

NATIONAL CERTIFICATE MODULE: UNIT SPECIFICATION**STATEMENT OF STANDARDS**

UNIT NUMBER: 3252123

UNIT TITLE: PROCESS OPERATIONS 2 - DISTILLATION AND EXTRACTION

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME

1. EXPLAIN THE TECHNIQUES USED IN PROCESS OPERATIONS

PERFORMANCE CRITERIA

- (a) The explanation of physical and/or chemical factors underlying the operation is correct.
- (b) The explanation of the factors affecting the design of the process operation is correct.
- (c) The explanation of the factors affecting the operation is correct.

RANGE STATEMENT

The range statement for this outcome is specified within the performance criteria.

EVIDENCE REQUIREMENTS

Written evidence of the ability to explain physical and/or chemical factors underlying the operation, explain factors affecting the design and operation of the process operation.

The above performance criteria should be achieved on at least 2 occasions, each covering a different process operation.

OUTCOME

2. EXPLAIN THE APPLICATION OF PROCESS UNITS FOR GIVEN PROCESS OPERATIONS

PERFORMANCE CRITERIA

- (a) The explanation of the choice of process units required for a given process operation is correct with respect to the level of specification.
- (b) The description of the operation of a complete process unit is correct with respect to a given specification.
- (c) The explanation of safety system requirements is correct with respect to hazard levels, effect of loss on personnel, plant and environmental safety.
- (d) The explanation of the implications of the loss of plant services is correct with respect to the effect on process and plant.

RANGE STATEMENT

The range statement for this outcome is specified within the performance criteria.

EVIDENCE REQUIREMENTS

Written evidence of the ability to explain the choice of process units, safety systems requirements and the implications of the loss of plant services.

Written evidence of the ability to describe the operation of a complete process unit. The above performance criteria must be achieved on at least 2 occasions, each covering a different process operation.

ASSESSMENT RECORDS

In order to achieve this unit, candidates are required to present sufficient evidence that they have met all the performance criteria for each outcome within the range specified. Details of these requirements are given for each outcome. The assessment instruments used should follow the general guidance offered by the SQA assessment model and an integrative approach to assessment is encouraged. (See references at the end of support notes).

Accurate records should be made of assessment instruments used showing how evidence is generated for each outcome and giving marking schemes and/or checklists, etc. Records of candidates' achievements should be kept. These records will be available for external verification.

SPECIAL NEEDS

In certain cases, modified outcomes and range statements can be proposed for certification. See references at end of Support Notes.

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NATIONAL CERTIFICATE MODULE: UNIT SPECIFICATION**SUPPORT NOTES**

UNIT NUMBER	3252123
UNIT TITLE	PROCESS OPERATIONS 2 - DISTILLATION AND EXTRACTION

SUPPORT NOTES: This part of the unit specification is offered as guidance. None of the sections of the support notes is mandatory.

NOTIONAL DESIGN LENGTH: SQA allocates a notional design length to a unit on the basis of time estimated for achievement of the stated standards by a candidate whose starting point is as described in the access statement. The notional design length for this unit is 20 hours. The use of notional design length for programme design and timetabling is advisory only.

PURPOSE This module is suitable for candidates wishing to gain an understanding of process units. The module would be suitable for full-time and day release candidates, and could form part of the National Certificate Award in Processing.

SQA publishes summaries of NC units for easy reference, publicity purposes, centre handbooks, etc. The summary statement for this unit is as follows:

This module will enable you to gain an understanding of the techniques used in process operations. You will also learn about the application of process units for particular operations.

CONTENT/CONTEXT This section is for guidance only and the content/context relevant to the candidate's area of study/employment should be chosen.

For those candidates completing the National Certificate Group Award in Processing at least 2 areas within the content/context could be selected to meet the requirements of the award, which is to select at least 2 modules from the five within this descriptor.

Safety and possible hazards should be considered at all times.

PROCESS OPERATIONS 2: DISTILLATION AND EXTRACTION

Distillation: vapour pressure; partial pressure; miscible/immiscible mixtures; simple temperature composition diagrams; azeotrope; maximum and minimum boiling.

Methods of distillation: simple; flash; continuous and batch fractionation; azeotropic: steam; vacuum and pressure operation; cryogenic.

Construction and operation of: plate and packed columns; control of flow, pressure and temperature relating to distillation, solvent extraction; liquid-liquid.

Properties of solvents; partition co-efficients; use of mix settlers; column contactors; podbičiac. Applications.

