Performance Based Objectives – Process Technology

Process Technician practical skills expressed as PBO's

Target Audience: Process Operators

At the completion of the coursework, the Process Technology student will be able to:

PBO No.	Performance Based Objective	Course No.
PT 1	Demonstrate ability to transfer/convert measurements between metric and English scales including millimeters, centimeters, meters, kilometers, and inches, feet, yards, miles. Scales may include fractional numbers, decimals, whole numbers or a combination of 2 or more (e.g.: 12' 5" converted to meters)	1
PT 2	Demonstrate ability to convert any volumetric measurements (pint, quart, gallons, barrels, liters) over a given unit of time (sec, minute, hour, day, shift, day, week, month, year) to any mass measurement (ounce, pound, ton, gram, kilogram) over a given unit of time – and vice versa.	1
PT 3	Demonstrate ability to measure, calculate, and convert between any of several pressure scales including PSIA, PSIG, Absolute, Atmospheric and Vacuum.	1
PT 4	Demonstrate working knowledge of liquid head pressure and how it is calculated at varying specific gravities.	1
PT 5	Demonstrate ability to measure temperature and convert between Celsius, Fahrenheit and Kelvin scales.	1
PT 6	Demonstrate ability to troubleshoot using P&ID drawings for a control loop and a process upset. By utilizing process drawings, demonstrate ability to predict process changes upstream and downstream of a specific problem within the process.	4
PT 7	Demonstrate ability to take field temperature and flow reading of an operating heat exchanger and calculate heat consumption by using the BTU formula (or $Q=MC\triangle T$)	2
PT 8	Understand field installed manual gauges (temperature, pressure, level) by being able to read their numbers, understand the scale that	3

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	they are using and express this number as a percentage.	
PT 9	Demonstrate ability to trace a process line from a designated piece of equipment (origin) to any peripheral equipment that it is connected to. This should include runs of varying elevation, wall or floor penetrations, and those lines that run closely with other process lines.	1
PT 10	Startup and shutdown a process pump (electric and pneumatic) after first establishing a flow path by opening the proper valves to the intended destination/tank. Pump cannot be deadheaded when starting up and should be shutdown with all fluids evacuated (starve-choke-kill method) (written exercise). Identify centrifugal vs positive displacement type pumps in the field (textbook reference) and the type (if appropriate). Recognize pressure relief devices installed to protect pumps from unwanted pressurization both in the field and on P&ID drawings (written exercise). Identify 3 types of impellers (open, closed, semi-closed) in use with centrifugal pumps (textbook reference).	1
PT 11	Demonstrate ability to open or close process valves (ball, plug) without causing water hammer or over-pressurization of process lines. Also in a system of multiple valves, a demonstrating of a proper open/closing order should be shown in both upstream and downstream applications of a pump recently secured, or for a pump that is about to be started up.	1-7
PT 12	Demonstrate the correct opening of a process line by first eliminating any hazards related to process chemicals or pressure (block/bleed/drain). Identification of all possible hazards should be demonstrated. Proper body positioning and loosening of bolts away from operator should be demonstrated. Proper tool use of wrenches (bolts), flange tool, and pipe wrenches (pipe) should be demonstrated (written exercise). Demonstration of (loosen 3 / remove 1) for gasket change and (loosen	1-7

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	1 / remove 3) inspection/cleaning of 4 bolt flanges should be completed (written exercise).	
PT 13	Demonstrate ability to disassemble a double diaphragm pneumatic pump (Wilden type) that is clean and on a benchtop by using proper tools and proper tool use. Ability to identify and inspect key working parts and assembly to "Return to Service" condition to complete exercise.	1
PT 14	Demonstrate proper recordkeeping by applying GLP standards to all field data entry records including SOP's, Runsheets, Logsheets, Lab Analysis Logs and any other data collection/retention forms (safety checks, PM sheets, etc.)	1-7
PT 15	Demonstrate the safe handling and transportation of steel drums, fiberpaks and polyethylene drums at empty, ½ full and full levels. This includes proper tightening of lids/bungs, the ability to safety transport from one point to another with and without the help of a drum cart.	4-7
PT 16	By following proper LO/TO standard, plan, prepare, isolate, of perform the control of hazardous energy for a designated piece of equipment or in-situ process equipment (instrument, valve, pump, etc.).	2-7
PT 17	Demonstrate ability to take a lead role within a process work group including leading "pre task planning", assigning roles, conflict resolution, critical thinking skills, and overall responsibility for compliance of team and team performance.	4-7
PT 18	Given a process drawing, demonstrate the ability to assemble a piping structure, with varying types of fittings and sizes of pipe. Student should exhibit proper body positioning, tool usage, and use of Teflon tape on threads.	1
PT 19	Demonstrate ability and understanding of the putting online or taking offline of a redundantly installed process unit (pump, heat exchanger, filter).	4-7
PT 20	Demonstrate safe handling of live process steam (25#, 50#, 150#, 400#) by utilizing correct PPE, field tightening of valve packing,	1-7

