

## Research

**Problem Statement (Year 1: first 3 months)-Including 3 RAC in the first year**

Questions	Judging Criteria	Max Points	Scoring Details	Score Received
<b>What question/problem will your team be investigating?</b>	Selected problem deals with an interesting or challenging issue	15	0 points: Does not state a problem 5 points: Statement present, but is not a researchable problem (does not state a question with answers) 10 points: States an interesting or challenging researchable problem 15 points: States a unique researchable problem <i>Note: Minimum score needed to move to the next stage is 10 points.</i>	
<b>What did you find out about your problem that you didn't know before?</b>	Background Research - Learned relevant information that relates to the selected problem	10	0 points: No background research 5 points: Simple research using non-scientific sources 10 points: Used scientific research databases <i>Note: Minimum score needed to move to the next stage is 5 points.</i>	

**Hypothesis (Year 1: 4th month)**

Questions	Judging Criteria	Max Points	Scoring Details	Score Received
<b>What is your hypothesis for this investigation?</b>	Develops a logical hypothesis based on background research	10	0 points: Does not provide a hypothesis 10 points: Hypothesis is valid and written in proper format <i>Note: Minimum score needed to move to the next stage is 10 points.</i>	

<p><b>Have you performed the literature search/survey?</b></p>	<p>Understanding of the present scenario regarding the scientific literature on hypothesis, background, experiments, and allied aspects using scientific platforms such as PubMed, PubMed Central, Google Scholar, SCOPUS, Web of Science, and others</p>	<p>40</p>	<p>0 points: No literature search</p> <p>20 points: Literature search/ survey (state of the art) by referring to 20-50 articles</p> <p>40 points: Literature search /survey (state of the art) by referring to &gt;50 articles</p> <p><i>Note: Minimum score needed to move to the next stage is 20 points.</i></p>	
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**Experimental Design (Year 1: 8th month)**

Questions	Judging Criteria	Max Points	Scoring Details	Score Received
<p><b>What are the essential experiments required to test your hypothesis?</b></p>	<p>Develops different strategies</p>	<p>25</p>	<p>0 points: Does not provide any experiments</p> <p>25 points: Experiments are valid and written in proper format</p> <p><i>Note: Minimum score needed to move to the next stage is 25 points.</i></p>	

**Proposal Defense (Year 1: 12th month)**

Questions	Judging Criteria	Max Points	Scoring Details	Score Received
<p><b>Have you formed a Research Advisory Committee (RAC)</b></p>	<p>Follows the GYRA RAC guidelines</p>	<p>10</p>	<p>0 points: No RAC</p> <p>10 points: RAC</p> <p><i>Note: Minimum score needed to move to the next stage is 10 points.</i></p>	

<p><b>Have you presented, defended, and got approval from RAC?</b></p>	<p>Based on the overall research proposal including the identification of the problem, background knowledge, hypothesis, specific aims, experimental design, data analysis, statistics plans, anticipated outcomes, and overall impact.</p>	<p>40</p>	<p>0 points: No RAC approval 40 points: RAC approval <i>Note: Minimum score needed to move to the next stage is 40 points.</i></p>	
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<p><b>Experimental Process (Year 2: 1-9 months (Including 4 RAC meetings))</b></p>				
<p><b>Questions</b></p>	<p><b>Judging Criteria</b></p>	<p><b>Max Points</b></p>	<p><b>Scoring Details</b></p>	<p><b>Score Received</b></p>
<p><b>Do you have proper experimental groups?</b></p>	<p>Indicates whether an experimental group is well-defined</p>	<p>15</p>	<p>0 points: Does not have experimental groups 10 points: Experimental groups are valid 15 points: Experimental groups are valid with proper experimental repeats <i>Note: Minimum score needed to move to the next stage is 15 points.</i></p>	
<p><b>List all materials required for your experiments.</b></p>	<p>Accurately identifies all materials necessary for the experiment.</p>	<p>10</p>	<p>0 points: Lists no materials necessary for the experiment 10 points: Appears to have an essential list of all the materials necessary for the experiment <i>Note: Minimum score needed to move to the next stage is 10 points.</i></p>	

