

**-SQA- SCOTTISH QUALIFICATIONS AUTHORITY**

**HIGHER NATIONAL UNIT SPECIFICATION**

**GENERAL INFORMATION**

<b>Unit Number</b>	<b>D3RA 04</b>
<b>Unit Title</b>	<b>SEPARATION PROCESSES II</b>
<b>Superclass Category</b>	<b>RD</b>
<b>Date of Publication (month and year)</b>	
<b>Originating Centre for Unit</b>	<b>Cleveland Open Learning Unit</b>

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**DESCRIPTION**

**GENERAL COMPETENCE FOR UNIT:**

Applying the fundamentals of separation theory to the construction, operation and selection of evaporation, crystallization and filtration equipment used in industry.

**OUTCOMES:**

1. appraise the design and performance of evaporation equipment;
2. analyse the design of crystallization equipment;
3. appraise the performance of crystallization equipment;
4. analyse the factors which affect the rate of separation of solid particles from liquids;
5. appraise the design and performance of equipment used for separation of solid particles from liquids.

**CREDIT VALUE:** 1 HN Credit

**ACCESS STATEMENT:**

Access to this unit is at the discretion of the centre. However, it would be beneficial if the student had competence in Chemical Plant Operations, Chemistry and Mathematics. Evidence of this competence could be the successful completion of modules in Chemical Plant Operations, Chemistry and Mathematics at National Certificate level or equivalent.

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Additional copies of this unit can be obtained from: The Administrative Services Unit, SQA, Hanover House, 24 Douglas Street, Glasgow G2 7NQ (Tel: 0141-242 2166).

At the time of publication, the cost is £2.50 (minimum order £5.00)

## HIGHER NATIONAL UNIT SPECIFICATION

### STATEMENT OF STANDARDS

#### Unit Number

#### Unit Title

SEPARATION PROCESSES II

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 the standards are mandatory and cannot be altered without reference to SQA.

#### OUTCOME

##### 1. APPRAISE THE DESIGN AND PERFORMANCE OF EVAPORATION EQUIPMENT

#### PERFORMANCE CRITERIA

- (a) Identification and descriptions of the standard types of evaporator are correct in terms of their operating principles.
- (b) Comparisons of the performance of the standard types of evaporator for a given set of conditions are correct in terms of efficiency and running costs.
- (c) Evaluation of the effects of temperature and pressure on evaporator operation is correct in terms of product specification.
- (d) Selection of an evaporator unit for a given application is correct in terms of current industrial practice.
- (e) Solutions to problems relating to mass and energy balances on evaporation equipment are accurate for a given set of conditions.

#### RANGE STATEMENT

Evaporation equipment: short tube; long tube; forced circulation; plate and multiple effect.

#### EVIDENCE REQUIREMENTS

- PC (a) Written evidence showing candidates' ability to identify and describe the operation of evaporation equipment listed in the range statement.
- PC (b) & (c) Written evidence showing candidates' ability to compare the operation and performance of the evaporation equipment listed in the range statement.
- PC (d) Written evidence showing candidates' ability to select and justify an appropriate evaporator for a given stated application.
- PC (e) Written evidence showing candidates' ability to solve one problem involving a mass and energy balance from given information pertaining to a single effect evaporator.

#### OUTCOME

##### 2. ANALYSE THE DESIGN OF CRYSTALLIZATION EQUIPMENT

#### PERFORMANCE CRITERIA

- (a) Construction and interpretation of solubility and saturation curves, from a given set of data is correct and in accordance with the accepted convention.
- (b) Factors affecting the growth, size and rate of formation of crystals are correctly identified and evaluated.

- (c) Solutions to problems relating to mass and energy balances on crystallization equipment are accurate for a given set of conditions.
- (d) Explanation of the techniques used to produce supersaturated solution and crystal nuclei are correct in terms of evaporation, cooling and seeding.

**RANGE STATEMENT**

The range for this outcome is fully expressed within the performance criteria.

**EVIDENCE REQUIREMENTS**

- PC (a) Written and graphical evidence to show candidates' ability to construct and interpret two solubility/saturation curves.
- PC (b) Written evidence of candidates' ability to explain the factors affecting the growth, size and rate of formation of crystals.
- PC (c) Written evidence showing candidates' ability to solve one problem, involving a mass and energy balance, from given information.
- PC (d) Written evidence of candidates' ability to explain the techniques used to produce supersaturated solution as indicated in performance criteria (d).

