Scientific Method – Scientific Inquiry – Scientific Design Process

– depending on what you are trying to do, you may not need all steps or go in this exact order
-depending on what you are trying to do, you may not need to complete all the tasks for each step

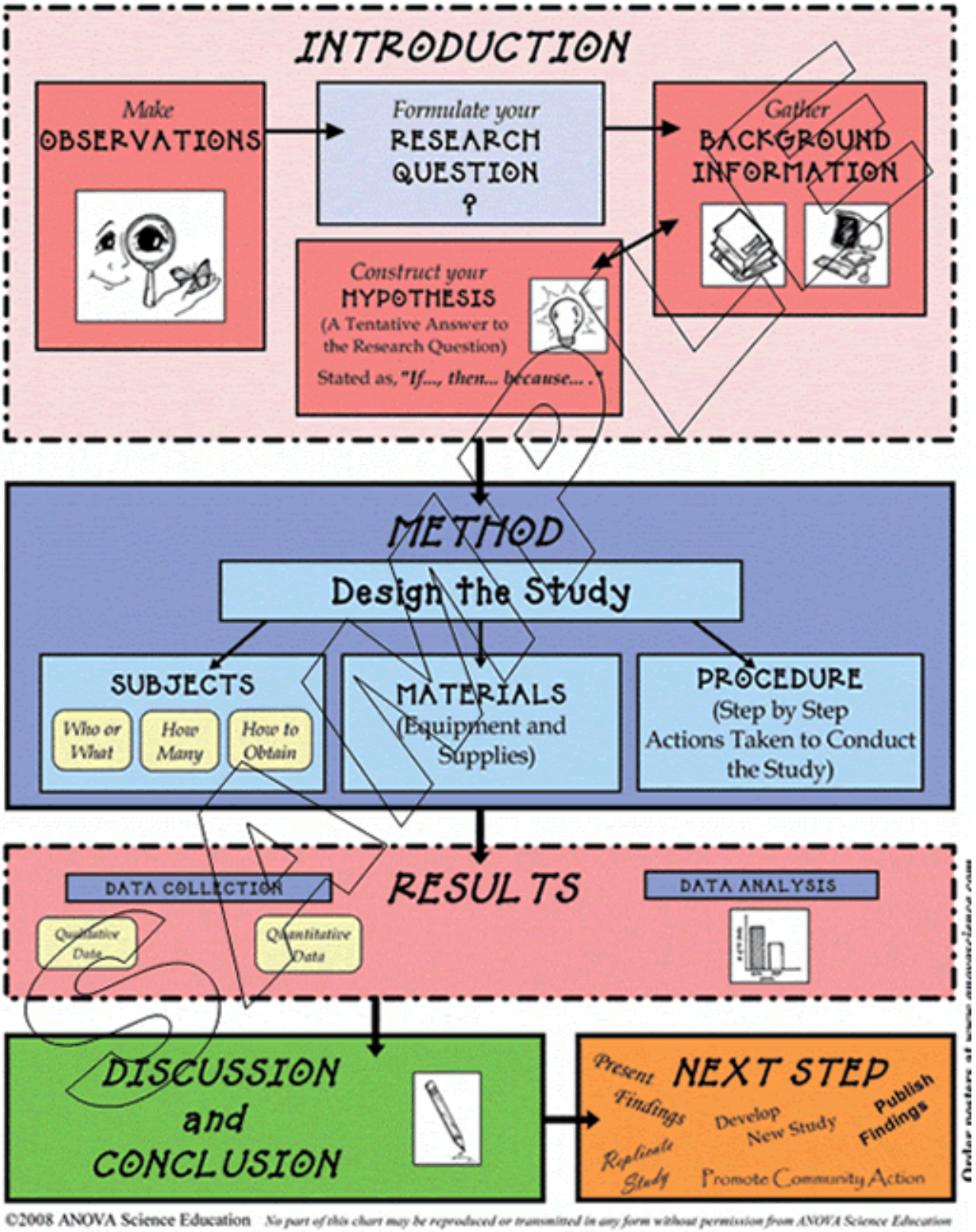
STEPS	KEY TASKS	PROCESS STANDARDS
1. Observe	☐ Make an observation ☐ Experience – think about what have you observed or done in the past?	• NS2 -Plan and carry out investigations as a class, in small groups or independently often over a period of several class lessons.
2. Question or Problem	☐ Ask a question – must be testable or be able to be researched ☐ Identify the problem – can it be solved?	• NS1- Make predictions and develop testable questions based on research and prior knowledge. • DP 1 - Identify a need or problem to be solved.
3. Research	☐ Do background research ☐ Learn important vocabulary terms ☐ Explore what has been done before ☐ Brainstorm solutions ☐ Imagine different possibilities and needs	• NS2 -Plan and carry out investigations as a class, in small groups or independently often over a period of several class lessons. • DP 2 - Brainstorm potential solutions. • DP 6 - Create the solution through a prototype.
4. Hypothesis or Prediction	☐ Come up with a hypothesis – a possible answer to the question ☐ Come up with a prediction – what you think is going to happen (based on experience or observations)	• NS1- Make predictions and develop testable questions based on research and prior knowledge. • DP 4 - Select a solution to the need or problem.
5. Procedure and Plan	☐ Plan your experiment or design ☐ Sketch your design – plan your prototype ☐ Figure out materials and tools you need for your experiment or design ☐ Consider what you need to look for in observations ☐ Determine that variables will stay the same and what will change (control, independent, dependent) ☐ Determine how you will organize and record data and other observations – qualitative, quantitative, data table, list, etc. ☐ Write out the steps you will take to test out your experiment	• NS2 -Plan and carry out investigations as a class, in small groups or independently often over a period of several class lessons. • NS 3 - Collect quantitative data with appropriate tools or technologies and use appropriate units to label numerical data. • NS 4 - Incorporate variables that can be changed, measured or controlled. DP 5 - Select the most appropriate materials to develop a solution that will meet the need. • DP 6 - Create the solution through a prototype.

