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**INTEGRATED SCIENCE**

**1. PREAMBLE**

This syllabus was evolved from the teaching syllabus for the Senior High School Integrated Science issued by the Ghana Education Service in September, 2010.

Integrated Science seeks to equip the individual with the integrated body of scientific knowledge and raise the level of scientific literacy of the individuals with comprehensive scientific skills that enable them to function in the present technological era. Education in science also provides opportunity for the development of positive attitudes and values.

**2. AIMS AND OBJECTIVES OF THE SYLLABUS**

This syllabus seeks to among other things, enable students to:

(1) acquire the skill to solve basic problems within their immediate environment through analysis and experimentation;

(2) keep a proper balance of the diversity of the living and non-living things based on their interconnectedness and repeated patterns of change;

(3) adopt sustainable habits for managing the natural environment for humankind and society;

(4) use appliances and gadgets effectively with clear understanding of their basic operations and underlying principles.

(5) explore, conserve and optimise the use of energy as an important resource for the living world;

(6) adopt a scientific way of life based on pragmatic observation and investigation of phenomena;

(7) search for solutions to problems of life recognizing the interaction of science, technology and other disciplines.

**3. REQUIREMENTS**

It is presumed that candidates taking the examination must have:

(1) carried out activities relating to rearing of at least one of the following groups of animals:

(i) chickens/ducks/turkeys

(ii) goats/sheep/cattle

(iii) guinea pigs, rabbits

(2) paid visits to well established farms, and institutions related to agriculture, research or manufacturing to observe scientific work and application of science;

(3) kept practical notebooks on records of individual laboratory and field activities performed.

**4. SCHEME OF EXAMINATION**

There will be three papers, Papers 1, 2 and 3 all of which must be taken. Papers 1 and 2 will be a composite paper to be taken at one sitting.

**PAPER 1:** Will consist of fifty multiple-choice objective questions all of which must be

answered within 1 hour for 50 marks.

**PAPER 2:** Will consist of six essay-type questions. Candidates will be required to answer four

questions within 1 hour 30 minutes for 20 marks each.

**PAPER 3:** Will consist of four questions on test of practical work. Candidates will be required

to answer all the questions within 2 hours for 60 marks.

**5**. **DETAILED SYLLABUS**

Questions will be asked on the topics set out in the column headed “CONTENTS”. The “NOTES” are intended to indicate the scope of the questions but they are not to be as an exhaustive list of limitations and illustrations.

NOTE: The S.I units will be used for all calculations. However multiples or sub- multiples of the units may also be used.

