

The Scientific Method: An Information Search Process

Stage 1: Task Initiation

The scientist **recognizes the need for information** in some area. This need could arise from his or her own curiosity, from an outside request, or from any number of other sources. For example, a chemist working for an energy company might recognize the need for a non-petroleum automobile fuel to replace gasoline.

Stage 2: Topic Selection

The scientist **chooses a general area to investigate**. For example, the chemist interested in gasoline alternatives might decide to explore fuels made from plant materials.

Stage 3: Topic Exploration

The scientist **explores what is already known** about his or her chosen topic. This stage is also called a "review of the literature." For example, our chemist might use the books and online databases of her company's library or a university library to find scientific publications about alternative fuels. She might investigate the chemical reactions of combustion (oxidation), the required chemical & physical properties of automobile fuels, the process of turning plant materials into liquid fuel (refinement), and the problems others have encountered with plant-based fuels.

Stage 4: Focus Formulation

The scientist **chooses a specific area to investigate further**. He or she will narrow the topic to a specific situation to be examined, and will **state this as a hypothesis to be tested**. For example, our chemist might find in her review of the literature that a plant-based fuel developed in the 1970s was abandoned because it did not burn properly in the cars of that era. She might decide to "replicate," or repeat, an experiment that was performed back then, but this time using a computer-controlled engine like those found in modern cars. Her hypothesis might be, "If the test fuel is used to power an automobile engine with computerized fuel and ignition controls, the engine's combustion efficiency will be higher than when powered with gasoline."

Stage 5: Information Collection

The scientist **conducts an experiment** to test the hypothesis. For example, our chemist might design a test with two identical engines, one burning gasoline and the other burning the test fuel. She might measure the combustion efficiency of the two engines by tracking how much fuel they consume compared to their power output and sampling the exhaust gases they produce for signs of incomplete combustion.

Stage 6: Presentation of Findings

The scientist **interprets the data** collected in the experiment and **documents the results**. For example, our chemist might find that the fuel she is testing performs the same as (but not better than) gasoline. (Notice that although her hypothesis is wrong, her results are still important.) She might document her findings in an internal company report or publish them in a scientific journal article.

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