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	checking steam traps for plugging and stowage of hoses.	
PT 21	Demonstrate proper lifting and transportation technique for process equipment exceeding 50 lbs. This should include objects of odd shapes/sizes (bags of resin, pipe) and student should seek out clear path of travel, use legs and not back, use proper hand protection and never put back or co-workers at risk.	4-7
PT 22	Demonstrate ability to perform typical technician PM tasks such as filling grease zerks, tightening packing on a valve and/or pump, and liquid/gas leak detection on/in process equipment.	1
PT 23	Manually manipulate field installed hand valves of all types without causing water hammer (written exercise). Proper body positioning should be demonstrated and each type of valve should be identified (ball, gate, globe, plug, butterfly) Field identification of an automatic (pneumatic) valve and its key components (textbook reference). Demonstrate proper troubleshooting technique for a pneumatic automatic valve by checking for airflow through regulator, checking solenoid for open/close when signaled, checking solenoid for airflow once opened, and checking the operation of valve (open/close) if airflow is supplied (written exercise). Identify fail open vs fail closed valves in field by removing air supply and observing valve stem movement. Demonstrate working knowledge of air fittings by removing and re-installing brass ferule on pressurized poly-tubing and by hand tightening (no tool use).	1-7
PT 24	Demonstrate check valve operation and direction of flow. Where these are required, different types (ball, inline, swing), and how each are designed to perform.	1
PT 25	Properly open and shutdown process steam lines, including inline steam traps. Student should be able to safely valve in live process steam and troubleshoot inline steam valves for proper operation. A thorough understanding of thermal expansion and the vapor/liquid	2-3

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	phase of process steam is required.	
PT 26	Demonstrate ability to identify field installed piping (316 stainless, carbon steel, aluminum, conduit, PVC, Inconel, hastelloy, titanium) entirely by sight.	1
PT 27	Demonstrate ability to identify sensing devices in the field (pressure, flow, level, temperature) by sight, and by their field label. Student should be able to transpose these (identify) on the process drawings (P&ID).	4-5
PT 28	Install a flexible steel (braided) line for transfer from a process pump to designated vessel. Demonstrate ability to successfully pressure check after sealing all joints with Teflon tape. Demonstrate ability to identify and stop leaks (plant air) by using proper leak detection methods (Snoop bubbles, listening, etc.) Perform transfer and gas purging of line to evacuate any liquids.	6-7
PT 29	Demonstrate ability to safely disconnect/reconnect 110v and 220v process equipment. This includes switchgear/breaker switches, use of field switches in disconnect and testing of electrical equipment before safe work can begin.	3

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PT 30	Identify in the field the hardware commonly used in the process industry: Plugs, caps, elbows, unions, tees, 4 ways, snubbers, pigtails, reducers, pipe nipples, couplings, bushings, swedges, y-strainers, blanks, orifice plates, gaskets, blank flanges, steam traps. Equipment: condensers, shell and tube heat exchangers, filter housings, agitators, electrical cutoffs. Instrumentation: transmitters, transducers, field gauges, RTDs, thermocouples, DP cells, flow indicators, level indicators, controllers, mag flow meters, micromotions, level devices, bubblers. Pump related parts: impeller types (closed, open, semi-closed). Positive displacement pumps vs centrifugal type pumps. Manual valves: (ball, check, gate, globe, butterfly, knife, plug, diaphragm, pop) All types of pipe connections: (welded, glued, bonded, screwed, flanged). Different types of lines: P-tubing, flex (braided) hose, process lines, conduit, air hoses, steam hoses, nitrogen hoses, vacuum hoses, water hoses.	1
PT 31	Using programming logic, demonstrate ability to troubleshoot a non-operable automatic valve. Using programming logic, demonstrate ability to troubleshoot a non-operable pump.	3
PT 32	Demonstrate process for starting up a cold distillation column Demonstrate process for putting a running distillation column into full recycle Demonstrate process for shutting down a distillation column	5
PT 33	Demonstrate understanding of P&ID drawings by valves, pumps and instruments represented on the drawings to actual hardware in the field. Utilize process drawings to explain flowpaths of designated process lines including origin, flow direction and destination.	7