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| **CONTENTS** | **NOTES** |
| **A. DIVERSITY OF MATTER**  1. Introduction to Integrated  Science  1.1 Concept of  Integrated Science  Science  1.2 The scientific  Method  1.3 Safety precautions  in the laboratory  2. Measurement  2.1 Basic quantities,  derived quantities and their units.  2.2 Measuring instruments  2.3 Measurement of density and relative density  3. Diversity of living and non-living things    3.1 Characteristics of living things  3.2 Classification schemes of living  and non-living things.  4. Matter  4.1 Particulate nature of matter  4.2 Elements, compound and mixtures  4.3 Ionic and covalent compounds  4.4 Atomic number, mass number,  isotopes and relative atomic mass of given elements  4.5 Mole, molar mass and formula  mass  4.6 Preparation of solutions  5. Cells  5.1 Plant and animal cells  5.2 Types of plant and animal cells  (Specialised cells)  6. Rocks  6.1 Types, formation and characteristics of rocks.    6.2 Weathering of rocks  7. Acids, bases, and salts  7.1 Simple definition  of acids, bases,  salts  7.2 Physical and  chemical properties  of acids, bases and  salts  7.3 Examples of  chemical substances  classified as acids,  bases or salts  7.4 Methods of  preparation of salts  7.5 Acid-base  indicators  7.6 Determination of  pH of a given solutions.  8. Soil conservation  8.1 Principles of soil  and water  conservation  8.2 Classification of soil nutrients  8.3 Functions and deficiency  symptoms of nutrients  8.4 Maintenance of soil fertility  8.5 Organic and inorganic fertilizers  8.6 Depletion of soil resources  9. Water  9.1 Physical and  chemical properties  of water  9.2 Hardness and softness of water.  9.3 Treatment of water for public  consumption  10. Metals and non-metals  10.1 Classification of materials  10.2 Uses of metals, semi-metals and non-metals  10.3 Alloys  11. Exploitation of minerals  12. Rusting  12.1 Process of rusting  12.2 Prevention of rusting  13. Organic and inorganic compounds  13.1 Classification of chemicals as organic and inorganic  13.2 Neutralization and esterterification  13.3 Petrochemicals  **B. CYCLES**  1. Air movement  1.1 Land and sea breeze    1.2 Types of air masses and their  movement      1.3 Effect of moving air masses  2. Nitrogen cycle  2.1 Importance  3. Hydrological cycle  3.1 Distribution of earth’s water  3.2 Hydrological cycle  3.3 Sources of water contamination  3.4 Effects of water contamination    3.5 Water conservation methods  4. Life cycles of pests and parasites  4.1 Types of pests and parasites      4.2 Life cycles of some pests and parasites of human, plants and farm animals  5. Crop production  5.1 General principles of crop production  5.2 Production of crops  6. General principles of farm animal  production:  6.1 Main activities involved in farm  animal production    6.2 Ruminant production  6.3 Production of non-ruminant  **C. SYSTEMS**  1. Skeletal system  1.1 The mammalian skeleton  2. 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Heat energy  8.1 Nature and sources of heat  energy  8.2 Modes of heat transfer  8.3 Temperature  8.4 Thermal expansion  8.5 Change of state of matter  9. Nuclear energy  9.1 Radioactivity  9.2 Radioisotopes  9.3 Uses of nuclear energy  9.4 Protection from the  effects of radioactivity  9.5 Nuclear waste disposal  **E. INTERACTIONS OF MATTER**  1. Ecosystem  1.1 Basic ecological terms  1.2 Types of ecosystem and their  components  1.3 Food chain and food web  2. Atmosphere and climate change  2.1 Regions of atmosphere  2.2 Human activities and their effects on  the atmosphere  2.3 Atmospheric pollutants  2.4 Green house effect  2.5 Ozone layer  2.6 Acid rain  3. Infection and diseases  3.1 Causes of Diseases  3.2 Common diseases  4. Magnetism  4.1 Magnetic and non-magnetic materials  4.2 Magnetic field  4.3 Magnetization and demagnetization  5. 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Biotechnology  10.1 Genetic engineering  10.2 Tissue culture | Explanation of Science as an interrelated body of knowledge. Carriers in science and technology.  Identification of the problem. Hypothesis formulation. Experimentation. Data collection. Analysis and conclusion.  Safety measures taken in the laboratory and reasons for them.  Basic quantities and units of scientific measurement: Length (m), Mass (kg),Time (s), Temperature (K), Current (A), Light intensity (cd), Amount of substance (mol).Derived quantities and their units: Volume (m3), Density (kgm-3), Velocity(ms-1), Force (N), Work and Energy (J), Quantity of electricity (C), Electric resistance (&!), Potential difference (V), Power (W).  