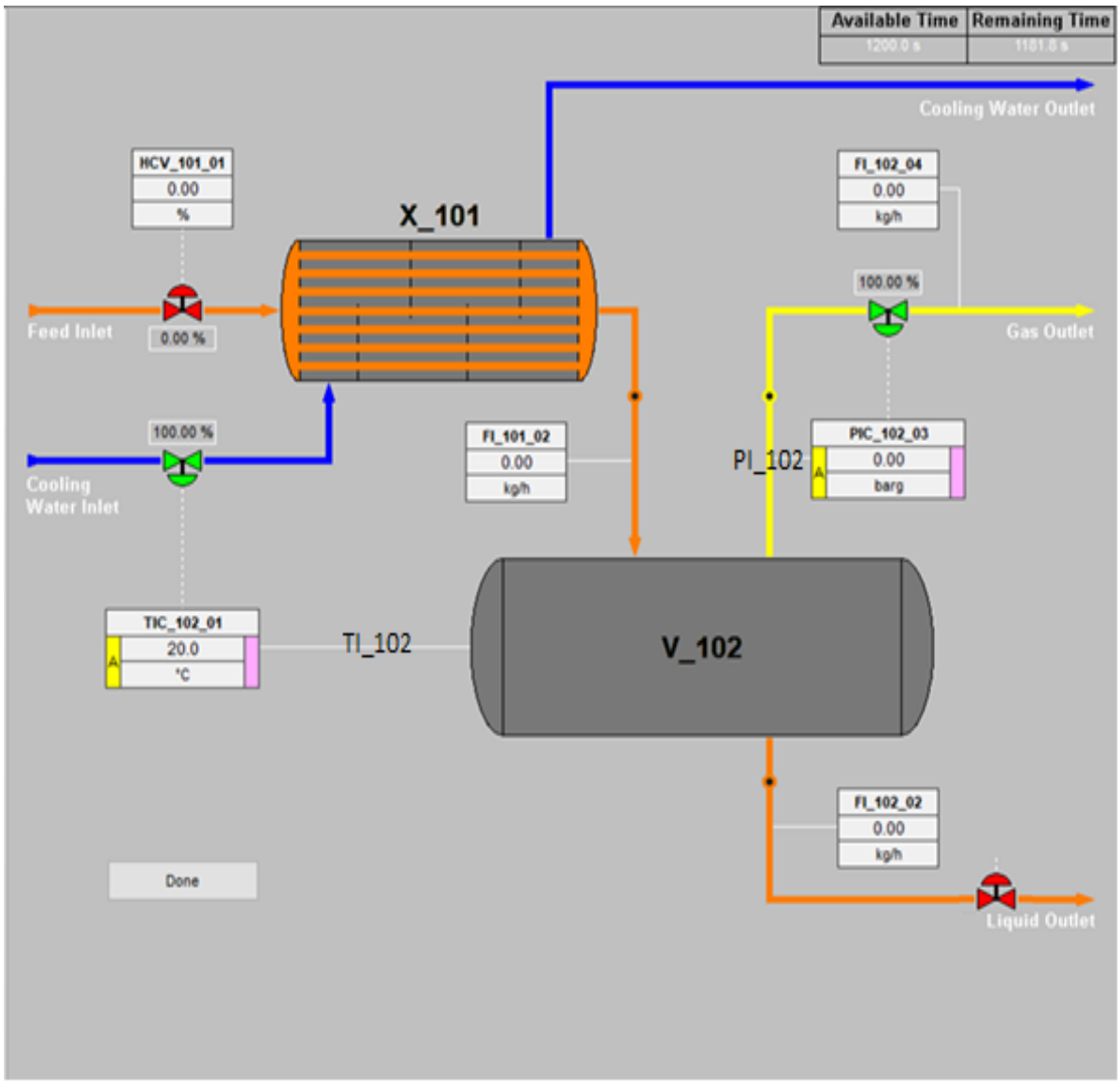

No	Questions and Answers	Marks
1.	**What is the relationship between temperature and pressure and how would you use that principle to ensure plant efficiency?** ✓ Pressure is directly proportional to temperature ✓ When the pressure increases temperature also increases ✓ Since the vessel needs to be maintained at a specific temperature to achieve the desired composition, the pressure also needs to be maintained at a specific set point.	8

