

STEM QUIZ COMPETITION GUIDELINES HANDBOOK

FOR PRIVATE SCHOOLS

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1. INTRODUCTION

The National STEM Quiz for Private Senior High Schools in Ghana is a structured academic competition designed to strengthen learning in Mathematics and Science through competitive engagement. It adopts a five-round format that progresses from advanced conceptual recall to interdisciplinary problem-solving, incorporating scenario-based questions, case studies, digital assessments, and design challenges.

The competition is curriculum-aligned and covering a broad range of topics while reinforcing core concepts and addressing areas that require deeper understanding. It assesses key competencies such as precision, analytical reasoning, application of knowledge, creativity, and collaboration, moving beyond memorization to real-world application.

All rounds are conducted under standardized conditions to ensure fairness, consistency, and equal levels of difficulty across participating teams.

2. OBJECTIVES

The competition seeks to:

- i. Promote deep conceptual understanding in STEM subjects
- ii. Develop problem-solving and analytical skills
- iii. Encourage innovation and creativity among learners
- iv. Enhance teamwork and collaboration
- v. Prepare learners for digital and real-world STEM challenges

3. COMPETITION STRUCTURE

The competition consists of five (5) structured rounds designed to progressively assess learners' competencies from recall to advanced problem-solving.

3.1 ROUND 1: STEM SPRINT (High-Level Recall – Rotational Mode)

Component	Details
Purpose	Test teams' ability to demonstrate deep conceptual recall and precise STEM knowledge under time pressure
Format	<ul style="list-style-type: none"> • Rotational in • Questions directed in sequence • Equal number of questions per team • 10 seconds to answer
Question Standard	<ul style="list-style-type: none"> • Assesses rapid application of concepts within the approved curriculum under time constraints • Requires interpretation of short problem contexts to identify the governing concept or principle • Emphasizes precise use of scientific and mathematical terminology, symbols, and units where applicable • Demands accurate selection of the most appropriate concept based on underlying relationships • Responses must be concise, unambiguous, and aligned with key marking points consistent with West African Examinations Council standards • Prioritizes correctness, relevance, and clarity within a limited response time
Question Types	<ul style="list-style-type: none"> • Concept identification from brief applied situations • Principle recognition based on observed effects or outcomes • Single-step decision questions requiring interpretation of relationships • Classification or naming based on functional or behavioural descriptions • Rapid application of laws, properties, or processes to determine a single correct outcome
Flow	<ol style="list-style-type: none"> 1. Question directed to team 2. 2 Attempts 3. If incorrect → passed to next team
Scoring	<ul style="list-style-type: none"> • Award 3 points for correct response • 1 point for bonus

Key Rule	Answers must be precise and scientifically accurate

3.2 ROUND 2: THINK & EXPLAIN (scenario and Case Study Analysis Round)

Component	Details
Purpose	Assess deep reasoning, structured explanation, and real-world problem-solving
Format	<ul style="list-style-type: none"> • Same case study for all teams • Written or oral response
Question Standard (Visual & Video Case Study)	<ul style="list-style-type: none"> • Assesses application of concepts using visuals (diagrams/images) and short video clips within the approved curriculum • Requires accurate interpretation of static and dynamic representations (e.g., processes, systems, changes over time) • Each question is independent, with no linkage or clue from preceding or subsequent items • Demands precise use of scientific and mathematical terminology, symbols, and units where applicable • Responses must align strictly with key marking points consistent with West African Examinations Council standards • Requires single, unambiguous answers to ensure fairness and consistency in marking • Prioritizes correctness, clarity, and direct relevance to the presented visual or video
Question Types	<ul style="list-style-type: none"> • Diagram interpretation questions requiring identification of components or structures • Video-based observation questions requiring identification of processes or changes • Concept identification based on features observed in images or short clips

	<ul style="list-style-type: none"> • Direct application questions derived from labelled or implied elements in visuals/videos • Recognition of processes, properties, or relationships demonstrated dynamically • Short-response items requiring one precise answer (no explanation required)
Flow	<ul style="list-style-type: none"> • Question directed to team • 2 Attempts • If incorrect → passed to next team
Scoring	<ul style="list-style-type: none"> • 3 points rule
Key Rule	Moves from answering questions to analyzing real-world problems
Time Allocation	<input type="checkbox"/> Problem-solving: 20- 25minutes <input type="checkbox"/>