Mixer leaching: factors affecting leaching rate. Percolation and dispersion leaching plant. Use of leaching.

Gas absorption: effects of pressure and temperature; solubility of gases and liquids; absorption; packed and plate columns.

EVAPORATION AND CRYSTALLISATION

Evaporation methods: direct and indirect heating.

Construction and operation of: short tube evaporators; long tube evaporators; forced circulation evaporators; plate evaporators; multiple effect evaporators; vapour recompression; mass and energy balances.

Drying: simple drying theorem saturated; moisture content; humidity; heat transfer rate. Drying equipment.

Crystallisation: solubility; temperature; crystal formation; saturated and super saturated solutions; seeding.

Construction and operation of: cooling and evaporative type crystallisers; batch and continuous drying plant; tray driers; fluidised bed driers; vacuum driers; freeze driers; spray driers; rotary drum.

Filtration: effect of pressure; particle size on filtration rate; pressure filters; vacuum filters; use of centrifugal force; filter aids; pre-treatment of slurries e.g. sedimentation.

MIXING, BLENDING AND HEAT EXCHANGE

Heat exchange equipment: shell tube; spiral plate; fired heater; coolers; floating heads; fixed heads; multiple pass; plate frame construction and operation of the above.

Reactors: (theory); endothermic and exothermic reactions. Factors affecting reaction rate.

Equipment: fixed beds; fluidised beds; liquid phase; jacketed agitated vessels with coils; tubular reactors.

Mixing and blending: gas; liquids; solids; selection of equipment for blending.

Factors affecting: surface tension (liquids); particle size; density difference (solids).

SIZE REDUCTION/CLASSIFICATION

Reasons for size reduction/aggregation.

Construction and operation of: crushing; grinding and attrition grinding equipment; primary crushing; secondary crushing, e.g. fluid energy mill, ball mills; shredding.

Classification: sieving and size classification; air classification; wet and dry classification.

Size reduction: sintering; briquetting; pellicising; size aggregation.

Gas cleaning: wet and dry methods; settling tanks; cyclones; electron precipitator; bag filters; venturi scrubber.

Adsorption: (reasons for use) adsorption processes; typical applications e.g. activated charcoal; molecular sieves; ion exchange; adsorption resins.

GAS COMPRESSION

Industrial uses: gas liquefaction, refrigeration, separation.

Gases: (reasons for) gas compression and review of gas laws; adiabatic compression/expansion; Joule Thomson effect, definition of compression ratio; factors affecting head of compression; multi-stage compression; intercooling.

Types of compressor: positive and negative centrifugal, reciprocating, turbine.

Construction and operation of centrifugal compressors: impeller - open and closed type; shaft seals; seal oil; lubricating oil systems; bearings; balancing drums.

Basic instrument of a centrifugal compressor temperature pressure and flow control.

Safety devices: overload controls; thermostats; governors; vents and by-passes; surge and stonewall.

Basic rules of start-up and shut-down procedures for positive displacement compressors.

Construction operation and use of: rotary lobe compressor; rotary vane compressor; sliding vane compressor; screw compressor.

Ancillary equipment: types of inlet/outlet valves; cylinder liners; different forms of piston seals; lubrication systems; piston construction and use of piston rings.

Construction, operation and use of expanders.

APPROACHES TO GENERATING EVIDENCE A candidate-centred, resource-based learning approach is recommended. The outcomes in this module need not be taught separately and it is likely that an integrated approach will be used. The outcomes do not need to be tackled in the order shown.

Each candidate should be assessed at appropriate parts throughout the module. Where a candidate is unsuccessful in achieving an outcome, provision should be made for remediation and reassessment.

ASSESSMENT PROCEDURES Centres may use the Instruments of Assessment which are considered by tutors/trainers to be most appropriate. Examples of Instruments of Assessment which could be used are as follows:

OUTCOMES 1 & 2. It is recommended that structured questions are set here. An appropriate number should be set in order that the performance criteria and specific content/context are met.

RECOGNITION Many SQA NC units are recognised for entry/recruitment purposes. For up-to-date information see the SQA guide 'Recognised and Recommended Groupings'.

REFERENCES

1. Guidelines for Module Writers.
2. SQA's National Standards for Assessment and Verification.
3. For a fuller discussion on assessment issues, please refer to SQA's Guide to Assessment.
4. Procedures for special needs statements are set out in SQA's guide 'Students with Special Needs'.

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