BOTSWANA
EXAMINATIONS
COUNCIL

BOTSWANA GENERAL CERTIFICATE
OF SECONDARY EDUCATION

ASSESSMENT SYLLABUS

BIOLOGY

CODE 0573

Effective for examination from 2020

Changes to Syllabus effective from 2020

The major changes in this Assessment Syllabus are;

Structure of Assessment

Some of the papers have been renamed. The papers are now:

Paper 1: Multiple Choice

Paper 2: Theory

Paper 3: Practical Test

Paper 4: Alternative to Practical

All candidates take Paper 1: Multiple Choice, Paper 2: Theory and either Paper 3: Practical Test or Paper 4: Alternative to Practical Test

Syllabus Content

The syllabus content has been aligned with that of the teaching syllabus.

The specific objectives are now captured as they are in the teaching syllabus.

The syllabus does not have the core and extended specific objectives.

The two have been merged to form specific objectives.

Reporting

The Grade descriptors have been revised to make them communicate better.

The grade desciptors for F have been replaced by grade descriptors for E.

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1. INTRODUCTION

As part of the Botswana General Certificate of Secondary Education, this Chemistry Assessment Syllabus is designed to assess the outcome of instruction for candidates who have completed a course based on the Senior Secondary Chemistry Teaching Syllabus.

This syllabus aims to assess positive achievement at all levels of ability. Candidates will be assessed in ways that encourage them to show what they know, understand and can do, and which provide opportunities to articulate their insights, perceptions and responses.

This Chemistry Assessment Syllabus should be read in conjunction with the Senior Secondary Chemistry Teaching Syllabus

Progression

The BGCSE is a general qualification that enables candidates to progress either directly to employment or to proceed to further qualifications.

2. SCHEME OF ASSESSMENT

All candidates must take **three** papers; Paper 1, Paper 2 and Paper 3 or Paper 4, which are described below.

The questions will be based on the whole syllabus.

2.1 The components

<table>
<tr><th colspan="2">All candidates must take:</th></tr>
<tr>
<td>Paper 1 1 hour
Multiple Choice

A multiple-choice paper consisting of 40 items each with 4 options.

The questions will test skills in Assessment Objectives 1 (AO 1) and 2 (AO 2) and will be of a difficulty appropriate to grades A to G.

The paper will be weighted at 30% of the final total mark</td>
<td>Paper 2 1 hour 15 minutes
Theory

A written paper consisting of short-answer and structured questions.

The questions will test skills in Assessment Objectives 1 (AO 1) and 2 (AO 2) and will be of a difficulty appropriate to grades A to G.

70 marks.

The paper will be weighted at 50% of the final total marks</td>
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<tr><th>either:</th><th>or:</th></tr>
<tr>
<td>Paper 3 1 hour
Practical Test

This paper will test Assessment Objective 3 (AO 3). It is a laboratory based paper with questions covering experimental and observational skills.

The paper will be of difficulty appropriate to grades A to G.

40 marks.

The paper will be weighted at 20% of final total mark</td>
<td>Paper 4 1 hour
Alternative to Practical Test

This paper will test Assessment Objective 3 (AO 3). It is designed to test familiarity with laboratory equipment and procedures.

The paper will be of difficulty appropriate to grades A to G.

40 marks.

The paper will be weighted at 20% of the final total mark.</td>
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</table>

2.2 Availability

This syllabus is available to both school candidates and private candidates.

2.3 Combining this syllabus with other syllabuses

Candidates may **not** combine this syllabus in an examination series with the following:

- 0568 Science Single Award
- 0569 Science Double Award
- 0573 Human and Social Biology

3. SYLLABUS AIMS AND ASSESSMENT OBJECTIVES

3.1 Aims

According to the Biology Teaching Syllabus, candidates following the syllabus should:

1. develop manipulative skills to assist them in solving technical and technological problems as they relate to day-to-day life situations.

2. become confident citizens in a technological world to make informed decisions in matters of scientific interest.

3. develop desirable attitudes and behavioural patterns in interacting with the environment in a manner that is protective, preserving, developmental and nurturing.

4. develop an understanding of the applications of science and of the technological, economic, ethical and social implications of these.

5. develop an understanding of the significance of information and communication technology in the day-to-day life situations and the world of work.

6. acquire knowledge, attitudes and practices that will promote good family life and health including awareness and management of epidemics such as HIV/AIDS practices that prepare them for productive life.

7. develop positive attitudes such as open-mindedness, inventiveness, concern for accuracy and precision, objectivity, integrity and initiative towards scientific skills

8. develop an interest in and an enjoyment of science and science related-work.

9. develop an understanding of key concepts and principles of science as they are experienced in everyday life.

10. develop abilities and skills that are relevant to the study, safe practice and application of science (such as experimenting and investigating).

11. develop problem solving, critical thinking, communication, inquiry and teamwork / interpersonal skills to help them to be productive and adaptive to cope in a changing environment.

12. develop an appreciation of the role of science in improving the quality of life.

13. recognise the usefulness of science, and limitations of scientific method.

14. promote an awareness that the applications of science may be both beneficial and detrimental to the individual, the community and the environment.

3.2 Assessment Objectives

The main Assessment Objectives are:

AO1 Knowledge with Understanding

AO2 Handling Information and Problem Solving

AO3 Experimental Skills and Investigations

A description of each assessment objective is:

AO1 Knowledge with Understanding

Candidate should be able to demonstrate knowledge and understanding of:

1. the concepts, laws, theories and principles of Science;
2. the vocabulary, terminology and conventions of Science, including symbols, quantities and units;
3. applications of Science and of their technological, economic, environmental and social implications;
4. the significance of information and communication technology in the day-to-day life and in the world of work.

Questions assessing these objectives will often begin with words such as *define, state, describe, outline, etc.*

AO2 Handling Information and Solving Problems

Candidates should be able to:

1. solve problems as they relate to day-to-day life, including some of a quantitative nature;
2. use information to identify patterns, report trends, draw inferences, make predictions and propose hypotheses;
3. locate, select, organise and present information from a variety of sources;
4. translate information from one form to another;
5. manipulate numerical and other data;
6. present explanations for phenomena, patterns and relationships.

Questions assessing these objectives may contain information which is unfamiliar to candidates. In answering such questions, candidates are required to take principles and concepts in the syllabus and apply them to the situations described in the questions.

Questions assessing these objectives will often begin with words such as *discuss*, *predict*, *suggest*, *calculate*, *determine, etc*.