<b>Explain all experimental processes.</b>	The proposed experiment is conducted sufficiently (qualitatively and quantitatively) and is a valid test of the hypothesis	25	<p>0 points: Does not list an experimental process</p> <p>5 points: An experimental process that is related to the problem stated is listed, but is largely incomplete</p> <p>15 points: An experimental process that is related to the problem stated is listed, but isn't repeatable and is unable to be followed step-by-step</p> <p>25 points: An experimental process that is related to the problem stated is listed with step-by-step instructions including standard safety &amp; operating procedure, and adequately tests the hypothesis stated</p> <p><i>Note: Minimum score needed to move to the next stage is 15 points.</i></p>	
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**Data Collection and Analysis 1-9 months (Including 4 RAC meetings)**

Questions	Judging Criteria	Max Points	Scoring Details	Score Received
<b>Document the data you collected from your experiment.</b>	Sufficient data is collected and well-documented	20	<p>0 points: No data documentation</p> <p>10 points: Data documented but not following GYRA guidelines</p> <p>20 points: Data documented exactly per GYRA guidelines</p> <p><i>Note: Minimum score needed to move to the next stage is 20 points.</i></p>	
<b>List potential sources of error.</b>	Lists sources of error and explains how these could have affected the results	10	<p>0 points: Does not list any errors</p> <p>5 points: Incomplete list of sources of error</p> <p>10 points: Lists sources of error, alternative strategies to overcome the errors, explanations are very thorough and free of spelling or grammatical errors</p> <p><i>Note: Minimum score needed to move to the next stage is 10 points.</i></p>	
<b>Statistical analysis.</b>	Lists statistical tests used to validate the data	20	<p>0 points: Does not list any statistics</p> <p>20 points: Lists statistical tests with very thorough explanations and represents the statistical significance</p> <p><i>Note: This applies only to studies that require any statistical analysis.</i></p>	

			<i>Minimum score needed to move to the next stage is 20 points.</i>	
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**Meaningful Conclusions Year 2 : 9-12th month (Including 2 RAC meetings)**

Questions	Judging Criteria	Max Points	Scoring Details	Score Received
<b>What conclusions can you draw from your project?</b>	Provides solid conclusions drawn based on their experiment	50	0 points: No conclusion was provided 5 points: General conclusion provided 10 points: Conclusion is related to the experimental conducted 30 points: The conclusion is related to the experiment, and includes data collected and refers to the hypothesis stated 50 points: The conclusion is related to the experiment, and includes data collected refers to the hypothesis stated, refers to the original problem/question stated and is well-written <i>Note: Minimum score needed to move to the next stage is 50 points.</i>	

<b>RESEARCH SUBTOTAL</b>	<b>300</b>
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Overall Impact				
Questions	Judging Criteria	Max Points	Scoring Details	Score Received
<b>Impact of Your Findings</b>	Indicates how this project impacts and benefits the world	50	0 points: Does not answer the question 20 points: Adequate explanation regarding how findings help in the betterment of the world 50 points: Adequate explanation regarding how findings help in the betterment of the world and advancement of current knowledge/practice <i>Note: Minimum score needed to move to the next stage is 20 points.</i>	
<b>OVERALL IMPACT SUBTOTAL</b>				<b>50</b>

<b>Team Collaboration</b>				
<b>Questions</b>	<b>Judging Criteria</b>	<b>Max Points</b>	<b>Scoring Details</b>	<b>Score Received</b>
<b>How was your team formed?</b>	Explains how the team was formed	5	0 points: Does not explain how the team was formed 5 points: Fully explains how the team was formed <i>Note: Minimum score needed to move to the next stage is 5 points.</i>	
<b>Division of operation: How were roles and responsibilities distributed?</b>	A clear description of the roles and responsibilities of each team member and their contribution to achieving the outcome	15	0 points: Does not explain the operational roles 10 points: Not all members took responsibility/contributed 15 points: All members took responsibility/contributed <i>Note: Minimum score needed to move to the next stage is 10 points.</i>	
<b>What challenges were faced while working together? What strategies were adopted to overcome these challenges? NB: This is regarding teamwork/collaboration.</b>	Explains the problems faced by the team and strategies used to overcome challenges	20	0 points: Does not list any errors 10 points: Incomplete list of sources of error 20 points: Lists sources of error, explanations are very thorough and free of spelling or grammatical errors <i>Note: Minimum score needed to move to the next stage is 10 points.</i>	
<b>Potential benefits of collaboration</b>	Details how you enjoyed working as a team	10	0 points: No answer 10 points: Detailed explanation of the advantages and benefits of working as a team <i>Note: Minimum score needed to move to the next stage is 10 points.</i>	
<b>TEAM COLLABORATION SUBTOTAL</b>				<b>50</b>