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PT 34	Demonstrate understanding of T by using BTU formula, with process flow information, to calculate heat consumed by a process heat exchanger.	2
PT 35	Demonstrate ability to safely sample a live process stream Proper methodology, PPE and labelling. Correctly checking for excess pressure, contamination or other hazardous conditions that may exist.	7
PT 36	Calculate the mass balance of a continuous train distillation column with varying compositions of feed material. Calculate the mass balance of a continuous train distillation column given various output ratios and multiple cuts.	2
PT 37	Demonstrate ability to safely insert/remove a blank in a process line for energy isolation. This includes safe release of hazardous energy prior to line opening and proper technique for labelling of blank once installed.	3
PT 38	Demonstrate understanding of inline process check valves, how they work and how to determine flow direction. Identify different types of process check valves and when each are used in a chemical process. Demonstrate ability to safely disassemble, clean, inspect and re-assemble any type of process check valve.	1
PT 39	Demonstrate understanding of process safety devices by identifying in the field and being able to describe their function and purpose. These include frangibles (rupture disks), pop valves, explosion panels (powder processes). Describe how to troubleshoot each device in the field as well as typical process alarms that are associated with them.	4
PT 40	Calculate energy balance of an operating distillation column by totalizing all BTU's used to heat and vaporize product (electric or steam sources) and finding the difference from BTU's utilized to condense the product.	2

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PT 41	Demonstrate understanding of 4-20 mA and 3-15 psi process signals Convert any of the above signals to a process value given a range Be able to convert between above signals, fractions, decimals, % and CFV (current field values). Given a CFV, calculate its process signal value in psi or mA.	3
PT 42	Demonstrate understanding of history displays by determining correlation between designated process variables. Demonstrate ability to predict future performance by utilizing history displays and identifying trends and patterns. Relate past performance, current field condition, and predict future performance based on history displays.	6
PT 43	Demonstrate knowledge of programming logic by using logic statement to solve process problem (inoperable pump, valve, etc.) Write basic logical statement utilizing OR, AND and XOR. Identify types of alarms used in the process industry and why a "not" statement is used. Write program logic for digital and analog process equipment.	3
PT 44	Use the 7 step troubleshooting methodology to solve an abnormal process condition. Identify, prioritize, test, verify, correct and record route to solve problem.	4
PT 45	Demonstrate proper use of PPE by properly donning and proper disposal after use (contaminated vs non-contaminated). Demonstrate correct selection of PPE for specific task/hazard including gloves, respirator, eye protection, and clothing.	1-7
PT 46	Demonstrate ability to calculate liquid volume in a vertical cylindrical tank given ($5.87518 \times L \times D^2$) Demonstrate ability to calculate liquid volume in horizontal cylindrical tank given ($D^2 \times L \times 5.87518$) Demonstrate ability to calculate liquid volume in a spherical tank given	5