AO3 Experimental Skills and Investigations

Candidates should be able to:

1. follow a sequence of instructions;
2. use appropriate techniques, apparatus and materials;
3. handle instruments, apparatus and materials safely;
4. make and record observations, measurements and estimates;
5. interpret and evaluate observations and data;
6. plan investigations and / or evaluate methods and suggest possible improvements;
7. convert acquired skills into creative innovations;
8. apply knowledge and draw conclusions in practical situations.

3.3 Relationship between Assessment Objectives and Components

The table shows the raw marks and the weighting of each skill area by component as well as the total for each skill area in the overall assessment.

Assessment Objectives		Marks for Skill Areas and Weightings in Paper				Weighting of AO in qualification
		Paper 1	Paper 2	Paper 3	Paper 4	
AO1: Knowledge with Understanding	recall	12 ± 2 (30 %)	22 ± 2 (30 %)	–	–	50 %
	understanding	13 ± 2 (33 %)	22 ± 2 (33 %)	–	–	
AO2: Handling Information and Problem Solving		15 (37 %)	26 (37 %)	–	–	30 %
AO3: Experimental Skills		–	–	100 %	100%	20 %
Total Marks		40	70	40	40	
Weighting of paper in overall qualification		30 %	50 %	20 %	20 %	100 %

4. CONTENT

This section presents the content as prescribed in the Biology Teaching Syllabus.

EXPERIMENTAL / INVESTIGATION SKILLS

TOPIC	GENERAL OBJECTIVES	SPECIFIC OBJECTIVES
	Learners should	*Learners should*
Experimental / Investigation Skills	apply basic skills for scientific investigation:	- follow a sequence of instructions
	• using and organising apparatus and materials:	- identify apparatus and materials useful for scientific activities - practise accepted safety procedures - apply appropriate techniques in manipulating laboratory equipment and materials
	• collecting data	- make observations using the senses - collect qualitative and quantitative data - measure and make estimations - accurately record an observation - record data on a table or chart or graphs -- predict outcome of an event based upon previous observations - identify relationships among phenomena - draw and interpret graphs or tables
	• handling experimental observations and data	- interpolate or extrapolate conclusions when given appropriate data - identify conditions which cause or influence change - distinguish among independent, dependent or controlled variables

		- draw conclusions - comment, recognise anomalies and make modifications - describe orally and in writing a sequence of events occurring in an experiment or investigation
	• apply basic process skills to problem solving	- identify a problem - plan for an investigation - carry out an investigation - evaluate investigations

1.0 CELL PROCESSES AND MAINTENANCE

Topic	General Objectives	Specific Objectives
	Candidates should be able to:	***Candidates should be able to:***
1.1 Cell Structure	1.1.1 acquire knowledge and understanding of plant and animal cells	1.1.1.1. identify different parts of plant and animal cells 1.1.1.2. identify from fresh preparations and diagrams or on photomicrographs the cell wall, cell surface membrane, sap vacuole, cytoplasm nucleus, chloroplasts, mitochondria and ribosomes of a plant cell 1.1.1.3. state the functions of the cell surface membrane and nucleus of an animal cell 1.1.1.4 state the functions of the mitochondrion, nucleus, and ribosomes 1.1.1.5. examine under the microscope an animal cell (including protozoan) and a plant cell (including moss or onion epidermis) using appropriate staining techniques.
1.2 Cell specialisation	1.2.1 acquire knowledge on cell specialisation and organisation.	1.2.1.1 describe the relationship between cell structure and function using specialised animal cell and specialised plant cell as examples 1.2.1.2 define tissue, organ, system, and organism. 1.2.1.3 examine under a microscope sections of tissues from any locally available plant and animal material
1.3 Movement of substances in and out of cells	1.3.1 acquire knowledge and understanding of the process of diffusion.	1.3.1.1 define diffusion as movement of molecules from a region where they are at a higher concentration to a region where they are at a lower concentration i.e. down a concentration gradient. 1.3.1.2 demonstrate diffusion in gases and liquids. 1.3.1 3 describe how concentration gradient, particle size and temperature affect diffusion rate.
	1.3.2 acquire knowledge and understanding of the process of osmosis and its role in living things.	1.3.2.1 define osmosis (a special form of diffusion) as movement of water molecules from a region where they are at a higher concentration to a region where they are at a lower concentration through a partially permeable membrane. 1.3.2.2 state that osmosis is a special form of diffusion 1.3.2.3 describe the effect of concentration gradient in the uptake of water by plants. 1.3.2.4 describe the effect of osmosis on plant tissues, in terms of flaccid cells, turgid cells, wilting and plasmolysis 1.3.2.5 describe the effect of osmosis on animal tissues [refer to bursting and shrinking]. 1.3.2.6 conduct experiments using solutions of varying concentration to demonstrate the process of osmosis.

	1.3.3	acquire knowledge and understanding of the process of active and passive transport in living things.	1.3.3.1	define active transport as an energy consuming process in which substances are transferred against their concentration gradient.
			1.3.3.2	define passive transport as a non-energy consuming process in which substances are transferred down their concentration gradient.
			1.3.3.3	distinguish active transport from osmosis and diffusion, which are passive processes.

2. Transport and circulation

Topic	General Objectives	Specific Objectives
	Candidates should be able to:	***Candidates should be able to:***
2.1 Transport in flowering plants	2.1.2 acquire knowledge and understanding of the process of transport in plants.	2.1.2.1 describe the structure and function of root hairs in relation to their surface area, and to water and ion uptake. 2..1.2.2 conduct experiments using dyes (stains) to identify vascular tissues in cross sections and vertical sections of stems, roots and leaves of herbaceous dicotyledons and monocotyledons. 2.1.2.3 state the structure and functions of vascular tissues (xylem vessels and phloem tissues) 2.1.2.4 describe absorption of mineral ions in terms of active transport 2.1.2.5 describe absorption of water in terms of diffusion and osmosis.
2.2 Transpiration and translocation	2.2.1 acquire knowledge and understanding of the process of transpiration and translocation	2.2.1.1 define transpiration as loss of water vapour from stomata 2.2.1.2 investigate the effect of temperature, humidity, light intensity and wind on the rate of transpiration. 2.2.1.3 discuss how transpiration is related to cell structure, stomata and intercellular air spaces 2.2.1.4 describe transpiration stream as a process of water movement through xylem vessels. 2.2.1.5 define translocation as transport of organic materials through the phloem
2.3 Mammalian Circulatory System	2.3.1 acquire knowledge and understanding of the role of the mammalian circulatory system.	2.3.1.1 explain why multicellular animals need a circulatory system. 2.3.1.2 describe the circulatory system as a system of tubes (blood vessels) with a pump (heart) and valves to ensure one-way flow of blood. 2.3.1.3 describe the dual circulation as consisting of pulmonary and systemic circuits. 2.3.1.4 discuss the difference between the two circuits (pulmonary and systemic) in terms of pressure, direction of blood flow and quality of blood. 2.3.1.5 name the main blood vessels to and from the heart, lungs, liver, and kidney. 2.3.1.6 describe the structure and function of the heart . 2.3.1.7 compare and contrast the structure and function of arteries, veins and capillaries. 2.3.1.8 locate pulse points and count the pulse rate 2.3.1.9 investigate the effect of physical activity on pulse rate. 2.3.1.10 describe coronary heart disease in terms of the occlusion of coronary arteries 2.3.1.11 discuss possible causes of coronary heart diseases (diet, stress, smoking) 2.3.1.12 discuss preventative measures of coronary heart diseases

