

INTERNATIONAL BACCALAUREATE MIDDLE YEARS PROGRAMME DESIGN CYCLE (Source: International Baccalaureate Middle Years Programme Design Guide, 2014)	NASA'S BEST ENGINEERING DESIGN MODEL (Source:Engineering Design Process. Retrieved from <a href="https://www.nasa.gov/audience/foreducators/best/edp.html">https://www.nasa.gov/audience/foreducators/best/edp.html</a> )	ENGINEERING DESIGN PROCESS (Source: Engineering Design Process. Retrieved from <a href="https://www.teachengineering.org/design/designprocess">https://www.teachengineering.org/design/designprocess</a> )
<b>STAGE 1: INQUIRING AND ANALYZING</b>	<b>ASK:</b>	<b>ASK: IDENTIFY THE NEED AND CONSTRAINTS</b>
<p>Students are presented with a design situation, from which they identify a problem that needs to be solved. They analyse the need for a solution and conduct an inquiry into the nature of the problem.</p> <p>In order to reach the aims of design, students should be able to:</p> <ol style="list-style-type: none"> <li>I. explain and justify the need for a solution to a problem for a specified client/target audience</li> </ol>	Students identify the problem, requirements that must be met, and constraints that must be considered.	<p>Engineers ask critical questions about what they want to create.</p> <p>These questions include:</p> <ul style="list-style-type: none"> <li>• What is the problem to solve?</li> <li>• What do we want to design?</li> <li>• Who is it for?</li> <li>• What do we want to accomplish?</li> <li>• What are the project requirements?</li> <li>• What are the limitations?</li> <li>• What is our goal?</li> </ul>
<ol style="list-style-type: none"> <li>II. identify and prioritize the primary and secondary research needed to develop a solution to the problem</li> </ol>		<b>RESEARCH THE PROBLEM:</b>
<ol style="list-style-type: none"> <li>IV. develop a detailed design brief which summarizes the analysis of relevant research</li> </ol>		This includes talking to people from many different backgrounds and specialties to assist with researching what products or solutions already exist, or what technologies might be adaptable to your needs.
<ol style="list-style-type: none"> <li>III. analyse a range of existing products that inspire a solution to the problem</li> </ol>	<b>IMAGINE:</b>  Students brainstorm solutions and research ideas. They also identify what others have done.	<b>IMAGINE: DEVELOP POSSIBLE SOLUTIONS</b>  You work with a team to brainstorm ideas and develop as many solutions as possible. This is the time to encourage wild ideas and defer judgment! Build on the ideas of others! Stay focused on topic, and have one conversation at a time.
<b>STAGE 2: DEVELOPING IDEAS</b>	<b>PLAN:</b>	<b>PLAN: SELECT A PROMISING SOLUTION</b>
<p>Students write a detailed specification, which drives the development of a solution. They present the solution.</p> <p>In order to reach the aims of design, students should be able to:</p> <ol style="list-style-type: none"> <li>II. develop a range of feasible design ideas which can be correctly interpreted by others</li> <li>III. present the final chosen design and justify its selection</li> </ol>	Students choose two to three of the best ideas from their brainstormed list and sketch possible designs, ultimately choosing a single design to prototype.	For many teams this is the hardest step! Revisit the needs, constraints and research from the earlier steps, compare your best ideas, select one solution and make a plan to move forward with it.
<ol style="list-style-type: none"> <li>I. develop a design specification which clearly states the success criteria for the design of a solution</li> <li>IV. develop accurate and detailed planning drawings/diagram</li> </ol>		
<b>STAGE 3: CREATING THE SOLUTION</b>	<b>CREATE:</b>	<b>CREATE: BUILD A PROTOTYPE</b>
<p>Students plan the creation of the chosen solution and follow the plan to create a prototype sufficient for testing and evaluation.</p> <p>In order to reach the aims of design, students should be able to:</p> <ol style="list-style-type: none"> <li>III. follow the plan to create the solution, which functions as intended</li> </ol>	Students build a working model, or prototype, that aligns with design requirements and that is within design constraints.	Building a prototype makes your ideas real! These early versions of the design solution help your team verify whether the design meets the original challenge objectives. Push yourself for creativity, imagination and excellence in design.
<ol style="list-style-type: none"> <li>I. construct a logical plan, which describes the efficient use of time and resources, sufficient for peers to be able to follow to create the solution</li> <li>II. demonstrate excellent technical skills when making the solution</li> <li>IV. fully justify changes made to the chosen design and plan when making the solution</li> <li>V. present the solution as a whole, either: <ol style="list-style-type: none"> <li>a. in electronic form, or</li> <li>b. through photographs of the solution from different angles, showing details.</li> </ol> </li> </ol>		
<b>STAGE 4: EVALUATING</b>	<b>TEST:</b>	<b>TEST AND EVALUATE PROTOTYPE</b>
<p>Students design tests to evaluate the solution, carry out those tests and objectively evaluate its success.</p> <p>In order to reach the aims of design, students should be able to:</p> <ol style="list-style-type: none"> <li>I. design detailed and relevant testing methods, which generate data, to measure the success of the solution</li> <li>II. critically evaluate the success of the solution against the design specification</li> </ol>	Students evaluate the solution through testing; they collect and analyze data; they summarize strengths and weaknesses of their design that were revealed during testing.	Does it work? Does it solve the need? Communicate the results and get feedback. Analyze and talk about what works, what doesn't and what could be improved.
<p>Students identify areas where the solution could be improved and explain how their solution will impact on the client or target audience.</p> <ol style="list-style-type: none"> <li>III. explain how the solution could be improved</li> <li>IV. explain the impact of the solution on the client/target audience.</li> </ol>	<b>IMPROVE:</b>  Based on the results of their tests, students make improvements on their design. They also identify changes they will make and justify their revisions.	<b>IMPROVE: REDESIGN AS NEEDED</b>  Discuss how you could improve your solution. Make revisions. Draw new designs. Iterate your design to make your product the best it can be. And now, repeat!