BOTSWANA
EXAMINATIONS
COUNCIL

JUNIOR CERTIFICATE EXAMINATION

ASSESSMENT SYLLABUS

SCIENCE
CODE 014

2013

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FOREWORD

The Botswana Examinations Council is pleased to release the assessment syllabus for the revised Junior Secondary Education curriculum implemented in January 2010.

The purpose of this assessment syllabus is to guide schools, teachers and other educational institutions on what will be assessed in the subject area and how the assessment will be carried out for certification of students completing the Junior Secondary Education.

The curriculum at junior secondary level, puts emphasis on understanding and application of concepts; development of high order thinking skills (HOTS) such as inquiry, decision making, reasoning, creative, analytical, problem solving and process skills. It also calls for the acquisition of hands on experience that should increase the participation and performance of all groups e.g. groups of different abilities, learners with special needs, girls and boys.

All these skills entail more practical and challenging content and tasks that require higher levels of engagement of a learner's cognitive ability. The assessment syllabus has been designed to allow these higher order thinking skills to be assessed. It assesses what candidates know, understand and can do, enabling them to demonstrate their full potential.

The assessment syllabus is intended to promote a variety of styles of teaching, learning and assessment to enable candidates to progress to higher levels of learning. Therefore, teachers must be proficient in planning and directing a variety of learning activities. They should be conscious of the need for the students to be accountable and responsible for their own learning to some extent. They must also take into account the widening different levels of achievement which they aspire to. This implies active participation by both students and teachers, the creation of rich and diverse learning environments and the use of relevant assessment procedures to monitor the development of each learner.

It is important then that we value the student's own experiences, build upon what they know and reward them for positive achievement. This assessment syllabus is the outcome of a great deal of professional consultation and collaboration. On behalf of the Botswana Examinations Council, I wish to express my sincere gratitude to all those who contributed to the development and production of this assessment syllabus.

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Executive Secretary

ACKNOWLEDGEMENTS

The Botswana Examinations Council wishes to acknowledge the contributions of the following Advisory Committee Members for their valuable contributions in the development of this Science Assessment syllabus.

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Mr Menyatso	Department of Curriculum Development and Evaluation
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The Botswana Examinations Council acknowledges contributions made by the different departments of the Ministry of Education and Skills Development.

1. Introduction

As part of the Botswana Junior Secondary Education Programme, this Science syllabus is designed to provide a framework for the assessment of candidates who have completed the three-year course based on the revised Junior Secondary Science teaching syllabus.

The Junior Secondary Education Science Assessment Syllabus aims to afford the candidate an opportunity to fully demonstrate their potential and exhibit the knowledge and skills they possess through a variety of assessment modes. The syllabus also aims at providing information on what will be assessed and how it will be assessed with the intention of achieving comparable standards from year to year.

Candidates will be assessed on a scale of A – E. Candidates who fail to meet the minimum requirement will be awarded a U.

This syllabus should be read in conjunction with:

(a) the Junior Secondary School Science Teaching syllabus;

(b) the specimen question papers and marking schemes.

This syllabus is available for private candidates.

The outcome of instruction in the content prescribed by the Science teaching syllabus will be assessed through a multiple-choice paper and a written paper.

2. General Aims of Assessment

The syllabus embraces the subject aims defined in the Science teaching syllabus.

The assessment syllabus has the following additional aims:

- To ensure proper assessment of all the important skills in the curriculum.
- To enable both teaching and assessment to cater for all ability levels.
- To provide an efficient evaluative mechanism of the curriculum.
- To encourage an investigative approach to learning.
- To provide internationally recognised standards.
- To enable the students to realise their full potential.
- To encourage candidates to apply learned skills to manipulate life.

3. Assessment Objectives

For purposes of assessment, the behavioural outcomes of instruction in the prescribed content have been classified into broad skill areas known as assessment objectives. Brief descriptions of the assessment objectives are given below.

Assessment Objective 1: Knowledge and Understanding

Candidates will be assessed on their knowledge and understanding of;

1.1 the concepts, laws, theories and principles of science;
1.2 terminology, vocabulary and conventions of science, including symbols, quantities and units;
1.3 applications of science and their environmental and social implications;
1.4 the significance of information and communication technology in day to day life situations and the world of work.

Assessment Objective 2: Application and problem solving

Candidates will be assessed on their ability to;

2.1 solve problems as they relate to day to day life situations;
2.2 translate information from one form to another e.g. graphs, tables and charts;
2.3 manipulate numerical data;
2.4 explain patterns and relationships;
2.5 use information to identify patterns, report trends, draw inferences, make predictions and hypothesis.

Assessment Objective 3: Experimental and investigative skills

Candidates will be assessed on their ability to;

3.1 follow a sequence of instructions;
3.2 use appropriate techniques, apparatus and materials;
3.3 handle instruments, apparatus and materials safely;
3.4 make and record observations, measurements and estimates;
3.5 interpret and evaluate observations and data;
3.6 plan investigations and/or evaluate methods and suggest possible improvements;
3.7 use acquired skills creatively;
3.8 apply knowledge and draw conclusions in practical situations.

4. Scheme of Assessment

The JCE Science syllabus will be assessed through a multiple-choice paper and a written paper.

Paper 1	**Multiple Choice Items**		
Time	**1 hour**	**Marks**	**40**
Weighting	**30%**		

This will be a 40 item multiple-choice paper assessing knowledge, understanding and application of Science concepts including problem solving. Each item will have four options.

Note: Candidates are allowed to use a calculating aid in this paper.

