232 – PHYSICS

GENERAL OBJECTIVES

By the end of the course, the learner should be able to:

(a) select and use appropriate instruments to carry out measurements in the physical environment;
(b) use the knowledge acquired to discover and explain the order of the physical environment;
(c) use the acquired knowledge in the conservation and management of the environment;
(d) apply the principles of Physics and acquired skills to construct appropriate scientific devices from the available resources;
(e) develop capacity for critical thinking in solving problems in any situation;
(f) contribute to the technological and industrial development of the nation;
(g) appreciate and explain the role of Physics in promoting health in society;
(h) observe general safety precautions in all aspects of life;
(i) acquire and demonstrate a sense of honesty and high integrity in all aspects of Physics and life in general;
(j) acquire positive attitude towards Physics;
(k) acquire adequate knowledge in Physics for further education and/or training.

1.0.0 INTRODUCTION TO PHYSICS

1.1.0 Specific Objectives

By the end of this topic, the learner should be able to:
(a) explain what the study of physics involves
(b) relate physics to other subjects and to technology
(c) identify career opportunities related to physics
(d) state and explain basic laboratory safety rules.

1.2.0 Content

1.2.1 Physics as a Science (reference to Primary Science Syllabus)
1.2.2 Meaning of Physics
1.2.3 Branches of Physics
1.2.4 Relation between Physics, other subjects and technology
1.2.5 Career opportunities in Physics
1.2.6 Basic laboratory safety rules
1.2.7 **Testing on any aspect of this topic should be in relation to other topics**

2.0.0 MEASUREMENT I

2.1.0 Specific Objectives

By the end of this topic, the learner should be able to:
a) define length, area, volume, mass, density, time interval and state the corresponding symbols and SI units
b) convert other metric units to SI units

c) estimate length, mass and time
d) use accurately various measuring instruments:
e) determine experimentally the densities of substances
f) solve numerical problems on density

2.2.0 Content

2.2.1 Definition of length, area, volume, mass, density and time
2.2.2 SI units and symbols
2.2.3 Estimation of quantities
2.2.4 Conversion of units
2.2.5 Measuring instruments: metre rule, tape measure, beam balance, stop clock/watch, measuring cylinder, pipette and burette
2.2.6 Experiments on density
2.2.7 Problems on density

3.0.0 MEASUREMENT II

3.1.0 Specific Objectives

By the end of this topic the learner should be able to:
a) measure length using vernier callipers and micrometer screw gauge
b) estimate the diameter of a molecule of oil
c) solve numerical problems in measurement

3.2.0 Content

3.2.1 Measurement of length using Vernier callipers and micrometer screw gauge
3.2.2 Decimal places, significant figures and standard form
3.2.3 Estimation of the diameter of a molecule of oil (relate to the size of the HIV virus, mention effects of oil spills on health and environment)
3.2.4 Problems in measurements

4.0.0 FORCE

4.1.0 Specific Objectives

By the end of this topic, the learner should be able to:
a) define force and state its SI unit
b) describe types of forces
c) describe experiments to illustrate cohesion, adhesion and surface tension
d) state the effects of force
e) state the difference between mass and weight
f) state the relation between mass and weight, W=mg
g) define scalar and vector quantities
h) solve numerical problems involving W=mg

4.2.0 Content

4.2.1 Definition of force
4.2.2 Types of forces (including cohesive, adhesive and surface tension)
4.2.3 Experiments to demonstrate cohesion, adhesion and surface tension (actual measurement of surface tension not required)

4.2.4 Effects of force
4.2.5 Mass, weight and their relationship
4.2.6 Scalar and vector quantities
4.2.7 Problems involving W=mg

5.0.0 PRESSURE

5.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define pressure and state its SI units;
b) determine pressure exerted by solids;
c) describe experiments to investigate factors affecting pressure in fluids;
d) derive the formula $p=\rho gh$;
e) state the principle of transmission of pressure in fluids (Pascals principle);
f) explain atmospheric pressure and its effect;
g) state and explain the applications of pressure;
h) solve numerical problems involving pressure.