3.3 ROUND 3: STEM IN CONTEXT (Digital Response Round)

Component	Details
Purpose	Assess application, interpretation, speed, and digital competence in solving STEM problems within real-world and technology-supported contexts
Format	<input type="checkbox"/> Same set of questions for all teams <input type="checkbox"/> Teams respond using digital devices (laptop/tablet/mobile) <input type="checkbox"/> Delivered via Google Forms <input type="checkbox"/> Timed response (5 minutes total)
Question Standard (Digital & Context-Based)	<ul style="list-style-type: none"> • Assesses rapid application of STEM concepts using varied digital stimuli (data, graphs, formulas, and brief contexts) • Requires accurate interpretation of information and relationships • Questions are independent with single, unambiguous answers • Demands precise use of scientific and mathematical terms, symbols, and units • Prioritizes correctness, speed, and clarity using digital devices

Question Types	<ul style="list-style-type: none"> • <input type="checkbox"/> Data interpretation questions based on tables or datasets • Graph analysis questions requiring identification of values, trends, or relationships • Numeric-entry questions based on calculations or given information • Multiple-choice questions based on digital or contextual information • Short-answer questions requiring one precise response • Quick problem-solving items involving formulas, relationships, or real-life contexts
Flow	<ol style="list-style-type: none"> 1. <input type="checkbox"/> Questions released simultaneously to all teams 2. Teams respond individually on their devices 3. Submission within 5 minutes 4. Responses automatically collected and displayed
Scoring	<input type="checkbox"/> Objective (Auto-marked) – Majority of items <input type="checkbox"/> Structured (Manual, if included) – Optional <input type="checkbox"/> Total score based on accuracy and completeness A
Key Rule	Emphasizes fast, accurate interpretation and application of STEM concepts across varied digital contexts under time-bound conditions

3.4 ROUND 4: DESIGN & INNOVATE (STEM Challenge Round)

Component	Details
Purpose	Assess practical application of STEM concepts, creativity, design thinking, and experimental skills in solving real-world problems
Format	<input type="checkbox"/> Team-based design and experimentation task <input type="checkbox"/> Hands-on or conceptual solution development <input type="checkbox"/> Use of available materials for testing, prototyping, or demonstration
Question Standard (Design, Experimentation & Innovation-Based)	<ul style="list-style-type: none"> • Assesses application of STEM concepts through design, experimentation, construction, or conceptual modeling within real-world contexts • Requires teams to identify problems, propose solutions, and test or simulate outcomes through experimentation where applicable

	<ul style="list-style-type: none"> • Demands integration of scientific principles, mathematical reasoning, and technological processes • Encourages creativity, originality, and feasibility of solutions • Requires systematic thinking, including planning, testing, observing, and refining solutions • Requires clear justification of design and experimental choices using appropriate scientific and technical language • Promotes collaboration, role distribution, and effective teamwork
Question Types	<ul style="list-style-type: none"> • Design tasks requiring development of a solution to a given problem • Experimental tasks involving testing, observation, and refinement of ideas • Construction or prototyping tasks using available materials • Conceptual design tasks (sketches, labelled diagrams, or system plans) • Problem-solving tasks based on community or environmental challenges • Optimization tasks requiring improvement of an existing system through testing • Short presentation explaining design, experimental process, and outcomes
Flow	<ol style="list-style-type: none"> 1. Task presented to all teams simultaneously 2. Teams plan, design, and conduct simple experiments or testing 3. Teams refine solutions based on observations 4. Teams present design and findings within allocated time 5. Judges assess based on defined criteria
Time Allocation	<input type="checkbox"/> Task & Experimentation: 15 minutes <input type="checkbox"/> Presentation: 5 minutes
Scoring	<input type="checkbox"/> Functionality – 8 <input type="checkbox"/> Scientific Reasoning – 5 <input type="checkbox"/> Experimentation & Testing – 5 <input type="checkbox"/> Creativity – 4 <input type="checkbox"/> Team Collaboration – 3
Key Rule	Moves from theoretical knowledge to design, experimentation, and innovation, emphasizing real-world problem-solving, testing, and teamwork

Time Allocation	<input type="checkbox"/> Problem-solving: 10 - 15 minutes <input type="checkbox"/> Presentation: 3 minutes
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3.5 ROUND 5: GRAND CHALLENGE (Integrated STEM Problem)

