JAMB Physics Syllabus

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General Objectives

1. Sustain their interest in physics
2. Develop attitude relevant to physics that encourage accuracy, precision and objectivity
3. Interpret physical phenomena, laws, definitions, concepts and other theories
4. Demonstrate the ability to solve physics problems correctly using relevant theories and concepts

1. MEASUREMENTS & UNITS

Length, area and volume

Content:

• Metre rule

• Vernier calipers

• Micrometer Screw-gauge

• Measuring cylinder

Learning Objectives:

1. Identify the units of length, area and volume
2. Use different measuring instruments
3. Determine the lengths, surface areas and volume of regular and irregular bodies

Mass

Content:

• Unit of mass

• Use of simple beam balance

• Concept of beam balance

Learning Objectives:

1. Identify the unit of mass
2. Use simple beam balance, e.g Buchart’s balance and chemical balance

Time

Content:

• Unit of time

• Time-measuring devices

Learning Objectives:

1. Identify the unit of time
2. Use different time-measuring devices

Fundamental physical quantities

Learning Objectives:

1. Relate the fundamental physical quantities to their units

Derived physical quantities and their units

Content:

• Combinations of fundamental quantities and determination of their units

Learning Objectives:

1. Deduce the units of derived physical quantities

Dimensions

Content:

• Definition of dimensions

• Simple examples

Learning Objectives:

1. Determine the dimensions of physical quantities
2. Use the dimensions to determine the units of physical quantities
3. Test the homogeneity of an equation

Limitations of experimental measurements

Content:

• Accuracy of measuring instruments

• Simple estimation of errors

• Significant figures

• Standard form

Learning Objectives:

1. Determine the accuracy of measuring instruments
2. Estimate simple errors

3. Express measurements in standard form

2. SCALARS & VECTOR QUANTITY

Scalars and Vectors

Content:

• Definition of scalar and vector quantities

• Examples of scalar and vector quantities

• Relative velocity

• Resolution of vectors into two perpendicular directions including graphical methods of solution

Learning Objectives:

1. Distinguish between scalar and vector quantities
2. Give examples of scalar and vector quantities
3. Determine the resultant of two or more vectors
4. Determine relative velocity
5. Resolve vectors into two perpendicular components
6. Use graphical methods to solve vector problems

3. MOTION

Types of motion

Content:

• Translational, oscillatory, rotational, spin and random

Learning Objectives:

1. Identify different types of motion

Relative motion

Learning Objectives:

1. Solve numerical problem on collinear motion

Causes of motion

Learning Objectives:

1. Identify force as cause of motion

Types of force

Content:

• Contact

• Force field

Learning Objectives:

1. Identify push and pull as forms of force
2. Identify electric and magnetic attractions, gravitational pull as forms of field forces

Linear motion

Content:

• Speed, velocity and acceleration

• Equations of uniformly accelerated motion

• Motion under gravity

• Distance-time graph and velocity time graph

• Instantaneous velocity and acceleration

Learning Objectives:

1. Differentiate between speed, velocity and acceleration
2. Deduce equations of uniformly accelerated motion
3. Solve problems of motion under gravity
4. Interpret distance-time graph and velocity-time graph
5. Compute instantaneous velocity and acceleration

Projectiles

Content:

• Calculation of range, maximum height and time of flight from the ground and a height

• Applications of projectile motion

Learning Objectives:

1. Establish expressions for the range, maximum height and time of flight of projectiles
2. Solve problems involving projectile motion

Newton’s laws of motion

Content:

• Inertia, mass and force

• Relationship between mass and acceleration

• Impulse and momentum

• Force – time graph

• Conservation of linear momentum (Coefficient of restitution not necessary)

Learning Objectives:

1. Solve numerical problems involving impulse and momentum
2. Interpretation of area under force – time graph
3. Interpret Newton's laws of motion
4. Compare inertia, mass and force
5. Deduce the relationship between mass and acceleration
6. Interpret the law of conservation of linear momentum and application

Motion in a circle

Content:

• Angular velocity and angular acceleration

• Centripetal and centrifugal forces

• Applications

Learning Objectives:

1. Establish expression for angular velocity, angular acceleration and centripetal force
2. Solve numerical problems involving motion in a circle

Simple Harmonic Motion (S.H.M)

Content:

• Definition and explanation of simple harmonic motion

• Examples of systems that execute S.H.M

• Period, frequency and amplitude of S.H.M

• Velocity and acceleration of S.H.M

• Simple treatment of energy change in S.H.M

• Force vibration and resonance (simple treatment)

Learning Objectives:

1. Establish the relationship between period and frequency
2. Analyze the energy changes occurring during S.H.M
3. Identify different types of forced vibration
4. Enumerate applications of resonance

4. GRAVITATIONAL FIELD

Gravitation

Content:

• Newton’s law of universal gravitation

• Gravitational potential

• Conservative and non-conservative fields

• Acceleration due to gravity

• Variation of g on the earth’s surface

• Distinction between mass and weight escape velocity

• Parking orbit and weightlessness

Learning Objectives:

1. Identify the expression for gravitational force between two bodies
2. Apply Newton’s law of universal gravitation
3. Give examples of conservative and non-conservative fields
4. Deduce the expression for gravitational field potentials
5. Identify the causes of variation of g on the earth’s surface
6. Differentiate between mass and weight
7. Determine escape velocity

5. EQUILIBRIUM OF FORCES

Equilibrium of particles

Content:

• Equilibrium of coplanar forces

• Triangles and polygon of forces

• Lami’s theorem

Learning Objectives:

1. Apply the conditions for the equilibrium of coplanar forces to solve problems
2. Use triangle and polygon laws of forces to solve equilibrium problems
3. Use Lami’s theorem to solve problems

Principles of moments

Content:

• Moment of a force

• Simple treatment and moment of a couple

• Applications

Learning Objectives:

1. Analyze the principle of moment of a force
2. Determine moment of a force and couple
3. Describe some applications of moment of a force and couple

Conditions for equilibrium of rigid bodies

Content:

• Resolution and composition of forces in two perpendicular directions

• Resultant and equilibrant

Learning Objectives:

1. Apply the conditions for the equilibrium of rigid bodies to solve problems
2. Resolve forces into two perpendicular directions
3. Determine the resultant and equilibrant of forces

Center of gravity and stability

Content:

• Stable, unstable and neutral equilibrium

Learning Objectives:

1. Differentiate between stable, unstable and neutral equilibra

6. WORK, ENERGY AND POWER

Work, Energy and Power

Content:

• Definition of work, energy and power

• Forms of energy

• Conservation of energy

• Qualitative treatment between different forms of energy

• Interpretation of area under the force-distance curve

Learning Objectives:

1. Differentiate between work, energy and power
2. Compare different forms of energy, giving examples
3. Apply the principle of conservation of energy
4. Examine the transformation between different forms of energy
5. Interpret the area under the force – distance curve
6. Solve numerical problems in work, energy and power

Energy and society

Content:

• Sources of energy

• Renewable and non-renewable energy e.g. coal, crude oil etc.

• Uses of energy

• Energy and development

• Energy diversification

• Environmental impact of energy e.g. global warming, greenhouse effect and spillage

• Energy crises

• Conversion of energy

• Devices used in energy production

Learning Objectives:

1. Itemize the sources of energy
2. Distinguish between renewable and nonrenewable energy, examples should be given
3. Identify methods of energy transition
4. Explain the importance of energy in the development of the society
5. Analyze the effect of energy use to the environment
6. Identify energy sources that are friendly or hazardous to the environment
7. Identify energy uses in their immediate environment
8. Suggests ways of safe energy use
9. State different forms of energy conversion

Dams and energy production

Content:

• Location of dams

• Energy production

Nuclear energy

Solar energy

Content:

• Solar collector

• Solar panel for energy supply

7. FRICTION

Friction

Content:

• Static and dynamic friction

• Coefficient of limiting friction and its determination

• Advantages and disadvantages of friction

• Reduction of friction

• Qualitative treatment of viscosity and terminal velocity

• Stoke's law

Learning Objectives:

1. Differentiate between static and dynamic friction
2. Determine the coefficient of limiting friction
3. Compare the advantages and disadvantages of friction
4. Suggest ways by which friction can be reduced
5. Analyze factors that affect viscosity and terminal velocity
6. Apply Stoke's law

8. SIMPLE MACHINES

Simple Machines

Content:

• Definition of simple machines

• Types of machines

• Mechanical advantage, velocity ratio and efficiency of machines

Learning Objectives:

1. Identify different types of simple machines
2. Solve problems involving simple machines

9. ELASTICITY

Elasticity

Content:

• Elastic limit, yield point, breaking point, Hooke's law and Young's modulus

• The spring balance as a device for measuring force

• Work done per unit volume in springs and elastic strings

Learning Objectives:

1. Interpret force-extension curves
2. Interpret Hooke's law and Young's modulus of a material
3. Use spring balance to measure force
4. Determine the work done in spring and elastic strings

10. PRESSURE

Atmospheric Pressure

Content:

• Definition of atmospheric pressure

• Units of pressure (S.I) units (Pa)

• Measurement of pressure

• Simple mercury barometer, aneroid barometer and manometer

• Variation of pressure with height

• The use of a barometer as an altimeter

Learning Objectives:

1. Recognize the S.I units of pressure; (Pa)
2. Identify pressure measuring instruments
3. Relate the variation of pressure to height
4. Use a barometer as an altimeter

Pressure in liquids

Content:

• The relationship between pressure, depth and density (P = Ágh)

• Transmission of pressure in liquids (Pascal's Principle)

• Application

Learning Objectives:

1. Determine the relationship between pressure, depth and density
2. Apply the principle of transmission of pressure in liquids to solve problems
3. Determine and apply the principle of pressure in liquid

11. LIQUIDS AT REST

Liquids at Rest

Content:

• Determination of density of solids and liquids

• Definition of relative density

• Upthrust on a body immersed in a liquid

• Archimedes' principle and law of floatation and applications, e.g. ships and hydrometers

Learning Objectives:

1. Distinguish between density and relative density of substances
2. Determine the upthrust on a body immersed in a liquid
3. Apply Archimedes' principle and law of floatation to solve problems

12. TEMPERATURE AND ITS MEASUREMENTS

Temperature

Content:

• Concept of temperature

• Thermometric properties

• Calibration of thermometers

• Temperature scales -Celsius and Kelvin

• Types of thermometers

• Conversion from one scale of temperature to another

Learning Objectives:

1. Identify thermometric properties of materials that are used for different thermometers
2. Calibrate thermometers
3. Differentiate between temperature scales e.g Celsius and Kelvin
4. Compare the types of thermometers
5. Convert from one scale of temperature to another

13. THERMAL EXPANSION

Solids

Content:

• Definition and determination of linear, volume and area expansivities

• Effects and applications, e.g. expansion in building strips and railway lines

• Relationship between different expansivities

Learning Objectives:
1. Determine linear and volume expansivities
2. Assess the effects and applications of thermal expansivities
3. Determine the relationship between different expansivities

Liquids

Content:
• Volume expansivity
• Real and apparent expansivities
• Determination of volume expansivity
• Anomalous expansion of water

Learning Objectives:
1. Determine volume, apparent, and real expansivities of liquids
2. Analyze the anomalous expansion of water

14. GAS LAWS

Gas Laws

Content:
• Boyle’s law (isothermal process)
• Charles’ law (isobaric process)
• Pressure law (volumetric process
• Absolute zero of temperature
• General gas equation (PV/T = constant)
• Ideal gas equation Eg. Pv = nRT
• Van der waal gas

Learning Objectives:
1. Interpret the gas laws
2. Use expression of these laws to solve numerical problems
3. Interpret Van der waal equation for one mole of a real gas

15. QUANTITY OF HEAT

Quantity of Heat

Content:

• Heat as a form of energy

• Definition of heat capacity and specific heat capacity of solids and liquids

• Determination of heat capacity and specific heat capacity of substances by simple methods e.g method of mixtures and electrical method and Newton's law of cooling

Learning Objectives:

1. Differentiate between heat capacity and specific heat capacity
2. Determine heat capacity and specific heat capacity using simple methods
3. Solve numerical problems