5.2.0 Content

5.2.1 Definition of pressure
5.2.2 Pressure in solids
5.2.3 Factors affecting pressure in fluids (Experimental treatment required)
5.2.4 Derivation of $p =\rho gh$
5.2.5 Atmospheric pressure
5.2.6 Simple mercury barometer, manometers
5.2.7 Applications of pressure: drinking straw, syringe, siphon, hydraulic press, hydraulic brakes, bicycle pump, force pump, lift pump
5.2.8 Problems on pressure

6.0.0 PARTICULATE NATURE OF MATTER

6.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) Give evidence that matter is made up of tiny particles
b) describe experiments to show that particles of matter are at constant random motion
c) explain the states of matter in terms of particle movement
d) explain diffusion

6.2.0 Content

6.2.1 Experiments to show that matter is made up of tiny particles (e.g. cutting papers into small pieces, dilution experiments etc.)
6.2.2 Brownian motion
6.2.3 States of matter
6.2.4 Diffusion (Graham's law not required)

7.0.0 THERMAL EXPANSION

7.1.0 Specific Objectives

By the end of this topic, the learner should be able to

a) define temperature;
b) describe the functioning of various thermometers;
c) describe thermal expansion in solids, liquids and gases;
d) explain expansion in terms of particle behaviour;
e) describe the unusual expansion of water and its effects;
f) explain the effects and applications of thermal expansion.

7.2.0 Content

7.2.1 Temperature
7.2.2 Thermometers: Liquid-in-glass, including Clinical and Six's maximum and minimum
7.2.3 Expansion of solids, liquids and gases
7.2.4 Effects of expansion and contraction
7.2.5 Unusual expansion of water (Anomolous expansion)
7.2.6 Applications of thermal expansion, include Bimetallic strip

8.0.0 HEAT TRANSFER

8.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state the difference between temperature and heat
b) state and explain the modes of heat transfer
c) describe experiments to illustrate factors affecting heat transfer
d) explain applications of heat transfer

8.2.0 Content

8.2.1 Heat and temperature
8.2.2 Modes of heat transfer
8.2.3 Factors affecting heat transfer (Experimental treatment required)
8.2.4 Applications of heat transfer on vacuum flask, domestic hot water system, solar concentrators

9.0.0 RECTILINEAR PROPAGATION OF LIGHT AND REFLECTION AT PLANE SURFACE

9.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) perform and describe experiments to show that light travels in a straight line;
b) describe the formation of shadows and Eclispses;
c) explain the functioning of a pin-hole camera;
d) state the laws of reflection;
e) verify experimentally laws of reflection;
f) state the characteristics of images formed by plane mirrors;
g) explain the applications of reflection at plane surfaces;

h) solve numerical problems involving pin-hole camera and mirrors inclined at an angle.

9.2.0 Content

9.2.1 Rectilinear propagation of light (experimental treatment required)
9.2.2 Formation of shadows and eclipses (umbra and penumbra)
9.2.3 Pin-hole camera: image formation and magnification
9.2.4 Laws of reflection
9.2.5 Images formed by plane mirrors, ray diagrams, parallel and inclined mirrors
9.2.6 Devices based on reflection: periscope, kaleidoscope
9.2.7 Problems on pin-hole camera and mirrors inclined at an angle

10.0.0 ELECTROSTATICS I

10.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe electrostatic charging of objects by rubbing;
b) explain the source of electrostatic charges;
c) state the two types of charges;
d) state the basic law of charges;
e) state the unit of charge;
f) construct a simple leaf electroscope;
g) explain the charging of a leaf electroscope;
h) use a charged leaf electroscope to identify conductors, insulators and types of charge.

