



GOVERNMENT OF THE REPUBLIC OF ZAMBIA (GRZ)
MINISTRY OF GENERAL EDUCATION (MOGE)

**Junior Engineers Technicians
and Scientists (JETS)**

JETS Guidelines

Directorate of National Science Center

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Message from The Honourable Minister of General Education



These guidelines have been produced provide information to all guidance to the youths, learners and educators on the implementation of JETS programme. The various stakeholders guided the review process and recommendations were provided during the Regional Organizers' meeting held in January, 2018 and continued the process in 2019.

The review was necessitated by the need to provide a system that would not only incorporate latest social, economic, technological and political developments but also to equip learners with vital knowledge, skills and values that were necessary to contribute to the attainment of Vision 2030.

My Ministry is committed to the support of research and innovation in Science, Technology, Engineering and Mathematics (STEM) which is the main hope for developing the country sustainably in line with the Patriotic Front (PF) Manifesto and the Seventh National Development Plan (7thNDP). We count on all the educators and learners, to take the information on JETS seriously with renewed commitment and vigour to improve things and help set up a support network of information multipliers.

It is my sincere hope that these guidelines will greatly improve the quality of innovations being presented at JETS fairs.

Hon. Mr. David Mabumba (MP)
Minister
Ministry of General Education

Message from The Permanent Secretary—MOGE



The aim of the Ministry of General Education is to share a culture of achievement and excellence through the promotion of an efficient and effective education and training system that is inclusive, integrated, comprehensive and holistic. This cannot be achieved without the support and commitment of the teachers who are the main pillars on which rests the foundation of quality education.

Science can change our future; and the future of our society is in the hands of aspiring young scientists such as the ones in JETS; young people who can research, innovate, produce, collaborate with others and rise up to the challenge to make our earth a better place.

We need to develop a scientific culture among young people so that they could be better scientists, better citizens, capable of governing their personal thoughts and actions in a scientific manner. Science exhibitions will generate a deep interest in young minds. Furthermore, scientific mind should be inculcated in the learners at an early stage in their education in order to develop the potential of individuals and communities to achieve sustainable development through scientific knowledge.

Teachers in the schools should encourage science, mathematics and technology exhibitions and should try to build creativity among the learners in order to bring out the inherent talent from them. Teachers should interact with their learners while conducting science/math lessons through hands-on activities. This document provides guidance to achieve this. This will call for

Dr. Jobbicks Kalumba
Permanent Secretary
Ministry of General Education

Message from The Director—National Science Centre



This guide is written for all stakeholders involved in JETS activities. The main purpose of the guidelines is to facilitate stakeholders' understanding in the activities and operations of JETS. The rationale for the guidelines is based on the understanding and belief that JETS desires to:

- (1) positively impact on the society it interacts with, by the development of expertise in the teachers, student teachers and learners to investigate the local environment using scientific methods;
- (2) allow for focused and timely planning;
- (3) allow the Programme to assess/evaluate itself for the benefit of self-improvement and to make the activities effectively relevant.
- (4) implement and execute the new mandate.

These guidelines are significant because they have proposed a paradigm shift towards strengthening the JETS activities and placing responsibility on the various stakeholders in order to appreciate the role of JETS in national development. It is targeted at all the stakeholders in JETS in order to revitalize all the activities expected from JETS.

The major targets are the learners and the out of school youths. The teachers and lecturers have been brought on board to participate in the activities of JETS as they are the mentors of all their learners. In this way, the quality of JETS activities are expected to tremendously improve since the mentors will be kept abreast of all developments in research and innovations.

Mr. Benson Banda
Director—National Science Centre
Ministry of General Education

1.1 Background

JETS has been in existence since 1968 when it was formed by teachers of science under the Zambia Association of Science Educators (ZASE). Until 2017, the activities of JETS were institutionalised in the Directorate of Standards and Curriculum. From then, activities have been re-aligned to the Directorate of National Science Centre, the directorate responsible for co-curricular activities in STEM in the MOGE.

1.2 JETS Vision Statement

Quality scientific and technical education with increased focus on research, innovations and product development in the fields of science, mathematics and technology in order to contribute to the development of our country.

1.3 JETS Mission Statement

To develop Human Capital of knowledgeable young scientists, mathematicians and technologists that will provide service and leadership to the nation and to pursue creative research and strive for new innovations in the fields of science, technology, engineering and mathematics in order to enhance sustainable development in Zambia.

1.4 JETS Goal

To become a national leader in research, innovation and product development in scientific, mathematical and technological fields in Schools and Colleges as well as among out-of-school youth in order to support youths/learners' success in their careers in SMT.

2.0 JETS Objectives

The objectives of JETS are to:

- (i) promote creativity and innovation in Science, Mathematics, Engineering and Technology among learners in schools, students in Colleges of Education and teachers;
- (ii) help learners in Schools and Colleges of Education and youths get a better foundation to meet the increasing demands of Engineering and Technical Institutes;
- (iii) give learners in Schools and Colleges of Education and youths an opportunity to learn and apply scientific principles in the design and construction of technical innovations and preparation of technical reports;
- (iv) help learners in Schools and Colleges of Education and youths in discovering and appraising their own abilities, aptitudes and interests;
- (v) provide a preview of engineering, technology and other sciences and an acquaintance with personnel in the field;
- (vi) make learners in Schools and Colleges of Education aware of opportunities for careers in engineering, sciences and related technical fields in the public and private sectors of the commercial and industrial life; and
- (v) cooperate with and affiliate to other associations and bodies with similar interests.

3.0 Summary of processes involved in conducting JETS research

Research involves a number of processes. This section discusses some of these.

The following are the steps required for one to carry out a research:

STEP 1 Choose a topic or question.

STEP 2 Researchers must submit their research plan to their instructors/ supervisors or approval before starting the innovation.

STEP 3 Do background search on the chosen topic to find out what has already been done on that particular topic. What does one need to know to answer the question?

STEP 4 Form a hypothesis/state the engineering goals. What can the answer possibly be?

STEP 5 Test the hypothesis/test the prototype/evaluate the prototype and redesign if necessary.

STEP 6 Draw conclusions based on the results of the testing.

3.1 Report format layout

The Report format for all research work carried out should be presented with the title as outlined:

(i) Abstract

An abstract summarizes, usually in one paragraph of 300 words or less, the major aspects of the entire innovation in a prescribed sequence that includes:

- a. the overall purpose of the innovation and the research problem (s) investigated;
- b. the basic design of the innovation;
- c. major findings or trends found as a result of the innovation

(ii) Introduction

This section sets the context for the proposed innovation and captures the reader's interest; explains the background of the innovation starting from a broad picture narrowing in on the research questions, review what is known about the research topic as far as it is relevant to the innovation.