2.4 Blood	2.4.1 acquire knowledge on the different components of blood and their functions.	2.4.1.1 list the components of blood as red blood cells, white blood cells, platelets, and plasma 2.4.1.2 identify red and white blood cells as seen in diagrams and/or photomicrographs. 2.4.1.3 describe the functions of blood: red blood cells - haemoglobin and oxygen transport; white blood cells - phagocytosis, antibody formation and tissue rejection; platelets - fibrinogen to fibrin causing clotting; plasma - transport of blood cells , ions, end products of digestion, hormones, carbon dioxide, urea, vitamins, plasma proteins. 2.4.1.4 describe the transfer of materials between capillaries and tissue fluid. 2.4.1.5 discuss common blood-related diseases including HIV/AIDS, malaria, leukaemia, and anaemia. 2.4.1.6 discuss how the blood-related diseases can be prevented. 2.4.1.7 explain why immunity often results after an infection or a vaccination. 2.4.1.8 explain why some people do not become immune to some diseases.
2.5 Blood groups	2.5.1 acquire knowledge and understanding of blood groups and blood transfusions.	2.5.1.1 describe the four blood groups (A, B, AB, O) in terms of antigens. 2.5.1.2 discuss blood transfusions in terms of donors and recipients

3. **Nutrition**

Topic	General Objectives	Specific Objectives
	Candidates should be able to:	***Candidates should be able to:***
3.1 Modes of nutrition	3.1.1 appreciate different ways of how organisms obtain their nutrients.	3.1.1.1 describe autotrophic and heterotrophic modes of nutrition.
3.2 Leaf structure	3.2.1 acquire knowledge and understanding of the structure and functions of a leaf	3.2.1.1 describe the significance of the cellular and tissue structures of a dicotyledon leaf in terms of: distribution of chloroplasts - photosynthesis; stomata and mesophyll cells - gaseous exchange; vascular bundles - transport 3.2.1.2 identify and label the cellular and tissue structure of a dicotyledonous leaf, as seen in cross section under the microscope.
3.3 Plant nutrition	3.3.1 acquire knowledge and understanding of nutrition in plants	3.31.1 define photosynthesis 3.3.1.2 state both the word and symbol equation for photosynthesis. 3.3.1.3 describe the intake of carbon dioxide and water by plants, the trapping of light energy by chlorophyll, the conversion of light energy into chemical energy, the formation of carbohydrates, their subsequent storage, and the release of oxygen. 3.3.1.4 investigate the necessity for chlorophyll, light and carbon dioxide for photosynthesis. 3.3.1.5 discuss the effect of varying light intensity, carbon dioxide concentration and temperature on the rate of photosynthesis (e.g. in submerged aquatic plants
3.4 Mineral nutrition	3.4.1 understand the need for mineral nutrients in plants.	3.4.1.1 state the importance of nitrogen-containing ions for protein synthesis and magnesium ions for chlorophyll synthesis. 3.4.1.2 investigate the effect of nitrogen deprivation on plant growth.
3.5 Animal nutrition	3.5.1 appreciate how diet relates to energy intake.	3.5.1.1 define balanced diet 3.5.1.2 explain why diet, especially energy intake, should be related to age and physical activity of an individual.

3.6	Enzymes	3.6.1	acquire knowledge and understanding of enzymes	3.6.1.1 3.6.1.2 3.6.1.3 3.6.1.4 3.6.1.5	define the term enzyme discuss the importance of enzymes in anabolic and catabolic reactions. describe intra-cellular and extra-cellular enzymes. investigate the catalytic effect of enzymes investigate and describe the effect of temperature and/or pH on enzyme activity.
3.7	Food tests	3.7.1	acquire knowledge on the procedure of carrying out food tests.	37.1.1 3.7.1.2	carry out food tests. escribe tests for starch (iodine solution), reducing sugars (Benedict's solution), protein (biuret test) and fats (ethanol)
3.8	Human alimentary canal	3.8.1	acquire knowledge on parts and functions of the human alimentary canal	3.8.1.1 3.8.1.2 3.8.1.3	using diagrams and models, identify the main regions of the alimentary canal and the associated organs: mouth, salivary glands, oesophagus, stomach, duodenum, pancreas, gall bladder, liver, ileum, colon, rectum and anus. describe the main functions of the identified parts of the alimentary canal in relation to ingestion, digestion, absorption, assimilation and egestion of food, as appropriate. state the reason why most food must be digested
3.9	Digestion	3.9.1	acquire knowledge on the physical and chemical processes of digestion	3.9.1.1 3.9.1.2 3.9.1.3	describe chewing and peristalsis describe chemical digestion in the alimentary canal, the function of typical amylase, protease and lipase in digestion investigate the action of amylase on starch.
3.10	Absorption and assimilation	3.10.1	acquire knowledge on the absorption process and some possible uses of the end-products of digestion.	3.10.1.1 3.10.1.2 3.10.1.3 3.10.1.4 3.10.1.5 3.10.1.6 3.10.1.7	describe absorption and assimilation. describe the significance of villi in increasing the internal surface area describe the significance of villi in increasing the internal surface area state the function of the hepatic portal vein as the route taken by most of the food absorbed from the small intestines. state that large molecules are synthesised from smaller basic units: glycogen from simple sugars; proteins from amino acids; lipids (fats and oils) from glycerol and fatty acids state the role of the liver in the metabolism of glucose, as a storage organ, deamination and detoxification. list the chemical elements which make up: carbohydrates, fats and proteins