10.2.0 Content

10.2.1 Electrostatic charging of objects by rubbing (experimental treatment required)
10.2.2 Types of charges and law of charges
10.2.3 The source of charge
10.2.4 The coulomb
10.2.5 Leaf electroscope: features, charging and discharging
10.2.6 Charging by contact and by induction
10.2.7 Identification of charge
10.2.8 Conductors and insulators

11.0.0 ELECTROSTATICS II

11.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) sketch electric field patterns around charged bodies;
b) describe charge distribution on conductors of various shapes;
c) define capacitance and state its SI unit;
d) describe charging and discharging of a capacitor (calculation involving curves not required);
e) state the factors affecting the capacitance of a parallel plate capacitors;
f) state the applications of capacitors;
h) solve numerical problems involving capacitors.

11.2.0 Content

11.2.1 Electric field patterns
11.2.2 Charge distribution on conductors: spherical and pear shaped conductors
11.2.3 Action at points: lightning arrestors
11.2.4 Capacitance: unit of capacitance (farad, microfarad) factors affecting capacitance
11.2.5 Applications of capacitors
11.2.6 Problems involving capacitors {using $Q=CV$, $C_T=C_1+C_2$},

$$\left.\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2}\right\}$$

12.0.0 CELLS AND SIMPLE CIRCUITS

12.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) draw and set-up simple electric circuits;
b) identify circuit symbols;
c) define electric current;
d) explain the working of primary and secondary cells;
e) explain the care and maintenance of secondary cells.

12.2.0 Content

12.2.1 Simple electric circuits: cell, ammeter, voltmeter, variable resistor, connecting wires, bulb and switches
12.2.2 Circuit symbols
12.2.3 Electric current and its units
12.2.4 Primary and secondary cells. (simple cell, dry Leclanche' cell, Lead acid cell)
12.2.5 Care and maintenance of secondary cells

13.0.0 MAGNETISM

13.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe the properties and uses of magnets;
b) identify magnetic and non-magnetic materials;
c) state the basic law of magnetism;
d) describe patterns of magnetic field;
e) describe methods of magnetisation and demagnetization;
f) explain magnetisation and demagnetisation using the domain theory;
g) construct a simple compass.

13.2.0 Content

13.2.1 Magnets: properties and uses
13.2.2 Magnetic and non-magnetic materials
13.2.3 Basic law of magnetism
13.2.4 Magnetic field patterns
13.2.5 Magnetisation and demagnetisation

13.2.6 Domain theory of magnetism
13.2.7 Care of magnets
13.2.8 Construction of a simple magnetic compass

14.0.0 TURNING EFFECT OF A FORCE

14.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define moment of a force about a point and state its SI unit;
b) state and verify the principle of moments;
c) solve problems involving the principle of moments.

14.2.0 Content

14.2.1 Moment of a force, SI unit of moment of a force
14.2.2 Principle of moments
14.2.3 Problems on principle of moments (consider single pivot only)

15.0.0 EQUILIBRIUM AND CENTRE OF GRAVITY

15.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define centre of gravity;
b) determine experimentally the centre of gravity of lamina objects;
c) identify and explain the states of equilibrium;
d) state and explain factors affecting stability of an object;
e) explain the applications of stability;
f) solve numerical problems involving centre of gravity and moments of a force.

15.2.0 Content

15.2.1 Centre of gravity (Experimental treatment required)
15.2.2 States of equilibrium
15.2.3 Factors affecting stability
15.2.4 Problems on centre of gravity and moments of a force(consider single pivot only)

16.0.0 REFLECTION AT CURVED SURFACES

16.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe concave, convex and parabolic reflectors;
b) describe using ray diagram the principal axis, principal focus, centre of curvature and related terms;
c) locate images formed by curved mirrors by construction of ray diagrams;
d) determine experimentally the characteristics of images formed by a concave mirror;
e) define magnification;
f) explain the applications of curved reflecting surfaces.