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	(D^3 X 3.91679) Determine tank innage and outage values in any type of tank given % of liquid volume.	
PT 47	Demonstrate ability to read a field installed PSI gauge and convert this value to liquid height (2.31/ft X 1 psi (specific gravity of water = 1.0). Determine head of liquid if a change in specific gravity is present. Predict PSI value when given liquid head height (at any specific gravity).	4
PT 48	Plot process data on a SPC chart for a given period of time and magnitude. Explain trends in data and why any deviations from setpoint. Demonstrate understanding of Setpoint, UCL and LCL	6
PT 49	Demonstrate ability to communicate in writing, electronically, verbally and by using any of several media including signage, hand signals, lighting or color utilization.	2
PT 50	Identify hand tools in both SAE and metric sizes. Demonstrate when each is appropriate and how to ensure tool fits properly onto item to be tightened/loosened. (sockets, machined wrenches, allen wrenches). Demonstrate appropriate adjustment and use of pipe wrench on cylindrical pipe. Wrench must not slip and scour pipe and user must position themselves so as not to become injured if wrench slips or object loosens quickly. User must also not put hands in jeopardy due to movement wrench and should demonstrate best body positioning in regards to strength and back health (written exercise). Demonstrate use of slip joint pliers (channel locks) in a safe manner. For use only with cylindrical objects and proper adjustment of jaws to fit object should be exercised. Demonstrate proper use of machine faced tools (end wrenches, allen wrenches, sockets) with machine faced objects (nuts, bolts) (written exercise). Identification of correct tool (SAE or metric) and size so as to prevent any slippage should be demonstrated. Proper use of impact tools (hammers, chisels) should be demonstrated so as to be done safely and with appropriate usage (written exercise).	1-7

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	Demonstrate proper selection and usage of hand held screwdrivers (standard, Philipps, and torx) so as not to damage object or cause injury (written exercise). Demonstrate proper use of flange tool in the loosening or re-aligning of 4 bolt flange. Proper body positioning and operational knowledge of tool should be identified (written exercise).	
PT 51	Identify and assemble screwed pipe fittings by using pipe fitting tools properly. Demonstrate sealing of pipe threads by properly installing Teflon tape to threads before tightening fittings (written exercise).	2
PT 52	Identification of all possible hazards should be demonstrated. Proper body positioning and loosening of bolts away from operator should be demonstrated. Proper tool use of wrenches (bolts), flange tool, and pipe wrenches (pipe) should be demonstrated (written exercise). Demonstration of (loosen 3 / remove 1) for gasket change and (loosen 1 / remove 3) inspection/cleaning of 4 bolt flanges should be completed (written exercise).	1-7
PT 53	Demonstrate proper installation of thread sealing tape while wearing PPE (written exercise). Wrap in correct direction (with threads) and with no overlap that would shear off and become entrapped in process line/equipment.	1
PT 54	Demonstrate the proper tightening of packing gland on a field installed gate valve so as to prevent leaking, while using proper hand tool and safety techniques (written exercise). Discuss amount of packing that remains and how valve would be isolated if removal would be warranted.	1
PT 55	Demonstrate the proper use of “flange tool” to aid in the opening of a loosened flange. Demonstrate the proper use of a “drift pin” to align a loosened flange and to aid in reassembly.	1
PT 56	Determine understanding of valve positioning by describing as “open” or “closed” only by observing the position of the handle.	1

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PT 57	Transfer liquid material from a standing drum by use of a drum pump into a designated vessel. Proper grounding of drum is essential. Transfer liquid material from a standing drum by use of a stationary process pump into a designated vessel. Proper grounding of drum is essential.	2
PT 58	Demonstrate knowledge of process line termination by inspecting line for properly installed plugs, caps and blank flanges before the transfer of materials.	1
PT 59	Perform a "pre-task" analysis of a designated task. Identify any/all hazards associated with a specific work area or specific task. Express measures that could be taken to reduce hazards. Describe what the process is if an emergency happens (evacuation, injury, leak/spill)	2
PT 60	Describe Behavior Based Safety, the important of positive reinforcement and demonstrate a proper "intervention" of a co-worker who is demonstrating an unsafe behavior.	2
PT 61	Describe the roles of a "First Responder" in a chemical plant.	2
PT 62	Discuss a LOPC (Loss of Primary Containment). What is the operator's role, what can be done to prevent them?	2
PT 63	Demonstrate understanding of SDS materials by explaining key terms, using to identify chemical physically, what PPE is required to handle and how it would behave in water (Specific Gravity in relation to 1.0).	2
PT 64	Describe what a "Confined Space Entry" is, what must be done to prepare for it, what are the 3 key roles and types of environmental monitoring that can be used to ensure safe entry.	3
PT 65	Demonstrate ability to safely secure, lift and relocate a piece of process equipment by using proper rigging techniques, body positioning and support techniques.	4
PT 66	Explain the difference between electrical "bonding" and electrical "grounding".	4