Identification and use of measuring instruments such as ruler, balances, stop watch, thermometer, measuring cylinder, callipers, hydrometer, pipette and burette to measure in various units. Necessity for measurement  Sources of error  Experiments to determine the density of equal volumes of water and salt solution. Comparison of densities of water and salt solution. Simple experiments of density of regular and irregular objects.  Differences between living and non-living  things based on the life processes:  movement, nutrition, growth, respiration, excretion, reproduction, irritability should be considered. Detailed treatment of the life processes **not** required.  Explanation of biodiversity  Importance of classification. Contribution of Aristotle, Linnaeus, and Mendeleev. Treatment to include the following levels or ranks: Living things- kingdom, division/ phylum, class, order, family, genus and species.    Elements- metals and non metals  (1st to 20th elements in the periodic table).  Atoms, molecules, ions, atomic structure.  Differences between elements, compounds and mixtures.  Ionic and covalent bond formation. Characteristic properties of ionic and covalent compounds.  IUPAC names of common compounds.  Relative atomic masses should be explained using the periodic table.  Carbon-12 isotope should be mentioned as reference scale.  The mole as unit of the physical quantity; amount of substance. Mention should be made of Avogadro’s number. Calculation of formula mass and molar mass using relative atomic masses. Calculation of amount of substance in moles given its mass.  Preparation of standard solution of NaOH, HCl, NaCl and sugar. Dilution of standard solution.  Structure and function of plant and animal cells. Drawing and labelling required.  Red blood cell, nerve cell, leaf epidermal cell, sperm cell, leaf palisade cells, lymphocyte and phagocyte. Functions of cell organelles required.  Formation of igneous, sedimentary and  metamorphic rocks and their  characteristics.  Physical, biological and chemical  weathering of rocks. Explanation of the  effect of hydration, hydrolysis,  carbonation and oxidation on rocks is  required.  Definition of acids and bases in terms of  Proton transfer (Bronsted- Lowry concept).  Properties and uses of acids, bases and salts.  Description of laboratory preparation of hydrogen, carbon dioxide and ammonia gases. Test for hydrogen, carbon dioxide and ammonia gases.  Simple chemical tests to classify chemical substances as acids, bases, or salts.  Preparation of salts using the following methods: neutralization, precipitation, acid + salt, and acid + metal.  Description of the colours developed by  phenolphthalein, litmus and methyl orange in dilute acids and dilute bases.  The nature and use of the universal  indicator and pH metre. Determination of soil pH is required.  Explanation of the concept of soil  conservation. Description of activities to  conserve soil water and maintain soil  fertility; irrigation, mulching, addition of  organic matter or crop rotation.  Macro (major) nutrients; nitrogen (N),  potassium (K), phosphorus (P), calcium (Ca), magnesium (Mg), sulphur (S).  Micro (minor) nutrients: boron(B), zinc(Zn) molybdenum(Mo), manganese(Mn), copper(Cu), chlorine(Cl), iron(Fe).    Description of the deficiency symptoms of the following nutrients in plants: nitrogen, potassium, phosphorus, mangenese and iron.  Application of organic and inorganic  manures/ fertilizers, crop rotation, cover  cropping, liming, and green manuring.  Identification and classification of organic and inorganic fertilizers. Methods of applying fertilizers.  Factors which lead to the depletion of soil resources: erosion, overgrazing, poor farming methods, dumping of non-biodegradable waste on land, improper  irrigation and drainage practices, surface mining and quarrying, deforestation, and excessive use of fertilizer.  Experiments to determine/ demonstrate:  (i) boiling point of water.  (ii) the solvent action of water on a  variety of substances.  (iii) presence of dissolved substances  (iv) polar nature of water.  Uses of water.  Advantages and disadvantages of hard  and soft water. Causes of hardness of  water (Ca++, Mg++, Fe++ ions). Softening hard water (addition of washing soda, ion exchange, boiling and distillation).  Steps involved in the treatment of water  for public consumption.  Classification of materials into metals,  semi-metals (metalloids), and non-metals.  Physical properties of metals, semi-metals and non-metals under conductivity, luster, malleability, ductility, sonority, density, melting point and tensile strength.  Uses of the following elements: Al, Cu,  Fe, Au, C, O2, N2. Application of semi-metals.  