JAMB SYLLABUS FOR PHYSICS

CAPACITORS

- CAPACITORS

OBJECTIVES

Candidates should be able to:

i. determine uses of capacitors.

ii. analyse parallel plate capacitors.

iii. determine the capacitance of a capacitor.

iv. analyse the factors that affect the capacitance of a capacitor.

v. solve problems involving the arrangement of capacitor.

vi. determine the energy stored in capacitors.

CONTENT

(a) Types and functions of capacitors.

(b) Parallel plate capacitors.

(c) Capacitance of a capacitor.

(d) The relationship between capacitance, area separation of plates and medium between the plates.

$C = {}^{EA}/_{d}$

(e) Capacitors in series and parallel.

(f) Energy stored in a capacitor.

CHANGE OF STATE

- CHANGE OF STATE

OBJECTIVES

Candidates should be able to:

i. differentiate between latent heat and specific latent heats of fusion and vaporization.

ii. differentiate between melting, evaporation and boiling.

iii. examine the effects of pressure and of dissolved substance on boiling and melting points.

iv. solve numerical problems.

CONTENT

(a) Latent heat.

(b) Specific latent heats of fusion and vaporization.

(c) Melting, evaporation and boiling.

(d) The influence of pressure and of dissolved substances on boiling and melting points.

(e) Application in appliances.

CHARACTERISTICS OF SOUND WAVES

- CHARACTERISTICS OF SOUND WAVES

OBJECTIVES

Candidates should be able to:

i. differentiate between noise and musical notes.

ii. analyse quality, pitch, intensity and loudness of sound notes.

iii. evaluate the application of (ii) above in the construction of musical instruments.

iv. identify overtones by vibrating strings and air columns.

v. itemize acoustical examples of resonance.

vi. determine the frequencies of notes emitted by air columns in open and closed pipes in relation to their lengths.

CONTENT

(a) Noise and musical notes.

(b) Quality, pitch, intensity and loudness and their application to musical instruments.

(c) Simple treatment of overtones produced by vibrating strings and their columns
$F_o = {}^{1}\!/_{2L}\sqrt{({}^{T}\!/_{\mu})}$
where $\mu = {}^{m}\!/_{l}$

(d) Acoustic examples of resonance.

(e) Frequency of a note emitted by air columns in closed and open pipes in relation to their lengths.

CONDUCTION OF ELECTRICITY

- CONDUCTION OF ELECTRICITY THROUGH GASES

OBJECTIVES

Candidates should be able to:

i. analyse discharge through gases.

ii. determine some applications/uses of conduction of electricity through gases.

CONTENT

(a) Discharge through gases (qualitative treatment only).

(b) Application of conduction of electricity through gases.

- CONDUCTION OF ELECTRICITY THROUGH LIQUIDS

OBJECTIVES

Candidates should be able to:

i. distinguish between electrolytes and non-electrolytes.

ii. analyse the processes of electrolysis.

iii. apply Faraday□s laws of electrolysis to solve problems.

CONTENT

(a) Electrolytes and non-electrolyte.

(b) Concept of electrolysis.

(c) Faraday□s law of electrolysis.

(d) Application of electrolysis, e.g. electroplating, calibration of ammeter etc.

CURRENT ELECTRICITY

- CURRENT ELECTRICITY

OBJECTIVES

Candidates should be able to:

i. differentiate between emf, p.d., current and internal resistant of a cell.

ii. apply Ohm□s law to solve problems.

iii. use metre bridge to calculate resistance.

iv. compute effective total resistance of both parallel and series arrangement of resistors.

v. determine the resistivity and the conductivity of a conductor.

vi. measure emf, current and internal resistance of a cell using the potentiometer.

vii. identify the advantages of the potentiometer.

viii. apply Kirchoff's law in electrical networks.

CONTENT

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

(b) Ohm□s law.

(c) Measurement of resistance.

(d) Meter bridge.

(e) Resistance in series and in parallel and their combination.

(f) The potentiometer method of measuring emf, current and internal resistance of a cell.

(g) Electrical networks.

DAMS AND ENERGY PRODUCTION

- DAMS AND ENERGY PRODUCTION

CONTENT

(a) Location of dams.

(b) Energy production.