16. CHANGE OF STATE

Change of State

Content:

• Latent heat

• Specific latent heats of fusion and vaporization

• Melting, evaporation and boiling

• The influence of pressure and of dissolved substances on boiling and melting points

• Application in appliances

Learning Objectives:

1. Differentiate between latent heat and specific latent heats of fusion and vaporization
2. Differentiate between melting, evaporation and boiling
3. Examine the effects of pressure and of dissolved substance on boiling and melting points
4. Solve numerical problems

17. VAPOURS

Vapours

Content:

• Unsaturated and saturated vapors

• Relationship between saturated vapor pressure (S.V.P) and boiling

• Determination of S.V.P by barometer tube method

• Formation of dew, mist, fog, and rain

• Study of dew point, humidity and relative humidity

• Hygrometry; estimation of the humidity of the atmosphere using wet and dry bulb hygrometers

Learning Objectives:

1. Distinguish between saturated and unsaturated vapors
2. Relate saturated vapor pressure to boiling point
3. Determine S.V.P by barometer tube method
4. Differentiate between dew point, humidity and relative humidity
5. Estimate the humidity of the atmosphere using wet and dry bulb hygrometers
6. Solve numerical problems

18. STRUCTURE OF MATTER AND KINETIC THEORIES

Molecular nature of matter

Content:

• Atoms and molecules

• Molecular theory: explanation of Brownian motion, diffusion, surface tension, capillarity, adhesion, cohesion and angles of contact etc

• Examples and applications

Learning Objectives:

1. Differentiate between atoms and molecules
2. Use molecular theory to explain Brownian motion, diffusion, surface, tension, capillarity, adhesion, cohesion and angle of contact

Kinetic Theory

Content:

• Assumptions of the kinetic theory

• Using the theory to explain the pressure exerted by gas, Boyle’s law, Charles’ law, melting, boiling, vapourization, change in temperature, evaporation, etc.

Learning Objectives:

1. Examine the assumptions of kinetic theory
2. Interpret kinetic theory, the pressure exerted by gasses Boyle’s law, Charles law melting, boiling vaporization, change in temperature, evaporation, etc.

19. HEAT TRANSFER

Heat Transfer

Content:

• Conduction, convection and radiation as modes of heat transfer

• Temperature gradient, thermal conductivity and heat flux

• Effect of the nature of the surface on the energy radiated and absorbed by it

• The conductivities of common materials

• The thermos flask

• Land and sea breeze

• Engines

Learning Objectives:

1. Differentiate between conduction, convection and radiation as modes of heat transfer
2. Solve problems on temperature gradient, thermal conductivity and heat flux
3. Assess the effect of the nature of the surface on the energy radiated and absorbed by it
4. Compare the conductivities of common materials
5. Relate the component part of the working of the thermos flask
6. Differentiate between land and sea breeze
7. Analyze the principles of operating internal combustion jet engines, rockets

20. WAVES

Production and Propagation

Content:

• Wave motion

• Vibrating systems as source of waves

• Waves as mode of energy transfer

• Distinction between particle motion and wave motion

• Relationship between frequency, wavelength and wave velocity V = f »

• Phase difference, wavenumber and wave vector

• Progressive wave equation e.g Y = A sin 2À/» (vt ± x)

Learning Objectives:

1. Interpret wave motion
2. Identify vibrating systems as sources of waves
3. Use waves as a mode of energy transfer
4. Distinguish between particle motion and wave motion
5. Relate frequency and wavelength to wave velocity

6. Determine phase difference, wavenumber and wave vector
7. Use the progressive wave equation to compute basic wave parameters

Classification

Content:
• Types of waves; mechanical and electromagnetic waves
• Longitudinal and transverse waves
• Stationary and progressive waves
• Examples of waves from springs, ropes, stretched strings and the ripple tank

Learning Objectives:
1. Differentiate between mechanical and electromagnetic waves
2. Differentiate between longitudinal and transverse waves
3. Distinguish between stationary and progressive waves
4. Indicate the example of waves generated from springs, ropes, stretched strings and the ripple tank