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	✓ This will result in product non-conformance **(2 marks each)**	
2.	**Considering the information given above, how would you adjust the following operating parameters to ensure plant efficiency?** **Assuming the following** **Temperature Indicator – TI_102 30°C (normally 35°C)** **Pressure Indicator – PI_102 ___ 1.9 bar (normally 2.8 bar)** **TOP Product Composition 60% (normally 70%,)** ✓ From the data collected it is clear that the temperature has dropped from 35°C to 30°C and the pressure also dropped from 2.8 bar to 1.9 bar ✓ This resulted in our top product composition of 60% instead of 70%. ✓ Adjustments needs to be made to return the process to its normal operating parameters which are temperature of 35°C and a pressure of 2.8 bar ✓ Since the feed is passing through the heat exchanger, we can reduce the amount/flow rate of coolant to increase the temperature of the feed before it goes into the separator. ✓ The temperature in the separator is also affected by the exit streams if the exit flow is too high the pressure in the separator decreases thus affecting the temperature in the separator. ✓ Therefore, we should also decrease the gas exit flow rate from the separator to try and regulate the pressure this will result in increase in the temperature. **(2 marks each)**	12
3.	**Explain how the temperature in the vessel is monitored.** ✓ Temperature will be sensed and monitored by TT 102 inside the vessel. ✓ Looking at the above diagram you can see the control loop TIC102 that controls the temperature in the vessel. ✓ There is a temperature sensor that measures the temperature inside the vessel then sends the information to the control valve on the coolant cooling water inlet valve. ✓ When the temperature is high the cooling water inlet control valve will increase the flow of coolant and when the temperature is low the control valve will reduce the flow of coolant. ✓ PIC 102 also needs to be monitored to ensure that there is no disturbance in vessel. (2 marks each)	10
	Total Marks	**30**

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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.

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.

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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.

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

Time	Equipment	Condition	Action
07:25	Reactor	Plant handed over from night shift in "boxed up, ready for cold start" condition.	N2 purging of reactor started with opening F1605 purging valve.
07:30 – 07:55	Whole plant	Pre start-up purging routine running	Pre start-up plant inspection according to SOP 113(a)
08:03	Line 1607 vent valve	Purging routine still running	Flammable gas test, SOP 124(c)
08:09	None	Plant ready for start-up	Communicate "ready to go" plant condition with Control Room Operator Hlapo
08:11	None	Plant ready for start-up	Go ahead with start-up received from Control Room Operator Hlapo
08:15	Feed Pump	Pump started and running smoothly	Pump Pressure gauge inspected and within operating parameters
08:16	Reactor Recycle loop	On recycle, 15m3/h	Check
08:20	Reactor	Pre-heat, 110 deg C	Check
08:30	Reactor	Pre-heat, 120 deg C	Check
08:35	Reactor	Pre-heat, 122 deg C	Go ahead with feed inlet received from Control Room Operator Hlapo
08:40	Reactor	Ready to receive feed	Crack open feed block valve
08:40	Reactor	TI 1601 = 115 deg C	Check

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08:57	Reactor	TI 1601 = 124 deg C	"Full feed" go-ahead received from Control Room Operator Hlapo. Feed valve fully opened
09:17	Whole plant	Normal running conditions	Complete normal running conditions checklist, SOP 105(a)-(g) and log.
Comments: 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.			

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

(40 Marks)

2.1.3 Case Study
Allocate ten mark from Number 1 and 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.

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No	Question and Answer	Marks
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.** ✓ On Monday morning during routine inspections, Pieter discovered a seal leak on PC101. ✓ He immediately reported it to the panel operator through radio communication and noted it in the shift logbook. ✓ The Outside Senior Process Controller was aware and gave his comments as this was not a serious leak. ✓ During shift handover Pieter did inform his colleague of the leak. ✓ During Moses shift the incident took place where the system was shut down because of the explosion caused by the leak on PC101. Conclusion ✓ Shift handover was done correctly and there was proper communication within the team. ✓ Inspections were done as they did identify the leak, however the correct decision was not taken as this could have been avoided. ✓ Therefore, the SOP was not followed to the teeth. ✓ If the pump was leaking, they should have commissioned the standby pump and isolated the pump until repairs could be done.	10
2.	**Main causes for this incident** **a) What was the cause of the explosion e.g. utility failure?** Chemical leak from a centrifugal pump and decision making. There are many reasons for the seal to fail namely: ✓ **ALLOWING THE PUMP TO RUN DRY** Allowing your pump to run dry can be very damaging to a mechanical seal. Under the right conditions, mechanical seals can experience thermal shock and shatter within 30 seconds or less. ✓ **VIBRATION** Pump vibration is caused by pump imbalance, improper alignment, operating the pump too far to the right or left of the BEP (Best Efficiency Point) on the performance curve, etc. Vibration hurts your equipment and can result in damaged seals and shortened seal life. ✓ **HAMMERING COUPLINGS ONTO THE SHAFT** When it comes to pumps, hammers are not friends! Mechanical seal faces can be very fragile. Pounding couplings onto the shaft will damage the mechanical seal. ✓ **OPERATOR ERROR/SOP non-conformance** Skipping initial start-up procedures and installation errors are a big factor when it comes to mechanical seal failure. Improperly starting the pump can cause the	10

