

-SQA- SCOTTISH QUALIFICATIONS AUTHORITY

NATIONAL CERTIFICATE MODULE: UNIT SPECIFICATION

GENERAL INFORMATION

-Module Number- 3330006 **-Session-**1996-97
-Superclass- YC
-Title- **INTRODUCING CHEMICAL ENGINEERING: PROCESS CALCULATIONS**

-DESCRIPTION-

GENERAL COMPETENCE FOR UNIT: Applying chemical arithmetic techniques and chemical engineering principles to process calculations.

OUTCOMES

1. apply chemical arithmetic techniques to process calculations;
2. explain and apply the principles of mass balance techniques to process calculations.

CREDIT VALUE: 0.5 NC Credit

ACCESS STATEMENT: Preferred entry would be Industrial Science 2 or equivalent Stage 2 Chemistry or Physics modules.

For further information contact: Committee and Administration Unit, SQA, Hanover House, 24 Douglas Street, Glasgow G2 7NQ.

Additional copies of this unit may be purchased from SQA (Sales and Despatch section). At the time of publication, the cost is £1.50 (minimum order £5.00).

NATIONAL CERTIFICATE MODULE: UNIT SPECIFICATION**STATEMENT OF STANDARDS****UNIT NUMBER:** 3330006**UNIT TITLE:** INTRODUCING CHEMICAL ENGINEERING: PROCESS CALCULATIONS

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. APPLY CHEMICAL ARITHMETIC TECHNIQUES TO PROCESS CALCULATIONS

PERFORMANCE CRITERIA

- (a) The completion of calculations involving interconversion of mass and number of mole of substance are correct.
- (b) The completion of calculations involving interconversion of mass fraction, volume fraction and mole fraction are correct.
- (c) The completion of calculations involving interconversion of fluid quantities and concentration are correct.

RANGE STATEMENT

Calculations involving; solid, liquid, gaseous and solution systems.

EVIDENCE REQUIREMENTS

Written evidence of the candidates ability to complete 6 calculations correctly by applying chemical arithmetic techniques to mass, number of mole, mass fraction, volume fraction, mole fraction, fluid quantities and concentration, from process data.

Within the 6 calculations, each of the states mentioned in the range statement must be covered.

OUTCOME

2. EXPLAIN AND APPLY THE PRINCIPLES OF MASS BALANCE TECHNIQUES TO PROCESS CALCULATIONS

PERFORMANCE CRITERIA

- (a) The explanation of mass balance techniques and their application in chemical process operations is correct.
- (b) The selection of mass balance techniques is appropriate to a given use.
- (c) The completion of calculations in which mass balance techniques are applied to chemical process operations is correct.

RANGE STATEMENT

Mass balance techniques: tie component, component, mixing streams.

Applications: evaporation, distillation, drying fluid flow.

EVIDENCE REQUIREMENTS

Written evidence of the candidates ability to explain mass balance techniques and their application, select appropriate techniques and complete 3 calculations on chemical process operations (one calculation for each application mentioned in the range).

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

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:** 3330006**UNIT TITLE:** INTRODUCING CHEMICAL ENGINEERING: PROCESS CALCULATIONS**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 will enable candidates to develop an understanding of the Principles of Mass balances and how to apply these to processes engineering systems. This module would be suitable for providing the necessary underpinning knowledge required for later H.N. Units in Industrial Chemistry and Chemical Engineering.

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

This half credit module will give candidates an introduction to the applications of chemical arithmetic techniques and chemical engineering principles to process calculations.

CONTENT/CONTEXT

1. Density, relative density. Concentration, mass fraction, volume fraction, mole fraction. Interconversion of these terms. Wet and dry basis moisture contents. Mole, kmol, molar volume for gases. Partial pressure conversion of gas volumes between STP and stated temperature and pressure. Calculation of formula mass. Calculation of yield, quantities of reactants required.

$$\text{Use of formulae, } p = \frac{m}{v}, p = R.D. \times P_{H_2O}, n_A = \frac{ma}{M_A} C_A = \frac{n_A}{na + nb},$$

$$r_A = p_A^o C_A, \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

2. Basic principles of mass balances. Purpose, applications. Types of balance: tie component, component balances, mixing streams. Choice of calculation basis.

Preparation of mass balances from data for a range of unit operations involving physical change.

Presentation of material balances: flow sheets, balance sheet.

APPROACHES TO GENERATING EVIDENCE During the work of the module, candidates should have a number of opportunities to develop problem solving and communication skills. Each candidate should be assessed at appropriate points throughout the module. Where a candidate is unsuccessful in achieving an outcome, provision should be made for remediation followed by reassessment.

ASSESSMENT PROCEDURES In order to achieve this module, it is suggested that candidates attempt sequentially, at appropriate times, two summative assessments in a formal context and must present sufficient evidence that they have met all performance criteria for each outcome, as specified within the evidence requirements. Examples of instruments of Assessment which could be used are as follows but should not be taken as mandatory.

Outcome 1

It is suggested that 6 calculation type questions are set to match the evidence requirements for all the performance criteria and the given ranges.

The calculations could be allocated as follows:

PC(a) 1 calculations
PC(b) 3 calculations
PC(c) 2 calculations

Outcome 2

It is suggested that 6 questions are set to match the evidence requirements for all the performance criteria and given ranges.

The questions could be allocated as follows:

PC(a) 2 questions
PC(b) 1 question
PC(c) 3 calculations

PROGRESSION This module would provide candidates with the underpinning knowledge necessary for certain Higher National units in Industrial Chemistry and Chemical Engineering.

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

REFERENCES

1. Guide to unit writing. (A018).
2. For a fuller discussion on assessment issues, please refer to SQA's Guide to Assessment. (B005).
3. Procedures for special needs statements are set out in SQA's guide 'Candidates with Special Needs'. (B006).
4. Information for centres on SQA's operating procedures is contained in SQA's Guide to Procedures. (F009).
5. For details of other SQA publications, please consult SQA's publications list. (X037).

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