(iii) Hypothesis/Rationale

A scientific hypothesis is the initial building block in the scientific method. Many describe it as an "educated guess," based on prior knowledge and observation. While this is true, the definition can be expanded.

(iv) **Statement of the Problem**

The statement of the problem is the description of an issue which needs to be investigated and addressed. It provides the context for the innovation study and generates the questions which the innovation aims to answer. The statement of the problem is the focal point of any innovation/ research .

(v) **Aims/Objectives**

The aim is about what one hopes to achieve, the overall intention in the innovation. It signals what and/or where one aspires to be by the end. It is what one wants to know. It is the point of doing the research. An aim is therefore generally broad. It is ambitious, but not beyond possibility.

Objectives, on the other hand, should be specific statements that define measurable outcomes, e.g. what steps will be taken to achieve the desired outcome.

(vi) **Process/Methodology**

The methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge.

(vii) **Results/Discussion**

The results section is where the findings of the innovation based upon the methodology [or methodologies] applied to gather information is reported. The **results** section should state the findings of the research arranged in a logical sequence without interpretation. The discussion interprets the results in the light of the innovation's objectives.

The most important goal is to interpret the results so that the reader is informed of the insight or answers that the results provide. The discussion should also present an evaluation of the particular approach taken. For example: Based on the results, how could the experimental procedure be improved? What additional, future work may be warranted? What recommendations can be drawn?

(viii) **Conclusion & Recommendation**

Conclusions summarize how the results support or contradict the original hypothesis: Summarize the research results in a few sentences and use this summary to support the conclusion. Key facts from the background research should be included to help explain the results. Restate the topic: The topic should be restated as well as explain why it is important. Restate the hypothesis. Aside from the topic, the statement of the problem should be restated. Briefly summarize the main points.

(ix) **References**

Referencing means giving credit to the various sources used when writing a report. A reference list should include any documentation that is not one's own. The sources should be arranged alphabetically according to the surname of the authors. The reference should be written in the following order: Author's surname and initials, year of publication, title underlined or italics, edition. Place of publication, publisher. This is Harvard style of referencing. Other refereeing styles are also acceptable.

(x) Acknowledgements

An acknowledgement page is the place where one thanks the people who made contributions to the work in various ways and give them credit for their assistance. It is a way to publicly display the appreciation for their assistance and support.

A simple, “Thank you to my teacher, friends, family, and Matron” is not sufficient. The reasons why one is acknowledging the individuals should be listed. For example, “This innovation would not have been possible without the support and encouragement of Mr. Banda Or, “Words cannot express my gratitude to the Patron for his professional advice and assistance in polishing this innovation.”

Teachers should use the innovation as part of class work. When assessing the innovations at school level, teachers must assist the learners in upgrading their innovations so that they can successfully participate at all levels of competition. All JETS innovations need evidence that a learner carried out the innovation and must include current year results of their own investigation. No results can be copied from another source.

3.2 Investigation

An investigation is a innovation where the problem, or answer to a question, is ‘solved’. When undertaking an investigation, a method is followed that allows for the testing of an idea, or finding a solution to a problem, which determines a clear conclusion to the problem or question asked. innovations for JETS must have original work done

3.3 Innovation Approval

All innovations need to be approved for judging; i.e. checked for compliance to the rules of JETS Fair and to ensure that they do not violate any ethics.

3.4 Ethics

Ethics is concerned with what is right or wrong, good or bad, fair or unfair, responsible or irresponsible. Research on micro-organisms, human or animal subjects, including surveys, need a letter signed by a supervising scientist and the teacher giving approval for the innovation to be done. Any surveys (questionnaires) need another form of ethics giving consent or permission by parents or institutions.

Researchers are encouraged to check for ethical infringements before exhibiting innovations at any JETS Fair. Please note that the following are not allowed at any JETS Fair:

- (i) Human or animal parts including tissues and body fluids (for example blood, urine, hooves, skins etc.)
- (ii) Dangerous chemicals: Poisons, drugs, medications, controlled substances, hazardous substances and devices (for example firearms, weapons, ammunition, reloading devices).
- (iii) Flammable substances.
- (iv) Photographs or other visual presentations depicting humans or vertebrate animals in surgical techniques, dissections, necropsies or other lab procedures, or belittle people in any way, or show animals being harmed in any way.
- (v) Any apparatus deemed unsafe by the JETS Fair organisers.

3.5 Safety

All electrical work must conform to the Electrical Code and Regulations. The on-site electrician may be requested to review any electrical work on any innovation. The safety guidelines here are general ones and other rules may apply to specific configurations.

3.6 Patents

Some participants display innovations that show innovative thinking and provide new products. JETS encourage the development of entrepreneurial products which may lead to the marketing of these products.

Researchers are therefore advised to obtain legal advice about patent applications before entering innovations at any JETS Fair as once a design or product has been on public display, it cannot be patented. However, if any exhibit is displayed for judges only, no patent rights will be lost.

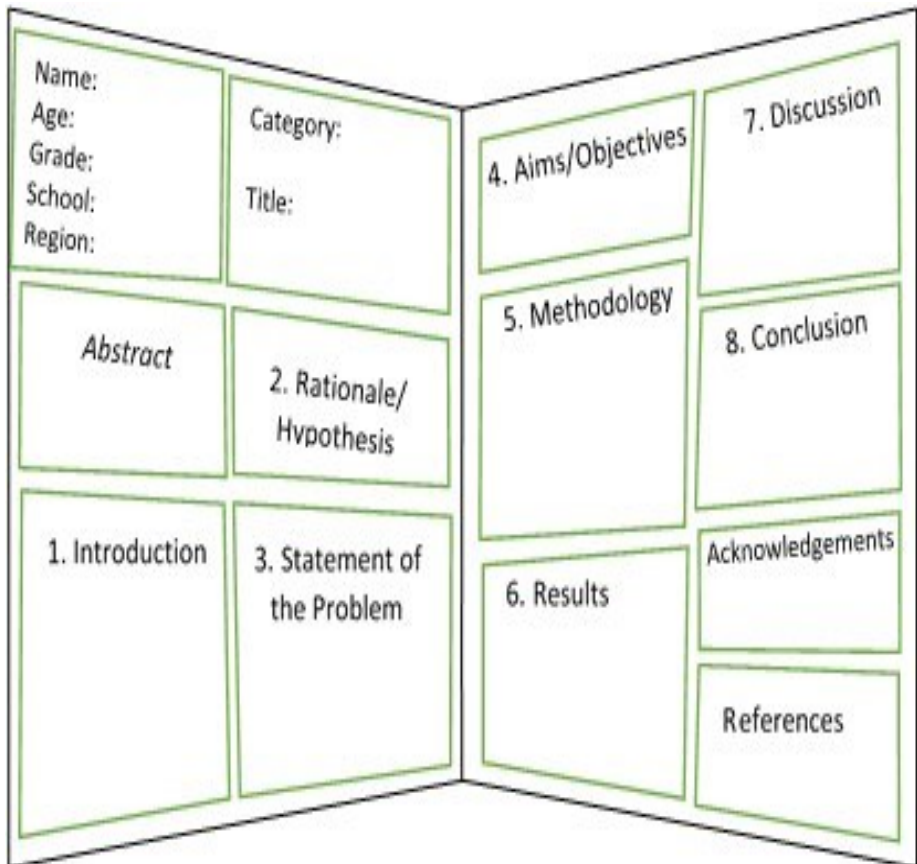
3.7 The presentation must include the Display Board:

All presentation must include a display board as it is a very important part of the exhibit. It should be easy to read and understand and it should explain what the researcher did, how it was done and what was found out. The presentation must be made interesting and attention-grabbing. The intention is to get visitors to stop and read what the innovation is all about. The summarised information must be laid out in a logical order. The detailed information will be in the report file.

(i) Compulsory logical order for display boards

For almost every JETS fair innovation, one needs to prepare a display board to communicate the work to others. In most cases a standard, three-panel display board that unfolds to be 1.0 meter tall by 1.2 meters wide is used as shown below.

(ii) Organize the information like a newspaper so that the audience can quickly follow the thread of the experiment by reading from top to bottom, then left to right. Include each step of the science fair innovation: Abstract, question, hypothesis, variables, background research, and so on.



(iii) **Use a font size of at least 16 points** for the text on the display board, so that it is easy to read from a few meters away. It's okay to use slightly smaller fonts for captions on picture and tables.

(iv) **The title should be big and easily read from across the room.** Choose one that accurately describes the work, but also grabs peoples' attention.

(v) **A picture speaks a thousand words!** Use photos or draw diagrams to present non-numerical data, to propose models that explain the results, or just to show the experimental setup. But, don't put text on top of photographs or images. It can be very difficult to read.

4.0 Categories in JETS

The categories have been repackaged and rebranded as Innovations in order to promote quality and avoid situations where participants bring ordinary classroom experiments which have no originality. In an innovation, an idea must be replicable at an economical cost and must satisfy a specific need. This includes constructing a model or device to duplicate existing technology or to demonstrate a well known physical theory as well as improving or demonstrating new applications for existing technological systems.

Furthermore, new categories which include teachers and students from colleges of education as well as skills have been introduced. The ICT category which was in the open categories has been re-assigned to the senior secondary level. The Environmental Sustainable Development (formerly Management of Environmental Issues) category has been re-aligned as one of the open categories.

4.1 JETS Categories

The following are the categories for the 2019 JETS Fair. A total of 56 participants will be competing in the various categories as indicated in Table 1.

	Categories	No. of Participants
ECE & Primary (ECE and Grade 1 to 7) 5	1. Mathematical Innovations	1
	2. Scientific Innovations	1
	3. Mathematics Olympiad	1
	4. Science Olympiad	1
	5. Quiz	2
Junior Secondary (Grade 8 to 9) 9	1. Agricultural Science Innovations	1
	2. Biology Innovations	1
	3. Chemistry Innovations	1
	4. Entomology Innovations	1
	5. Mathematics Innovations	1
	6. Physics Innovations	1
	7. Mathematics Olympiad	1
	8. Science Olympiad	1
	9. Quiz	2
Senior Secondary (Grade 10 to 12) 12	1. Agricultural Science Innovations	1
	2. Biology Innovations	1
	3. Chemistry Innovations	1
	4. Entomology Innovations	1
	5. Mathematics Innovations	1
	6. Physics Innovations	1
	7. Biology Olympiad	1
	8. Chemistry Olympiad	1
	9. Mathematics Olympiad	1
	10. Physics Olympiads	1
	11. ICT (Software and Hardware)	1
	12. Quiz	2

	Categories	No. of Participants
Open (ECE to Grade 12) 7	1. Energy Innovations 2. Oral Paper Presentations 3. Entrepreneurship Innovations 4. Rural Development Innovations 5. Environmental Sustainable Development Innovations 6. Value Addition Innovations 7. Robotics Innovations	1 1 1 1 1 1 1
Open (Out-of-School Youth/ College Students) 5	1. Scientific Innovations 2. Mathematical Innovations 3. Technology Innovations 4. ICT (Software and Hardware) 5. Robotics Innovations	1 1 1 1 1
Teachers 5	1. Scientific Innovations 2. Mathematical Innovations 3. Technology Innovations 4. ICT (Software and Hardware) 5. Robotics Innovations	1 1 1 1 1
Skills (Grade 10 to 12) 9	1. Bricklaying 2. Carpentry and Joinery 3. Electrical Installations 4. Wall and Floor Tiling 5. Landscape and Gardening 6. Welding 7. Food Technology (Baking) 8. Fashion Technology 9. Panel Beating and Spray Painting	1 1 1 1 2 1 1 1 1

Total: 56 categories

Table 2 shows the JETS categories, their description and the required number of participants for each. Innovation categories (Primary, Junior Secondary, Senior Secondary, skills, College and Open) are one participant

Table 2 : Description and Characteristics of JETS Categories

ECE & Primary Categories: Strictly for participants in ECE and Primary				
S/N	Category	Description	Characteristics	No. of Participants per region
1	Mathematical Innovations	Mathematical innovations involve presenting ideas in a real-world context to help learners understand how mathematics is related to and relevant in their lives.	Participants are expected to display critical thinking skills that address a variety of real-life problem solving scenarios through activities, games, and investigations showcasing research abilities and showing results	1
2	Scientific Innovations	This category involves presenting innovations in Integrated Science as one whole area of knowledge at a lower level, but still maintains the science processes.	Expected activities of scientific nature involving experiments or construction of simple models in any of the science disciplines showcasing research abilities and displaying results	1

