



Australian Government

# **PMAOPS751 Apply physiochemical knowledge to select raw materials for surface coatings**

Release: 1

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## **Modification History**

Release 1. Supersedes and is equivalent to PMAOPS751A Apply physiochemical knowledge to select raw materials for surface coatings

## **Application**

This unit of competency covers the skills and knowledge required to select raw materials for surface coatings. A surface coating is any liquid (e.g. solvent or emulsion-based) material applied to a solid surface for decorative and/or protective reasons.

This unit of competency applies to senior technicians, laboratory supervisors, research and development personnel, or those in similar roles who are required to apply in-depth physiochemical knowledge in order to evaluate and select coating components (resins, additives and pigments), and design solvent systems to meet surface coatings requirements/specifications.

This unit provides the underlying competency to select materials which may then be combined to make a decorative or non-decorative coating.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

## **Pre-requisite Unit**

Nil

## **Competency Field**

Operations

## **Unit Sector**

## **Elements and Performance Criteria**

Elements describe the essential outcomes.

Performance criteria describe the performance needed to demonstrate achievement of the element.

|   |                                                                  |     |                                                              |
|---|------------------------------------------------------------------|-----|--------------------------------------------------------------|
| 1 | <b>Apply knowledge of polymers to surface coating properties</b> | 1.1 | Predict coating properties related to nature of polymer base |
|   |                                                                  | 1.2 | Calculate the molecular weight of a polymer                  |
|   |                                                                  | 1.3 | Distinguish between the characteristics of solution,         |

|   |                                                     |     |                                                                                                          |
|---|-----------------------------------------------------|-----|----------------------------------------------------------------------------------------------------------|
|   |                                                     |     | emulsion and dispersion polymers                                                                         |
|   |                                                     | 1.4 | Identify health, safety and environment (HSE), economic and manufacturing-related properties of polymers |
|   |                                                     | 1.5 | Identify the effects of monomer selection on product properties                                          |
| 2 | <b>Select resins for surface coatings</b>           | 2.1 | Distinguish between the characteristics and uses of surface coating resins                               |
|   |                                                     | 2.2 | Identify HSE, economic and manufacturing-related properties of resins                                    |
|   |                                                     | 2.3 | Select a resin for a typical end use                                                                     |
| 3 | <b>Select additives for surface coatings</b>        | 3.1 | Identify the principal additives used in coatings                                                        |
|   |                                                     | 3.2 | Distinguish between the characteristics and uses additives                                               |
|   |                                                     | 3.3 | Identify HSE, economic and manufacturing-related properties of additives                                 |
|   |                                                     | 3.4 | Select an additive for a typical end use                                                                 |
| 4 | <b>Design a solvent system for surface coatings</b> | 4.1 | Identify the role and behaviour of solvent types and their properties                                    |
|   |                                                     | 4.2 | Select solvents which may be suitable for an application                                                 |
|   |                                                     | 4.3 | Identify HSE, economic and manufacturing-related properties of solvents/solvent systems                  |
|   |                                                     | 4.4 | Recommend a solvent system by applying solvent system design principles and solubility parameters        |
| 5 | <b>Select pigments for a surface coating</b>        | 5.1 | Balance the relationship between particle size, gloss and opacity to achieve required outcome            |
|   |                                                     | 5.2 | Distinguish between organic and inorganic pigment                                                        |

- 5.3 Identify applications for titanium dioxide (TiO<sub>2</sub>) pigments
- 5.4 Evaluate the need for the use of anti corrosive pigments
- 5.5 Verify the need for extenders
- 5.6 Identify HSE, economic and manufacturing-related properties of pigments
- 5.7 Select a pigment combination for a typical application

## Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

## Range of Conditions

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

**Regulatory framework** The latest version of all legislation, regulations, industry codes of practice and Australian/international standards, or the version specified by the local regulatory authority, must be used, and include one or more of the following:

- legislative requirements, including work health and safety (WHS)
- industry codes of practice and guidelines
- environmental regulations and guidelines
- Australian and other standards
- licence and certification requirements

All operations to which this unit applies are subject to stringent health, safety and environment (HSE) requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between performance criteria and HSE requirements, the HSE requirements take precedence.