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	motor to trip and the shaft to twist causing orbital movement, resulting in internal parts contact, seal failure, and shortened bearing life. Improperly installing the mechanical seal will cause damage to elastomers (o-rings or boots), along with a wide variety of other issues, as pictured to the right. Mechanical seals can be very sensitive because the faces are incredibly flat. Even a small amount of dirt or oil, even fingerprints, can cause the faces not to align. **b) Determine the extent of the explosion** The System had to be shutdown, due to this the company is losing money for every second that the plant is off. This would also impact the upstream and downstream units and could cause them to shut down as well or reduce loads.	
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** a) The incident happened during night shift, the senior manager on standby for production and maintenance had to be notified. b) After the investigation Pump PC101 must be made safe for maintenance. There is a shutdown checklist utilized by the panel operator to ensure standard operating procedures are followed. Make sure that the proper PPE is being used Remove all hazards in the area or obstruction in the area. Close all inlet valves to the pump. Close all outlets valves to the pump Close inlet and outlet of cooling water system Follow electrical isolation of the pump. Notify the relevant department that the pump is safe for maintenance c) The following steps must be taken to ensure a proper plan is in place for maintenance of PC 101. a) **A comprehensive list** or a checklist with every piece of equipment involved for the maintenance b) **Have it in inventory**. Ensure that all replacement parts, accessories and rebuilt equipment are in stock before the shutdown. The last thing any team needs is to have staff on hand to conduct maintenance, replacements and new installations only to be held up waiting for rebuilt equipment to return from a shop. c) **Safety first**. Safety should be the top priority during any outage. Before beginning work, all lock out/tag out (LOTO) procedures should be followed and personnel must wear all required personal protective equipment (PPE) d) **Within current specifications**. Double check that all equipment (new and rebuilt) is within current operating parameter specifications. When assets	12

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	were specified, they met the requirements of the process at that time. Condition changes, such as fluid temperature, flow requirement or process fluid pH must be considered. Different parts or different equipment may need to be used. e) **Inspect before installation**. Personnel should inspect all equipment before anything is installed; look for wear or damage. Installing new components into a worn piece of equipment is almost always counterproductive. Demise of the new components begins immediately. f) **Precise installation**. While this step seems obvious, improper installation happens all the time. Reliability begins with the asset selection and correct installation. If installed imprecisely, failure begins at start-up. g) **Inspection before restart**. The plant team should give everything one more look before restarting the plant or process. Even when every step is taken and every job plan is followed, stuff happens. A motor is bumped during work on another piece of equipment, causing misalignment. Housekeeping staff accidentally hits a piece of equipment. A wrench left on an asset may have fallen.	
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.** a) Once repairs have being completed a clearance of operation for the equipment worked on needs to be signed off by the required disciples to confirm completion of the jobs by a Senior Manager and that they give a go ahead for commissioning. (2 marks) b) The checklist for commissioning the equipment will be utilized by the panel operator to ensure the plant is started up according to safe operating procedures. Ensure the proper PPE is used for the start-up. Follow pre-start-up safe operation procedure. Follow start-up safe operating procedure. Monitor the equipments until all is working according to parameters Notify the panel operator that the pump is fully in commission. (six marks)	8
Total Marks		40

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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 conations have been achieved, why is it important to conduct a plant walk about?** ✓ Check plant safety Check safety of equipments ✓ Environmental aspects Checks for leaks and spillages Check plant for gas emissions Check energy wastage Check to ensure noise levels are within limits ✓ Monitor process variables Checking and comparing variables to control limits. Comparing equipment settings and operations to norms. ✓ Monitor product quality Check key risk areas for contamination Check product analyses and compare to control limits ✓ Monitor plant integrity Monitoring plant mechanical integrity Monitoring plant electrical integrity ✓ Good house keeping Checking to ensure everything is in place Cleanliness and tidiness Stacking and storage of materials ✓ Reporting deviations and taking corrective action	20
Total Marks		**20**

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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 from 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.