S/N	Category	Description	Characteristics	No. of Participants per region
3	Mathematics Olympiads	This category takes the format of a written examination based on problem solving and is taken by an individual candidate in stipulated time.	The levels of questions are slightly higher than the level of the candidate and are challenging enough.	1
4	Science Olympiads	This category takes the format of a written examination based on problem solving and is taken by an individual candidate in stipulated time.	The levels of questions are slightly higher than the level of the candidate and are challenging enough.	1
5	Quiz	A quiz is a form of game or mind sport in which teams demonstrate their knowledge in certain subjects by attempting to answer questions correctly. The questions are usually challenging but must be answered within 30 to 45 seconds. The questions are derived from the curriculum at that level or slightly above to encourage research and studying ahead.	Primary quiz consists of questions in Integrated Science at lower level, Mathematics and General Knowledge. The General Knowledge questions are science based and they deal with topics not directly taught at that level but may be common knowledge to an extent.	2

Junior Secondary Categories: Strictly for participants in Grades 8 & 9 only

S/N	Category	Description	Characteristics	No. of Participants per region
1	Agricultural Scientific Innovations	Agricultural Science concerns itself with the application of science to agriculture. It includes the practice of all kinds of farming.	Participants are expected to exhibit skills in line with scientific methods in manipulating the environment and create models and processes that improve society's livelihood. They must showcase their research abilities and display tangible results.	1
2	Biology Innovations	This category consists of innovations derived from Biological concepts. These may be new ideas or those improved upon, devices or processes applied through scientific method.	Participants are expected to develop such processes in an improved way if they are not novel or new, showcasing their research abilities and displaying results.	1

S/N	Category	Description	Characteristics	No. of Participants per region
3	Chemistry Innovations	This category consists of innovations derived from Chemistry concepts. These may be new ideas or those improved upon, devices or processes applied through scientific method.	Participants are expected to develop such processes in an improved way if they are not novel or new, showcasing their research abilities and displaying results.	1
4	Entomology Innovations	This category involves the manipulation of knowledge on insects for the purpose of improving society's livelihood. This follows a scientific way of research.	Participants are expected to display models / processes to produce interventions showcasing their research abilities	1

S/N	Category	Description	Characteristics	No. of Participants per region
5	Mathematical Innovations	Mathematical innovations involve presenting ideas in a real-world context to help learners understand how mathematics is related to and relevant in their lives.	Participants are expected to display critical thinking skills that address a variety of real-life problem solving scenarios through activities, games, and investigations showcasing their research abilities and displaying results	1
6	Physical Innovations	This category consists of innovations derived from Physics concepts. These may be new ideas or those improved upon, devices or processes applied through scientific method.	Participants are expected to develop such processes in an improved way if they are not novel or new, showcasing their research abilities and displaying results.	1

S/N	Category	Description	Characteristics	No. of Participants per region
7	Mathematics Olympiads	This category takes the format of a written examination based on problem solving and is taken by an individual candidate in stipulated time.	The levels of questions are slightly higher than the level of the candidate and are challenging enough.	1
8	Science Olympiads	This category takes the format of a written examination based on problem solving and is taken by an individual candidate in stipulated time.	The levels of questions are slightly higher than the level of the candidate and are challenging enough.	1
9	Quiz	A quiz is a form of game or mind sport in which teams demonstrate their knowledge in certain subjects by attempting to answer questions correctly. The questions are usually challenging but must be answered within 30 to 45 seconds. The questions are derived from the curriculum at that level or slightly above to encourage research and studying ahead.	Junior quiz consists of questions in Integrated Science (Biology, Chemistry, and Physics), Mathematics and General Knowledge. The General Knowledge questions are science based and they deal with topics not directly taught at that level but may be common knowledge to an extent	2

Senior Secondary Categories: Strictly for participants in Grades 10 – 12 only

S/N	Category	Description	Characteristics	No. of Participants per region
1	Agricultural Scientific Innovations	Agricultural Science concerns itself with the application of science to agriculture. It includes the practice of all kinds of farming.	Participants are expected to exhibit skills in line with scientific methods in manipulating the environment and create models and processes that improve society’s livelihood. They must showcase their research abilities and display tangible results.	1
2	Biology Innovations	This category consists of innovations derived from Biological concepts. These may be new ideas or those improved upon, devices or processes applied through scientific method.	Participants are expected to exhibit skills in line with scientific methods in manipulating the environment and create models and processes that improve society’s livelihood. They must showcase their research abilities and display tangible results.	1

S/N	Category	Description	Characteristics	No. of Participants per region
3	Chemistry Innovations	This category consists of innovations in which chemistry concepts have been used to develop the product of the innovation.	In this category chemistry theories and principles are applied as the main building blocks of the framework of the innovation although some physics and biology concepts may be used to a lesser extent showcasing their research abilities and displaying results	1
4	Entomology Innovation	This category involves the manipulation of knowledge on insects for the purpose of improving society's livelihood. This follows a scientific way of research.	Participants are expected to display models / processes to produce interventions showcasing their research abilities.	1

S/N	Category	Description	Characteristics	No. of Participants per region
5	Mathematical Innovations	Mathematical innovations involve presenting ideas in a real-world context to help learners understand how mathematics is related to and relevant in their lives.	Participants are expected to display critical thinking skills that address a variety of real-life problem solving scenarios through activities, games, and investigations showcasing their research abilities and displaying results	1
6	Physical Innovations	This category consists of innovations derived from Physics concepts. These may be new ideas or those improved upon, devices or processes applied through scientific method.	Participants are expected to develop such processes in an improved way if they are not novel or new, showcasing their research abilities and displaying results.	1
7	Biology Olympiads	This category takes the format of a written examination based on problem solving and is taken by an individual candidate in stipulated time.	The levels of questions are slightly higher than the level of the candidate and are challenging enough.	1

S/N	Category	Description	Characteristics	No. of Participants per region
8	Chemistry Olympiads	This category takes the format of a written examination based on problem solving and is taken by an individual candidate in stipulated time.	The levels of questions are slightly higher than the level of the candidate and are challenging enough.	1
9	Mathematics Olympiads	This category takes the format of a written examination based on problem solving and is taken by an individual candidate in stipulated time.	The levels of questions are slightly higher than the level of the candidate and are challenging enough.	1
10	Physics Olympiads	This category takes the format of a written examination based on problem solving and is taken by an individual candidate in stipulated time.	The levels of questions are slightly higher than the level of the candidate and are challenging enough.	1
11	ICT (Software &Hardware)	These often involve creating and writing new algorithms to solve a problem or improve on an existing algorithm. Simulations, models or ‘virtual reality’ and as well as maintenance of hardware.	Expected to develop software and maintain the hardware and create models or processes that respond to society needs showcasing their abilities of programming and displaying results	1