4. Respiration

Topic	General Objectives	Specific Objectives
	Candidates should be able to:	***Candidates should be able to:***
4.1 Respiration	4.1.1 acquire knowledge and understanding of respiration	4.1.1.1 define respiration as the release of energy from food substances in all living cells.
4.2 Aerobic respiration	4.2.1 acquire knowledge and understanding of aerobic respiration	4.2.1.1 define aerobic respiration as the release of a relatively large amount of energy by the break down of food substances in the presence of oxygen. 4.2.1.2 state the equation for aerobic respiration, using words and symbols. 4.2.1.3 describe the uses of energy in the body of humans including muscle contraction, cell division, growth, protein synthesis, active transport, transmission of nerve impulses and maintenance of constant temperature.
4.3 Anaerobic respiration	4.3.1 acquire knowledge and understanding of anaerobic respiration	4.3.1.1 define anaerobic respiration as the release of a relatively small amount of energy by the break down of food substances in absence of oxygen. 4.3.1.2 state the equation for anaerobic respiration in plants and animals using words and symbols. 4.3.1.3 describe the production of lactic acid in muscles during exercise 4.3.1.4 describe fermentation process as a form of anaerobic respiration 4.3.1.5 demonstrate the release of energy through anaerobic respiration using yeast.
4.4 Gaseous exchange in man	4.4.1 acquire knowledge and understanding of the process of breathing	4.4.1.1 describe the role of the exchange surface of the alveoli in gaseous exchange. 4.4.1.2 describe the role of the diaphragm, ribs and intercostal muscles in breathing. 4.4.1.3 investigate the effect of physical activity on the rate and depth of breathing. 4.4.1.4 identify on diagrams and name the larynx, trachea, bronchi, bronchioles, alveoli and associated capillaries. 4.4.1.5 describe the effects of tobacco smoke and its major toxic components (nicotine, tar and carbon monoxide) on health: strong association with bronchitis, emphysema, lung cancer and heart disease, and the association between smoking during pregnancy and reduced birth weight

5.0 Excretion

Topic	General Objectives	Specific Objectives
	Candidates should be able to:	***Candidates should be able to:***
5.1 Excretory system and waste products	5.1.1 acquire knowledge and understanding of the importance of removing waste from the body.	5.1.1.1 define excretion as the removal of toxic materials and waste products of metabolism from organisms. 5.1.1.2 identify parts of the urinary system: kidneys, ureter, bladder, urethra 5.1.1.3 describe the functions of kidneys, ureter, bladder and urethra 5.1.1.4 describe the removal of water and urea through the kidneys 5.1.1.5 describe dialysis in kidney machines as the diffusion of waste products and salts (small molecules) through membrane. 5.1.1.6 draw and label a cross section of a mammalian kidney 5.1.1.7 describe the structure and function of the nephron (ultrafiltration, selective reabsorption, urine formation)

6. Co-ordination and Response

Topic	General Objectives	Specific Objectives
	Candidates should be able to:	***Candidates should be able to:***
6.1 Sense organs /receptors	6.1.1 acquire knowledge of the different organs that are irritated by environmental stimuli	6.1.1.1 discuss the principle of detecting change in the environment and responding to it.
6.2 The eye	6.2.1 understand how the eye works to bring about vision of objects	6.2.1.1 describe the gross structure of the eye as seen in front view and in longitudinal section 6.2.1.2 draw and label a cross section of the eye 6.2.1.3 describe the pupil reflex in response to bright and dim light 6.2.1.4 discuss how the eye produces a focused image of near and distance objects (accommodation)
6.3 The nervous system	6.3.1 gain knowledge of functional parts of the nervous system and their relationship	6.3.1.1 discuss the relationship of sensory (receptor) cells, sense organs and the effector organs 6.3.1.2 describe the functions of a sensory neurone, a motor neurone and a relay neurone. 6.3.1.3 draw a labelled diagram of a sensory neurone, a motor neurone and a relay neurone
	6.3.2 appreciate how a reflex action occurs	6.3.2.1 demonstrate and describe a reflex action 6.3.2.2 describe, with the aid of a labelled diagram, a reflex arc. 6.3.2.3 measure and explain reaction time
6.4 The central nervous system	6.4.1 understand the general function of the central nervous system	6.4.1.1 identify and label on diagrams of the human central nervous system i.e. cerebrum, cerebellum, pituitary gland, hypothalamus, medulla and spinal cord. 6.4.1.2 describe the functions of cerebrum, cerebellum, pituitary gland, hypothalamus, medulla and spinal cord

6.5 Hormonal co-Coordination	6.5.1 understand and appreciate the function of hormones in body co-ordination.	6.5.1.1 distinguish between exocrine and endocrine gland 6.5.1.2 identify and label on diagram the endocrine glands of the human body 6.5.1.3 define a hormone as a chemical substance, produced by a gland, carried by the blood, which alters the activity of one or more specific target organs and is then destroyed by the liver 6.5.1.4 name the hormones produced by the glands in the body 6.5.1.5 discuss the functions of insulin, glucagon, adrenaline, oestrogen, and testosterone hormones. 6.5.1.6 compare and contrast the nervous and endocrine systems 6.5.1.7 explain the concept of negative feedback.
6.6 Tropism	6.6.1 acquire knowledge of the role of hormones in tropic responses of plants	6.6.1.1 define phototropism as the growth response of a plant to gravity. 6.6.1.2 define phototropism as the growth response of a plant to light. 6.6.1.3 describe geotropism and phototropism in terms of auxin regulating differential growth. 6.6.1.4 investigate the effect of removing the apical bud from plant seedlings. 6.6.1.5 describe the control of plant growth by auxins

7.0 Homeostasis

Topic	General Objectives	Specific Objectives
	Candidates should be able to:	***Candidates should be able to:***
7.1 Maintainance of the internal environment	7.1.1 acquire knowledge and understanding of the importance of maintaining a constant internal environment.	7.1.1.1 define homeostasis as the maintenance of a constant internal environment 7.1.1.2 locate and name the main organs which maintain a constant internal environment, namely pancreas and liver (blood glucose), kidneys (water content) and skin (temperature). 7.1.1.3 identify and label on a diagram of the skin: hairs, sweat glands receptors and blood vessels 7.1.1.4 describe the maintenance of a constant temperature in Man in trrms of the role of : temperature receptors in the skin, sweating, shivering, blood vessels near the skin surface and the co-ordination role of the brain. 7.1.1 .5 discuss the co-ordinating role of the brain in maintaining a constant body temperature.

