

Quality Assurance Requirements

This unit standard and others within this subfield may be awarded by institutions which meet the accreditation requirements set by the Namibia Qualifications Authority and the Namibia Training Authority and which comply with the national assessment and moderation requirements. Details of specific accreditation requirements and the national assessment arrangements are available from the Namibia Qualifications Authority and the Namibia Training Authority on www.nta.com.na.

Elements and Performance Criteria

Element 1: Apply advanced knowledge of motion, power and energy (movements).

Range

*Formulae (equations of motion) $s = ut + \frac{1}{2}at^2$, $s = \frac{1}{2}(u + v)t$ and $v = u + at$,
 $v = u + at$, $v^2 = u^2 + 2as$ and $s = ut + \frac{1}{2}at^2$.*

Terms related to belt drives may include but are not limited to circumferential velocity, belt speed, effective pulling force, power transmitted and angle of contact

Performance Criteria

- 1.1 The concepts of velocity and acceleration are described.
- 1.2 Equations of motions are manipulated and applied in calculations.
- 1.3 The concepts of force, mass and acceleration are described in terms of relation, distinction between balanced and unbalanced forces, the effect of forces on a body and the formula $F = mg$ on gravity is applied.
- 1.4 The concepts of work done, energy and power are described in terms of applications, conservation law of energy, application of the law and the calculations related to work done and power are performed.
- 1.5 The law of conservation of momentum is applied to carry out calculations on momentum.
- 1.6 Terms relevant to belt drives and contact angle are described and calculations on belt drives are carried out.
- 1.7 The effect of the angle of contact on a belt drive and/or pulley is described and a line sketch of a belt drive showing slack side force, tight side force, direction of rotation and the angle of contact is drawn.

Element 2: Carry out calculations related to conditions for equilibrium.

Range

Loads may include but are not limited to concentrated loads, uniformly distributed loads and combination of loads.

Performance Criteria

- 2.1 The concepts moment of a force, the law of moments and moment of an oblique force are described and conditions for equilibrium and moments are applied in calculations.
- 2.2 Reactions at the supports of beams are calculated and a sketch showing all loads and supports is made from a formulated problem according to scale of a beam.
- 2.3 Shearing force diagrams for beams are drawn according to scale and maximum and minimum shearing forces are determined.

Element 3: Apply knowledge of force.

Performance Criteria

- 3.1 The conditions of equilibrium of a system of forces are explained and the concepts equilibrium, equilibrant, resultant and triangle of forces are described.
- 3.2 Analytical resolution of problems related to forces, magnitude and the direction are carried out.
- 3.3 A diagram of a roof truss is shown and the nature and magnitude of the forces in the different parts of the framework are determined, graphically and analytically.

Element 4: Apply knowledge of friction.

Range

Calculations related to angle of friction and co-efficiency of friction are limited to formula $\tan \theta = \frac{F\mu}{N}$, $\tan \theta = \mu$, $\mu = \frac{F\mu}{N}$, where N = normal reaction force.

Performance Criteria

- 4.1 The concept of static and kinetic friction is described in terms of coefficients of friction, methods, advantages and disadvantages, effect of lubricants on friction and related calculations are carried out.
- 4.2 The concepts of friction force, coefficient of friction, angle of friction, angle of rest (repose) and normal reaction force are described.

- 4.3 Calculations related to the angle of friction and coefficient of friction and the angle of repose are carried out using the applicable formulae and the examples of applications are given.
- 4.4 Calculations related to frictional forces on an incline plane with pulling, pushing and slanted forces are carried out.

Element 5: Apply knowledge related to mechanical drives and lifting machines.

Range

Formulae to calculate linear and area expansion are: Linear expansion: $\Delta l = L_0 \alpha \Delta t$ and Area expansion: $\Delta A = 2A_0 \beta \Delta t$.

Performance Criteria

- 5.1 The concept of specific heat capacity is outlined.
- 5.2 The law of conservation of energy in terms of heat transfer is expressed and applied.
- 5.3 Heat value of a fuel is described and related calculations are carried out with respect to heat value of fuels and the efficiency of machines and/or engines.
- 5.4 The concept of area and heat expansion is described and the calculations for linear and area expansions as well as enthalpies of wet, dry and superheated steam are carried out using and/or manipulating the applicable formula.
- 5.5 Steam is described in terms of production, applications and effect of a change in pressure on the saturated temperature
- 5.6 The steam table is used to calculate enthalpy of wet, dry steam and superheated steam as well as the dryness of fraction of wet steam.

Element 6: Apply knowledge of hydraulics and carry out calculations related to pressure in fluids, work done and hydraulic presses.

Performance Criteria

- 6.1 The concepts of suction head, delivery head and static head are described.
- 6.2 Pressure in fluids and work done are described
- 6.3 The work done by single stroke pumps do deliver water against a pressure and/or a head are calculated.
- 6.4 The principle of hydraulic presses as applied through Pascal's principle and on hydraulic cranes is described using a diagram of a hydraulic press.
- 6.5 Calculations related to hydraulic presses are carried out.

- 6.6 The coefficient of friction, angle of friction, weight components and the effective upward and downward pulling forces are calculated by applying and/or manipulating the applicable formulae.

Element 7: Apply knowledge of the applications of electricity.

Performance Criteria

- 7.1 Electric circuits (series and parallel) are outlined and calculations related to electromotive force (emf), potential difference, current and resistance are carried out.
- 7.2 Terms coulomb, electrolyte, electrodes and electroplating as well as the chemical effect of an electrical current are described.
- 7.3 The principle of electrochemical equivalent of substances is applied to calculate electrolysis by formulating Faraday's laws of electrolysis.
- 7.4 Joule's law is formulated to calculate the cost of electric energy consumption as well as power and energy in direct current circuits.
- 7.5 The differences between direct and alternating current are explained.
- 7.6 A sketch showing the magnetic effects of electric current is produced.
- 7.7 Basic principles of a transformer are explain using a sketch of a simple single-phase transformer and calculations related to turns ratio, voltage ratio and current ratio are carried out.

Element 8: Demonstrate basic knowledge of chemistry.

Range

Component elements may include but are not limited to water, salt and sulphuric acid.

Performance Criteria

- 8.1 The constituents of matter are described in terms of properties of atom and bonding.
- 8.2 Component elements of well known components are identified.
- 8.3 The periodic table of elements is used to explain categories of elements, arrangements of elements and compounds.
- 8.4 Classification of metals and non-metals in the periodic table is explained and different materials are identified.
- 8.5 The concept of electron transfer is explained in terms of conductivity and non conductivity of metals and non metals.
- 8.6 Terms oxidation, reduction and corrosion are described and the precautionary measures which can be implemented to prevent corrosion are identified.

Registration Data

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