S/N	Category	Description	Characteristics	No. of Participants per region
12	Quiz	A quiz is a form of game or mind sport in which teams demonstrate their knowledge in certain subjects by attempting to answer questions correctly. The questions, derived from the curriculum at that level or slightly above to encourage research areas preamble and studying ahead, are usually challenging but must be answered within 30 to 45 seconds.	Senior quiz consists of questions in Biology, Chemistry, Physics, Mathematics and General Knowledge. The General Knowledge questions are science based and they deal with topics not directly taught at that level but may be common knowledge to an extent.	2

Open Categories: For participants from ECE to Grade 12 only

S/N	Category	Description	Characteristics	No. of Participants per region
1	Energy Innovations	This category involves innovations that provide energy efficiency and conservation as source of alternative fuels that promote clean energy.	Expected to produce innovations that display clean, cheap and sustainable energy sources through creation of processes and models that respond to society needs showcasing their research abilities.	1
2	Oral Paper Presentations	This category consists of a collection and analysis of data to reveal evidence of a fact or a situation of scientific interest.	Participants are expected to have carried out a study of cause and effect relationships or theoretical investigations of scientific data showcasing their research abilities and displaying results with conclusive evidence. A full written scientific report is expected.	1

S/N	Category	Description	Characteristics	No. of Participants per region
3	Entrepreneurship Innovations	This category aims at encouraging participants to design & develop business plans or ventures for profit.	Expected to come up with innovations such as those to deal with electronic (film industry, sound production, etc.), construction, food industry, etc.	1
4	Rural Development Innovations	This category consists of innovations which are scientific, mathematical or technological which are meant to solve problems in the rural areas.	Participants are expected to come up with solutions in order to improve service delivery and raise the standards of living of the rural people.	1
5	Environmental Sustainable Development Innovations	This category consists of innovations which are scientific, mathematical or technological which are meant to solve environmental problems.	Expected to provide innovations that include controlling human impact on and interaction with the environment in order to preserve natural resources and to address the environmental challenges.	1
6	Value Addition Innovations	These are innovations which involve making improvements to an existing product or device or creating a new innovation of value to society ²¹	Participants in this category are expected to integrate new features into products (especially endogenous resources), modify certain products for a just cause, improve products, etc.	1

S/ N	Category	Description	Characteristics	No. of Participants per region
7	Robotics Innovations	Robotics involves the conception, design, manufacture, and operation of robots. This field overlaps with electronics, computer science, artificial intelligence, mechatronics, nanotechnology and bioengineering	Participants are expected to exhibit skills, at this level, in line with scientific methods in manipulating the environment and create models of robots and processes that improve society's livelihood. They must showcase their research abilities and display tangible results.	1

Open Categories: For Out-of-school youth/College Students

S/ N	Category	Description	Characteristics	No. of Participants per region
1	Scientific Innovations	This category combines Physics, Chemistry, Biology and Agriculture fields into one whole area of knowledge but maintains the science processes.	Expected activities of scientific nature involving experiments or construction of models in any of the science disciplines showcasing their research abilities and displaying results	1
2	Mathematical Innovations	Mathematical innovations involve presenting ideas in a real-world context to help learners understand how mathematics is related to and relevant in their lives.	Participants are expected to display critical thinking skills that address a variety of real-life problem solving scenarios through activities, games, and investigations showcasing their research abilities and displaying results	1
3	Technology Innovations	These involve innovations in the area of practical subjects (Design & Technology; Home-Economics). 32	Participants are expected to develop innovations in the Practical Subjects that respond to the needs of the curriculum.	1

S/N	Category	Description	Characteristics	No. of Participants per region
4	ICT (Software and Hardware)	These often involve creating and writing new algorithms to solve a problem or improve on an existing algorithm. Simulations, models or ‘virtual reality’ and as well as maintenance of hardware.	Expected to develop software and maintain the hardware and create models or processes that respond to society needs showcasing their abilities of programming and displaying results.	1
5	Robotics Innovations	Robotics involves the conception, design, manufacture, and operation of robots. This field overlaps with electronics, computer science, artificial intelligence, mechatronics, nano technology and bioengineering	Participants are expected to exhibit skills, at this level, in line with scientific methods in manipulating the environment and create models of robots and processes that improve society’s livelihood. They must showcase their research abilities and display tangible results.	1

Teacher’s Categories

S/N	Category	Description	Characteristics	No. of Participants per region
1	Scientific Innovations	This category combines Physics, Chemistry, Biology and Agriculture Science fields into one whole area of knowledge.	Participants are expected to develop innovations in any of the science field in form of Visual Aids and School Apparatus and that respond to needs of the curriculum.	1

S/ N	Category	Description	Characteristics	No. of Participants per region
2	Mathematical Innovations	Mathematical innovations involve presenting ideas in a real-world context to help learners understand how mathematics is related to and relevant in their lives.	Participants are expected to develop innovations in Mathematics in form of Visual Aids and School Apparatus that respond to the needs of the curriculum.	1
3	Technology Innovations	These involve innovations in the area of practical subjects (Design & Technology; Home-Economics).	Participants are expected to develop innovations in the Practical Subjects in form of Visual Aids and School Apparatus that respond to the needs of the curriculum.	1
4	ICT (Software and Hardware)	These often involve creating and writing new algorithms to solve a problem or improve on an existing algorithm. Simulations, models or ‘virtual reality’ and as well as maintenance of hardware	Expected to develop software and maintain the hardware and create models or processes that respond to society needs showcasing their abilities of programming and displaying results	1
5	Robotics Innovations	Robotics involves the conception, design, manufacture, and operation of robots. This field overlaps with electronics, computer science, artificial intelligence, mechatronics, nano technology and bioengineering	Participants are expected to exhibit skills, at this level, in line with scientific methods in manipulating the environment and create models of robots and processes that improve society’s livelihood. They must showcase their research abilities and display tangible results.	1

Skills Categories: Strictly for Junior and Senior Secondary school participants

S/N	Category	Description	Characteristics	No. of Participants per region
1	Brick laying	Works on commercial and residential innovations using Bricks. Bricklaying is closely associated with other parts of construction industry.	Participants are expected to organise and manage work in a safe and conducive environment, interpret the drawings, be able to set out and make correct measurement, construct, joint finish and present work	1
2	Carpentry and Joinery	Works on constructing forms for concrete, wall and roof systems of structures. Installs components that are seen on the inside and outside of residential or commercial buildings.	Expected to set out and measure, cut, install components, exhibit safe working, organise and manage of work environment, able to interpret drawings and written instructions. Assemble and finish innovations.	1