8.0 Support, movement and locomotion

Topic	General Objectives	Specific Objectives
	Candidates should be able to:	***Candidates should be able to:***
8.1 Support, movement and locomotion	8.1.1 know and be familiar with the functions of bones and how they are related to muscles	8.1.1.1 identify from diagrams, photographs and real specimens, the main bones of the fore-limb (scapula, humerus, radius, ulna) of a mammal. 8.1.1.2 describe the component bones of the fore-limb of a mammal 8.1.1.3 describe the type of movement permitted by the ball and socket joint and the hinge joint of the fore-limb 8.1.1.4 describe the action of the antagonistic muscles at the hinge joint.

9.0 The use and abuse of drugs

Topic	General Objectives	Specific Objectives
	Candidates should be able to:	***Candidates should be able to:***
9.1 Drugs	9.1.1 understand drugs and their medicinal use	9.1.1.1 define a drug as any substance taken in from an external source to affect or modify chemical reactions in the body 9.1.1.2 distinguish between medicinal and non-medicinal drugs. 9.1.1.3 describe the medicinal use of drugs including antibiotics, painkillers, antacids etc. 9.1.1.4 discuss dependence (emotional and physical) and tolerance of medicinal drugs 9.1.1.5 discuss allergic reactions to drugs and other substances
9.2 Drug abuse	9.2.1 be aware of the dangers of abusing drugs	9.2.1.1 find out which drugs are commonly abused in the community e.g. dagga/marijuana, solvents, glue, alcohol 9.2.1.2 describe non-medicinal (abusive) drugs according to their effect on the central nervous system: depressants, stimulants,hallucinogens 9.2.1.3 discuss the dangers of drug abuse such as dependence and body tissues damage 9.2.1.4 classify a named drug of abuse e.g. dagga/marijuana: uses, dangers of taking the drug, signs of dependence, withdrawal symptoms and popular names 9.2.1.5 describe the dangers of consumption of alcohol: reduced self-control, depressant, effect on reaction time, damage to liver, social implications

10. Living Things

Topic	General Objectives	Specific Objectives
	Candidates should be able to:	***Candidates should be able to:***
10.1 Diversity of living things	10.1.1 acquire knowledge and skills of placing living things into their major categories and description of their structures, nutrition and reproduction	10.1.1.1 discuss the concept of diversity of organisms with examples from Botswana 10.1.1.2 list at least three main characteristics of Protozoa, Viruses, Bacteria, Fungi, Green Algae, Arthropoda and Vertebrates 10.1.1.3 discuss the role of protozoa and mosquitoes in causing malaria 10.1.1.4 describe control of malaria

11. Ecology

Topic	General Objectives	Specific Objectives
	Candidates should be able to:	***Candidates should be able to:***
11.1 Energy flow	11.1.1 acquire knowledge and understanding that the sun is the principal source of energy that flows through ecosystems	11.1.1.1 state that the sun is the principal source of energy input into the biological system 11.1.1.2 describe the non cyclic nature of energy flow 11.1.1.3 describe the importance of the sun as the principal source of energy for biological systems 11.1.1.4 describe how energy is transferred through an ecosystem (Producer, Primary consumer, secondary consumer, tertiary consumer, pyramid of numbers
11.2 Nutrients cycles	11.2.1 appreciate and understand that nutrients are cycled in nature	11.2.1.1 state that nutrients are used and retained in the ecosystem 11.2.1.2 describe the carbon cycle including the roles of photosynthesis, respiration, animal nutrition, decomposers, fossil fuels and combustion 11.2.1.3 describe the nitrogen cycle in terms of he role of micro-organisms in providing usable nitrogen containing substances by decomposition and nitrogen fixation in roots. The absorption of these substances by plants and their conversion to protein followed by passage through food chains, death decay and the return of nitrogen to the soil or the atmosphere.

11.3	**Man's effect on the environment**	11.3.1	be aware of how man affects his environment thriugh agriculture	11.3.1.1	discuss how poor agricultural methods result in destruction of the ecosystem e.g. monoculture, excessive use of fertilisers and pesticides, overstocking, deforestation.
				11.3.1.2	discuss the problems which contribute to famine such as unequal distribution of food, natural disasters (such as floods and drought) and increase in population.
11.4	**Pollution**	11.4.1	be able to manage problems associated with pollution	11.4.1.1	describe the undesirable effects of water pollution by sewage and inorganic waste, air pollution by sulphur dioxide and pollution due to pesticides and herbicides.
				11.4.1.2	investigate common sources of pollution in their area and find out ways of reducing or controlling it.
11.5	**Conservation**	11.5.1	be aware of and appreciate the need to conserve our natural resources	11.5.1.1	discuss reasons for conservation of species with reference to local plants (sengaparile, mosukujane, monepenepe etc) and animals
				11.5.1.2	find out from the local community which plants and animals have become scarce and why.
				11.5.1.3	investigate threatened species (plants and animals) and the need to conserve them (emphasise examples from Botswana)
				11.5.1.4	state reasons for recycling of materials including sewage water, paper, bottles and tins.
				11.5.1.5	carryout a project to identify and list natural resources conserved in Botswana.

12. Reproduction

Topic	General Objectives	Specific Objectives
	Candidates should be able to:	***Candidates should be able to:***
2.1 Asexual reproduction	12.1.1 acquire knowledge of asexual reproduction.	12.1.1.1 define asexual reproduction as the process resulting in the production of genetically identical offspring from one parent 12.1.1.2 list examples of asexual reproduction to include tubers in potatoes and binary fussion in Amoeba 12.1.1.3 describe one named commercially important application of asexual reproduction in flowering plants: include stem cuttings in sweet potatoes and grapes 12.1.1.4 discuss the advantages and disadvantages of reproducing asexually
2.2 Sexual reproduction	12.2.1 acquire knowledge about sexual reproduction.	12.2.1.1 describe sexual reproduction as the process involving the fusion of nuclei to form a zygote
2.3 Sexual reproduction in flowering plants	12.3 1 acquire knowledge of reproductive parts of flowering plants.	12 .3 .1.1 identify the sepals, petals, stamens (filament, anther) and carpels (stigma, style, ovary) of one locally available insect-pollinated dicotyledonous flower such as a sweet pea 12 .3 .1.2 describe the functions of the sepals, petals (honey guides, nectaries), anthers and carpels. 12 .3 .1.3 observe using a hand lens the sepals, petals, stamens, and carpels of the flower and draw the named parts.
	12.3.2 acquire knowledge and understanding of the processes of pollination, fertilisation and seed dispersal.	12.3.2.1 discuss pollination in terms of types, agents and methods. 12.3.2.2 compare using fresh specimens wind pollinated and insect pollinated flowers 12.3.2.3 prepare a slide of the pollen grains from the stamens of a wind and insect pollinated flower and examine them under a microscope 12.3.2.4 describe the growth of the pollen tube and its entry into the ovule followed by fertilisation. 12.3.2.5 identify using a hand lens the anthers and carpels of one, locally available named wind pollinated flower 12.3.2.6 examine the structures of a non-endospermic seed 12.3.2.7 describe the structure and function of the seed in terms of embryo, (radicle, cotyledons and plumule) and testa