16.2.0 Content

16.2.1 Concave, convex and parabolic reflectors

16.2.2 Principal axis, principal focus, centre of curvature and related terms
16.2.3 Location of Images formed by curved mirrors by ray diagram method (Experiments on concave mirrors required)
16.2.4 Magnification formula
16.2.5 Applications of curved reflectors

17.0.0 MAGNETIC EFFECT OF ELECTRIC CURRENT

17.1.0 Specific Objectives

By the end of this topic, the leaner should be able to:

a) perform and describe experiments to determine the direction of the magnetic field round a current carrying conductor;
b) construct a simple electromagnet;
c) state the factors affecting the strength of an electromagnet;
d) determine experimentally the direction of a force on a conductor carrying current in a magnetic field (motor effect);
e) state the factors affecting force on a current carrying conductor in a magnetic field;
f) explain the working of simple electric motor and electric bell.

17.2.0 Content

17.2.1 Magnetic field due to a current
17.2.2 Oersted's experiment
17.2.3 Magnetic field patterns on straight conductors and solenoid (right hand grip rule)
17.2.4 Simple electromagnets
17.2.5 Factors affecting strength of an electromagnet
17.2.6 Motor effect (Flemings left hand rule)
17.2.7 Factors affecting force on a current carrying conductor in a magnetic field (Qualitative treatment only)
17.2.8 Applications - Electric bell, Simple electric motor.

18.0.0 HOOKE'S LAW

18.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state and verify experimentally Hooke's law;
b) determine the spring constant;
c) construct and calibrate a spring balance;
d) solve numerical problems involving Hooke's law.

18.2.0 Content

18.2.1 Hooke's law
18.2.2 Spring constant
18.2.3 Spring balance
18.2.4 Problems on Hooke's Law

19.0.0 WAVES I

19.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe the formation of pulses and waves;
b) describe transverse and longitudinal waves;
c) define amplitude(a), wavelength(λ), frequency(f) and periodic time(T) of a wave;
d) derive the relation $v = f\lambda$;
e) solve numerical problems involving $v = f\lambda$.

19.2.0 **Content**

19.2.1 Pulses and waves
19.2.2 Transverse and longitudinal waves
19.2.3 Amplitude (a),
Wavelength (λ),
Frequency(f), periodic time (T)
19.2.4 Relation $v = f\lambda$
19.2.5 Problems involving $v = f\lambda$

20.0.0 WAVES II

20.1.0 Specific Objectives

By the end of this topic the learner should be able to:

a) describe experiments to illustrate the properties of waves;
b) sketch wave-fronts to illustrate the properties of waves;
c) explain constructive interference and destructive interference;
d) describe experiments to illustrate stationary waves.

20.2.0 Content

20.2.1 Properties of waves including sound waves, reflection, refraction, diffraction and interference (Experimental treatment required)
20.2.2 Constructive interference and destructive interference (qualitative treatment only)
20.2.3 Stationary waves (qualitative and experimental treatment required)

21.0.0 SOUND

21.1.0 Specific Objectives

By the end of this topic the learner should be able to:

a) perform and describe simple experiments to show that sound is produced by vibrating bodies;
b) perform and describe an experiment to show that sound requires a material medium for propagation;
c) explain the nature of sound waves;
d) determine the speed of sound in air by the echo method;
e) state the factors affecting the speed of sound;
f) solve numerical problems involving speed of sound.

21.2.0 Content

21.2.1 Sound: nature and sources (experimental treatment required)
21.2.2 Propagation of sound: compressions and rarefactions
21.2.3 Speed of sound by echo method
21.2.4 Factors affecting speed of sound
21.2.5 Problems involving speed of sound

22.0.0 FLUID FLOW

22.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe streamline flow and turbulent flow;
b) derive the equation of continuity;
c) describe experiments to illustrate Bernoulli's effect;
d) explain the Bernoulli's effect;
e) describe the applications of Bernoulli's effect;
f) solve numerical problems involving the equation of continuity.