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	When/why is the purpose of each? What is the operator's role in maintaining each? Define/perform continuity check on a bonded piece of process equipment.	
PT 67	Demonstrate proper shutting down of equipment using a Hand-Off-Auto field switch. How is HOF switch used in LO/TO? Define/identify dangers to personnel and equipment	2
PT 68	Demonstrate a bumpless transfer on a PID controller by placing in automatic from manual control.	3
PT 69	Explain TDH (total discharge head), Static Head and NPSH (net positive suction head) in regards to process pump systems.	2
PT 70	Demonstrate understanding of purging and inerting with Nitrogen gas. What are the hazards? What can an operator do to improve safe operations in a plant where Nitrogen is used? What are the warning signs?	2
PT 71	Demonstrate sample analysis of process samples typical to process operators/technicians. (pH, Titration, %Solids, Viscosity)	6
PT 72	Perform a Hazard Recognition survey of a process area.	2
PT 73	Demonstrate proper use, testing and care of a plant floor safety shower and eyebath.	3
PT 74	Discuss acceptable practices regarding communication with other staff including (verbal, email, and written materials). Discuss workplace harassment and effective methods to report/communicate.	3
PT 75	Discuss "positive shift relief" Methods for coping with working rotating shifts (diet, sleeping,	5

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	exercise, social)	
PT 76	Demonstrate how a line tracing system works (steam or SR-1). How to detect leaks. Valving system in/out. Repairing broken line "in-situ". The environmental hazards associated with heat transfer fluids.	2
PT 77	Discuss RQ (reportable quantities) and first responder response to leaks and spills. Demonstrate a working knowledge of RCRA and the handling of all waste generated in a process plant (lab, office, PPE, chemical, sharps, product)	3
PT 78	Demonstrate an understanding of plant alert systems (audible and visual) in emergency situations (evacuation and assembly points). What is your role as an operator? What other roles are there in an emergency situation?	3
PT 79	Discuss respirator use, cleaning and disposal. How to choose the right filter for a given hazard What is the correct respirator (full or ½ face) Describe a breathing air and SCBA system. Describe the annual "fit test" and "fitness test".	2-4
PT 80	Demonstrate ability to remove contaminated gloves without any exposure to self.	1-7
PT 81	Describe the "4 routes of exposure" in regards to working with chemicals. What can you do to prevent each of the 4 types of chemical exposures? Locate exposure information within a SDS and recommended methods to protect from each type of exposure to said chemical.	1
PT 82	Demonstrate proper way to secure a ladder. Demonstrate proper way to work while standing on a ladder.	5

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	Discuss an "authorized" and an "affected" employee and what you can do to make an environment safe if working from a ladder.	
PT 83	Explain a "control loop" and each of its components (sensing device, transmitter, controller, transducer and final control element).	3
PT 84	Describe the 5 process variables (Pressure, Flow, Level, Analytical, Temperature) and how they interact with each other. Describe what happens to pressure when temperature increases and vice versa. Describe what happens to flow when pressure increases/decreases. Give several examples of "analytical" types of devices.	3
PT 85	Explain the difference between an RTD and a Thermocouple. Describe when each is applied in a process plant and what their limitations are. Identify a field installed application of each.	3
PT 86	Explain "Bernoulli's Principal" and how it is utilized to measure flow. Explain the interrelation between velocity and pressure within a process line.	3
PT 87	Describe a "floating roof tank", when is it used and how does it work. How is level measured with these units? What environmental concerns must be considered with these tanks?	6
PT 88	Describe a "dike system" for storage vessels. What firefighting methods are applicable? What is an operator's role in maintaining these dikes? What hazards are associated with Dike systems?	6
PT 89	Describe a "confined space". What 3 elements determine if it is a confined space? What safety concerns must be considered/allowed for when entering a confined space? What 3 roles are defined by OSHA in regards to a confined space entry?	4