DISPERSION OF LIGHT AND COLOURS

- DISPERSION OF LIGHT AND COLOURS

CONTENT

(a) Dispersion of white light by a triangular prism.

(b) Production of pure spectrum.

(c) Colour mixing by addition and subtraction.

(d) Colour of objects and colour filters.

(e) Rainbow.

EDDY CURRENT

- EDDY CURRENT

CONTENT

(a) Reduction of eddy current.

(b) Applications of eddy current.

ELASTICITY

- ELASTICITY

CONTENT

(a) Elastic limit, yield point, breaking point, Hooke□s law and Young□s modulus.

(b) The spring balance as a device for measuring force.

(c) Work done per unit volume in springs and elastic strings.

ELECTRIC CELLS

- ELECTRIC CELLS

CONTENT

(a) Simple voltaic cell and its defects.

(b) Daniel cell, Leclanché cell (wet and dry).

(c) Lead □acid accumulator and Nickel-Iron (Nife) Lithium lron and Mercury cadmium.

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

(e) Arrangement of cells.

(f) Efficiency of a cell.

ELECTRICAL ENERGY AND POWER

- ELECTRICAL ENERGY AND POWER

CONTENT

(a) Concepts of electrical energy and power.

(b) Commercial unit of electric energy and power.

(c) Electric power transmission.

(d) Heating effects of electric current.

(e) Electrical wiring of houses.

(f) Use of fuses.

ELECTROMAGNETIC INDUCTION

- ELECTROMAGNETIC INDUCTION

CONTENT

(a) Faraday□s laws of electromagnetic induction.

(b) Factors affecting induced emf.

(c) Lenz□s law as an illustration of the principle of conservation of energy.

(d) A.C. and D.C. generators

(e) Transformers.

(f) The induction coil.

ELECTROMAGNETIC SPECTRUM

- ELECTROMAGNETIC SPECTRUM

CONTENT

Description of sources and uses of various types of radiation.

ELECTROSTATICS

- ELECTROSTATICS

CONTENT

(a) Existence of positive and negative charges in matter.

(b) Charging a body by friction, contact and induction.

(c) Electroscope.

(d) Coulomb□s inverse square law electric field and potential.

(e) Electric field intensity and potential difference.

(f) Electric discharge and lightning.

ELEMENTARY MODERN PHYSICS

- ELEMENTARY MODERN PHYSICS

CONTENT

(a) Models of the atom and their limitations.

(b) Elementary structure of the atom.

(c) Energy levels and spectra.

(d) Thermionic and photoelectric emissions.

(e) Einstein□s equation and stopping potential.

(f) Applications of thermionic emissions and photoelectric effects.

(g) Simple method of production of x-rays.

(h) Properties and applications of alpha, beta and gamma rays.

(i) Half-life and decay constant.

(j) Simple ideas of production of energy by fusion and fission.

(k) Binding energy, mass defect and Einstein's energy equation

$\Delta E = \Delta mc^2$

(l) Wave-particle paradox (duality of matter)

(m) Electron diffraction.

(n) The uncertainty principle.

ENERGY AND SOCIETY

- ENERGY AND SOCIETY

CONTENT

(a) Sources of energy.

(b) Renewable and non-renewable energy e.g. coal, crude oil etc.

(c) Uses of energy.

(d) Energy and development.

(e) Energy diversification.

(f) Environmental impact of energy e.g. global warming, green house effect and spillage.

(g) Energy crises.

(h) Conversion of energy.

(i) Devices used in energy production.

EQUILIBRIUM OF FORCES

- CENTRE OF GRAVITY AND STABILITY.

CONTENT

Stable, unstable and neutral equilibra.

- CONDITIONS FOR EQUILIBRIUM OF RIGID BODIES UNDER THE ACTION OF PARALLEL AND NON-PARALLEL FORCES

CONTENT

(a) Resolution and composition of forces in two perpendicular directions.

(b) Resultant and equilibrant.

- EQUILIBRIUM OF PARTICLES

CONTENT

(a) Equilibrium of coplanar forces.

(b) Triangles and polygon of forces.

(c) Lami□s theorem.

- PRINCIPLES OF MOMENTS

CONTENT

(a) Moment of a force.

(b) Simple treatment and moment of a couple (torgue).

(c) Applications.

FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD

- FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD

CONTENT

(a) Quantitative treatment of force between two parallel current-carrying conductors.

(b) Force on a charge moving in a magnetic field.

(c) The d. c. motor.

(d) Electromagnets.

(e) Carbon microphone.

(f) Moving coil and moving iron instruments.

(g) Conversion of galvanometers to ammeters and voltmeter using shunts and multipliers.

(h) Sensitivity of a galvanometer.

FRICTION

- FRICTION

CONTENT

(a) Static and dynamic friction.

(b) Coefficient of limiting friction and its determination.

(c) Advantages and disadvantages of friction.

(d) Reduction of friction.

(e) Qualitative treatment of viscosity and terminal viscosity.

(f) Stoke's law.

GAS LAWS

- GAS LAWS

CONTENT

(a) Boyle's law (isothermal process).

(b) Charle's law (isobaric process).

(c) Pressure law (volumetric process).

(d) Absolute zero of temperature.

(e) General gas quation

($^{PV}/_{T}$ = constant)

(f) ideal gas equation:

e.g. PV = nRT

(g) Van der Waals gas.

GRAVITATIONAL FIELD

- GRAVITATIONAL FIELD

CONTENT

(a) Newton's law of universal gravitation.

(b) Gravitational potential.

(c) Conservative and non-conservative fields.

(d) Acceleration due to gravity.

(e) Variation of g on the earth's surface.

(f) Distinction between mass and weight.

(g) Escape velocity.

(h) Parking orbit and weightlessness.

HEAT TRANSFER

- HEAT TRANSFER

CONTENT

(a) Conduction, convention and radiation as modes of heat transfer.

(b) Temperature gradient, thermal conductivity and heat flux.

(c) Effect of the nature of the surface on the energy radiated and absorbed by it.

(d) The conductivities of common materials.

(e) The thermos flask.

(f) Land and sea breeze.

(g) Engines.

INDUCTANCE

- INDUCTANCE

CONTENT

(a) Explanation of inductance.

(b) Unit of inductance.

(c) Energy stored in an inductor.

$E = {}^{1}\!/_{2} \times I^2 \times L$

(d) Applications/uses of inductors.

INTRODUCTORY TO ELECTRONICS

- INTRODUCTORY TO ELECTRONICS

CONTENT

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

(b) Intrinsic and extrinsic semi-conductors.

(c) Uses of semiconductors and diodes in rectification and transistors in amplification.

(d) n-type and p-type semiconductors.

(e) Elementary knowledge of diodes and transistors.

LIGHT ENERGY

- PROPAGATION OF LIGHT

CONTENT

(a) Speed, frequency and wavelength of light.

(b) Formation of shadows and eclipse.

(c) The pin-hole camera.

- SOURCE OF LIGHT

CONTENT

(a) Natural and artificial source of light.

(b) Luminous and non-luminous objects.

LIQUIDS AT REST

- LIQUIDS AT REST

CONTENT

(a) Determination of density of solid and liquids.

(b) Definition of relative density.

(c) Upthrust on a body immersed in a liquid.

(d) Archimede□s principle and law of floatation and applications, e.g. ships and hydrometers.

MAGNETS AND MAGNETIC FIELDS

- MAGNETS AND MAGNETIC FIELDS

CONTENT

(a) Natural and artificial magnets.

(b) Magnetic properties of soft iron and steel.

(c) Methods of making magnets and demagnetization.

(d) Concept of magnetic field.

(e) Magnetic field of a permanent magnet.

(f) Magnetic field round a straight current carrying conductor, circular wire and solenoid.

(g) Properties of the earth's magnetic field; north and south poles, magnetic meridian and angle of dip and declination.

(h) Flux and flux density.

(i) Variation of magnetic field intensity over the earth's surface.

(j) Applications: earth's magnetic field in navigation and mineral exploration.

MEASUREMENTS AND UNITS

- DERIVED PHYSICAL QUANTITIES AND THEIR UNITS
- DIMENSIONS
- FUNDAMENTAL PHYSICAL QUANTITIES
- LENGTH, AREA AND VOLUME
- LIMITATIONS OF EXPERIMENTAL MEASUREMENTS

- MASS

- MEASUREMENT, POSITION, DISTANCE AND DISPLACEMENT

- TIME

MOTION

- LINEAR MOTION

CONTENT

(a) Speed, velocity and acceleration.