22.2.0 Content

22.2.1 Streamline and turbulent flow
22.2.2 Equation of continuity
22.2.3 Bernoulli's effect (Experimental treatment required)
22.2.4 Applications of Bernoulli's effect: Bunsen burner, spray gun, carburetor, aerofoil and spinning ball
22.2.5 Problems involving equation of continuity

23.0.0 LINEAR MOTION

23.1.0 Specific Objectives

By the end of this topic the learner should be able to:

a) define distance, displacement, speed, velocity and acceleration;
b) describe experiments to determine velocity and acceleration;
c) determine acceleration due to gravity;
d) plot and explain motion time graphs;
e) apply the equations of uniformly accelerated motion;
f) solve numerical problems on uniformly accelerated motion.

23.2.0 Content

23.2.1 Distance, displacement, speed, velocity, acceleration(Experimental treatment required)
23.2.2 Acceleration due to gravity free - fall, simple pendulum
23.2.3 Motion-time graphs- displacement time graphs, Velocity time graphs
23.2.4 Equations of uniformly accelerated motion
23.2.5 Problems on uniformly accelerated motion

24.0.0 REFRACTION OF LIGHT

24.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe simple experiments to illustrate refraction of light;
b) state the laws of refraction of light;
c) verify Snell's law;
d) define refractive index;;
e) determine experimentally the refractive index;
f) describe experiments to illustrate dispersion of white light;
g) explain total internal reflection and its effect;
h) state the application of total internal reflection;
i) solve numerical problems involving refractive index and critical angle.

24.2.0 Content

24.2.1 Refraction of light – laws of refraction (Experimental treatment required)
24.2.2 Determination of refractive index- Snell's law, Real/apparent depth, Critical angle
24.2.3 Dispersion of white light (Experimental treatment required)
24.2.4 Total internal reflection and its effects: critical angle
24.2.5 Applications of total internal reflection - Prism periscope, Optical fibre
24.2.6 Problems involving refractive index and critical angle

25.0.0 NEWTON'S LAWS OF MOTION

25.1.0 Specific Objectives

By the end of this topic, the learner should be able to:
a) state Newton's laws of motion;
b) describe simple experiments to illustrate inertia;
c) state the law of conservation of linear momentum;
d) define elastic collision, inelastic collision and impulse;
e) derive the equation F = ma;
f) describe the application of frictional force;
g) define viscosity;
h) explain terminal velocity;
i) solve numerical problems involving Newton's laws and the law of conservation of linear momentum.

25.2.0 Content

25.2.1 Newton's laws of motion (Experimental treatment on inertia required)
25.2.2 Conservation of linear momentum elastic collisions, inelastic collisions, recoil velocity, impulse (oblique collisions not required)
25.2.3 The relation F = ma
25.2.4 Frictional forces:
- Advantages and disadvantages,
- Viscosity and terminal velocity (qualitative treatment only).

25.2.5 Problems involving Newton's Laws and law of conservation of linear momentum (exclude problems on elastic collisions).

26.0.0 WORK, ENERGY, POWER AND MACHINES

26.1.0 Specific Objectives

By the end of this topic, the learners should be able to:

a) describe energy transformations
b) state the law of conservation of energy
c) define work, energy, power and state their SI units
d) define mechanical advantage, velocity ratio and efficiency of machines
e) solve numerical problems involving work, energy, power and machines.

26.2.0 Content

26.2.1 Forms of energy and energy transformations
26.2.2 Sources of energy- Renewable, Non-renewable.
26.2.3 Law of conservation of energy
26.2.4 Work, energy and power (work done by resolved force not required)
26.2.5 Kinetic energy and potential energy
26.2.6 Simple machines
26.2.7 Problems on work, energy, power and machines

27.0.0 CURRENT ELECTRICITY

27.1.0 Specific Objectives

By the end of this topic, the learner should be able to:
a) define potential difference and state its SI unit;
b) measure potential difference and electric current in a circuit;
c) verify Ohm's law;
d) define resistance and state its SI unit;
e) determine experimentally the voltage – current relationships for various conductors;
f) define emf and explain internal resistance of a cell;
g) derive the formulae for effective resistance of resistors in series and in parallel;
h) solve numerical problems involving ohm's law, resistors in series and in parallel.