Paper 2	Short-Answer and Structured Items

Time	**2 hours**	**Marks**	**80**
Weighting	**70%**		

This will be a written paper assessing knowledge, understanding and application of Science concepts, including problem solving, investigative and experimental skills. There will be **two** sections in the paper, that is, Sections **A** and **B**.

Section A: This section will present short-answer items assessing candidates' ability to demonstrating in-depth knowledge and understanding of concepts of the subject as well as application to real life situations. Candidates will answer **all** questions. This section will be worth **60 marks**.

Section B: This section will present **two** structured items of 10 marks each assessing candidates' graphical and investigative skills including problem solving skills. This section will be worth **20 marks**.

Note: Candidates are allowed to use a calculating aid in this paper.

5. Assessment Grid

The grid below shows the assessment objectives that will be mainly assessed in each paper.

ASSESSMENT OBJECTIVES	COMPONENTS	
	Paper 1	Paper 2
1.1	√	√
1.2	√	√
1.3	√	√
1.4	√	√
2.1	√	√
2.2	√	√
2.3	√	√
2.4	√	√
2.5	√	√
3.1		√
3.2		√
3.3		√
3.4		√
3.5	√	√
3.6		√
3.7		√
3.8	√	√

6. Grade Descriptors

The descriptions below provide a general indication of the skill acquisition expected of candidates for the award of key grades A, C and E.

GRADE A

Candidates should be able to;

- use scientific vocabulary and a wide range of scientific facts, concepts, principles and theories;
- relate a wide range of scientific concepts to scientific principles and theories and recognise scientific relationships;
- apply scientific knowledge and understanding, identify patterns, and report trends from given information and draw appropriate conclusions and give recommendations to new 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 with ease;
- make concise and complete experimental procedures (plan); generate hypotheses to solve a scientific problem, which may involve a wide range of variables;
- use appropriate apparatus and techniques safely and correctly; follow given instructions to perform an experiment involving a series of steps;
- make accurate observations, process data, make conclusions and generalisations where appropriate with ease, identify and explain anomalous observations, and suggest possible improvements.

GRADE C

Candidates should be able to;

- use scientific vocabulary, recall a wide range of scientific facts, concepts, principles and theories;
- relate a wide range of scientific concepts to scientific principles and theories and recognise scientific relationships with some assistance;
- apply scientific knowledge and understanding, identify patterns, and report trends from given information and give recommendations 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 with some assistance;
- make 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 given instructions to perform an experiment involving a few steps;
- make accurate observations, measurements and record experimental data, process data, make conclusions and generalisations where appropriate with some assistance; recognise when it is necessary to repeat observations and measurement.

GRADE E

Candidates should be able to;

- use scientific vocabulary, recall a basic range of scientific facts, concepts, principles and theories with some assistance;
- relate basic scientific concepts to scientific principles and theories and recognise scientific relationships with some assistance;
- apply basic scientific knowledge and concepts as well as identify simple patterns;
- translate simple information from one form to another; process information from graphs, tables and charts; represent information in the form of simple graphs, tables and charts with assistance;
- make simple and complete experimental procedures (plan); devise a fair test which only involves a few factors;
- use some apparatus and techniques safely and correctly; follow given instructions to perform an experiment involving a few steps with assistance;
- make simple observations, measurements and record experimental data, process data; make obvious qualitative conclusions and generalisations where appropriate with some assistance all the way

7. Inclusive Assessment

BEC intends to ensure that all assessment is inclusive of all candidates regardless of their ability or challenges. This will afford all candidates the opportunity to display what they know without fear or prejudice. The assessment will therefore ensure that in the written papers items cater for all ability levels. Special needs candidates will be catered for through modification of assessments to suit visually challenged candidates, learners with hearing impairment as well as learners with learning disabilities. Candidates will also be accommodated as much as possible to gain access into the practically oriented syllabuses.

Centres are however requested to;

- inform BEC of any candidates who need special arrangements by March every year;
- ensure familiarity with the BEC special arrangements manual;
- make the necessary accommodations for learners with disabilities during the teaching and learning;
- modify learners assessments according to their various needs during the teaching and learning.

This will ensure that the special arrangements carried out by BEC do not come as a shock to candidates during examination time.

8. 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
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-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
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*		
current	*I*	ampere (A)	milliampere (mA)

Derived quantities and units

Physical quantity	Symbols	Unit(s)
area	*A*	cm^2; m^2
volume	*V*	cm^3; m^3
density	*P*	kg/m^3; g/cm^3
force	*F*	Newton (N)
pressure	*P*	Pascal (Pa); N/m^2; N/cm^2
speed	*u ,v*	m/s; km/h
acceleration	*a*	m/s^2
energy	*E*	joule (J); kilojoule (kJ); megajoule (MJ)
frequency	*f*	hertz (Hz); kilohertz (kHz)
electrical charge	*Q, q*	coulomb (C)
potential difference	*V*	volt (V)
resistance	*R*	ohm (Ω)
weight	*W*	Newton (N)
acceleration of free fall	*g*	m/s^2, N/kg
work	*W*	joule (J)
wavelength	*λ*	m, cm

NOTE:

Units, significant figures. Candidates should be aware that misuse of units and/ or significant figures, that is, failure to code units where necessary, the inclusion of units in quantities defined as ratios or quoting answers to an inappropriate number of significant figures 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. 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 three 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 (▪)

  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.

D. NOTES FOR USE IN QUALITATIVE ANALYSIS

The table below indicates the approved test and test results for the gases noted, anything other than what is written in the table would **not** be accepted.

Gas	Test and test result
carbon dioxide (CO_2)	turns limewater milky
hydrogen (H_2)	"pops" with a lighted splint
oxygen (O_2)	relights a glowing splint

E. THE PERIODIC TABLE