		12.3.2.8	describe modes of seed and fruit dispersal such as wind, animal, self (explosive) and give examples
		12.3.2.9	state the advantages of fruit and seed dispersal.
		12.3.2.10	investigate and state the environmental conditions which affect germination of seeds
		12.3.2.11	describe the role of enzymes in seed germination
12.4 Sexual reproduction in mammals	12.4.1 acquire knowledge about human reproductive parts.	12.4.1.1	identify on diagrams of the male reproductive system, testes, scrotum, sperm ducts, prostate gland, seminal vesicle, urethra and penis
		12.4.1.2	state the functions of the testes, scrotum, sperm ducts, prostate gland, urethra and penis
		12.4.1.3	identify on diagrams of the female reproductive system, ovaries, oviducts, uterus, cervix and vagina
		12.4.1.4	state the functions of the ovaries, oviducts, uterus, cervix and vagina
		12.4.1.5	compare the male and female gametes in terms of size, number, mobility and life span
	12.4.2 acquire knowledge about the menstrual cycle.	12.4.2.1	discuss the menstrual cycle.
		12.4.2.2	discuss the menstrual cycle in terms of LH, FSH, oestrogen and progesterone
		12.4.2.3	describe the effects of diet and emotional state on the menstrual cycle
		12.4.2.4	describe fertilisation and early development of the zygote in terms of the formation of a ball of cells which becomes implanted in the wall of the uterus
		12.4.2.5	distinguish between identical and fraternal twins
		12.4.2.6	describe implantation.
		12.4.2.7	describe the functions of the placenta and umbilical cord in relation to exchange of dissolved nutrients, gases and wastes
		12.4.2.8	state the functions of the amniotic sac and amniotic fluid
		12.4.2.9	describe the special dietary needs of a pregnant woman.
		12.4.2.10	discuss the advantages of breast milk compared to bottle milk.
	12.4.3 acquire knowledge about the use of a variety of birth control methods.	12.4.3.1	discuss the following methods of birth control: natural, mechanical, chemical, hormonal and surgical

12.5	**Sexually transmitted diseases**	12.4.4 acquire knowledge of sexually transmitted diseases and be aware of their prevalence and seriousness.	12.4.4.1 describe the causes, transmission, symptoms/signs, effects and treatment of gonorrhoea, syphilis and AIDS. 12.4.4.2 discuss the control of the spread of sexually transmitted diseases. 12.4.4.3 interpret data to establish prevalence rates of sexually transmitted diseases.

13 Inheritance

Topic	General Objectives	Specific Objectives
	Candidates should be able to:	***Candidates should be able to:***
13.1 Chromosomes and genes	13.1.1 acquire knowledge and understanding of genes, chromosomes and mutation	13.1.1.1 define gene, allele and chromosome 13.1.1.2 describe and compare, in simple terms, mitosis and meiosis (names and stages not required, restrict only to number of chromosomes) 13.1.1.3 describe the stages in mitosis and meiosis 13.1.1.4 discuss relationship between gene and chromosome 13.1.1.5 discuss complete dominance incomplete and co-dominance 13.1.1.6 explain co-dominance with reference to inheritance of the alleles I^A, I^B and I^O and the consequent ABO blood group phenotypes (A, B, AB & O) 13.1.1.7 distinguish between phenotype and genotype, recessive and dominant 13.1.1.8 describe gene and chromosomal mutation 13.1.1.9 discuss factors which may lead to mutation
13.2 Variation	13.2.1 appreciate variation in living things	13.2.1.1 describe differences between continuous and discontinuous variation and give examples of each
13.3 Monohydrid inheritance	13.3.1 acquire knowledge and understanding of inheritance	13.3.1.1 describe monohybrid inheritance 13.3.1.2 predict results of simple crosses with ratios of 3:1 and 1:1 using terms homozygous, heterozygous, F1 and F2 generations 13.3.1.3 explain why observed ratios differ from expected ratios especially when there are small number of progeny 13.3.1.4 discuss Mendelian experiments in peas and maize 13.3.1.5 discuss the determination of sex in humans 13.3.1.6 construct pedigrees for monohybrid crosses 13.3.1.7 describe a back cross to determine the genotype of a dominant phenotype

13.4 Natural selection and evolution	13.4.1 acquire knowledge and understanding of the origin of life and its changes	13.4.1.1 state that competition leads to differential survival of, and reproduction by, those organisms best fitted to the environment 13.4.1.2 discuss the importance of natural selection as a possible mechanism for evolution 13.4.1.3 describe the role of artificial selection in the production of economically important plants and animals.

14.0 Biotechnology

Topic	General Objectives	Specific Objectives
	Candidates should be able to:	***Candidates should be able to:***
14.0 Biotechnology	14.1 appreciate biotechnology as an approach to solving day to day problems and its role in the provision of food, fuels, medicines and new materials for industry	14.1.1.1 define biotechnology as the application of biological organisms, systems or processes to manufacturing and service industries 14.1.1.2 explain why micro-organisms are used in biotechnology 14.1.1.3 discuss and investigate the role of micro-organisms in food production e.g. bread, madila, chibuku 14.1.1.4 discuss and investigate the role of micro-organisms in fuels and chemicals including biogas, alcohol, biological enzyme washing powders 14.1.1.5 discuss the role of micro-organisms in genetic engineering including insulin production, crop plant resistance, gene therapy 14.1.1.6 discuss and investigate the role of micro-organisms in food production including single cell protein 14.1.1.7 discuss the role of micro-organisms in medicine production including antibiotics production and vaccines production 14.1.1.8 discuss how industry can benefit from biotechnology

5. OTHER INFORMATION

5.1 GRADING AND REPORTING

BGCSE results are reported on a scale of A* – G, A* being the highest and G the lowest. Ungraded (U) indicates that the candidate's performance fell short of the standard required for grade G. Ungraded (U) will be reported on the statement of results but not on the certificate. The letters Q (result pending) and X (no result) may also appear on the statement of results.