(b) Equations of uniformly accelerated motion.

(c) Motion under gravity.

(d) Distance-time graph and velocity-time graph.

(e) Instantaneous velocity and acceleration.

- MOTION

CONTENT

(a) Types of motion:

translational, oscillatory, rotational, spin and random.

(b) Relative motion.

(c) Causes of motion.

(d) Types of force:

i. contact.

ii. force field.

- MOTION IN A CIRCLE

CONTENT

(a) Angular velocity and angular acceleration.

(b) Centripetal and centrifugal forces.

(c) Applications.

- NEWTON'S LAWS OF MOTON

CONTENT

(a) Inertia, mass and force.

(b) Relationship between mass and acceleration.

(c) Impulse and momentum.

(d) Force-time graph.

(e) Conservation of linear momentum (Coefficient of restitution not necessary).

- PROJECTILES

CONTENT

(a) Calculation of range, maximum height and time of flight from the ground and height.

(b) Applications of projectile motion.

- SIMPLE HARMONIC MOTION (S.H.M.)

CONTENT

(a) Definition and explanation of simple harmonic motion.

(b) Examples of systems that execute S.H.M.

(c) Period, frequency and amplitude of S.H.M.

(d) Velocity and acceleration of S.H.M.

(e) Simple treatment of energy change in S.H.M.

(f) Force vibration and resonance (simple treatment).

NUCLEAR ENERGY

- NUCLEAR ENERGY

OPTICAL INSTRUMENTS

- OPTICAL INSTRUMENTS

CONTENT

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

(b) Power of a lens.

(c) Angular magnification.

(d) Near and far points.

(e) Sight defects and their corrections.

PRESSURE

- ATMOSPHERIC PRESSURE

CONTENT

(a) Definition of atmospheric pressure.

(b) Units of pressure (S.I) units (Pa).

(c) Measurement of pressure.

(d) Simple mercury barometer aneroid barometer and manometer.

(e) Variation of pressure with height.

(f) The use of barometer as an altimeter.

- PRESSURE IN LIQUIDS

CONTENT

(a) The relationship between pressure, depth and density (P = ρgh).

(b) Transmission of pressure in liquids (Pascal's Principle).

(c) Application.

PROPAGATION OF SOUND WAVES

- PROPAGATION OF SOUND WAVES

CONTENT

(a) The necessity for a material medium.

(b) Speed of sound in solids, liquids and air.

(c) Reflection of sound; echoes, reverberation and their applications.

(d) Disadvantages of echoes and reverberations.

QUANTITY OF HEAT

- QUANTITY OF HEAT

CONTENT

(a) Heat as a form of energy.

(b) Definition of heat capacity and specific heat capacity of solids and liquids.

(c) 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.

REFLECTION OF LIGHT AT PLANE AND CURVED SURFACES

- REFLECTION OF LIGHT AT PLANE AND CURVED SURFACES

CONTENT

(a) Laws of reflection.

(b) Application of reflection of light.

(c) Formation of images by plane, concave and convex mirrors and ray diagrams.

(d) Use of the mirror formula
$^{1}/_{f} = {}^{1}/_{u} + {}^{1}/_{v}$

(e) Linear magnification.

REFRACTION OF LIGHT THROUGH

- GLASS PRISM

CONTENT

(a) Use of the minimum deviation formula:
$U = \frac{\sin A + D/2}{\sin A/2}$.

(b) Type of lenses.

(c) Use of lens formula:

$^{1}/_{f} = {}^{1}/_{u} + {}^{1}/_{v}$ and Newton's formular ($F^{2} = ab$).

(d) Magnification.

REFRACTION OF LIGHT THROUGH A PLANE AND CURVED SURFACES

- REFRACTION OF LIGHT THROUGH A PLANE AND CURVED SURFACES

CONTENT

(a) Explanation of refraction in terms of velocity of light in the media.

(b) Laws of refraction.

(c) Definition of refractive index of a medium.

(d) Determination of refractive index of glass and liquid using Snell□s law.

(e) Real and apparent depth and lateral displacement.

(f) Critical angle and total internal reflection.

SCALARS AND VECTORS

- SCALARS AND VECTORS

CONTENT

(a) Definition of scalar and vector quantities.

