

1. MEASUREMENTS AND UNITS

- Length, area and volume: Metre rule, Venier calipers Micrometer Screw-guage, measuring cylinder
- (b) Mass
- unit of mass
- use of simple beam balance
- concept of beam balance
- (c) Time
- unit of time
- time-measuring devices
- (d) Fundamental physical quantities
- (e) Derived physical quantities and their units
- Combinations of fundamental quantities and determination of their units
- (f) Dimensions
- definition of dimensions
- simple examples
- (g) Limitations of experimental measurements
- accuracy of measuring instruments
- simple estimation of errors.
- significant figures.
- standard form.
- (h) Measurement, position, distance and displacement
- concept of displacement
- distinction between distance and displacement
- concept of position and coordinates
- frame of reference

2. Scalars and Vectors

- 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.

3. Motion

- Types of motion: translational, oscillatory, rotational, spin and random
- Relative motion
- causes of motion
- Types of force
- contact

- force field
- linear motion
- speed, velocity and acceleration
- equations of uniformly accelerated motion
- motion under gravity
- distance-time graph and velocity time graph
- instantaneous velocity and acceleration.
- Projectiles:
 - calculation of range, maximum height and time of flight from the ground and a height
 - applications of projectile motion
- Newton's laws of motion:
 - inertia, mass and force
 - relationship between mass and acceleration
 - impulse and momentum
 - force - time graph
 - conservation of linear momentum (Coefficient of restitution not necessary)
- Motion in a circle:
 - angular velocity and angular acceleration
 - centripetal and centrifugal forces.
 - applications
- Simple Harmonic Motion (S.H.M):
 - 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)

4. Gravitational field

- 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.

5. Equilibrium of Forces

- triangles and polygon of forces
- Lami's theorem
- principles of moments

- moment of a force
- simple treatment and moment of a couple (torque)
- applications
- conditions for equilibrium of rigid bodies under the action of parallel and non-parallel forces
- resolution and composition of forces in two perpendicular directions,
- resultant and equilibrant
- centre of gravity and stability
- stable, unstable and neutral equilibrium

6. Work, Energy and Power

- definition of work, energy and power
- forms of energy
- conservation of energy
- sources of energy
- renewable and non-renewable energy eg coal, crude oil etc
- uses of energy
- energy crises
- (viii) conversion of energy
- devices used in energy production.
- Dams and energy production
- location of dams
- energy production
- nuclear energy
- solar energy
- solar collector
- solar panel for energy supply.

7. Friction

- 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.

8. Simple Machines

- definition of simple machines
- types of machines
- mechanical advantage, velocity ratio and efficiency of machines

9. Elasticity

- elastic limit, yield point, breaking point, Hooke's law and Young's modulus
- the spring balance as a device for measuring force
- (iii.) work done per unit volume in springs and elastic strings
- work done per unit volume in springs and elastic strings.

10. Pressure

- Atmospheric Pressure
- 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 barometer as an altimeter.
- Pressure in liquids
- the relationship between pressure, depth and density ($P = \rho gh$)
- transmission of pressure in liquids (Pascal's Principle)
- application

11. Liquids At Rest

- 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.

12. Temperature and Its Measurement

- concept of temperature
- thermometric properties
- calibration of thermometers
- temperature scales -Celsius and Kelvin.
- types of thermometers
- conversion from one scale of temperature to another

13. Thermal Expansion

- Solids
- 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
- Liquids
- volume expansivity
- real and apparent expansivities
- determination of volume expansivity

- anomalous expansion of water

14. Gas Laws

- Boyle's law (isothermal process)
- Charles' law (isobaric process)
- Pressure law (volumetric process)
- absolute zero of temperature
- general gas equation ($PVT = \text{constant}$)
- ideal gas equation Eg. $Pv = nRT$
- Van der waal gas

15. Quantity of Heat

- 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

16. Change of State

- 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.
- (ii) application in appliances

17. Vapours

- unsaturated and saturated vapours
- relationship between saturated vapour 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.

18. Structure of Matter and Kinetic Theory

19. Heat Transfer

- conduction,
- convection and
- radiation

20. Waves

21. Propagation of Sound Waves

- 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
- Characteristics of Sound Waves
- 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 columns $F_0 = 12LV/T_0$, $(\mu = ml)$
- acoustic examples of resonance
- frequency of a note emitted by air columns in closed and open pipes in relation to their lengths.

23. Light Energy

- Sources of Light:
- natural and artificial sources of light
- luminous and non-luminous objects
- Propagation of light
- speed, frequency and wavelength of light
- formation of shadows and eclipse
- the pin-hole camera.

24. Reflection of Light at Plane and Curved Surfaces

- 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 $1/f = 1/u + 1/v$ (v) linear magnification

25. Refraction of Light Through at Plane and Curved Surfaces

- 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
- (b) Glass Prism
- use of the minimum deviation formula $U = \sin[A + D/2] / \sin[A/2]$ (ii) type of lenses
- use of lens formula $1/f = 1/u + 1/v$ and Newton's formula ($F_2 = ab$)
- magnification

26. Optical Instruments

- 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

27. Dispersion of light and colours

- dispersion of white light by a triangular prism
- production of pure spectrum
- colour mixing by addition and subtraction
- colour of objects and colour filters
- rainbow
- Electromagnetic spectrum
- description of sources and uses of various types of radiation.

28. Electrostatics

- 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

29. Capacitors

- 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 ($C = \epsilon Ad$)
- capacitors in series and parallel
- energy stored in a capacitor

30. Electric Cells

- 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

31. Current Electricity

- 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.
- (v) electrical networks

32. Electrical Energy and Power

- 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

33. Magnets and Magnetic Fields

- 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 round 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.

34. Force on a Current-Carrying Conductor in a Magnetic Field

- 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

35. Electromagnetic Induction

- 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
- (b) Inductance
- explanation of inductance
- unit of inductance
- energy stored in an inductor $E = \frac{1}{2}LI^2$
- application/uses of inductors
- (ix) Eddy Current
- reduction of eddy current
- applications of eddy current

36. Simple A. C. Circuits

- 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 $f_o = \frac{1}{2\pi\sqrt{LC}}$

37. Conduction of Electricity Through;

- liquids
- electrolytes and non-electrolyte
- concept of electrolysis
- Faraday's laws of electrolysis
- application of electrolysis, e.g electroplating, calibration of ammeter etc.
- gases
- discharge through gases (qualitative treatment only)
- application of conduction of electricity through gases

38. Elementary Modern Physics

- 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 [$\Delta E = \Delta MC^2$]
- wave-particle paradox (duality of matter)
- electron diffraction
- the uncertainty principle

39. Introductory Electronics

- 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

JAMB Physics Recommended Textbooks for 2021

- Essential Principles of Physics by Ike E.
- Numerical Problems and Solutions in Physics by Ike E.
- Fundamentals of Physics by Nelson M.
- Advanced Level Physics by Nelson M.
- Senior Secondary School Physics by Okeke P. and Co.
- Comprehensive Certificate Physics by Ogunkoya O. and Co.