

APPLY MATERIAL SCIENCE PRINCIPLES

UNIT CODE: ENG/OS/QS/CC/03/6/A

Unit Description:

This unit describes the competencies required by a Quantity Surveyor in order to apply material science principles. It involves analyzing properties of engineering materials, utilize engineering materials, performing heat treatment, material testing and identifying corrosion and its prevention.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements <i>(Bold and italicized terms are elaborated in the Range)</i>
1. Analyse properties of engineering materials	1.1 Type of engineering materials are identified as per prescribed procedures 1.2 <i>Physical properties</i> of engineering material are determined according material specifications 1.3 <i>Mechanical properties</i> of engineering materials are identified according to material specifications 1.4 Crystal structures of materials and their characteristics are analysed according to material specifications
2. Utilise <i>engineering materials</i>	2.1 Identify and select engineering material according to production requirements. 2.2 Operation plan is developed according to engineering drawing. 2.3 Appropriate machine is set up according to manufacturer manual 2.4 Production parameters are set according to production requirement 2.5 Production is performed according to work requirements
3. Perform heat treatment	3.1 Safety practices are observed according to OSHA 2007 3.2 <i>Heat treatment processes</i> are identified according to material specifications 3.3 Procedure in heat treatment processes is identified according to work requirements 3.4 Heat treatment of metals is performed according to work requirements

4. Perform material testing	<p>4.1 Safety is observed in material testing procedures according to OSHA, 2007</p> <p>4.2 Material testing methods are identified according to work requirement</p> <p>4.3 Procedure of material testing is followed as per material testing method</p> <p>4.4 Material testing results are tabulated, presented, calculated and interpreted according to testing results</p> <p>4.5 Material testing equipment are maintained according to manufacturer specifications.</p>
5. Prevent material corrosion	<p>5.1 Safety is observed during corrosion prevention according to OSHA 2007</p> <p>5.2 Corrosion types are identified according to work requirements</p> <p>5.3 Methods of corrosion prevention are identified according to work requirements</p> <p>5.4 Corrosion is prevented as per the prescribed corrosion prevention methods</p>

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

VARIABLE	RANGE
Physical properties may include but is not limited to:	<ul style="list-style-type: none"> • Density • Color • Texture • Melting point • Thermal conductivity • Electrical resistivity • Electro-magnetism
Mechanical properties may include but is not limited to:	<ul style="list-style-type: none"> • Ductility • Malleability • Elasticity • Toughness • Hardness • Brittleness • Plasticity

	<ul style="list-style-type: none"> • Strength
Material testing methods may include but is not limited to:	<ul style="list-style-type: none"> • Compression test • Hardness tests • Impact tests • Creep tests • Bending tests • Fatigue tests • Torsional tests • Sharing tests
Heat treatment processes may include but is not limited to:	<ul style="list-style-type: none"> • Annealing • Tempering • Normalizing • Hardening • Case hardening
Engineering materials may include but is not limited to:	<ul style="list-style-type: none"> • Metals • Metal alloys • Ceramics • Composites • Polymers • Plastics • Wood
Corrosion type may include but is not limited to:	<ul style="list-style-type: none"> • Galvanic • Stress corrosion cracking
Methods of corrosion prevention may include but is not limited to:	<ul style="list-style-type: none"> • Painting • Electroplating • Galvanizing • Cathodic • Chromizing

REQUIRED KNOWLEDGE AND SKILLS

The individual needs to demonstrate the following skills

Required Skills

- Measuring and marking
- Material testing
- Use of hand tools

- Inspection
- Testing

REQUIRED KNOWLEDGE AND UNDERSTANDING

The individual needs to demonstrate knowledge and understanding of:

- Occupational Health and Safety Act of Kenya laws 2007 with focus on personal safety, machine safety and workplace
- National Environment Management Authority Act, Kenya 2004
- OSH ACT 2007
- Equipment manuals
- Mathematics & science
- Physics and mechanics
- Metallurgy and materials
- Inspection and testing
- WIBA ACT
- Report writing

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the learner <ul style="list-style-type: none"> 1.1 Observed safety as per work place procedures 1.2 Demonstrated understanding of physical, chemical and mechanical properties of engineering materials 1.3 Utilized engineering materials 1.4 Performed heat treatment 1.5 Performed material testing 1.6 Demonstrated understanding of corrosion types and its prevention
2. Resource Implications	<ul style="list-style-type: none"> 2.1 Testing materials 2.2 Measuring instruments 2.3 Inspection tools
3. Methods of Assessment	Competency in this unit may be assessed through: <ul style="list-style-type: none"> 3.1 Observation 3.2 Oral questioning 3.3 Written test

	<p>3.4 Portfolio of Evidence</p> <p>3.5 Interview</p> <p>3.6 Third party report</p>
4. Context of Assessment	<p>Competency may be assessed:</p> <p>4. 1 On-the-job</p> <p>4. 2 Off-the –job</p> <p>4. 3 During Industrial attachment</p>
5. Guidance information for assessment	<p>Holistic assessment of other units relevant to the industry sector, workplace and job role is recommended.</p>

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