5.2 ASSESSMENT CRITERIA FOR PRACTICALS SKILLS

By its nature Biology is an experimental discipline. Accordingly, it is important that the practical work and experimental skills, identified in Assessment Objective 3, are made a central part of the assessment. However, it is recognised that, in certain circumstances, it will not be possible for some centres to provide the facilities and materials required for a laboratory-based experiment. Thus, at present, this syllabus provides two methods of assessing practical skills.

Paper 3: A practical test, administred in the centre and externally marked.
Or, for candidates in those centres which do not have the facilities properly to administer Paper 3 **and** which have been granted written permission to it,

Paper 4: An alternative to pratical test, a written paper, administered in the centre and externally marked.

Criteria for Assessing Practicals Skills

These criteria describe what a candidate will be expected to do and will provide the basis for making the papers.

Paper 3, Practical test

This paper is designed to assess a candidate's familiarity with appropriate chemistry Biology laboratory apparatus and techniques. The candidate will be required to perform given tasks, which will be based on the requirements of Assessment Objective 3.

Candidates may be asked to carry out exercises involoving:

(a) the ability to carry out a sequence of instructions

(b) the use of familiaar and unfamiliar, techniques to record observations and make deductions from them.

(c) simple physiological experiements, e.g. tests for food substances and use of hydrogen carbonate indicator;

(d) manipulative skills using scapel or razor blade, forceps, scissors and mounted needles;

(e) the use of a microscope and a hand lens of not less than x 6 magnificvation, observation and recording of famil;iar and unfamiliar biologiacal specimens

(f) clear line drawing of specimens provided, an indication of magnification of the drawing and labelling as required

(h) simple arithmetical calculations;

(i) to meausure to an accuracy of 1mm using a ruler;

(j) apply knowledge and draw conclusions in practical situations.

It is expected that glassware, instruments, chemeicals and other materials normally found in a laboratory should be availiable for these experiements. These include the following:

Beakers, test tubes, test tubes racks, test tubes holders, funnels, thermometers, specimen tubes, petri-dishes, forceps, disseecting needles, syringes, drppers, glass rods, water bath contianers Bunsen burners, lenses pestle and mortar, evaporating dishes, scalpels iodine solution, cobalt chroride paper, hydrogencarbonate indicator etc.

When planning practical work teachers should make sure that they do not contravene any school, education authority or government regulation which restrict the sampling , in educational establishments, of saliva, blood, urine other body secretions and tissues.

During the practical test, candidates are expected always to practice proper safety measures when handling the different instruments, chemicals and other materials.

Paper 4

This paper is designed to test candidates' familiarity with laboratory practice and procedure. It is recognised that this paper cannot directly test those parts of Assessment Objective 3 associated with manipulative and practical work. However, the questions set will be based on the assumption that candidates taking the paper will have had appropriate direct experience of applying their skills to such work.

Candidates will be require to:

(a) follow carefully a sequence of instructions;

(b) use familiar and unfamiliar, techniques to record observations and make deductions from them;

(c) recall simple physiological experiements, e.g. tests for food substances, use of a potometer, use of hydrogen carbonate indicator, litmus and Universal Indicator paper;

(d) Recognise, observe and record familiar and unfamiliar biological specimen;

(e) make clear line drawings from a photograph (or other visual representation) of a specimen, indicate the magnification of the drawing and label as required.;

(f) perfrorm simple arithmetical calculations

(g) apply knowledge and draw conclusions in practical situations.

5.3 GRADE DESCRIPTORS

As a guide to what might be expected of a candidate, Grade Descriptors are given as follows.
A **Grade A** candidate should be able to:

- ✓ recall a wide range of scientific facts, concepts, principles and theories and use complex scientific knowledge
- ✓ understand the relationship between complex scientific concepts and relate them to scientific principles and theories in real life situations
- ✓ apply appropriate scientific knowledge and understanding, identify complex patterns, and report trends from given information and draw appropriate conclusions and give recommendations to novel situations
- ✓ translate abstract information from one form to another: process information from graphs, tables and charts; represent information in the form of graphs, tables and charts
- ✓ make concise and complete experimental procedures (plan); critically discuss the plan; generate hypotheses to solve a scientific problem, identify and deal with a wide range of variables
- ✓ use appropriate apparatus and techniques safely and correctly; follow all given instructions to perform an experiment
- ✓ make accurate observations; decide the level of precision needed in measurements and record detailed experimental data; process data, make appropriate conclusions and generalisations; identify and explain anomalous observation

A **Grade C** candidate should be able to:

- ✓ recall a range of scientific facts, concepts, principles and theories and use scientific knowledge
- ✓ understand the relationship between scientific concepts and relate them to scientific principles and theories in real life situations
- ✓ apply scientific knowledge and understanding, identify patterns, and report trends from given information and draw relevant conclusions and give recommendation to simple situations
- ✓ translate information from one form to another: process information from graphs, tables and charts; represent information in the form of graphs, tables and charts
- ✓ make concise and complete experimental procedures (plan); generate hypotheses to solve a scientific problem and identify some key factors to vary and control
- ✓ use appropriate apparatus and techniques safely and correctly; follow most given instructions to perform an experiment

- ✓ make accurate observations, measurements and record experimental data; process data, make conclusions and generalisations; recognise when it is necessary to repeat observation and measurement

A **Grade E** candidate should be able to:

- ✓ recall simple scientific facts, concepts, principles and theories and use simple scientific knowledge
- ✓ understand the relationship between simple scientific concepts and relate them to simple scientific principles and theories in real life situations
- ✓ apply simple scientific knowledge and understanding, identify patterns, and report trends from given information and draw conclusions and give recommendation to familiar situations
- ✓ translate simple information from one form to another: process information from graphs, tables and charts with some assistance; represent information in the form of graphs, tables and charts
- ✓ make simple and complete experimental procedures (plan); devise a fair test which only involves a few factors, generate hypotheses
- ✓ use basic apparatus and techniques safely and correctly; follow a few given instructions to perform an experiment involving a few steps
- ✓ make simple observations; measurements and record experimental data; process data, make conclusions where appropriate

6. APPENDICES

A. MATHEMATICAL SKILLS

Candidates will be required to perform quantitative work, including calculations. They should be able to use scientific calculators and mathematical instruments.