Characteristics/Properties

Content:
• Reflection, refraction, diffraction and plane Polarization
• Superposition of waves e.g interference
• Beats
• Doppler effects (qualitative treatment only)

Learning Objectives:
1. Differentiate between reflection, refraction, diffraction and plane polarization of waves
2. Analyze the principle of superposition of waves
3. Solve numerical problems on waves
4. Explain the phenomenon of beat, beat frequency and uses
5. Explain Doppler effect of sound and application

21. PROPAGATION OF SOUND WAVES

Sound Waves

Content:
• The necessity for a material medium
• Speed of sound in solids, liquids and air
• Reflection of sound; echoes, reverberation and their applications
• Disadvantages of echoes and reverberations

Learning Objectives:

1. Determine the need for a material medium in the propagation of sound waves
2. Compare the speed of sound in solids, liquids and air
3. Relate the effects of temperature and pressure to the speed of sound in air
4. Solve problem on echoes, reverberation and speed
5. Compare the disadvantages and advantages of echoes
6. Solve problems on echo, reverberation and speed of sound

22. CHARACTERISTICS OF SOUND WAVES

Sound Characteristics

Content:

• Noise and musical notes

• Quality, pitch, intensity and loudness and their application to musical instruments

• Simple treatment of overtones produced by vibrating strings and their c
m/l))

• Acoustic examples of resonance

• Frequency of a note emitted by air columns in closed and open pipes in relation to their lengths

Learning Objectives:

1. Differentiate between noise and musical notes
2. Analyze quality, pitch, intensity and loudness of sound notes
3. Evaluate the application of (ii) above in the construction of musical instruments
4. Identify overtones by vibrating strings and air columns
5. Itemize acoustical examples of resonance
6. Determine the frequencies of notes emitted by air columns in open and closed pipes in relation to their lengths

23. LIGHT ENERGY

Sources of Light

Content:

• Natural and artificial sources of light

• Luminous and non-luminous objects

Learning Objectives:

1. Compare the natural and artificial sources of light
2. Differentiate between luminous and non luminous objects

Propagation of light

Content:

• Speed, frequency and wavelength of light

• Formation of shadows and eclipse

• The pin-hole camera

Learning Objectives:

1. Relate the speed, frequency and wavelength of light
2. Interpret the formation of shadows and eclipses
3. Solve problems using the principle of operation of a pin-hole camera

24. REFLECTION OF LIGHT AT PLANE AND CURVED SURFACES

Reflection of Light

Content:

• Laws of reflection

• Application of reflection of light

• Formation of images by plane, concave and convex mirrors and ray diagrams

• Use of the mirror formula $1/f = 1/u + 1/v$

• Linear magnification

Learning Objectives:

1. Interpret the laws of reflection
2. Illustrate the formation of images by plane, concave and convex mirrors
3. Apply the mirror formula to solve optical problems
4. Determine the linear magnification
5. Apply the laws of reflection of light to the working of periscope, kaleidoscope and the sextant

25. REFRACTION OF LIGHT THROUGH PLANE AND CURVED SURFACES

Refraction of Light

Content:

• Explanation of refraction in terms of velocity of light in the media

• Laws of refraction

• Definition of refractive index of a medium

• Determination of refractive index of glass and liquid using Snell’s law

• Real and apparent depth and lateral displacement

• Critical angle and total internal reflection

• Glass Prism: use of the minimum deviation formula U = sin[(A + D)/2] / sin [A/2]

• Type of lenses

• Use of lens formula 1/f = 1/u + 1/v and Newton's formula (F^2 = ab)

• Magnification

Learning Objectives:

1. Interpret the laws of reflection
2. Determine the refractive index of glass and liquid using Snell's law
3. Determine the refractive index using the principle of real and apparent depth
4. Determine the conditions necessary for total internal reflection
5. Examine the use of periscope, prism, binoculars, optical fiber
6. Apply the principles of total internal reflection to the formation of mirage
7. Use of lens formula and ray diagrams to solve optical numerical problems
8. Determine the magnification of an image
9. Calculate the refractive index of a glass prism using minimum deviation formula

26. OPTICAL INSTRUMENTS

Optical Instruments

Content:

• The principles of microscopes, telescopes, projectors, cameras and the human eye (physiological details of the eye are not required)

• Power of a lens

• Angular magnification

• Near and far points

• Sight defects and their corrections

Learning Objectives:

1. Apply the principles of operation of optical instruments to solve problems
2. Distinguish between the human eye and the cameras
3. Calculate the power of a lens
4. Evaluate the angular magnification of optical instruments
5. Determine the near and far points
6. Detect sight defects and their corrections

27. DISPERSION OF LIGHT AND COLORS

Dispersion and Colors

Content:

• Dispersion of white light by a triangular prism

• Production of pure spectrum

• Color mixing by addition and subtraction

• Color of objects and color filters

• Rainbow

• Electromagnetic spectrum: description of sources and uses of various types of radiation

Learning Objectives:

1. Identify primary colors and obtain secondary colors by mixing
2. Understand the formation of rainbow
3. Deduces why objects have colors
4. Relate the expression for gravitational force between two bodies
5. Apply Newton's law of universal gravitation
6. Analyze colors using color filters
7. Analyze the electromagnetic spectrum in relation to their wavelengths, sources, detection and uses

28. ELECTROSTATICS

Electrostatics

Content:

• Existence of positive and negative charges in matter

• Charging a body by friction, contact and induction

• Electroscope

• Coulomb's inverse square law, electric field and potential

• Electric field intensity and potential difference

• Electric discharge and lightning

Learning Objectives:

1. Identify charges
2. Examine uses of an electroscope
3. Apply Coulomb's square law of electrostatics to solve problems
4. Deduce expressions for electric field intensity and potential difference
5. Identify electric field flux patterns of isolated and interacting charges
6. Analyze the distribution of charges on a conductor and how it is used in lightning conductors

29. CAPACITORS

Capacitors

Content:

• Types and functions of capacitors

• Parallel plate capacitors

• Capacitance of a capacitor

• The relationship between capacitance, area separation of plates and medium between the plates (C = EA/d)

• Capacitors in series and parallel

• Energy stored in a capacitor

Learning Objectives:

1. Determine uses of capacitors
2. Analyze parallel plate capacitors
3. Determine the capacitance of a capacitor
4. Analyze the factors that affect the capacitance of a capacitor
5. Solve problems involving the arrangement of capacitor
6. Determine the energy stored in capacitors

30. ELECTRIC CELLS

Electric Cells

Content:

• Simple voltaic cell and its defects

• Daniel cell, Leclanche cell (wet and dry)

• Lead-acid accumulator and Nickel-Iron (Nife) Lithium iron and Mercury cadmium

• Maintenance of cells and batteries (detail treatment of the chemistry of a cell is not required)

• Arrangement of cells

• Efficiency of a cell

Learning Objectives:

1. Identify the defects of the simple voltaic cell and their correction
2. Compare different types of cells including solar cell
3. Compare the advantages of lead-acid and Nickel iron accumulator
4. Solve problems involving series and parallel combination of cells

31. CURRENT ELECTRICITY

Current Electricity

Content:

• Electromagnetic force (emf), potential difference (p.d.), current, internal resistance of a cell and lost Volt

• Ohm's law

• Measurement of resistance

• Meter bridge

• Resistance in series and in parallel and their combination

• The potentiometer method of measuring emf, current and internal resistance of a cell

• Electrical networks

Learning Objectives:

1. Differentiate between emf, p.d., current and internal resistance of a cell
2. Apply Ohm's law to solve problems
3. Use meter bridge to calculate resistance
4. Compute effective total resistance of both parallel and series arrangement of resistors
5. Determine the resistivity and the conductivity of a conductor
6. Measure emf, current and internal resistance of a cell using the potentiometer
7. Identify the advantages of the potentiometer
8. Apply Kirchoff's law in electrical networks

32. ELECTRICAL ENERGY AND POWER

Electrical Energy and Power

Content:

• Concepts of electrical energy and power

• Commercial unit of electric energy and power

• Electric power transmission

• Heating effects of electric current

• Electrical wiring of houses

• Use of fuses

Learning Objectives:

1. Apply the expressions of electrical energy and power to solve problems
2. Analyze how power is transmitted from the power station to the consumer
3. Identify the heating effects of current and its uses
4. Identify the advantages of parallel arrangement over series
5. Determine the fuse rating

33. MAGNETS AND MAGNETIC FIELDS

Magnets and Magnetic Fields

Content:

• Natural and artificial magnets

• Magnetic properties of soft iron and steel

• Methods of making magnets and demagnetization

• Concept of magnetic field

• Magnetic field of a permanent magnet

• Magnetic field around a straight current carrying conductor, circular wire and solenoid

• Properties of the earth's magnetic field; north and south poles, magnetic meridian and angle of dip and declination

• Flux and flux density

• Variation of magnetic field intensity over the earth's surface

• Applications: earth's magnetic field in navigation and mineral exploration

Learning Objectives:

1. Give examples of natural and artificial magnets
2. Differentiate between the magnetic properties of soft iron and steel
3. Identify the various methods of making magnets and demagnetizing magnets
4. Describe how to keep a magnet from losing its magnetism
5. Determine the flux pattern exhibited when two magnets are placed together pole to pole
6. Determine the flux of a current carrying conductor, circular wire and solenoid including the polarity of the solenoid
7. Determine the flux pattern of a magnet placed in the earth's magnetic fields
8. Identify the magnetic elements of the earth's flux
9. Determine the variation of earth's magnetic field on the earth's surface
10. Examine the applications of the earth's magnetic field

34. FORCE ON A CURRENT CARRYING CONDUCTOR IN A MAGNETIC FIELD

Force on Current-Carrying Conductor

Content:

• Quantitative treatment of force between two parallel current-carrying conductors

• Force on a charge moving in a magnetic field

• The d.c. motor

• Electromagnets

• Carbon microphone

• Moving coil and moving iron instruments

• Conversion of galvanometers to ammeters and voltmeter using shunts and multipliers

• Sensitivity of a galvanometer

Learning Objectives:

1. Determine the direction of force on a current carrying conductor using Fleming's left-hand rule

2. Interpret the attractive and repulsive forces between two parallel current-carrying conductors using diagrams

3. Determine the relationship between the force, magnetic field strength, velocity and the angle through which the charge enters the field

4. Interpret the working of the d.c. motor

5. Analyze the principle of electromagnets and give examples of its application

6. Compare moving iron and moving coil instruments

7. Convert a galvanometer into an ammeter or a voltmeter

8. Identify the factors affecting the sensitivity of a galvanometer

35. ELECTROMAGNETIC INDUCTION

Electromagnetic Induction

Content:

• Faraday's laws of electromagnetic induction

• Factors affecting induced emf

• Lenz's law as an illustration of the principle of conservation of energy

• A.C. and D.C generators

• Transformers

• The induction coil

• Inductance: explanation of inductance, unit of inductance, energy stored in an inductor ($E = 1/2\ I^2\ L$), application/uses of inductors

• Eddy Current: reduction of eddy current, applications of eddy current

Learning Objectives:

1. Interpret the laws of electromagnetic induction

2. Identify factors affecting induced emf

3. Recognize how Lenz's law illustrates the principle of conservation of energy

4. Interpret the diagrammatic set up of A.C. generators

5. Identify the types of transformer

6. Examine principles of operation of transformers

7. Assess the functions of an induction coil

8. Draw some conclusions from the principles of operation of an induction coil

9. Interpret the inductance of an inductor
10. Recognize units of inductance
11. Calculate the effective total inductance in series and parallel arrangement
12. Deduce the expression for the energy stored in an inductor
13. Examine the applications of inductors
14. Describe the method by which eddy current losses can be reduced
15. Determine ways by which eddy currents can be used

36. SIMPLE A.C CIRCUITS

Simple A.C Circuits

Content:

• Explanation of a.c. current and voltage
• Peak and r.m.s. values
• A.c. source connected to a resistor
• A.c source connected to a capacitor- capacitive reactance
• A.c source connected to an inductor inductive reactance
• Series R-L-C circuits
• Vector diagram, phase angle and power factor
• Resistance and impedance
• Effective voltage in an R-L-C circuits
• Resonance and resonance frequency (F€ = 1/2À"(LC))