**OUTCOME**

**3. APPRAISE THE PERFORMANCE OF CRYSTALLIZATION EQUIPMENT**

**PERFORMANCE CRITERIA**

- (a) Identification and description of the standard types of crystallizer are correct in terms of their operating principles
- (b) Comparisons of the performance of crystallization equipment are accurate in terms of efficiency and running costs.
- (c) Evaluation of the effects of temperature and pressure on crystallization processes is correct in terms of operational requirements.
- (d) Selection of a crystallizer for a given application is correct in terms of current industrial practice.

**RANGE STATEMENT**

Crystallization equipment: cooling type; evaporative type.

**EVIDENCE REQUIREMENTS**

- PC (a), (b) & (c) Written evidence to show candidates' ability to identify, describe and compare the operation and performance of crystallization equipment listed in the range statement and to evaluate the effects of temperature and pressure.
- PC (d) Written evidence to show candidates' ability to select a suitable evaporator for a given application from given information. One cooling type and one evaporative type.

**OUTCOME**

**4. ANALYSE THE FACTORS WHICH AFFECT THE RATE OF SEPARATION OF SOLID PARTICLES FROM LIQUIDS**

**PERFORMANCE CRITERIA**

- (a) Identification and evaluation of factors affecting the rate of filtration of solid particles from fluids is correct in terms of the properties of the particles, fluid, filter medium and ambient condition.
- (b) Solution to problems relating to the rate of filtration of solid particles from fluids is accurate for a given set of conditions.

**RANGE STATEMENT**

Properties of particles: density; size; shape.  
Properties of fluid: viscosity; density; temperature; concentration of solid particles.  
Filter medium: size of holes in filter; size of holes in coke.  
Ambient conditions: pressure above atmospheric; pressure below atmospheric.

**EVIDENCE REQUIREMENTS**

- PC (a) Written evidence to show candidates' ability to identify and evaluate the factors affecting the rate of filtration of solid particles from fluids.
- PC (c) Written evidence to show candidates' ability to solve one problem related to the rate of filtration of solid particles from a fluid from given information.

**OUTCOME**

**5. APPRAISE THE DESIGN AND PERFORMANCE OF EQUIPMENT USED FOR SEPARATION OF SOLID PARTICLES FROM LIQUIDS**

**PERFORMANCE CRITERIA**

- (a) Identification and description of the standard types of filtration equipment are correct in terms of their operating principles.
- (b) Comparisons of the performance of the standard types of filtration equipment, for a given set of conditions are accurate in terms of efficiency and running costs.
- (c) Selection of a piece of filtration equipment for a given application is correct in terms of current industrial practice.

**RANGE STATEMENT**

Equipment for separation of solids from liquids: vacuum; pressure; centrifugal types.

**EVIDENCE REQUIREMENTS**

- PC (a) & (b) Written evidence of candidates' ability to identify, describe and compare the operation of each type of equipment given in the range.
- PC (c) Written evidence of the candidates' ability to select an appropriate equipment type for a given application.

**MERIT**

To gain a pass in this unit, a candidate must meet the standards set out in the outcomes, performance criteria, range statements and evidence requirements.

To achieve a merit in this unit, a candidate must demonstrate a superior or more sophisticated level of performance. In this unit this might be shown by a systematic approach to the solution of problems of a more complex nature involving, for example, the extraction and interpretation of information from standard reference sources.

**ASSESSMENT**

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 the 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**

Proposals to modify outcomes, range statements or agreed assessment arrangements should be discussed in the first place with the external verifier.

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## HIGHER NATIONAL UNIT SPECIFICATION

### SUPPORT NOTES

#### Unit Number

#### Unit Title

SEPARATION PROCESSES II

#### 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 40 hours. The use of notional design length for programme design and timetabling is advisory only.

#### REFERENCES

1. Guide to unit writing.
2. For a fuller discussion on assessment issues, please refer to SQA's Guide to Assessment.
3. Information for centres on SQA's operating procedures is contained in SQA's Guide to Procedures.
4. For details of other SQA publications, please consult SQA's publications list.

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