

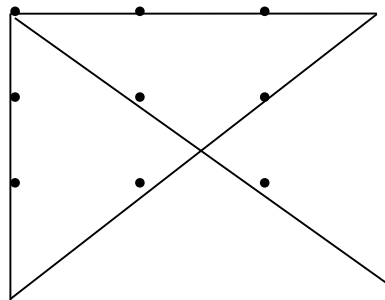
Introductory Workshop Exercise and Scientific Method.

ANSWERS to Part 1

NOTE to FACILITATORS: One of the main purposes of the Workshops is to allow free exchange of information by **having each member of a Learning Community in turn answer one part** of a discussion question. As each student explains a term or gives a definition in their own words, it should allow for free verbal EXCHANGE and promote learning by interaction. **Please make sure that everyone does a question or two and the purpose of the exercise is that they must EXPLAIN THEIR ANSWERS to the rest of the community.**

Part 1. Team Building & Ice Breaker. The total of any row or column should be **34**. This is from Albrecht Durer's 1514 painting, *Melencolia I*, and is known as a Magic Square. First created by the Egyptians over 4,000 years ago they often seem mystical. In India they are known as Kubera Kolam and can be found on pooja altars.

16	3	2	13
5	10	11	8
9	6	7	12
4	15	14	1

**Part 2. Scientific Method**

A. The Scientific Method, is a term denoting the principles that guide scientific research and experimentation, and also the philosophic bases of those principles. Whereas philosophy in general is concerned with the why of things, science occupies itself with the how of things, in a rigorous manner. Definitions of scientific method use such ideas as objectivity of approach and acceptability of the results. Objectivity indicates the attempt to observe things as they are, without falsifying observations to accord with some preconceived view. Acceptability is the degree to which observations and experiments can be reproduced.

The Scientific Method involves the interplay of inductive reasoning (reasoning from specific observations and experiments to more general hypotheses and theories) and deductive reasoning (reasoning from theories to account for specific experimental results). By such reasoning processes, science attempts to develop the broad laws—such as Isaac Newton's law of gravitation—that become part of our understanding of the natural world.

Science has very broad scope and its many separate disciplines differ greatly in terms of subject matter and the possible ways of studying that subject matter. No single path to discovery exists in science, and no one clear-cut description can be given that accounts for all the ways scientific truth is pursued.

Scientists, like other human beings, may individually be swayed by some prevailing view to look for certain experimental results rather than others, or to "intuit" some broad theory that they then seek to prove. The scientific community as a whole, however, judges the work of its members by the objectivity and rigor with which that work has been conducted; in this way the scientific method prevails.

B. Have one member each of your learning community, in turn, arrange the following in the correct sequence: *prediction, hypothesis, observations, induction, deduction, experiment, facts*. (refer to pages 16-24 of chapter 1 [10e]).

1) Each member is to define the term as they place it in the correct sequential order.

OBSERVATION - The act of noting and recording something, such as a phenomenon, with instruments, an experimental observation.

FACTS - information presented as objectively real; A real occurrence; an even; Something having real, demonstrable existence

INDUCTION - The process of deriving general principles from particular facts or instances; Presentation of material, such as facts or evidence, in support of an argument or a proposition.

DEDUCTION - The drawing of a conclusion by reasoning; The process of reasoning in which a conclusion follows necessarily from the stated premises; inference by reasoning from the general to the specific.

HYPOTHESIS - A tentative explanation that accounts for a set of facts and can be tested by further investigation; a theory.

PREDICTION - a statement about some data or facts made known in advance and usually based upon special knowledge of the data

EXPERIMENT - A test under controlled conditions that is made to demonstrate a known truth, examine the validity of a hypothesis, or determine the efficacy of something previously untried.

Observation → Facts → Induction → Deduction → Hypothesis → Prediction → Experiment

C. A controlled experiment that tests the effect of

1) age of UM students on GPA. Make a hypothesis [younger students will have a higher average GPA]. Look at historical data of GPA (0.0 to 4.0) vs. age of students. Look for correlations and trends to confirm or disprove a hypothesis.

2) Make a prediction [taller candidates will be elected to office more often than shorter candidates]. Collect the data from the fall 1990 election for Congress. Look for trends and correlations to confirm or disprove a hypothesis.

3) Collect data from pregnant women who had X-ray at the dental visit while pregnant and compare to women who did not have X-ray, but visited dentist. Compare fetal parameters as weight, height basic blood metabolic parameters, abnormalities, etc...

4) and 5) as above.

D. Describe (step by step) how one follows the hypothetico-deductive method in one of your daily activities. Be explicit about induction and deduction in your description.

A free and open discussion by the students and facilitator should occur on for example: *Fixing a car, baking a cake, etc...* Stress the concepts of Deduction and Induction.

E. 1) N, 2) E, 3) N, 4) E, 5) E, 6) E, 7) N, 8) E, 9) N, 10) E.