Examples of alloys and their constituent elements (steel, bronze, brass).Uses of alloys. Advantages of alloys in manufacture of certain household items.  Exploitation of the following minerals in Ghana: Bauxite, diamond, gold, crude oil and kaolin.  Negative impact of exploitation of minerals mentioned and how to minimize the effect.  Conditions necessary for rusting.  Experiments to show that air and water are necessary for rusting. Experiments to show that salt, dilute acid, dilute base and heat affect the rate of rusting in iron.  Methods of preventing rusting: oiling/  greasing, painting, galvanizing, tin-coating, electroplating, cathode protection and keeping the metal dry. Effectiveness of the various methods of preventing rusting. Items in the home that undergo rusting.  Hydrocarbons (first four members in  each group), alkanols (methanol, ethanol, propanol), alkanoic acids (first two members), alkanoates (first two members), fats and oils. Functional groups, properties and uses of organic compounds.  Differences between organic and inorganic compounds.  Importance of organic chemistry in industrialization.  Differences between neutralization and  esterification. Equations representing neutralization and esterification reactions.  Sources, application and effects of  petrochemicals on the environment.  The refinery of crude oil. Uses of petrochemical such as plastics, pharmaceuticals and  agrochemicals.  Explanation of formation of land and sea  breezes. Demonstration of convectional  currents using smoke-box and heated water with crystals of KMnO4.  Trade winds: Easterlies and Westerlies.  Description of the direction of movement of major air masses on the earth’s surface.  Differences between air masses and storm.  Effect of moving air masses: spread of  pollutants and effect on climate.  Precautions against effects of storms.  Use of the future’s wheel to trace effects of spread of pollutants by air masses required.  Tornados, hurricanes, typhoons should be mentioned.  Drawing and description of the nitrogen cycle  Importance of the nitrogen cycle to plants and animals.  Location of earth’s water (groundwater and surface water) and how much of it is  available for human use. Percentage  distribution of water on the earth’s surface to be mentioned.  Processes involved in the hydrological  cycle using appropriate diagrams.  Relevance of hydrological cycle to plants and animals.  Main sources of water contamination:  domestic waste, trade waste, industrial  waste, radioactive waste, and ‘special’  waste such as waste from hospital.  Water-washed, water-based and insect-  based carrier diseases  Household water treatment, waste water  treatment, safe water storage, modern and traditional rainwater harvesting systems.  Distinguish between pests and parasites.  Common pests of humans and farm animals (cockroach, housefly, tsetsefly, and mosquito) common endoparasites, tapeworm, liver fluke and round worm), common ectoparasites (tick, bed bug louse, flea, mite). Common pests and parasites of plants (rice and maize weevils, mistletoe, dodder and cassytha beetle and stem borers.  Life cycles of the following: an endoparasite (tape worm, and guinea worm), pest of humans [Anopheles mosquito] malaria parasite (*Plasmodium*), a crop pest (weevil). Control methods of the pests and parasites are required.  Selection of appropriate varieties, site selection and land preparation, methods of propagation and planting methods, cultural practices, pest and disease control, harvesting, processing, storage and marketing.  Application of all crop production mentioned in 5.1 to produce a crop, harvest, generate new planting materials, keep records and market. Precautions against post harvest losses. Production should be limited to the following crops: vegetables (okro/lettuce/carrot); cereals (maize/millet); legumes (cowpea/groundnut); root crop (cassava); stem tuber (yam).  Selection of suitable breeds, choice of management system, breeding systems and care of the young, management practices including animal health care and feeding, finishing, processing and marketing of produce.  Types of breeds and their characteristics,  management practices, breeding systems, common pests and diseases and marketing of products. Production should be limited to cattle, goats and sheep.  Main activities outlined in 6.1 to produce a non-ruminant farm animal. Production limited to poultry, pigs and rabbits.  Major parts and functions of the mammalian skeleton.  Axial skeleton: skull and vertebral column.  Appendicular skeleton: limbs and the limb girdles.  Types of joints.  Detailed treatment of the individual bones not required.  Parts of a flower and variation in flower  structure. Examination of complete flower and half flower with free parts. Bi-sexual flower ( Flamboyant or Pride of Barbados or *Hibiscus sp*.).  