**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 laboratory2. Measurement  2.1 Basic quantities,  derived quantities and their units. 2.2 Measuring instruments  2.3 Measurement of density and relative density3. 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 solutions5. 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 rocks7. 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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. 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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. Functionsof 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 bloodpressure 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 andinvoluntary 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. 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Demonstration of the principle of transformation byconsidering the transformation of potential energy to kinetic energy using a falling object.Explanation of efficiency using the expression: E = energy output x 100% energy inputThe main applications of solar energy:generating electricity, drying materialsand heating substances.Practical activities to demonstrate theapplication of solar energy to: dry clothes,heat water for bathing, dry crops forpreservation, 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 dioxidefor photosynthesis.Equations to show how light energy istrapped 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 LightEmitting 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 lightingbased on electrostatics. Protection ofbuildings and installations with lightningarrestors. 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 powerrationing. 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 andearthing.Production of sound from different instruments(pipes, rods or strings andpercussions). Nature of sound: velocity, reflection and refraction. Differences in velocity of sound in different media (gas, liquid, solid, and vacuum). 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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 ofnuclear 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 thecharacteristics 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. Greenhousegases 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. Completedemagnetization 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 Principleand law of flotation. Explanation of thefollowing phenomena: the flight of birds and flotation of boats.Definition of the terms: distance,displacement, speed, velocity, acceleration, and momentum. Simple calculations requiredExplanation 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 varioushazards, 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 andphenotype. 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 factorand 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 andequipment. Scientific principles underlying the following small scale industries: soap production, salt making,palm oil production, bread making, and yogurt production.Explanation of biotechnology. Examplesof industries based on biotechnology.Explanation of genetic engineering. Application in medicine, agriculture, food processing.Explanation of tissue culture. Importance of tissue culture in agriculture. |