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PT 90	Calculate the given area of a square or circle and compute PSI from given mass value (solid or gas). Determine the force exerted by a pneumatic valve given the size of the accumulator (bonnet) and supplied air pressure in PSI.	2
PT 91	Demonstrate ability to use current computer or PC technology including email, Excel, Microsoft Word, Powerpoint. Demonstrate ability to utilize search engine (e.g. Google) to research a scientific topic, being careful to recognize credible sources of information providers. Articulate information obtained online to address specific plant issue or problem.	7
PT 92	Explain environmental issue of today's chemical plants including those pertaining to air permits/discharge, waste water treatment, LOPC and RQ, and DOT.	6
PT 93	Explain the difference between pneumatic and electronic signals in process operations. What are the advantages/limitations of each?	3
PT 94	Demonstrate an understanding of the different types of air supplied to chemical plants and the applications of each type. Plant air Instrument air Breathing air HVAC	3
PT 95	Demonstrate an understanding of each type of utility that is a part of each chemical plant and what an operator's role is regarding them. Steam (all level of pressures) Water (drinking, firefighting, safety showers, de-ionized, washdown, cooling tower) Gasses (nitrogen, helium, argon, oxygen) Communication (cable/internet, phone, TV, remote ops, radio,	6

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	emergency phone, security/alerts) Waste hauling Trucking Those listed above (#94) Electricity (High/Low voltage) Sewers (sanitary and hazardous)	
PT 96	Explain how skilled trades support the efforts of production facilities, when each is utilized, and the operator's role in interfacing with trades personnel. Pipefitter, Riggers, Millwrights, Welders, Fabricators, Machinists, Electricians, Instrumentation.	7
PT 97	Describe the 4 states of matter and given an example of each	2
PT 98	Describe "latent heat" and calculate BTU's for a given mass of frozen water heated to boiling point at atmospheric conditions.	2
PT 99	Describe and give examples of all 3 types of heat transfer.	2
PT 100	Demonstrate a working knowledge of a shell and tube heat exchanger including: Types of flows (laminar, transitional, turbulent) also (counter, parallel, cross) Shell side vs tube side Types of heads Tube bundle/tube sheet Single pass vs multi passes Types of baffles used (longitudinal vs segmental) Terms such as fouling, plugging, pressure drop, leaking and effects of higher or lower delta T between product and heat/cooling fluids. How and where sampled?	2
PT 101	Regarding chemical reactors, define and give examples of the following terms:	5

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	Residence time Contact time Catalyst/poisoning/inhibitors Stripping Exothermic and Endothermic Homogenous	
PT 102	Identify and discuss centrifugal pump parts such as: Casing Shaft Impeller Suction eye Volute bearings	1
PT 103	Identify and discuss different types of furnaces (cabin, cylindrical, A-frame) Types of draft used by furnaces (natural, forced, induced, balanced) Types of fuel used in furnaces (process/fuel oils, natural/fuel/process gasses)	6
PT 104	Identify and discuss distillation towers as used in today's process industry: Terms such as trays, condensers, reflux, stripping and rectifying section, reboiler, bottoms and overhead (distillate) streams, steady state, recycle)	2
PT 105	Demonstrate an understanding and recognition of different types of printed drawings used in the process industry including: Isometrics, Electrical, UFD (utility flow), P&ID, PFD (process flow), BFD (block flow).	3-4
PT 106	Discuss administrative and engineering controls in regards to workplace hazard reduction (OSHA).	2

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PT 107	Demonstrate understanding of quality tools including TQM, Lean Manufacturing, SAP, Six Sigma, SPC, Continuous Improvement.	6
PT 108	Describe a relief/flare system and their use in reducing environmental contamination via air release.	4
PT 109	Demonstrate an understanding of the different types of separation processes and give an example of each including: Adsorption Centrifugation Crystallization Decantation Dehydration Distillation Electrolysis Evaporation Extraction Filtration Flocculation Freezing Magnetic Reverse osmosis Screening Sedimentation Sublimation Stripping	5
PT 110	Demonstrate an understanding of dry solids processing and the unique equipment it encompasses including:	5

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	Rotary, Iris and Knife valves Powder pumps, dense phase conveyers Diverters Types of mills (ball, roller, hammer, air) Types of mixers and blenders Types of screeners (Sweco, barrel, Rotex) Hazards associated with dry solids (inhalation, dust explosions) Relief devices and bonding of powder equipment	
PT 111	Describe the difference between an "open" and a "closed" control loop. Give an example of each. Describe "cascade control", when is it used?	3
PT 112	Describe each element of a P-I-D controller and how they are used. Describe PID controller terms such as hunting, offset, tuning, setpoint, load change, windup, trend, lag time, spanning,	3
PT 113	Describe a DCS (distributed control system) and a PLC (programmable logic control). When they are used and how operators interface with them. Describe the role of the process engineer and instrument technician in adjusting, programming and maintaining these systems.	3
PT 114	Describe common issues with powder processes and what an operator can do to remedy. Bridging, ratholing, compaction	5
PT 115	Demonstrate an understanding of powder systems transfer methods by describing: Dense phase conveying Screw conveyor Powder pumping Airvey system (jet boosters)	5