S/N	Category	Description	Characteristics	No. of Participants per region
3	Electrical Installations	These are works on domestic electrical installations in residential buildings	Participants are expected to organise and manage work; communicate and show interpersonal skills; solve problems; display innovation & creativity; plan, design, install, test and trouble shoot electrical installations.	1
4	Wall and Floor Tiling	This is the art of decorating walls and floors using tiles, bricks and blocks.	Participants are expected to organise and manage work; communicate and show interpersonal skills; solve problems; display innovation & creativity; plan, design, interpret drawings, set out, measure, prepare and fix tiles.	1
5	Landscape & Gardening	The key role for landscape and gardening is to design, install and maintain gardens and landscaped areas.	Participants are expected to provide customer service and communication, do garden design and implementation; substrate, soil and mulch, plant and care of plants & trees, garden technology and install and maintain water features.	2

S/N	Category	Description	Characteristics	No. of Participants per region
6	Welding	This involves preparation and joining of a range of metals of various gauges using electrical/gas shielded processes.	Participants are expected to interpret engineering work drawings, standards and symbols correctly; translate these requirements into accurate structures and products. Assembling techniques, finish; quality assurance and testing skills.	1
7	Food Technology (Baking)	This involves the production of a wide range of bread and pastry items.	Participants are expected to have high level of understanding about reformulating recipes and adapting to a changing environment. Ability to work on their own.	1
8	Fashion Technology	This is the art of creating garments.	Participants are expected to design, pattern construction, cutting and garment manufacture.	1
9	Panel beating and Spray painting	This is the art and skill that involves straightening bent bodies, removing dents, and replacing crumpled parts that are beyond repair.	In this category, participants are expected to remove dents, shape panels to match the original contours, then smoothen, re-surface and spray-paint the damaged surface to a perfect finish.	1
Total Number of Participants				56
N.B: Changes to application of guidelines may vary from competition to competition				

5.0 Coordination and Implementation Structure

The JETS activities and Fairs will be implemented at School, District, Regional and National levels as indicated in the Table 3.

Table 3: Roles and Functions of Implementing structures

Level	Coordination/ Implementing Structure	Roles and Functions
Primary School	<p>School Coordinating Committee</p> <ul style="list-style-type: none"> • The Deputy Head (Chair) • Senior Teacher • SIC • School JETS Organiser 	<ul style="list-style-type: none"> * Stimulate creative and scientific instincts in learners * Direct and guide learners through the stages of a scientific process * Arrange for visits to factories, research institutions, farms etc. for learners to carry out their research * Arrange for talks by professionals in SMT fields, * Organise essay competitions on scientific and technological themes * Arrange inter class / school quiz competitions * Liaise with the zonal organising committee on the organisation of the zonal fairs
Secondary School	<p>School Coordinating Committee</p> <ul style="list-style-type: none"> • The Deputy Head (Chair) • HoD/HoS (NS) • HoD/HoS (M) • HoD/HoS (Practical Subjects) • School JETS Organiser 	<ul style="list-style-type: none"> * Stimulate creative and scientific instincts in learners * Direct and guide learners through the stages of a scientific process * Arrange for visits to factories, research institutions, farms etc. for learners to carry out their research * Arrange for talks by professionals in SMT fields, * Organise essay competitions on scientific and technological themes * Arrange inter class / school quiz competitions * Liaise with the zonal organising committee on the organisation of the zonal fairs

Level	Coordination/ Implementing Structure	Roles and Functions
Zone	Zonal Coordinating Committee <ul style="list-style-type: none"> • The Zonal Deputy Head (Chair) • Zonal JETS Coordinator • 1 Representative from Subject Associations • Zonal INSET Coordinator • 1 HOS at Primary school • 1 HOD at Secondary school 	<ul style="list-style-type: none"> * Organise schools to take keen interest in Science, Mathematics and Technology activities in the zone, * Organise zonal fairs to select representatives for the district fair * Responsible for inviting members of the public and educational leaders to the zonal fair * Liaise with the district organising committee on the organisation of the district fairs
College	College Coordinating Committee <ul style="list-style-type: none"> • Vice Principal (Chair), • HoS (NS) • HoS (M) • HoS (Technology) • JETS Coordinator 	<ul style="list-style-type: none"> * Organise College students to take keen interest in Science, Mathematics and Technology activities in the college, * Organise College fair to select representatives for the district fair * Responsible for inviting members of the public and educational leaders to the College fair * Liaise with the district organising committee on the organisation of the district fairs
District	District Coordinating Committee <ul style="list-style-type: none"> • District Education Standards Officer (Chair), • Education Standards Officer-General Inspections/ODL, • District JETS Organiser • District JETS Secretary • College JETS Coordinator • DRCC • Rep - Heads Association • Rep - Subject Associations (Rotational) 	<ul style="list-style-type: none"> * Organise schools and colleges to take keen interest in Science, Math and Technology activities in the district, * Organise district fairs to select representatives for the regional fair * Responsible for inviting members of the public and educational leaders to the district fair * Lead winners of the district to the Regional Fair * Liaise with the regional committee on the organising of district science fairs

Level	Coordination/Implementing Structure	Roles and Functions
Provincial	<p>Provincial Coordinating Committee</p> <ul style="list-style-type: none"> • Principal Education Standard Officer (Chair), • Provincial SMT Coordinator, • Senior Education Standards Officer - NS, • Senior Education Standards Officer- Math, • Senior Education Standards Officer - PS, • Education Officer- TE • Regional JETS Organiser • Rep - Vice Principal • Rep - Heads (Primary) • Rep - Heads (Secondary) • Rep - Subject Associations (Rotational) 	<ul style="list-style-type: none"> * Organise schools and colleges to take keen interest in Science, Math and Technology activities, * Organise regional fairs to select representatives for the national fair * Lead winners of the region to the National Fair * Liaise with NSC on organising of science fairs * Responsible for inviting members of the public and educational leaders to the regional fair
National	<p>National Coordinating Committee</p> <ul style="list-style-type: none"> • Director (Chair) • Assistant Director – R & I • Assistant Director– T & CS • Assistant Director - P & M • Senior JETS Officer (Secretariat) • Senior Research & Innovation Officer, • Senior SMT Education & Training Officer, • Senior Product Development and Improvement Officer • JETS Officer (Secretariat) • Dean - PESOs • Dean - Vice Principals (Colleges) 	<ul style="list-style-type: none"> * Make policy decisions, * Approve work programs, * Monitor, evaluate and review activities, * Organise the annual National Fair, * Source for funds, * Supervise the regions * In-charge of the day-to-day execution and management of the JETS programs and activities (Secretariat) * Prepare the program of activities for each year (Secretariat) * Liaise with the Regional Organisers (Secretariat) * Prepare annual report for all JETS activities (Secretariat)

6.0 Adjudication

Adjudication is the process of acting as a judge in a contest, competition, court or tribunal according to laid down criteria acceptable to the contestants. In the contests at the JETS fairs, adjudication is the process of making and giving a decision on who should get the prize in a particular category.