27.2.0 Content

27.2.1 Scale reading: Ammeter, Voltmeter
27.2.2 Electric circuits: current, potential difference
27.2.3 Ohm's law (experimental treatment required)
27.2.4 Resistance: types of resistors, measurement of resistance, unit of resistance
27.2.5 Electromotive force (emf) and internal resistance of a cell The relation ($E = V + Ir$)
27.2.6 Resistors in series and in parallel
27.2.7 Problems involving Ohm's law, resistors in series and in parallel

28.0.0 HEATING EFFECT OF AN ELECTRIC CURRENT

28.1.0 Specific Objectives

By the end of this topic, the learner should be able to:
a) Perform and describe experiments to illustrate heating effect of an electric current;
b) State the factors affecting heating by an electric current;

c) Derive the equations for electrical energy and electrical power;
d) Identify devices in which heating effect of an electric current is applied ;
e) Solve numerical problems involving electrical energy and electrical power.

28.2.0 Content

28.2.1 Simple experiments on heating effect
28.2.2 Factors affecting electrical energy, The relation E=VIt and P =VI
28.2.3 Heating devices: electric kettle, electric iron, bulb filament, electric heater
28.2.4 Problems involving electrical energy and electrical power

29.0.0 QUANTITY OF HEAT

29.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define heat capacity and specific heat capacity;
b) determine experimentally specific heat capacity of solids and liquids;
c) define specific latent heat of fusion and specific latent heat of vaporization of steam;
d) determine experimentally the specific latent heat of fusion of ice and the specific latent heat of vaporization of steam;
e) state factors affecting melting point and boiling point;
f) explain the functioning of a pressure cooker and a refrigerator;
g) solve problems involving quantity of heat.

29.2.0 Content

29.2.1 Heat capacity, specific heat capacity, units(Experimental treatment required)
29.2.2 Latent heat of fusion, latent heat of vaporization, units(Experimental treatment required)
29.2.3 Boiling and melting points
29.2.4 Pressure cooker, refrigerator
29.2.5 Problems involving quantity of heat ($Q=mc\Delta\theta$, $Q = mL$)

30.0.0 GAS LAWS

30.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

(a) state the gas laws for an ideal gas;
(b) verify experimentally the gas laws;
(c) explain how the absolute zero temperature may be obtained from the pressure – temperature and volume-temperature graphs;
(d) convert Celsius scale to Kelvin scale of temperature;
(e) state the basic assumptions of the kinetic theory of gases;
(f) explain the gas laws using the kinetic theory of gases;
(g) solve numerical problems involving gas laws.

30.2.1 Content

30.2.1 Boyle's law, Charles' law, pressure law, absolute zero

30.2.2 Kelvin scale of temperature
30.2.3 Gas laws and kinetic theory of gases
30.2.4 ($p = \frac{1}{3}\rho c^2$ not required)
30.2.4 Problems involving gas laws [including $\frac{V}{T} = $ constant]

31.0.0 THIN LENSES

31.1.0 Specific objectives

By the end of this topic, the learner should be able to:

a) describe converging lenses and diverging lenses;
b) describe using ray diagrams the principal focus, the optical centre and the focal length of a thin lens;
c) determine experimentally the focal length of a converging lens;
d) locate images formed by thin lenses using ray construction method;
e) describe the characteristics of images formed by thin lenses;
f) explain image formation in the human eye;
g) describe the defects of vision in the human eye and how they can be corrected;
h) describe the use of lenses in various optical devices;
i) solve numerical problems involving the lens formula and the magnification formula.