Most companies' stock sales were hard hit during the Year 2020 ending and the major cause was Covid-19. Cracks are beginning to show and as one notices table A below, there is the large error margin on demand forecasted production and not sure if the Year 2021 will it yield better results or be worse.

Below is Yearly Octene Production Sales beginning from 2017 until 2020. Actual Octene Production demand is compared to Octene Production demand forecast.

Table A					
Yearly Octene Sale – Actual Demand VS Demand forecast (Tons Production Per Year)					
	Year2017	**Year2018**	**Year2019**	**Year2020**	Total
Octene Production (Tons) y1	**85**	**95**	**110**	**120**	410
Actual Demand (Tons) y1	**80**	**90**	**105**	**110**	385
Demand Forecast (Tons) yt^+	**85**	**95**	**100**	**120**	400
Absolute Error % (abs [y1 – yt^+] * 100%	**6.3%**	**5.5%**	**4.7%**	**9.1%**	25.6%
	0.063	**0.055**	**0.047**	**0.091**	0.256
MAD					? (A)

Table B

Forecasting Error Analysis January			
Year	Actual Data (Y1)	Forecasting (yt')	(|Y1- yt'|)
2017	45.3		a
2018	47.2		b
2019	44.2		c
2020	43.1	44.3	d
Total	**179.8**		**e**

Table C.

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In the below example, a company starts the month with 220 of stock quantity. According to records, initial stock inventory of 220 items on the 1st of August 2020, and Sale and Purchase Units (stock replenishment) figures are also recorded.

	Quantity Change	Actual Unit Cost ($)	Actual Unit Cost ($)
Beginning Inventory (1st Aug 20)	**220**	**40**	**8800**
Sale	**-160**	**–**	**–**
Purchase	**120**	**45**	**5400**
Sale	**-190**	**–**	**–**
Purchase	**70**	**35**	**2450**
Ending Inventory (31st Aug 20)	**60**		

No	Questions and Answers	Marks
1.	**a) Table A - Calculate MAD (i.e. Mean Absolute Deviation)** **b) On Table B - Calculate MAPE (i.e. Mean Absolute Percentage Error) and the corresponding a-e values** **Given the formulas,** **MAD = ∑|y1– yt'| / n; with 'n' representing the number of year production.** **MAPE = (∑|Y1– yt'| / y1)/ n) * 100** From Table A MAD = (0.256)/4 = 0.064 (6.4 %) From Table B MAPE = [(5.2/179.8)/ 4)] * 100 = 0.72% Answers for a – e values Forecasting Error Analysis January Year / Actual Data (Y1) / Forecasting (yt') / (|Y1- yt'|) 2017 / 45.3 / / 1 2018 / 47.2 / / 2.9 2019 / 44.2 / / 0.1 2020 / 43.1 / 44.3 / 1.2 Total / 179.8 / / 5.2 **(10 marks. i.e. 4 marks for MAD and 6 marks for MAPE)**	10
2.	**Question from Table C** **Given: Formula to calculate:**	6

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	A. Weighted Average Cost (WAC) per unit = Cost of Goods Sold ÷ Units available for sale. **B. COGS = Costs of Goods Sold * WAC** **Alternatively, COGS = Beginning Inventory + Purchases made during the period – Ending Inventory** **Using Table C values, calculate weighted average cost (WAC), the inventory valuation cost at the end and Cost of Goods Sold (COGS)** **Answer:** **The actual total cost for the inventory is $16,650 ($8800 worth of beginning inventory + $7,850 worth of purchased subsequently)** **The total inventory units are 410 with a beginning stock of 220 and 190 (120+70) stock purchased later.** **The weighted average cost per unit is $16,650/ 410 = $40.6** **The inventory valuation at the end is 60 units x 40.6 WAC = $2436.** **The COGS is $14,210 (350 nos. x 40.6 WAC.)** **Both of these amounts total to $16,646, which is nearly equal to $16650 (the actual cost of beginning inventory and subsequent purchases) when rounded off.**	
3.	**Plant X business uses the calendar year to record their inventory. The beginning inventory was recorded on 1st January 2020 and the ending inventory was recorded on 31st December 2020.** **The beginning inventory cost was R20,000. While the sales were on, the retailer realized that the business might need an additional inventory worth R7,000. At the end of the calendar year, the ending inventory proved out to be worth R4,000. Calculate the cost of goods sold for the entire year.** **Answer** **Using the given formula above:** **COGS = Beginning Inventory + Purchases made during the period – Ending Inventory** **COGS = R20,000 + R7,000 – R4,000** **COGS = $23,000**	4
	Total Marks	20

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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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