What is Required of Adjudicators

Adjudication criteria on the adjudication sheets are based on the following:

- i) Written Innovation report and its quality
- ii) Knowledge, content and ability
- iii) Oral Presentation

- iv) Presentation (layout)

- v) Research work involved

- vi) Educational value of innovation

- vii) Relevance and importance

Conduct of Adjudicators

Adjudicators are expected to conduct both themselves and the proceedings in a judicial manner. To this end, adjudicators should,

- i) approach every exhibitor with an open mind with respect to every innovation and avoid comments or conduct that could cause presenter to think otherwise;
- ii) listen carefully and respectfully to the views and submissions of the presenter and; and
- iii) show respect for the presenter and for the proceeding process

itself, through their conduct, timeliness, and dress throughout the adjudication process.

Adjudicators have an on-going duty of confidentiality during and after the adjudication process.

No Conflict of Interest:

A person cannot serve as an eligible adjudicator in any adjudication process if he or she has interest in the outcome of the particular Innovation. The adjudicator should disclose as soon as possible and recuse themselves from such a situation which may give rise to a conflict of interest. In particular, an adjudicator who is a member or director of a company or party to the exhibitor should not act as adjudicator without the fully informed consent of the Chief Adjudicator.

Impartiality:

An adjudicator must always maintain impartiality during the adjudication process towards the exhibitors involved in the competition. Impartiality means freedom from favoritism or bias in word or action towards an exhibitor. Furthermore, an adjudicator is not to play an adversarial role and must maintain an even-handed approach towards all exhibitors involved. An adjudicator should not become an adviser to any of them.

Neutrality:

If the adjudicator believes that his/her background or personal experiences or relationships would prejudice the adjudicator's role or detract from his/her impartiality, the adjudicator must withdraw from the adjudication, unless the Chief Adjudicator agree to proceed after full disclosure of all relevant facts relating to the issue of neutrality.

Objectivity:

In considering the submissions, accompanying supporting documents, information and comments of the exhibitor, an adjudicator must be objective. This entails the Adjudicator being free from subjective personal feelings, including notions of justice and fairness.

An adjudicator's decision must disclose proper analysis, objectivity and regard only to those limited matters referred in the Adjudication sheet.

Conscientiousness and Diligence:

An adjudicator should carry out his/her task in a diligent manner in order to do what is right at any particular time.

All adjudicators in a category are bound by the same criteria to avoid disagreements. The role of a judge is not only to evaluate the merit of the innovations, but also to provide helpful, constructive feedback as an expert in the field.

There are 4 different types of Adjudication sheets. These have “different” sets of specific criteria. There are adjudication sheets for innovations for ECE & primary level, innovations for junior and senior secondary school, innovations for college students and out-of-school, oral paper presentation and innovations for teachers.

The value of the innovations will be evaluated based on three major criteria, namely: scientific thought, originality and creativity, and communication (weighted in that order). The innovation display and presentation are important in that they demonstrate the competitors’ ability to communicate concepts, methods and results relevant to the work presented.



JETS OF ZAMBIA

ADJUDICATION SHEET FOR INNOVATIONS (ECE & PRIMARY SCHOOL CATEGORIES)

PART A: TO BE FILLED IN BY THE EXHIBITOR

REGION

CATEGORY

TITLE OF INNOVATION

NAME

EXHIBITOR

GRADE

DOB

SEX

NAME AND ADDRESS OF SCHOOL OR INSTITUTION

PART B: FOR OFFICIAL USE BY ADJUDICATOR ONLY

S/No	CRITERIA	4	3	2	1	0	REMARKS
I.	INNOVATION REPORT AND ITS QUALITY Title, Introduction, Aim/s, Method/s, Result/s, Conclusion/s, Reference/s						
II.	KNOWLEDGE AND COMMUNICATION ABILITY						
	1. Ability to explain						
	2. Confidence						
	3. Ability to answer questions						
III.	PRESENTATION						
	1. Orderliness						
	2. Labelling						
	3. Neatness						
IV.	RESEARCH WORK INVOLVED						
	1. Imaginativeness & Innovativeness						
	2. Is the innovation relevance						
	3. Cleverness in the use of simple materials						
	4. Workability of prototype / model						
	SUBTOTALS						GRAND TOTAL

NOTE: 5 - VERY GOOD, 4 - GOOD, 3 - AVERAGE, 2 - BELOW AVERAGE, 1 - UNSATISFACTORY, 0 - ABSENCE

MAKE ANY SPECIAL COMMENT AND SUGGESTION ON ANY PART OF THIS PROJECT

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NAME OF ADJUDICATOR:SIGNATURE..... DATE.....



JETS OF ZAMBIA

ADJUDICATION SHEET FOR INNOVATIONS (JUNIOR & SENIOR SECONDARY SCHOOL CATEGORIES)

PART A: TO BE FILLED IN BY THE EXHIBITOR

REGION

CATEGORY

TITLE OF
INNOVATION

NAME
EXHIBITOR

GRADE

DOB

SEX

NAME AND ADDRESS OF INSTITUTION

PART B: FOR OFFICIAL USE BY ADJUDICATOR ONLY

S/No	CRITERIA	5	4	3	2	1	0	REMARKS
I.	INNOVATION REPORT AND ITS QUALITY Title, Introduction, Aim/s, Method/s, Result/s, Conclusion/s, Reference/s							
II.	KNOWLEDGE AND COMMUNICATION ABILITY							
	1. Understanding of Subject Matter							
	2. Understanding of Techniques Involved							
III.	PRESENTATION							
	1. Orderliness							
	2. Labelling							
IV.	RESEARCH WORK INVOLVED							
	1. Originality of Idea							
	2. Innovativeness							
V.	EDUCATIONAL VALUE							
	1. How Well a Scientific / Mathematical / Technological Principle is Applied or Illustrated							
	2. Suitability as a Nucleus for further Research							
VI.	ENVIRONMENTAL MITIGATION Measures taken in the use of the innovation for environmental mitigation							
SUBTOTALS								GRAND TOTAL