31.2.0 Content

31.2.1 Types of lenses
31.2.2 Ray diagrams and terms used
31.2.3 Images formed - Ray diagrams, Characteristics, Magnification.
31.2.4 Determination of Focal length: (Experimental treatment required) - estimation method, lens formula, lens-mirror method
31.2.5 Human eye, defects (short sightedness and long sightedness)
31.2.6 Optical devises - Simple microscope, Compound microscope, The camera
31.2.7 Problems involving the lens formula and the magnification formula

32.0 UNIFORM CIRCULAR MOTION

32.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) define angular displacement and angular velocity;
b) describe simple experiments to illustrate centripetal force;
c) explain the applications of uniform circular motion;
d) solve numerical problems involving uniform circular motion.

32.2.0 Content

32.2.1 The radian, angular displacement and, angular velocity
32.2.2 Centripetal force;
The relations $F = \frac{mv^2}{r}$, $F = mr\omega^2$
(derivation of formulae not necessary experimental treatment is required)

32.2.3 Applications of uniform circular motion
32.2.4 Centrifuge, vertical, horizontal circles banked tracks (calculations on banked tracks and conical pendulum not required).
32.2.5 Problem solving (application of relations $F = \frac{mv^2}{r}$, $F=mr\omega^2$ in numerical calculations)

33.0.0 FLOATING AND SINKING

33.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) state Archimedes' principle;
b) verify Archmedes' principle;
c) state the law of floatation;
d) define relative density;
e) describe the applications of Archimedes' principle and relative density;
f) solve numerical problems involving Archimedes' principles.

33.2.0 Content

33.2.1 Archimedes' principle law of flotation. (experimental treatment required),
33.2.2 Relative density
33.2.3 Applications of Archimedes' principle and relative density
33.2.4 Problems on Archimedes' principle

34.0.0 ELECTROMAGNETIC SPECTRUM

34.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) describe the complete electromagnetic spectrum;
b) state the properties of electromagnetic waves;
c) describe the methods of detecting electromagnetic radiations;
d) describe the applications of electromagnetic radiations;
e) solve numerical problems involving $c=f\lambda$.

34.2.0 Content

34.2.1 Electromagnetic spectrum
34.2.2 Properties of electromagnetic waves
34.2.3 Detection of electromagnetic (e.m.) radiations
34.2.4 Applications of e.m. radiations (include green house effect)
34.2.5 Problems involving $c=f\lambda$

35.0.0 ELECTROMAGNETIC INDUCTION

35.1.0 Specific Objectives

By the end of this topic, the learner should be able to:

a) perform and describe simple experiments to illustrate electromagnetic induction;
b) state the factors affecting the magnitude and the direction of the induced emf;
c) state the laws of electromagnetic induction;
d) describe simple experiments to illustrate mutual induction;

e) explain the working of an alternating current (a.c) generator and a direct current (d.c) generator;
f) explain the working of a transformer;
g) explain the applications of electromagnetic induction;
h) solve numerical problems involving transformers.

35.2.0 Content

35.2.1 Simple experiments to illustrate electromagnetic induction
35.2.2 Induced emf - Faradays' law, Lenz's law
35.2.3 Mutual induction
35.2.4 Alternating current generator, direct current generator
35.2.5 Fleming's right hand-rule
35.2.6 Transformers
35.2.7 Applications of electromagnetic induction
35.2.8 Problems involving transformers

36.0.0 MAINS ELECTRICITY

36.1.0 Specific Objectives

By the end of this topic, the learner should be able to:
a) state the sources of mains electricity;
b) describe the transmission of electric power from the generating station to the consumer;
c) explain the domestic wiring system;
d) define the kilowatt hour;
e) determine the electrical energy consumption and cost;
f) solve numerical problems involving mains electricity.

