8.1.0 PHYSICAL SCIENCE

8.1.01 Introduction

This module unit is designed to equip the trainee with the knowledge, skills and attitudes in physical sciences necessary to enhance the understanding in the trade area.

8.1.02 General Objectives

At the end of this module unit the trainee should able to: -

a) Understand physical science principles
b) Apply relevant physical science principles in solving trade problems
c) Analyze and interpret physical quantity in physical science.

8.1.03 Module Unit Summary and Time Allocation

Physical Science

Code	Sub-Module Unit	Content	Time Hours
8.1.1	Nuclear physics	• Structure of atom • Nature of radiations • Radioactive decay • Detection of radiation • Radio isotopes • Nuclear reactions • X-rays	12
8.1.2	Vibrations	• Simple harmonic motion (S.H.M) • Damped and forced vibrations	8
8.1.3	Waves	• Wave phenomenon • Electromagnetic waves • Light waves • Sound waves	10
8.1.4	Heat	• Thermometry • Calorimetry • Heat transfer • Kinetic Theory of gases • Thermodynamics	8
8.1.5	Inorganic chemistry	• Periodic classification • Structure and bonding • Acids and bases • Thermo chemistry	6

		• Electrolysis	
8.1.6	Organic chemistry	• Homologous series • Hydro carbons • Compounds	4
Total time			48

8.1.1 NUCLEAR PHYSICS

Theory

8.1.1T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) describe the structure of nucleus
b) describe the properties and nature of radiation
c) perform simple calculations on law of radioactive decay
d) describe method of detection of radiation
e) describe radio isotopes and their applications
f) describe nuclear reactions
g) Explain production and properties of x-rays

Content

8.1.1T1 Description of structure of nucleus
i) Force in nucleus
ii) Neutron-proton ratios in relation to stability

8.1.1T2 Description of nature and properties of radiations
i) Modes of decay
ii) Law of radioactive decay
iii) Half life period
iv) Range of radiation:

8.1.1T3 Calculations
calculation involving law of radioactive decays

8.1.1T4 Description of method of detection of radiation
i) Spark counter
ii) Scintillation counters
iii) Photographic films
iv) Geiger Muller counter

8.1.1T5 Description of radio isotopes
i) Applications: medicine, industry, agriculture, dating
ii) Safety and hazards of radiation

8.1.1T6 Descriptions of nuclear reactions
i) Nucleus binding energy and binding energy graph
ii) Stable and unstable nuclei
iii) Fission chain reactions
iv) Controlled chain reaction
v) The nuclear reactor
vi) Uses

8.1.1T7 Explanation of production and properties of x-rays
i) Production
ii) Properties
iii) Applications
iv) Hazards and safety precautions

8.1.2 VIBRATIONS

Theory

8.1.2T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) describe and perform calculations on simple harmonic motion
b) explain and perform calculations on damped and forced vibrations

Content

8.1.2T 1 Description and calculations on simple harmonic motion (S.H.M)
- i) Conditions, acceleration, velocity and displacement
- ii) Energy changes in S.H.M
- iii) Simple pendulum
- iv) Extension springs
- v) Loaded tubes in liquids
- vi) LC circuit
- vii) Addition of mutually perpendicular vibrations
- viii) Simple calculations on S.H.M

8.1.2T Explanation and calculations on damped and forced vibrations
- i) Resonance and its importance

Practice

8.1.2TP0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
- a) perform simple harmonic motion experiments
- b) demonstrate damped and forced vibrations

Content

8.1.2P1 Perform simple harmonic motion

8.1.2P2 Demonstration of damped and forced vibrations

8.1.2C Competence

The trainee should have the ability to:
Handle effects of vibrations in engineering work.

8.1.3 WAVES

Theory

8.1.3T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
- a) explain wave phenomenon
- b) analyze electromagnetic waves
- c) analyze light waves
- d) analyze sound waves

Content

8.1.3T1 Explanation of wave phenomenon
- i) Plane progressive waves, equations and characteristics
- ii) Longitudinal and transverse waves
- iii) Stationery waves nodes and antinodes
- iv) Relationship between V.F and λ of waves

8.1.3T2 Analysis of electromagnetic waves
- i) Spectrum
- ii) Solutions of plane wave equations
- iii) Energy in travelling waves
- iv) Wave polarization

8.1.3T3 Analysis of light waves
- i) Superposition of waves

ii) Refraction and reflection
iii) Diffraction
iv) Interference
v) Polarization of light waves
vi) Applications

8.1.3T4 Analysis of sound waves
i) Propagation and detection
ii) Superposition
iii) Sound pressure level
iv) Effects of media on propagation
v) Acoustics
vi) Ultrasonics

Practice

8.1.3P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) Perform experiments to determine the sound pressure levels
b) Demonstrate the effects of media in sound propagation

Content

8.1.3P1 Determination of sound pressure levels

8.1.3P2 Propagation of sound through;
i) Solids
ii) Liquids
iii) Air

8.1.4 HEAT

Theory

8.1.4T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
a) define temperature scales
b) explain and analyze calorimetry
c) explain and analyze heat transfer
d) explain and analyze kinetic theory of gases
e) explain and analyze thermodynamic behaviour of gases