NOTE: 5 = VERY GOOD, 4 = GOOD, 3 = AVERAGE, 2 = BELOW AVERAGE, 1 = UNSATISFACTORY, 0 = ABSENCE

Comment on any Part of this Innovation

Name of Adjudicator: Signature Date



JETS OF ZAMBIA

ADJUDICATION SHEET FOR INNOVATIONS (TEACHERS' CATEGORIES)

PART A: TO BE FILLED IN BY THE EXHIBITOR

REGION CATEGORY

TITLE OF INNOVATION

NAME EXHIBITOR

NAME AND ADDRESS OF SCHOOL /INSTITUTION

PART B: FOR OFFICIAL USE BY ADJUDICATOR ONLY

S/No	CRITERIA	5	4	3	2	1	0	REMARKS
I.	INNOVATION REPORT AND ITS QUALITY Title, Introduction, Aim/s, Objectives/s, Method/s, Result/s, Conclusion/s, Reference/s							
II.	KNOWLEDGE AND COMMUNICATION ABILITY							
	1. Understanding of Subject Content							
	2. Understanding of Techniques Involved							
III.	PRESENTATION							
	1. Orderliness							
	2. Clarity							
IV.	RESEARCH WORK INVOLVED							
	1. Originality of Idea							
	2. Innovativeness / uniqueness of the idea							
V.	EDUCATIONAL VALUE							
	1. How Well a Scientific / Mathematical / Technological Principle is Applied or Illustrated							
	2. Suitability as a Nucleus for further Research							
	3. Relevance to Career Choices							
VI.	ENVIRONMENTAL MITIGATION							
	Measures taken in the use of the innovation for environmental mitigation							
SUBTOTALS								GRAND TOTAL

NOTE: 5 = VERY GOOD, 4 = GOOD, 3 = AVERAGE, 2 = BELOW AVERAGE, 1 = UNSATISFACTORY, 0 = ABSENCE

Comment on any Part of this Innovation

Name of Adjudicator: Signature Date



JETS OF ZAMBIA

ADJUDICATION SHEET FOR PAPER PRESENTATION

PART A: TO BE FILLED IN BY THE PRESENTER

REGION TITLE OF
PAPER

NAMES

PRESENTER GRADE DOB SEX NAME AND ADDRESS OF SCHOOL / INSTITUTION

PART B: FOR OFFICIAL USE BY ADJUDICATOR ONLY

CRITERIA		5	4	3	2	1	0	REMARKS	
I	PRESENTATION								
	1. Arrangement of Ideas								
	2. Clarity of Expression								
	3. Illustrations or demonstrations or models								
	4. Timing of Oral Presentation								
	5. Ability in answering questions								
	6. Rapport with audience								
II	TOPIC AND CONTENT								
	1. Suitability of the Topic as a subject for the paper								
	2. Originality / Novelty of the Idea								
	3. Practical / Educational suitability								
III	WRITTEN REPORT								
	1. Illustrations and Clarity								
	2. Project Study / Library Study / Collection / Interpretation								
IV	OVERALL EFFECT								
SUBTOTALS								GRAND TOTAL	

NOTE: 5 = VERY GOOD, 4 = GOOD, 3 = AVERAGE, 2 = BELOW AVERAGE, 1 = UNSATISFACTORY, 0 = ABSENCE

MAKE ANY SPECIAL COMMENT AND SUGGESTION ON ANY PART OF THIS PROJECT

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NAME OF ADJUDICATOR: SIGNATURE DATE



JETS OF ZAMBIA

ADJUDICATION SHEET FOR PANEL BEATING & SPRAY PAINTING

PART A: To be filled in by the candidate

Region

Category

Name of Candidate

Grade

DOB

Sex

Name and Address of School / Institution

PART B : FOR OFFICIAL USE BY THE ADJUDICATOR ONLY

CRITERIA	3	2	1	0	REMARKS
1. Has the job (works) been fully assessed?					
2. Has the cost of repair been thoroughly estimated?					
3. Is the technology or procedure been identified?					
4. Is there adequate planning for the task?					
5. Has a candidate demonstrated appreciation of underlying principles					
6. Is the appropriate procedure and timing followed?					
7. Exhibit appropriate handling and storage of materials and tools					
8. Is there a demonstration of an understanding of materials needed?					
9. Adherence to safety precautions					
10. Is the candidate appropriately dressed?					
11. Skilful handling and manipulation of equipment					
12. Is the finish of the final product neat?					
13. Do the contours fit in nicely?					
14. How perfectly does the restored part appear?					
15. Is there usage of the appropriate finish?					
SUB TOTALS					
GRAND TOTALS					

NOTE: 3 = ABOVE AVERAGE, 2 = AVERAGE, 1 = BELOW AVERAGE, 0 = ABSENCE

MAKE ANY SPECIAL COMMENT AND SUGGESTION ON ANY PART OF THIS PROJECT

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.....

NAME OF ADJUDICATOR:..... SIGNATURE..... DATE.....



JETS OF ZAMBIA

ADJUDICATION SHEET FOR INNOVATIONS (JUNIOR & SENIOR SECONDARY SCHOOL CATEGORIES)

Part A: To be filled in by the Exhibitor

Region

Category

Title of
Innovation

Name of
Exhibitor

Grade

DOB

Sex

Name and address of Institution

PART B: FOR OFFICIAL USE BY ADJUDICATOR ONLY

S/No	CRITERIA	3	2	1	0	REMARKS
I.	Innovation Report and Its Quality Title, Introduction, Aim/s, Method/s, Result/s, Conclusion/s, Reference/s					
II.	Knowledge and Communication Ability					
	1. Understanding of Subject Matter					
	2. Understanding of Techniques Involved					
III.	Presentation					
	1. Orderliness					
	2. Labelling					
IV.	Research Work Involved					
	1. Originality of Idea					
	2. Innovativeness					
V.	Educational Value					
	1. How Well a Scientific / Mathematical / Technological Principle is Applied or Illustrated					
	2. Suitability as a Nucleus for further Research					
VI.	Environmental Mitigation Measures taken in the use of the innovation for environmental mitigation					
SUBTOTALS						GRAND TOTAL

NOTE: 3 = ABOVE AVERAGE, 2 = AVERAGE, 1 = BELOW AVERAGE, 0 = ABSENCE

Comment on any Part of this Innovation

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Name of Adjudicator: Signature Date

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