36.2.0 Content

36.2.1 Sources of mains electricity e.g. geothermal, hydro, nuclear etc.
36.2.2 Power transmission (include dangers of high voltage transmission)
36.2.3 Domestic wiring system
36.2.4 kWh, consumption and cost of electric energy
36.2.5 Problems involving mains electricity

37.0.0 CATHODE RAYS AND CATHODE RAY TUBE

37.1.0 **Specific Objectives**

By the end of this topic, the learner should be able to:
a) describe the production of cathode rays;
b) state the properties of cathode rays;
c) explain the functioning of a Cathode RayOscilloscope (C.R.O) and a Television tube (TV tube);
d) explain the uses of a Cathode Ray Oscilloscope;
e) solve problems involving Cathode Ray Oscilloscope.

37.2.0 **Content**

37.2.1 Production of cathode rays, cathode ray tube

37.2.2 Properties of cathode rays
37.2.3 C.R.O and TV tubes
37.2.4 Uses of C.R.O
37.2.5 Problems involving C.R.O

38.0.0 X-RAYS

38.1.0 Specific Objectives

By the end of this topic, the learner should be able to:
(a) explain the production of X-rays;
(b) state the properties of X-rays;
(c) state the dangers of X-rays;
(d) explain the uses of X-rays.

38.1.0 Content

38.2.1 Production of X-rays, X-rays tube
38.2.2 Energy changes in an X-ray tube
38.2.3 Properties of X-rays.
38.2.4 Soft X-rays and hard X-rays
38.2.5 Dangers of X-rays and precautions
38.2.6 Uses of X-rays (Bragg's law not required)

39.0.0 PHOTOELECTRIC EFFECT

39.1.0 **Specific Objectives**

By the end of this topic, the learner should be able to:
a) perform and describe simple experiments to illustrate the photoelectric effect;
b) explain the factors affecting photoelectric emission;
c) apply the equation $E=hf$ to calculate the energy photons,
d) define threshold frequency, work function and the electron volt;
e) explain photoelectric emission using Einstein equation ($hf_0 + \frac{1}{2}mv^2 = hf$);
f) explain the applications of photoelectric effect;
g) solve numerical problems involving photoelectric emissions.

39.2.0 Content

39.2.1 Photoelectric effect, photons, threshold frequency, work function, Planck's constant, and electron-volt
39.2.2 Factors affecting photoelectric emission
39.2.3 Energy of Photons
39.2.4 Einstein's equation, $hf_0 + \frac{1}{2}mv^2 = hf$
39.2.5 Applications of photoelectric effect - Photo emissive cells, Photo conductive cells, Photovoltaic cells.

40.0.0 RADIOACTIVITY

40.1.0 Specific Objectives

By the end of this topic, the learner should be able to:
a) define radioactive decay and half-life;
b) describe the three types of radiations emitted in natural radioactivity;
c) explain the detection of radioactive emissions;

d) define nuclear fission and fusion;
e) write balanced nuclear equations;
f) explain the dangers of radioactive emissions;
g) state the applications of radioactivity;
h) solve numerical problems involving half-life.

40.2.0 Content

40.2.1 Radioactive decay
40.2.2 Half-life
40.2.3 Types of radiations, properties of radiations
40.2.4 Detectors of radiation,
40.2.5 Nuclear fission, nuclear fusion
40.2.6 Nuclear equations
40.2.7 Hazards of radioactivity, precautions
40.2.8 Applications
40.2.9 Problems on half-life (integration not required)

41.0.0 ELECTRONICS

41.1.0 Specific Objectives

By the end of this topic, the learner should be able to:
a) state the differences between conductors and insulators;
b) define instrinsic and extrinsic semi-conductors;
c) explain doping in semi-conductors;
d) explain the working of a p-n junction diode;
e) sketch current-voltage characteristics for a diode;
f) explain the application of diodes in rectification.

41.1.0 Content

41.2.1 Conductors, semi-conductors, insulators
41.2.2 Intrinsic and extrinsic semi-conductors
41.2.3 Doping
41.2.4 p-n junction diode
41.2.5 applications of diodes: half wave rectification and full wave rectification