Uni-sexual flower with free parts ( water melon, gourd and pawpaw).  Drawing and labelling of complete and half flower required.  Processes of pollination and fertilization.  Adaptations of flowers for pollination  required. Formation of fruits and seeds.  Classification of fruits into dry fruits and  fleshy or succulent fruits.  Seed structure: endospermous  (monocotyledon) and non- endospermous  (dicotyledon)seeds. Functions of parts of seeds.  Structure of seeds/ fruits and how they are adapted to their mode of dispersal. Agents of dispersal. Explosive mechanism in fruits of Balsam and Pride of Barbados. Advantages and disadvantages of seed and fruit dispersal.  The process and conditions for germination.  Types of germination: hypogeal and  epigeal.  Formation of new plants from corms,  bulbs, setts, rhizomes, cuttings, stolons,  runners. Distinction between budding and grafting. Importance of the methods of vegetative propagation.  Explanation of respiration and how energy is released from food substances for living organisms. Importance of respiration to living organisms.  Distinction between aerobic and anaerobic respiration.  Identification of the respiratory organs of the respiratory system. Functions of the trachea, lungs, ribs, intercostal muscles and diaphragm.  Mechanisms of inhalation and exhalation.  Lung cancer, asthma, tuberculosis,  whooping cough and pneumonia.  Prevention and control of these problems and disorders.  Description of how respiratory gases [oxygen and carbon (IV) oxide] are taken in and out of plants. Importance of cell (tissue) respiration. Glycolysis and Kreb’s cycle **not** required.  Classes of food and food substance and their importance: carbohydrates, proteins, lipids, vitamins, mineral salts and water. Importance of balanced diet. Food test for starch protein and lipids.  Explanation of malnutrition and its effects.  Relationship between diet and certain diseases – night blindness, high blood pressure, diabetes, obesity, lactose intolerance, and Kwashiorkor. Importance of roughage.  The essence of food fortification and enrichment. Determination of body mass index (BMI)  The importance of water to the human body.  Structure and functions of the teeth.  Drawing and labelling of a vertical section of a typical tooth. Differences in dentition in humans and other mammals in relation to diet.  Proper ways of caring for the teeth to prevent dental problems.  Structure and functions of digestive systems in humans.  Explanation of diffusion, osmosis, and plasmolysis. Simple experiments to demonstrate diffusion in air and in liquids; osmosis in living tissue and in non-living tissue. Examples of diffusion and osmosis in nature.  Explanation of excretion. Distinction between excretion and egestion.  Excretory organs ( lungs, skin, liver and kidney). Elimination of products from the body. Structure of the skin and the kidneys.  Bed wetting, urine retention, kidney stone prostate and their remedies.  Structure and function of male and female reproductive systems.  Advantages and disadvantages circumcision.  The process of fertilization, development of zygote (pregnancy) and birth. Formation of twins: identical, fraternal, and siamese.  Details of cell division and anatomy of the embryo **not** required.  The process of birth in mammals,  including pre-natal, post-natal and parental care.  Causes and effects of miscarriage, ectopic pregnancy, infertility, impotence, fibroid, disease infections and ovarian cyst.  Types: HIV/ AIDS, gonorrhea, syphilis,  candidiasis, herpes, chlamydia and their mode of transmission. Effects of STI’s on the health and reproduction in humans.  Physical and behavioural changes  associated with each phase of human  development: losing milk teeth and  development of permanent teeth, increase in mass, height, development of secondary sexual characters, e.g. menstruation in girls (pre-menstrual syndrome in some women- accompanied by violent moods or depression), wet dreams in boys. Changes in old age should include menopause and its associated problems.  The flow of blood through the heart, the  lungs and the body of humans. Functions  of the heart, the veins and the arteries in  the circulatory system . Detailed structure of cellular components of the blood vessels **not** required.  The structure of blood cells. Functions of blood and blood circulatory system.  High blood pressure, low blood  pressure and hole-in- heart, leukemia, anaemia.  Parts of the brain and their functions:  fore-brain (cerebrum), mid-brain  (cerebellum), hind-brain (medulla oblongata). The spinal cord as part of the central nervous system. Details of electrical and chemical nature of impulse transmission not required.  