Content

8.1.4T1 Definition of temperature scales
i) Absolute scale
ii) Celsius scale
iii) Fahrenheit scale
iv) Kelvin scale
v) Types of thermometers

8.1.4T2 Explanation and analysis of calorimetry
i) Definitions
ii) Calculations of heat capacity, specific heat capacity, capacity heat gain and loss
iii) Methods of determining heat capacity, specific heat capacity and latent heat
iv) Molecular terms and reason for change of state
v) Applications of heat capacities and latent heat
vi) Thermal storage systems
vii) Refrigeration
viii) Heat exchangers

8.1.4T3 Explanation and analysis of heat transfers
i) Forms of heat transfer

ii) Thermal conductivity
iii) Thermal resistance
iv) Newton's laws of cooling
v) Black body radiation
vi) U.V and IR radiations
vii) Interaction between radiation and matter

8.1.4T4 Explanation and analysis of kinetic Theory of gases
i) Assumptions
ii) The RMS and mean velocity of molecules
iii) Derivation of gas laws
iv) Boyles law
v) Charles' law
vi) Pressure law
vii) Ideal gas equations
viii) Dalton's law of partial pressures
ix) Deviation from ideal gas behaviour
x) Van-der-Waal's equation
xi) Liquefaction of gases

8.1.4T5 Explanation and analysis of thermodynamics
i) Thermal behaviour of ideal gasses
ii) Adiabatic changes
iii) Isothermal changes
iv) Isobaric changes
v) Isochoric changes
vi) Specific heat capacities
vii) First law of thermodynamics
viii) Relationship between the specific heat capacity at constant pressure

Practice

8.1.4P0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:
a) perform experiments on heat transfer
b) measure temperature

Content

8.1.4P1 Heat transfer methods
i) Conduction
ii) Convection
iii) Radiation

8.1.4P2 Measurement of temperature using mercury and digital thermometers

8.1.4C Competence

The trainee should have the ability to: Apply the study of heat in industrial electric heating

8.1.5 INORGANIC CHEMISTRY

Theory

8.1.5T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:
a) explain the Mendeleef periodic classification
b) describe the physical an chemical properties
c) analyze acid and bases
d) explain thermo-chemistry and its applications
e) describe electrolysis

Content

8.1.5T1 Explanation of Mendeleef periodic classification
-Electrochemical series

8.1.5T2 Description of physical and chemical properties
- i) Valence and atomic constitution
- ii) Size of atoms and ions
- iii) Electron affinity
- iv) Electro-negativity
- v) Polarization (Fajon's rule)
- vi) Types of reactions

8.1.5T3 Analysis of acids and bases
- i) Theory of acids and bases
- ii) Calculation of acid and base equations
- iii) Principle of ionic equilibrium
- iv) PH values and Theory of indicators

8.1.5T4 Explanation of thermo chemistry and its applications
- i) Enthalpy changes in chemical reactions
- ii) Law of conservation of energy and Hess's law
- iii) Types of heat reactions
- iv) Applications of laws of thermodynamics in calculation of enthalpy changes

8.1.5T5 Description of electrolysis
- i) Conductance and conductivity
- ii) Potential series
- iii) Faraday's laws
- iv) Application

Practice

8.1.5P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to perform experiments on Faradays' laws of electrolysis.

Content

8.1.5P1 Demonstration of faradays' laws of electrolysis

8.1.5C Competence
The trainee should have the ability to: Apply the law of electrolysis in batteries, corrosion and corrosion control

8.1.6 ORGANIC CHEMISTRY

Theory

8.1.6T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
- a) explain bonding in carbon compounds
- b) determine molecular weights of carbon compounds
- c) identify types of isomerisms
- d) identify types of functional groups
- e) list systematic names of organic compounds
- f) explain chemistry of aliphatic compounds

Content

8.1.6T1 Explanation of bonding in carbon compounds

8.1.6T2 Determination of molecular weights
- i) Empirical and molecular formula

ii) Calculation of molecular weights

8.1.6T3 Identification of Isomerisms

8.1.6T4 Identification of types of functional groups
- i) Halides
- ii) Hydroxyl
- iii) Carboxyl

8.1.6T5 List of systematic names of organic compounds
- i) Saturated compounds
- ii) Unsaturated compounds
- iii) Aromatic compounds

8.1.6T6 Explanation of Aliphatic compounds
- i) Sources of hydrocarbons
- ii) Properties and uses
- iii) Reactions
- iv) Resins

8.1.6C Competence

The trainee will have the ability to:
- i) Perform simple harmonic motion experiments
- ii) Perform experiments to determine the sound pressure levels
- iii) Perform experiments on heat transfer
- iv) Measure temperature
- v) Perform experiments on faradays' laws of electrolysis

Suggested Teaching/Learning resources
- i) Text books
- ii) Laboratory instruments
- iii) Overhead projectors