**Hazards** Hazards include one or more of the following:

- flammability and explosivity
- hazardous products and materials
- other hazards that might arise

**Procedures** All operations must be performed in accordance with relevant procedures.

Procedures are written, verbal, visual, computer-based or in some other form, include one or more of the following:

- work instructions
- standard operating procedures (SOPs)
- formulas/recipes
- batch sheets
- temporary instructions
- any similar instructions provided for the smooth running of the plant

## Unit Mapping Information

Release 1. Supersedes and is equivalent to PMAOPS751A Apply physiochemical knowledge to select raw materials for surface coatings

## Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=9fc2cf53-e570-4e9f-ad6a-b228ffdb6875>

# **Assessment Requirements for PMAOPS751 Apply physiochemical knowledge to select raw materials for surface coatings**

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## **Performance Evidence**

Evidence required to demonstrate competence in this unit must be relevant to and satisfy the requirements of the elements and performance criteria ,and include the ability to:

- evaluate resins, pigments and additives against specifications, including:
  - chemistry
  - structure
  - physical and chemical properties relevant to surface coating
  - modification reactions as relevant (e.g. alkyds)
  - impact on environment
  - benefits/costs
- select materials for purpose
- calculate the molecular weight of a polymer to determine the effects on the end product.

## **Knowledge Evidence**

Evidence must be provided that demonstrates knowledge of:

- characteristics and application of surface coating resins, including:
  - synthetic resins with drying oils
  - alkyd resins
  - modified alkyd resin
  - epoxy resins
  - saturated and unsaturated polyester resins
  - vinyl resin solutions
  - thermosetting acrylic resins
  - phenolic resins
- characteristics and application of additives, including:
  - cellulose
  - nitrocellulose
  - cellulose esters
  - cellulose ethers
- chemistry of raw materials
- safety data sheets (SDS)

- polymers used in surface coatings and their impact of the surface coating properties and applications
- importance and impact of polymer functional groups
- manufacturing techniques of alkyd resins
- the effects of additives on the final properties of surface coatings
- safety and environmental concerns in the use and handling of solvents
- glass transition temperature of polymers and film forming mechanisms
- the principles of emulsion polymerisation
- the role and behaviour of solvents
- the process of solvent evaporation used in formulating
- the functions of pigments
- reasons for the use of inorganic and organic pigments
- key differences between organic and inorganic pigments
- the performance properties of titanium dioxide (TiO<sub>2</sub>) pigments
- the use of anti-corrosive pigments
- the role and properties of extenders
- overall, the reasons for the selection of raw materials when used in surface coatings
- hierarchy of control
- hazards that may arise in the job/work environment, and:
  - their possible causes
  - potential consequences
  - appropriate risk controls.

## Assessment Conditions

- The unit should be assessed holistically and the judgement of competence based on a holistic assessment of the evidence.
- The collection of performance evidence is best done from a report and/or folio of evidence drawn from:
  - a single project which provides sufficient evidence of the requirements of all the elements and performance criteria
  - multiple smaller projects which together provide sufficient evidence of the requirements of all the elements and performance criteria.
- A third-party report, or similar, may be needed to testify to the work done by the individual, particularly when the project has been done as part of a project team.
- Assessment should use a real project in an operational workplace. Where this is not possible or practical assessment must occur using a sufficiently rigorous simulated environment reflecting realistic operational workplace conditions. This must cover all aspects of workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.
- Knowledge evidence may be collected concurrently with performance evidence or through an independent process, such as workbooks, written assessments or interviews (provided a record is kept).

- Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.
- Conditions for assessment must include access to all tools, equipment, materials and documentation required, including relevant workplace procedures, product and manufacturing specifications associated with this unit.
- The regulatory framework will be reflected in workplace policies and procedures and is not required to be independently assessed.
- Foundation skills are integral to competent performance of the unit and should not be assessed separately.
- Assessors must satisfy the assessor competency requirements that are in place at the time of the assessment as set by the VET regulator.
- In addition, the assessor or anyone acting in subject matter expert role in assessment must demonstrate both technical competency and currency. If the assessor cannot demonstrate technical competency and currency they must assess with a subject matter expert who does meet these requirements.
- Technical competence can be demonstrated through one or more of:
  - relevant VET or other qualification/Statement of Attainment
  - appropriate workplace experience undertaking the type of work being assessed under routine and non-routine conditions
  - appropriate workplace experience supervising/evaluating the type of work being assessed under routine and non-routine conditions
- Currency can be demonstrated through one or more of:
  - being currently employed undertaking the type of work being assessed
  - being employed by the organisation undertaking the type of work being assessed and having maintained currency in accordance with that organisation's policies and procedures
  - having consulted/had contact with an organisation undertaking the type of work being assessed within the last twelve months, the consultation/contact being related to assessment
  - conducting on-the-job training/assessments of the type of work being assessed
  - being an active member of a relevant professional body and participating in activities relevant to the assessment of this type of work

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