Accidents, diseases, drug abuse and  depression.  Distinction between voluntary and  involuntary actions. Importance of reflex action. The reflex arc.  Glands producing hormones, normal  functions of hormones and its effects of  overproduction and underproduction. The role of thyroxin, adrenaline, testosterone, oestrogen and insulin. Importance of iodated salt.  Illustrations with flow charts to show the  following energy transformations: solar  energy to chemical in photosynthesis,  Chemical energy to electrical energy in  voltaic cells, solar energy to electrical  energy in solar cells, chemical energy in  fossil fuel into thermal energy/ electrical energy, potential energy to kinetic energy in falling object, electrical energy to light energy in bulbs, chemical energy is released from glucose during cellular respiration.  Explanation of the principle of  conservation of energy. Demonstration of the principle of transformation by  considering the transformation of potential energy to kinetic energy using a falling object.  Explanation of efficiency using the  expression:  E = energy output x 100%  energy input  The main applications of solar energy:  generating electricity, drying materials  and heating substances.  Practical activities to demonstrate the  application of solar energy to: dry clothes,  heat water for bathing, dry crops for  preservation, cook ( boil an egg).  Advantages of solar energy over the use of fossil fuels as source of energy.  Conditions of photosynthesis: light,  chlorophyll, carbon dioxide and water. Experiments to show the necessity  of light, chlorophyll and carbon dioxide  for photosynthesis.  Equations to show how light energy is  trapped during the process of photosynthesis and converted to glucose.  Test for starch in food and leaf.  Classify solid materials into conductors,  semiconductors and insulators. P-type and N-type semiconductors. Behaviour of P.N junction diode in a d.c and a.c electronic circuit. Explanation of rectification.  A simple electronic circuit comprising a.c and d.c. source, a resistor and a Light  Emitting Diode (*LED*) in series. Behaviour of the *LED* when: the switch is closed, switch is opened, resistor is replaced with capacitor, capacitor is replaced with inductor or coil. Repetition of experiment by replacing the d.c. source wih an a.c. source.  Observe an NPN or PNP Transistor and identify the emitter, the base and the collector.  The use of transistor as a switch. Behaviourof *NPN* transistor in circuit with the base at the junction of two resisitors,its collector at the battery and an *LED* connected to the emitter.  Application of transistor as an amplifier.  Explanation of the formation of lighting  based on electrostatics. Protection of  buildings and installations with lightning  arrestors. Sources of static and current electricity. Difference between a.c and d.c and their limitations.  Drawing of electric circuit and the  functions of each component. Advantages and disadvantages of the components ofcircuit in series and parallel.  Simple calculation of resistance, current,  potential difference using the Ohm’s law.  Simple calculation for electric power.  Importance of power ratings and power  rationing. Efficient use of electric  appliances.  Sources of electric power generation:  Hydro, thermal, nuclear, solar, wind, tidal and biogas. Basic principles underlying the production of electricity e.g. relative motion between a coil and a magnet.  The gadgets and processes involved in the transmission of power: step-up and  step-down transformers, wiring a plug,  household wiring, stabilizers, fuses and  earthing.  Production of sound from different  instruments(pipes, rods or strings and  percussions). Nature of sound: velocity, reflection and refraction. Differences in velocity of sound in different media (gas, liquid, solid, and vacuum). Formation of echoes. Determination of the velocity of sound is **not** required.  Classification of different sounds as noise or musical notes (Distinction between musical notes and noise). Explanation of pitch, loudness and quality of musical notes.  Identification of parts of the human ear and description of their functions.  The importance of ear muffs.  Explanation of reflection and refraction of  light. Characteristics of images formed by plane mirror.  Structure and functions of the parts of the mammalian eye. Eye defects, causes and their correction using the appropriate lenses.  Explanation of dispersion of light.  Formation of rainbow.  Distinction between primary (red, green, blue) and secondary (yellow, violet, indigo, orange) colours. Demonstration of the behaviour of objects under different coloured lights.  