Component	Details
Purpose	Assess advanced problem-solving through integration of Science, Technology, Engineering, and Mathematics in addressing real-world challenges
Format	<input type="checkbox"/> One complex problem presented to all teams <input type="checkbox"/> Team-based response (written and oral presentation) <input type="checkbox"/> Requires structured, technology-informed solution development
Question Standard (Integrated STEM & Technology-Based)	<ul style="list-style-type: none"> • Assesses deep understanding and integration of concepts across Science, Technology, Engineering, and Mathematics • Requires comprehensive analysis of a complex, real-world problem using appropriate technological approaches or tools • Demands application of multiple STEM concepts and digital/technological solutions in a coordinated manner • Encourages logical reasoning, systems thinking, and use of technology to model, simulate, or optimize solutions • Requires development of a feasible, technology-supported and well-justified solution • Demands clear use of scientific and mathematical terminology, symbols, representations, and where applicable, digital tools or processes • Promotes structured thinking: analysis → application → technological integration → solution → justification
Question Types	<ul style="list-style-type: none"> • Integrated problem-solving tasks combining concepts from multiple STEM areas with technological application • Case-based analytical questions requiring use of digital or technological approaches • Design-and-solution tasks incorporating technological tools,

	<p>systems, or processes</p> <ul style="list-style-type: none"> • Multi-step reasoning problems involving calculations, modeling, and technology-supported decisions • Scenario-based tasks requiring evaluation of alternatives including technological options • Structured response tasks requiring explanation, justification, and integration of technology in solutions
Flow	<ol style="list-style-type: none"> 1. Problem presented simultaneously to all teams 2. Teams analyze and plan solution collaboratively 3. Teams apply STEM concepts and integrate appropriate technology 4. Teams develop and structure solution 5. Teams present and justify solution within allocated time 6. Judges assess based on defined criteria
Time Allocation	<input type="checkbox"/> Problem-solving: 10 - 15 minutes <input type="checkbox"/> Presentation: 3 minutes
Scoring (10 points)	<input type="checkbox"/> Problem Analysis – 3 <input type="checkbox"/> STEM & Technology Application – 3 <input type="checkbox"/> Solution Quality – 2 <input type="checkbox"/> Clarity –2
Key Rule	Tests true STEM integration with explicit use of technology to enhance problem-solving, innovation, and decision-making
Time Allocation	<input type="checkbox"/> Problem-solving: 10 - 15 minutes <input type="checkbox"/> Presentation: 3 minutes

3.6 OVERALL DESIGN STRENGTH

Aspect	Description
Progression	Recall → Reasoning → Application → Design → Integration
Balance	Speed, depth, and practical skills
Alignment	<ul style="list-style-type: none">• Modern STEM education practices• Real-world problem-solving approaches• Competency-based assessment

4. ROLES AND RESPONSIBILITIES

- Competition Coordinator – Overall supervision
- Quiz Master – Moderation and control
- Judges – Assessment and validation
- Timekeeper – Time enforcement
- Scorekeeper – Score tracking
- Technical Officer – Digital systems management
- Logistics Officer – Venue and materials preparation

5. COMPETITION LOGISTICS

- Venue with proper seating and visibility
- Projector and sound system
- Devices for digital round
- Reliable internet connectivity

6. MATERIALS AND RESOURCES

- Score sheets and writing materials
- Case study documents
- Digital devices
- Design kits for Round 4
- Problem briefs for Round 5

7. SCORING AND ASSESSMENT

- Objective responses: accuracy-based
- Subjective rounds: rubric-based evaluation
- Scores updated after each round

8. TIME ALLOCATION

Round	Duration
Round 1	15 – 20 min
Round 2	15 – 20 min
Round 3	15 – 20 min
Round 4	15 – 20 min
Round 5	15 – 25 min

9. RISK MANAGEMENT

- Internet failure → offline backup
- Power outage → backup supply
- Disputes → judges' decision final
- Materials → equal distribution

10. FAIRNESS AND INTEGRITY

- Equal number of questions
- Uniform difficulty
- Strict timing
- No external assistance

11. IMPLEMENTATION GUIDELINES

- Pre-event briefing
- Technical dry run
- Clear communication of rules
- Smooth round transitions

12. EXPECTED OUTCOMES

- Improved STEM competencies
- Enhanced critical thinking
- Increased digital literacy
- Identification of top-performing learners

13. CONCLUSION

This STEM Quiz Competition provides a comprehensive platform for assessing learners from foundational knowledge to advanced interdisciplinary problem-solving, aligning with GES's commitment to quality STEM education.