The mathematical requirements, which form part of this syllabus, are listed below.

add, subtract, multiply and divide numbers
recognize and use expression in decimal form
use simple formulae
make approximations and estimates to obtain reasonable answers
understand and use averages
read, interpret and draw simple inferences from tables and statistical diagrams
find fractions or percentages of quantities
construct and interpret pie-and bar charts
calculate with fractions, decimals, percentage or ratios
manipulate and solve simple equations
substitute numbers in simple equations
recognize and use expressions in standard form
interpret and use graphs
choose by simple inspection and then draw the best smooth curve through a set of points on a graph
select appropriate axes and scales for plotting a graph
determine the intercept of a linear graph
understand and use direct and indirect proportion

B. PHYSICAL QUANTITIES, SYMBOLS AND UNITS

Candidates will be required to demonstrate an understanding of the physical quantities, and their corresponding SI units, listed below. They will be required to use them in quantitative work and calculations.

physical quantity	**symbols**	**SI unit(s)**	**other unit(s)**
length	*l, h*	metre (m)	kilometre(km); centimetre (cm); millimetre (mm)
mass	*M, m*	kilogram (kg)	gram (g); milligram (mg)
time	*t*	seconds (s)	milliseconds (ms), minutes (min), hours (h)
temperature	*θ, T*	Kelvin (K)	degree Celsius (^{o}C)
current	*I*	ampere (A)	milliampere (mA)
energy	*E*	Joules (J)	kilojoules (kJ), megajoules (MJ)
area	*A*	m^2	dm^2, cm^2, mm^2
volume	*V*	m^3	m^3, cm^3 dm^3
density	*D or ρ*	Kg/m^3	g/cm^3

NOTE

Units, significant figures. Candidates would be advised in each question on the number of significant figures or decimal places they have to express their answers to. If there is no advice on such, answers can be given to any number of significant figures. Candidates should be aware that misuse of units that is, failure to code units where necessary or the inclusion of units in quantities defined as ratios is liable to be penalised.

Conventions (e.g. signs, symbols, terminology and nomenclature)

Syllabuses and question papers will conform to generally accepted international practice

C. GLOSSARY OF TERMS

Learning objectives in the content section of the syllabus are expressed in terms of what candidates **know**, **understand** and **can do**. The words used on the examination papers in connection with the assessment of these learning outcomes are contained in this glossary. This is neither exhaustive nor definitive but is meant to provide some useful guidance.

1. Writing questions about what candidates are expected to know

About 25 % of the marks are involved with *recall.* Words used on examination papers in connection with such questions may include:

"State...", "List...", "Give...", "Name....", "Define...", "Draw…", "Write…", "What…", "How….", What is meant by….."

State or Name… implies a concise answer with little or no supporting argument.

List… requires a number of points generally each of one word, with no elaboration.

Define… is intended literally, only a formal statement or equivalent paraphrase being required.

What is meant by... normally implies that a definition should be given together with some relevant comment on the significance or context of the term(s) concerned, especially when two or more terms are included in the question. The amount of supplementary comment intended should be interpreted in the light of the indicated mark value.

2. Writing questions about understanding

"***Understand***" may be associated with simple factual recall. In this sense the candidate is required to recall the relevant part of the defined syllabus and to use this recalled information to amplify, extend or expand this in a wider context. This wider context will include situations or materials with which the candidates are familiar.

Questions may include such words as:

"*Explain…" "Complete..." "Why.", "Construct...", "Which…*

Explain… may imply reasoning or some of reference to theory, depending on the context.

"**Understand**" may also be associated with skills other than factual recall. It can be used to assess the candidate's abilities in problem solving, interpretation and evaluation, data handling and in communication of scientific ideas, principles and concepts. Words such as "*Suggest...", "Work out…", "How would you know that*…" may be used in questions.

Suggest… Is used in two main contexts: either to imply that there is no unique answer or to imply that candidates are expected to apply their general knowledge to a situation that may not formally be in the syllabus. This would be related to the Assessment Objective 2.

3. Writing questions about "be able to".

The use of this phrase is always associated with higher-order skills of interpretation, evaluation, calculation and communication. It involves the ability to recall the appropriate material from the content and apply this knowledge.

Questions may include *"Be able to…", "deduce…", "relate….", "interpret…", "explain…", "carry out…", "evaluate…" "predict….", "discuss…", "construct…", "suggest…", "calculate…", "find…", "demonstrate…", "estimate…", "determine..".*

deduce… is used in a similar way as predict except that some supporting statement is required, e.g., reference to a law or principle, or the necessary reasoning to be included in the answer.
predict… implies that the candidate is not expected to produce the required answer by recall but by making a logical connection between other pieces of information. Such information may be wholly given in the question or may depend on answers extracted in an early part of the question.
calculate… is used when a numerical answer is required. In general, working should be shown when two or more steps are involved.
find… is general term that may be interpreted as calculate, measure, determine, etc.

measure… implies that the quantity concerned can be directly obtained from suitable measuring instruments.
estimate… implies a reasoned order of magnitude statement or calculation of the quantity concerned making such implying assumptions as may be necessary about points of principle and about the values of quantities not otherwise used in the question.
discuss… requires the candidates to give critical account of the points involved in the topic.
determine… often implies that the quantity concerned cannot be measured directly but is obtained by calculation, substituting measured or known values of other quantities into standard formula.

D. PRESENTATION OF DATA

Tables

- ✓ Each column of a table will be headed with the physical quantity and the appropriate SI units, e.g., time / s, rather than time (s)
- ✓ There are two acceptable methods of stating units, e.g., m / s or ms^{-1}
- ✓ Candidates should use the number of significant figures appropriate to the precision of the measuring instrument.
- ✓ The column headings of the table can then be directly transferred to the axes of a constructed graph.

Graphs

- ✓ The independent variable will be plotted on the x-axis (horizontal axis) and the dependent variable plotted on the y-axis (vertical axis).
- ✓ The graph is the whole diagrammatic presentation. It may have one or several curves / lines plotted on it.
- ✓ Points on the curve / line should be clearly marked as crosses (**×**) or encircled dot (**ʘ**).
- ✓ If a further curve / line is included, vertical crosses (**+**) may be used to mark the points.
- ✓ Plots of points should have an accuracy of better than 1mm and all read-offs.
- ✓ Plots should be made with a sharp pencil.