Explanation of electromagnetic spectrum. Application of each component in the spectrum. Calculation and detailed treatment **not** required.  Explanation of why heat is a form of  energy. Sources of heat energy.  Demonstration of the rate of flow of heat in a metal bar of different materials.  Applications of conduction, convection,  and radiation ( e.g. vacuum flask and  ventilation).  Definition of temperature. Concept of  thermal equilibrium between bodies.  Units: degree Celsius(oC) and kelvin(K) in which temperature is expressed. Fahrenheit should be mentioned. Uses and limitations of different types of thermometers e.g. liquid-in-glass (alcohol and mercury), gas, resistance thermometers. Advantages and  disadvantages of mercury and alcohol as  thermometric liquids. Clinical thermometer. Thermostat and how it works.  The ball and ring experiment to show that a body expands when heated. Applications of expansion e.g. thermostats, sagging of electric cable, bursting of inflated hot lorry tyres.  Explanation of how heat causes change of state of matter. Latent heat. Distinction between latent heat of fusion and latent heat of vaporization. Evaporation; Application of principles of evaporation in heat reduction e.g. regulation of body temperature by the skin, and cooling of water in local clay water pots.  Causes of nuclear instability and how they emit radiation to become stable. Types of radiation (alpha and beta particles, and gamma rays).  The nature, production and use of  radioisotopes: food preservation,  sterilization of equipment, treatment of  diseases, pest control and crop improvement.  Uses of nuclear energy e.g. in the  production of electricity.  Harmful effects of radioactivity and how  to protect people from the effects e.g.  atomic bombs.  Problems associated with the disposal of  nuclear waste.  Explanation of ecological terms: ecosystem, species, population, ecology, ecosphere and community.  Natural ecosystem: fresh water, marine,  estuarine, lake, rainforest, savanna and  desert. Artificial ecosystem: farmland,man-made lake, roads. Components of ecosystem: biotic/ living (plants and animals) and abiotic/ non-living(soil, air, and water). Effects of the components on each other. Ecological factors: biotic (predation and competition) and abiotic (climatic factors, salinity, altitude and slope of land) Appropriateness of instruments used to measure abiotic factors.  Explanation of food chain and food web.  Identification of components of food chain and food web: producers (green plants), primary consumers (herbivores), secondary consumers (carnivores). Decomposers should be mentioned.  Layers of the atmosphere: troposphere,  stratosphere, mesosphere, and  thermosphere. Description of the  characteristics of each layer in terms of  thickness, temperature, air quality and  composition, pressure and support  for human activities.  Effects of human activities on the  atmosphere: air transport, defence,  industrialization and agriculture.  Sources and effects of the following major pollutants: oxides of lead, nitrogen and sulphur; ozone, halons (carbon and halogen compounds).  Explanation of ‘greenhouse’ and its  effect: Global warming and climate  change. Possible factors to address the  problem of global warming. Greenhouse  gases e.g. carbon (IV)oxide and methane.  Ozone layer and how it protects living organisms. Causes and effects of the depletion of the ozone layer. Sources and effects of CFCs on the ozone layer.  Identification of acidic pollutants which  cause acid rain. The effects of acid rain on the environment (damage to buildings, paints forests etc).  Pathogenic: bacteria, virus, fungi, protozoa and rickettsia. Non-pathogenic: nutritional, genetic, stress conditions, and poor sanitation.  Modes of transmission, symptoms,  methods of prevention and control of  common diseases ( air borne, water related, insect borne, food contaminated, nutrition, sexually transmitted, communicable, zoonotic diseases).  Classification of various kinds of materials as magnetic and non-magnetic. Permanent and temporary magnets. The use of magnetism the following gadgets: telephone earpiece, loud speakers, microphones, magnetic compass, generation of electricity, fridge doors, etc.  Explanation of magnetic field.  Demonstration of magnetic fields around a bar magnet using compressor or iron fillings.  Processes of magnetization and  demagnetization. The production and use of electromagnets. Complete  demagnetization of permanent magnet.  Explanation of the various types of forces: frictional, viscous, gravitational, weight, electrostatic, magnetic, upthrust, tension and push / pull.  