Learning Objectives:

1. Identify a.c. current and d.c. voltage
2. Differentiate between the peak and r.m.s. values of a.c.
3. Determine the phase difference between current and voltage
4. Interpret series R-L-C circuits
5. Analyze vector diagrams
6. Calculate the effective voltage, reactance and impedance
7. Recognize the condition by which the circuit is at resonance
8. Determine the resonant frequency of R-L-C arrangement
9. Determine the instantaneous power, average power and the power factor in a.c. circuits

37. CONDUCTION OF ELECTRICITY THROUGH

Liquids

Content:

• Electrolytes and non-electrolyte

• Concept of electrolysis

• Faraday's laws of electrolysis

• Application of electrolysis, e.g electroplating, calibration of ammeter etc.

Learning Objectives:

1. Distinguish between electrolytes and nonelectrolytes
2. Analyze the processes of electrolysis
3. Apply Faraday's laws of electrolysis to solve problems

Gases

Content:

• Discharge through gasses (qualitative treatment only)

• Application of conduction of electricity through gasses

Learning Objectives:

1. Analyze discharge through gasses
2. Determine some applications/uses of conduction of electricity through gasses

38. ELEMENTARY MODERN PHYSICS

Elementary Modern Physics

Content:

• Models of the atom and their limitations

• Elementary structure of the atom

• Energy levels and spectra

• Thermionic and photoelectric emissions

• Einstein's equation and stopping potential

• Applications of thermionic emissions and photoelectric effects

• Simple method of production of x-rays

• Properties and applications of alpha, beta and gamma rays

• Half-life and decay constant

• Simple ideas of production of energy by fusion and fission

• Binding energy, mass defect and Einstein's Energy equation ("E = "MC²)

• Wave-particle paradox (duality of matter)

• Electron diffraction

• The uncertainty principle

Learning Objectives:

1. Identify the models of the atom and write their limitations
2. Describe elementary structure of the atom
3. Differentiate between the energy levels and spectra of atoms
4. Compare thermionic emission and photoelectric emission
5. Apply Einstein's equation to solve problems of photoelectric effect
6. Calculate the stopping potential
7. Relate some application of thermionic emission and photoelectric effects
8. Interpret the process involved in the production of x-rays
9. Identify some properties and applications of x-rays
10. Analyze elementary radioactivity
11. Distinguish between stable and unstable nuclei
12. Identify isotopes of an element
13. Compare the properties of alpha, beta and gamma rays
14. Relate half-life and decay constant of a radioactive element
15. Determine the binding energy, mass defect and Einstein's energy equation
16. Analyze wave particle duality
17. Solve some numerical problems based on the uncertainty principle and wave – particle duality

39. INTRODUCTORY ELECTRONICS

Introductory Electronics

Content:

• Distinction between metals, semiconductors and insulators (elementary knowledge of band gap is required)

• Intrinsic and extrinsic semiconductors

• Uses of semiconductors and diodes in rectification and transistors in amplification

• n-type and p-type semiconductors

• Elementary knowledge of diodes and transistors

Learning Objectives:

1. Differentiate between conductors, semi-conductors and insulators
2. Distinguish between intrinsic and extrinsic semiconductors
3. Distinguish between electron and hole carriers
4. Distinguish between n-type and p-type semiconductor

5. Analyze diodes and transistor
6. Relate diodes to rectification and transistors to amplification

Recommended Textbooks

1. Ike, E.E. (2014). Essential Principles of Physics, Jos ENIC Publishers.
2. Ike, E.E. (2014). Numerical Problems and Solutions in Physics, Jos: ENIC Publishers.
3. Nelson, M. (1977). Fundamentals of Physics, Great Britain: Hart Davis Education.
4. Nelson, M. and Parker … (1989). Advanced Level Physics, (Sixth Edition): Heinemann.
5. Okeke, P.N. and Anyakoha, M.W. (2000). Senior Secondary School Physics, Lagos: Pacific Printers.
6. Olumuyiwa, A. and Ogunkoya, O. O. (1992). Comprehensive Certificate Physics, Ibadan: University Press Plc.