(b) Examples of scalar and vector quantities.

(c) Relative velocity.

(d) Resolution of vectors into two perpendicular directions including graphical methods of solution.

SIMPLE A.C. CIRCUITS

- SIMPLE A.C. CIRCUITS

CONTENT

(a) Explanation of a.c. current and voltage.

(b) Peak and r.m.s. values.

(c) A.C. source connected to a resistor.

(d) A.C. source connected to a capacitor- capacitive reactance.

(e) A.C. source connected to an inductor-inductive reactance.

(f) Series R-L-C circuits.

(g) Vector diagram, phase angle and power factor.

(h) Resistance and impedance.

(i) Effective voltage in an R-L-C circuits.

(j) Resonance and resonance frequency

$F_o = {}^{1}\!/_{2\pi\sqrt{LC}}$

SIMPLE MACHINES

- SIMPLE MACHINES

CONTENT

(a) Definition of simple machines.

(b) Types of machines.

(c) Mechanical advantage, velocity ratio and efficiency of machines.

SOLAR ENERGY

- SOLAR ENERGY

CONTENT

(a) Solar collector.

(b) Solar panel for energy supply.

STRUCTURE OF MATTER AND KINETIC THEORY

- KINETIC THEORY

CONTENT

(a) Assumptions of the kinetic theory.

(b) Using the theory to explain the pressure exerted by gas, Boyle□s law, Charles□ law, melting, boiling, vaporization, change in temperature evaporation, etc.

- MOLECULAR NATURE OF MATTER

CONTENT

(a) Atoms and molecules.

(b) Molecular theory: explanation of Brownian motion, diffusion, surface tension, capillarity, adhesion, cohesion and angles of contact etc.

(c) Examples and applications.

TEMPERATURE AND ITS MEASUREMENT

- TEMPERATURE AND ITS MEASUREMENT

CONTENT

(a) Concept of temperature.

(b) Thermometric properties.

(c) Calibration of thermometers.

(d) Temperature scales□Celsius and Kelvin.

(e) Types of thermometers.

(f) Conversion from one scale of temperature to another.

THERMAL EXPANSION

- LIQUIDS

CONTENT

(a) Volume expansivity.

(b) Real and apparent expansivities.

(c) Determination of volume expansivity.

(d) Anomalous expansion of water.

- SOLIDS

CONTENT

(a) Definition and determination of linear, volume and area expansivities.

(b) Effects and applications, e.g. expansion in building strips and railway lines.

(c) Relationship between different expansivities.

VAPOURS

- VAPOURS

CONTENT

(a) Unsaturated and saturated vapours.

(b) Relationship between saturated vapour pressure (S.V.P) and boiling.

(c) Determination of S.V.P by barometer tube method.

(d) Formation of dew, mist, fog, and rain.

(e) Study of dew point, humidity and relatve humidity.

(f) Hygrometry; estimation of the humidity of the atmosphere using wet and dry bulb hygrometers.

WAVES

- CHARACTERISTICS/PROPERTIES

CONTENT

(a) Reflection, refraction, diffraction and plane polarization.

(b) Superposition of waves e.g. interference.

(c) Beats.

(d) Doppler effects (qualitative treatment only).

- CLASSIFICATION

CONTENT

(a) Types of waves; mechanical and electromagnetic waves.

(b) Longitudinal and transverse waves.

(c) Stationary and progressive waves.

(d) Examples of waves from springs, ropes, stretched strings and the ripple tank.

- PRODUCTION AND PROPAGATION

CONTENT

(a) Wave motion.

(b) Vibrating systems as source of waves.

(c) Waves as mode of energy transfer.

(d) Distinction between particle motion and wave motion.

(e) Relationship between frequency, wavelength and wave velocity ($V = f\lambda$)

(f) Phase difference, wave number and wave vector.

(g) Progressive wave equation e.g.

$Y = A \sin {}^{2\pi}/_{\lambda}(vt \pm x)$

WORK, ENERGY AND POWER

- WORK, ENERGY AND POWER

CONTENT

(a) Definition of work, energy and power.

(b) Forms of energy.

(c) Conservation of energy.

(d) Qualitative treatment between different forms of energy.

(e) Interpretation of area under the force-distance curve.