Explanation of the Archimedes Principle  and law of flotation. Explanation of the  following phenomena: the flight of birds and flotation of boats.  Definition of the terms: distance,  displacement, speed, velocity, acceleration, and momentum. Simple calculations required  Explanation of centre of gravity. Determination of centre of gravity of rectangular, triangular, and irregular shaped cardboards using the knife edge. Types of equilibrium: stable, unstable, neutral equilibrium. Stability based on the following activities: Demonstration of the three types of stability using a cone on a flat surface. Effect of loading a vehicle on the top carrier or on the base carrier on the stability of the vehicle.  Definition of pressure. Effects of pressure in solids, in liquids and in gases (use of bicycle pump, hydraulics, siphons and water pumps).  Proper use and handling of household appliances to prevent accidents at home: avoidance of overloading of electric sockets, extreme care in using the heating coil in metal/ plastic containers, use of gloves. Precautionary measures in preventing accidents in the home.  Demonstration of the following using models: mouth-to-mouth resuscitation method, methods of extinguishing different fires, treatment of burns, cuts and electric shocks.  Possible hazards that can occur in working environment e.g. dust, fumes, toxic substance, corrosive substances, fire, food contamination, harmful radiation (X-rays), poisonous substances from heated or frozen plastics. Effects of hazardous substances on human body, e.g. blindness, burns, nausea, vomiting, and allergies.  Appraisal of the adequacy of the various  hazards, warning labels on containers and other places. Techniques involved in preventing fire due to electrical and chemical causes, and bush fires.  Community hazards: diseases, pests and parasites outbreak, insanitary conditions,  traffic problems in towns and cities,  pollution problems and waste generation.  Functions of health organizations such as public health and sanitation, public health education, proper siting of refuse dumps, provision of waste disposal facilities, and provision of public toilets. Factors that promote public health. Importance of proper sanitation in diseases control. Efficient town planning and village planning systems, places of garbage disposal, good clean roads and street connections.  Chromosomes as bearers of genes/  hereditary materials and recessive and  dominant characters; genotype and  phenotype. Inheritance of a single pair of contrasting characters e.g height (tallness and shortness) to second filial generation.  Simple treatment of Mendel’s first law of inheritance. Application of the sequence of inheritance with respect to cloning of stem cells. DNA Test. Heritable and non-heritable characteristics in human.  Explanation of variation. Causes and  consequences of variation: Mutation should be mentioned as one of the causes of variation e.g. resistance of some organisms to drugs or chemicals, albinism in humans.  Explanation of sex determination at  fertilization. Effects of sex preference on family relationship. Sex- linked characters.  Types of blood groups and Rhesus factor  and their importance for marriage, blood transfusion and paternity test. Inheritance of blood groups and Rhesus factor. Problems in marriage due to incompatibility Rh-factor and how to avoid these problems.  Inheritance of sickle cell gene. Acquisition of sickle cell anaemia. Management of sickle cell anaemia.  Definition of work, energy and power. Simple calculations required.  Identification of simple machines such as levers, pulleys, wheels, and axle and  inclined planes. Classes of levers should  be mentioned. Explanation of mechanical advantage, velocity ratio and efficiency of machines. Simple calculations required.  Definition of friction, effects of friction  and methods of reducing friction.  Advantages and disadvantages of friction.  Explanation of endogenous technology. Effects of modern technology on the development of endogenous technolog.  Inter-dependence of science and technology. Distinction between science and technology. Significance of science and technology to the development of society.  Small scale industries: raw materials and  equipment. Scientific principles  underlying the following small scale  industries: soap production, salt making,  palm oil production, bread making, and yogurt production.  Explanation of biotechnology. Examples  of industries based on biotechnology.  Explanation of genetic engineering.  Application in medicine, agriculture, food processing.  Explanation of tissue culture. Importance of tissue culture in agriculture. |

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