Year 3: 12th month (Including 4 RAC meetings)

<b>Thesis Submission and Defense</b>				
<b>Portion</b>	<b>Judging Criteria</b>	<b>Max Points</b>	<b>Scoring Details</b>	<b>Score Received</b>
<b>Synopsis</b>	Abstract of the overall project	5	0 points: No synopsis 5 points: Synopsis submitted on time <i>Note: Minimum score needed to move to the next stage is 5 points</i>	
<b>Pre-submission</b>	Submission of thesis and presentation	10	0 points: fail 10 points: pass <i>Note: The points will be based on the evaluation by the thesis advisory committee. Minimum score needed to move to the next stage is 10 points.</i>	
<b>Thesis submission</b>	Submission of the thesis by incorporating all the comments by the advisory committee	60	0 points: All comments are addressed satisfactorily 5 Points each: Presentation in Regional/National conference 10 Points each: Presentation at in International conference 10 Points each: Awards/recognitions 15 Points each: A review article 20 Points each: Original research article <i>Note: Minimum score needed to move to the next stage is 30 points</i>	
<b>Open defense and final thesis submission</b>	Submission of the final thesis by incorporating all the comments by the external examiner's committee	25	5 points: All comments are addressed satisfactorily 20 points: Presentation and defense <i>Note: Minimum score needed to move to the next stage is 25 points.</i>	
<b>THESIS SUBMISSION AND DEFENSE SUBTOTAL</b>				<b>100</b>
<b>TOTAL SCORE</b>				<b>500</b>



## Guidelines

### Teaming up (Unit formation):

Here is the list of activities to complete this milestone:

1. Team formation based on the GYRA Aptitude Questionnaire and area of interest.
2. The school, Coach, and Student must be registered in the GYRA portal before team formation.
3. Each team includes 4-7 students and one coach.
4. The team must have facilitators, chosen by the parents.
5. After finalizing the team, the coach must register with the GYRA Unit.

### Question/ Problem:

Refer to the following:

<https://onedrive.live.com/edit.aspx?resid=279C536F2B85B3C2!1113&cid=279c536f2b85b3c2&CT=1706480892669&OR=ItemsView>

## Hypothesis

It is important to note that the scientific question reflects a problem/issue that does not have a definite answer/solution but is feasible for research; Type III questions. Once the students identify a research question, the next step is defining a hypothesis to plan their investigation.

The research can be of two types.

Research Type	Definition	Example
Basic Research	Identifies the basic principles, theories, and/or mechanisms underlying a Type III question	Considering the Type III question: <i>To what extent is the water in the pond near my school pure?</i> The GYRA unit can design experimental approaches to study the root cause of water impurity. Let's assume, the research by the GYRA unit found that water contamination is due to higher mercury content. This is a basic finding that can lead to several other research projects addressing environmental hazards, health issues, and others.

# GYRA RESEARCH RUBRIC

Applied Research	Applies basic principles, theories, and/or mechanisms to address the question Type III question	Considering the Type III question: <i>To what extent is the water in the pond near my school pure?</i> Let's assume, the basic research data found that water contamination is due to higher mercury content. Hence, this is a basic finding revealed by other researchers and the information is available in scientific literature/database where a solution/prototype can be designed. For example, mercury is positively charged and can be removed by binding with negatively charged surfaces. Based on this, a novel and innovative filtration approach can be developed.
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