6. Test or Create	☐ Test out your experiment ☐ Create, build, and make your model ☐ Test out your model ☐ Do multiple trials so you have enough data to identify patterns and trends, and to prevent bias ☐ Remember to use variables; compare results to the control variable	• NS2 -Plan and carry out investigations as a class, in small groups or independently often over a period of several class lessons. • NS 3 - Collect quantitative data with appropriate tools or technologies and use appropriate units to label numerical data. • NS 4 - Incorporate variables that can be changed, measured or controlled. • NS 5 - Use the principles of accuracy and precision when making measurement. • NS 6 -Test predictions with multiple trials. • DP 6 - Create the solution through a prototype. • DP 7 - Test and evaluate how well the solution meets the goal.
7. Data Collection	☐ Keep accurate records your results (data and observations) ☐ Be careful with your measurements – be precise and accurate ☐ Draw carefully – ABCD – accurate, big, colorful, detailed ☐ Take pictures of process and results ☐ Include labels – on drawings, diagrams, and pictures ☐ Record additional research ☐ Compare results to control variable ☐ Discuss and make sense of data, observations and results.	• NS2 -Plan and carry out investigations as a class, in small groups or independently often over a period of several class lessons. • NS 3 - Collect quantitative data with appropriate tools or technologies and use appropriate units to label numerical data. • NS 4 - Incorporate variables that can be changed, measured or controlled. • NS 5 - Use the principles of accuracy and precision when making measurement. • NS 7 - Keep accurate records in a notebook during investigations. • DP 3 - Document the design throughout the entire design process so that it can be replicated in a portfolio/notebook with drawings including labels. • DP 7 - Test and evaluate how well the solution meets the goal. • DP 8 - Evaluate and test the design using measurement.
8. Analyze and Evaluate	☐ Analyze - carefully examine your data and observations ☐ Evaluate and interpret – compare observations and data to reach a conclusion about the results - explain the meaning of data and observations ☐ Graph data – create a "picture" from information ☐ Look for patterns and trends in data and observations; make inferences from these patterns ☐ Do your results prove or disprove the prediction or hypothesis? Does your design solve the problem? ☐ Claims and evidence - What do you claim to be true? What evidence proves it to be true?	• NS 8 - Analyze data, using appropriate mathematical manipulation as required, and use it to identify patterns and make inferences based on these patterns. • NS 9 - Evaluate possible causes for differing results (valid data). • NS 10 - Compare the results of an experiment with the prediction • DP 4 - Select a solution to the need or problem. • DP 7 - Test and evaluate how well the solution meets the goal. • DP 8 - Evaluate and test the design using measurement. • DP 9 - Present evidence using mathematical representations (graphs, data tables).

9. Redesign and Improve	If your experiment or design doesn't answer the question or solve a problem look for: ☐ mistakes ☐ ways to improve or make better ☐ GO BACK TO PROCEDURE AND PLAN AGAIN	• NS 9 - Evaluate possible causes for differing results (valid data). • DP 4 - Select a solution to the need or problem. • DP 6 - Create the solution through a prototype. • DP 7 - Test and evaluate how well the solution meets the goal. • DP 8 - Evaluate and test the design using measurement. • DP 11 - Redesign to improve the solution based on how well the solution meets the need.
10. Conclusion	Summarize what you learned by writing a conclusion. ☐ Describe procedure ☐ Describe results and observations ☐ Compare results to prediction or hypothesis – do your results support or disprove? ☐ Claims, evidence and reasoning – how and why the evidence supports the claim ☐ Answer the question(s) ☐ Describe how the problem was solved	• NS 10 - Compare the results of an experiment with the prediction. • NS 11 - Communicate findings using graphs, charts, maps and models through oral and written reports. • DP 7 - Test and evaluate how well the solution meets the goal. • DP 8 - Evaluate and test the design using measurement. • DP 9 - Present evidence using mathematical representations (graphs, data tables). • DP 10 - Communicate the solution including evidence using mathematical representations (graphs, data tables), drawings or prototypes.
11. Communicate	Share what you learned (conclusion) by: ☐ Giving an oral report or presentation ☐ Create a poster or public service announcement ☐ Show a demonstration ☐ Writing a report	• NS 11 - Communicate findings using graphs, charts, maps and models through oral and written reports. • DP 9 - Present evidence using mathematical representations (graphs, data tables). • DP 10 - Communicate the solution including evidence using mathematical representations (graphs, data tables), drawings or prototypes.
12. Next Steps	☐ What further questions do you have? ☐ Are there new problems to solve? ☐ How does what you learned relate or connect to the real world?	• NS1- Make predictions and develop testable questions based on research and prior knowledge. • DP 1 - Identify a need or problem to be solved.

SCIENTIFIC INQUIRY

The Research Investigation Process (RIP®)



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