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	Traditional mechanical conveyors	
PT 116	Describe the difference between a storage tank (liquids) and a storage hopper/bin (powders/pellets).	4
PT 117	Describe how the 5 analytical variables are measured in regards to dry solids processing (Pressure, Flow, Level, Analytical, Temperature). What are the differences between these, and the measurement of liquids?	4
PT 118	Demonstrate a working knowledge of a powder filtration system including bag filters, cyclones and HEPA filters. How do these differ from filters used in liquid processes?	5
PT 119	Describe the packaging systems used for liquid transport. Describe the packaging systems used for solids transport.	6
PT 120	Describe the types of sampling commonly used with chemical processes, when they are used and how they are performed. Random Composite Wipe testing Representative Target Specific	5
PT 121	Demonstrate a working knowledge of the difference between a “batch operation” and a “continuous train” operation in regards to chemical processing.	5
PT 122	Describe the labelling system in use within chemical processing facilities. Color coding per hazard (blue, green, yellow, orange, red) Information required per label Proper way to stow, organize and dispose of process samples	3
PT 123	Describe the NFPA system and how it is applicable to storage vessels within a processing facility.	3

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	Numbering system (0-4) Special Characters Health, Reactivity, Flammability sections	
PT 124	Describe the Hazmat system and its application when transporting chemicals Placarding Operators role	3
PT 125	Demonstrate a working knowledge of each of the 5 classifications of fires. Which extinguisher is best/worst for A,B, C, D and K type fires What is the operator's role as a 1st responder?	3
PT 126	Explain "hearing conservation" in regards to working in an industrial setting. NRR system and specific PPE including ear muffs and ear plugs Baseline testing and hearing damage Acute vs Chronic hearing injuries	1
PT 127	Demonstrate a working knowledge of the GHS (global harmonized system) used in today's chemical plants and how it pertains to hazardous materials.	3
PT 128	Discuss "Hot Work", how work permits, fire and explosion hazards and environmental testing for explosive environments. Use of non sparking tools Electrical classified areas A-C	4
PT 129	Demonstrate the proper use of air tools and air tool sockets for wrenches Hazards associated with using sockets intended for manual ratchets (chrome plated) with air wrenches.	1
PT 130	Describe "galling" and how its negative effect on process hardware Prevention methods and good work practices.	1

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PT 131	Describe "harmonic oscillation" and its negative effects on process equipment. Current technology to offset damage Operator's role in sound reduction	6
PT 132	Describe a wastewater treatment system used in today's chemical plants. What are the roles/responsibilities of waste generators? What is the overall cost to process operations in regards to processing wastewater and the spillage of plant chemicals?	6
PT 133	Discuss the main types of heat exchangers commonly used in process operations. Safety concern, when is each type applicable, what type of heat exchange occurs. Fin and Tube, Shell and Tube, Straight Tube, Condenser	2
PT 134	Discuss conflict resolution and how it could be applied to conflict with co-workers, vendors, supervision, peers to be more effective as a team member.	5
PT 135	Demonstrate ability to research a specific industry related topic and report in both written format and as part of an oral presentation to a group of peers.	6-7
PT 136	Given a scenario involving several process tasks that need to be performed, be able to rank/prioritize each task and address any issues that would arise in the order you have chosen. (example: beginning a fluid transfer from a tank to a railcar with sticky valves, high oxygen problems and lines that may go to several destinations)	6
PT 137	Demonstrate a working knowledge of process upsets and describe/predict upstream and downstream issues that may arise due to the specific condition. (example: a cooling supply valve fails to a condenser on a distillation column)	4

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PT 138	Describe electronic, pneumatic, IR and RF process signals. Include all issues regarding cost, installation, advantages and any disadvantages that each may encompass.	3
PT 139	Describe the hydrocarbon molecule. How bonded. Name each product from 1-10 carbon atoms (methyl through decyl), the hierarchy in a distillation column, and the reasons their name may end with ane, ene or ine. (example: describe the ethane molecule and its tower hierarchical relationship to methane)	2
PT 140	Explain the "stability triangle" in regards to powered industrial lift vehicles. How this affects height of load and what occurs when weight is not properly centered to vehicle.	5
PT 141	Describe harmonic oscillation and its destructive effect on a process. What can operators do to offset damage and recognize symptoms?	5
PT 142	Explain NDT (nondestructive testing) techniques currently in use in a chemical operations plant. (Imaging, vibration testing, charting, x-ray, etc.)	7
PT 143	Describe SAP and its role within a business system. How SAP has been used to streamline waste and improve "on time maintenance". What is an operator's role involving SAP?	7
PT 144	Describe the role of the QA/QC laboratory and its essential function as part of a process team. How do operators interface with these labs? Describe proper labelling and field sampling techniques.	6
PT 145	Describe placarding and package labelling in regards to DOT shipping whether via rail, ship, or land. What are the rules for small packages being send via FEDEX or UPS?	3
PT 146	Explain the difference between "just in time maintenance", "run to fail maintenance", PM, opportunistic maintenance, shutdown maintenance, and predictive maintenance. Give an example where each would be used and an advantage/disadvantage of each type.	7
PT 147	Demonstrate the ability to repack the stem packing on a gate valve that is live installed into a system. How do we do this safety? What indicators do we have that it needs to be changed? What are the hazards associated with this type of maintenance?	2

Performance Based Objectives – Process Technology

PT 148	Describe the best practice for a packed valve install in a liquid process line (horizontal to floor, vertical or upside down).	2
PT 149	What type of valve should only be used for GAS service? Why?	1
PT 150	Describe the pros and cons of flow control indicator instillation. Vertical or horizontal pipe? Before or after a restriction? Is flow measurement negatively affected by turbulent flow? What can be done? What happens if the density of the material changes?	4
PT 151	Explain the difference between process "grounding" and process "bonding" of electrical potential. What is a "jumper" cable used for. How and why are continuity checks performed when reassembling process lines where liquid OR powder products flow through?	4
PT 152	Describe Laminar, Transitional and Turbulent flow in regards to fluid flow within process piping. What are the advantages and disadvantages? How can these aid in the exchanges of heat, mixing of fluids and what are the symptoms of erosion?	2
PT 153	Demonstrate how to properly maintain a ½ face filtered respirator and a full face air supplied respirator. This includes the checking/changing of exhaust and intake valves, cleaning and proper storage. Cleaning, labelling of cartridges and annual fitness testing (required OSHA)	1-7
PT 154	Demonstrate ability to remove contaminated gloves and place into a proper waste receptacle without any exposure to self or to co-workers. Explaining "layering" of PPE such as leather gloves and Nitrile gloves being worn at the same time.	1-7
PT 155	Articulate a process condition from history data and apply to actual issue in the field.	7
PT 156	Describe the symptoms of nitrogen poisoning (oxygen deprivation) and the 4 reasons that nitrogen is so dangerous in today's chemical plants.	3
PT 158	Describe the 4 step process used in waste water treatment to purify raw sewage into potable water which is then release back into the natural water system.	
PT 159	Describe the chemicals used to treat cooling tower water, their associated hazards, what an operators' role is, and how wet bulb test changes can have a positive or negative effect on evaporation.	4

Performance Based Objectives – Process Technology

PT 160	Describe all types of utility air used in a plant (instrument air, breathing air, plant air, HVAC) their purpose, what the operators role is in maintaining these systems and how they differ from each other.	4
PT 161	Describe process steam usage and generation. Uses for various available pressures (25#, 50#, 150#, 400#) and their associated temperatures (from saturation tables).	4
PT 162	Describe other utilities supplied to a process plant (electricity, cooling water, thermal systems, cable, city water, firefighting water, utility water, telephone, and logistical services.	4
PT 163	Describe the types of waste streams utilized by today's process plants. (metal waste, hazardous waste, sanitary sewer, wastewater, office trash, lab waste, RCRA, rotary kiln incinerator, air permits)	4

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