While description plays an important role in the sciences and social sciences, analytical reasoning is an essential aspect of such academic disciplines. The ultimate goal of science and social science is to uncover and understand the logical connections among facts. Below are a few examples of description and analytical reasoning from various disciplines. Notice the differences in detail and sophistication. Early education in a subject typically focuses on and is often limited to description. But any serious study will involve analytical reasoning.

1. Chemistry

- Description: When sulfuric acid is added to water, it dissolves and the solution heats up.

- Analytical reasoning: When sulfuric acid is added to water, the majority of hydrogen atoms that were previously bound to the oxygen in H_2SO_4 dissociate, leaving behind their electrons on the sulfate ions SO_4^{2-}. The resulting H^+ ions are surrounded by water molecules and share the electrons of the oxygen atoms in those water molecules, forming hydrogen bonds. The SO_4^{2-} ions are also surrounded by water molecules, and share their excess electrons with the hydrogen atoms on those water molecules, also forming hydrogen bonds. The reaction is exothermic, that is the total energy level of the resulting bonds is lower than the total energy level of the original bonds. The excess energy is released in the form of heat and increases the temperature of the solution. The general tendency of electrons to seek lower energy states is what drives the reaction.

2. Economics

- Description: The sudden crash of the US stock market on October 29, 1929 began a period of sharp economic decline worldwide known as the Great Depression. This was characterized by dropping interest rates, declining investment and consumer spending, falling prices, and high unemployment. Many banks were unable to pay back depositors, who desperately tried to withdraw their savings, and went bankrupt. International trade plunged sharply. Many companies were unable to generate sufficient revenue to survive and went out of business.

- Analytical reasoning: "During the Crash of 1929 preceding the Great Depression, margin requirements were only 10%. Brokerage firms, in other words, would lend $9 for every $1 an investor had deposited. When the market fell, brokers called in these loans, which could not be paid back. Banks began to fail as debtors defaulted on debt and depositors attempted to withdraw their deposits en masse, triggering multiple bank runs. Government guarantees and Federal Reserve banking regulations to prevent such panics were ineffective or not used. Bank failures led to the loss of billions of dollars in assets. Outstanding debts became heavier, because prices and incomes fell by 20–50% but the debts remained at the same dollar amount. After the panic of 1929, and during the first 10 months of 1930, 744 US banks failed. (In all, 9,000 banks failed during the 1930s). By April 1933, around $7 billion in deposits had been frozen in failed banks or those left unlicensed after the March Bank Holiday.
Bank failures snowballed as desperate bankers called in loans which the borrowers did not have time or money to repay. With future profits looking poor, capital investment and construction slowed or completely ceased. In the face of bad loans and worsening future prospects, the surviving banks became even more conservative in their lending. Banks built up their capital reserves and made fewer loans, which intensified deflationary pressures. A vicious cycle developed and the downward spiral accelerated.

The liquidation of debt could not keep up with the fall of prices which it caused. The mass effect of the stampede to liquidate increased the value of each dollar owed, relative to the value of declining asset holdings. The very effort of individuals to lessen their burden of debt effectively increased it. Paradoxically, the more the debtors paid, the more they owed. This self-aggravating process turned a 1930 recession into a 1933 great depression." (Source: `http://en.wikipedia.org/wiki/Great_depression`)

3. History

- Description: On December 7, 1942, six aircraft carriers of the Imperial Japanese Navy launched an attack of the against the U.S. Pacific Fleet anchored in Pearl Harbor.

- Analytical reasoning: "Public opinion, while initially on the side of the Japanese, began to shift following reports of atrocities like the Rape of Nanking. It was further swayed by incidents such as the Japanese sinking of the gunboat USS Panay on December 12, 1937, and increasing fears about Japan's policy of expansionism. [...] The American oil embargo caused a crisis in Japan. Reliant on the US for 80% of its oil, the Japanese were forced to decide between withdrawaling from China, negotiating an end to the conflict, or going to war to obtain the needed resources elsewhere. In an attempt to resolve the situation, [Japanese prime minister] Konoe asked US President Franklin Roosevelt for a summit meeting to discuss the issues. Roosevelt replied that Japan needed to leave China before such a meeting could be held. [...] On October 16, 1941, after unsuccessfully arguing for more time to negotiate, Konoe resigned as prime minister and was replaced by the pro-military General Hideki Tojo. While Konoe had been working for peace, the Imperial Japanese Navy (IJN) had developed its war plans. These called for a preemptive strike against the US Pacific Fleet at Pearl Harbor, HI, as well as simultaneous strikes against the Philippines, Netherlands East Indies, and the British colonies in the region. The goal of this plan was to eliminate the American threat, allowing Japanese forces to secure the Dutch and British colonies. The IJN's chief of staff, Admiral Osami Nagano, presented the attack plan to Emperor Hirohito on November 3. Two days later the emperor approved it, ordering the attack to occur in early December if no diplomatic breakthroughs were achieved." (Source: `http://militaryhistory.about.com/od/worldwarii/a/wwiipaccauses_2.htm`)

4. Mathematics

- Description: Solve the equation.

$$x - 9 + 5x = 2x - 3$$

for the real number x. Describe in detail each step of your work. Solution:

$$
\begin{aligned}
x - 9 + 5x &= 2x - 3 & \\
6x - 9 &= 2x - 3 & \text{Combine like terms.} \\
6x - 9 + 9 &= 2x - 3 + 9 & \text{Add 9 to both sides of the equation.} \\
6x &= 2x + 6 & \text{Simplify.} \\
6x - 2x &= 2x + 6 - 2x & \text{Subtract } 2x \text{ from both sides.} \\
4x &= 6 & \text{Combine like terms.} \\
\frac{4x}{4} &= \frac{6}{4} & \text{Divide both sides by 4.} \\
x &= \frac{3}{2} & \text{Simplify.}
\end{aligned}
$$

- Analytical reasoning: Solve the equation.

$$x - 9 + 5x = 2x - 3$$

for the real number x. Justify each step by referring to an appropriate algebraic property.
Solution:

$$x - 9 + 5x = 2x - 3$$

$x + (-9) + 5x = 2x + (-3)$	definition of subtraction
$x + ((-9) + 5x) = 2x + (-3)$	associativity of addition
$x + (5x + (-9)) = 2x + (-3)$	commutativity of addition
$(x + 5x) + (-9) = 2x + (-3)$	associativity of addition
$(1 + 5)x + (-9) = 2x + (-3)$	distributivity of multiplication over addition
$6x + (-9) = 2x + (-3)$	arithmetic
$(6x + (-9)) + 9 = (2x + (-3)) + 9$	addition property of equality
$6x + ((-9) + 9) = 2x + ((-3) + 9)$	associativity of addition
$6x + 0 = 2x + ((-3) + 9)$	inverse property of addition
$6x = 2x + ((-3) + 9)$	identity property of addition
$6x = 2x + 6$	arithmetic
$(-2x) + 6x = (-2x) + (2x + 6)$	addition property of equality
$(-2x) + 6x = ((-2x) + 2x) + 6$	associativity of addition
$(-2x) + 6x = (-2 + 2)x + 6$	distributivity of multiplication over addition
$(-2x) + 6x = 0x + 6$	inverse property of addition
$(-2x) + 6x = 0 + 6$	zero factor law
$(-2x) + 6x = 6$	identity property of addition
$(-2 + 6)x = 6$	distributivity of multiplication over addition
$4x = 6$arithmetic	
$\dfrac{1}{4}(4x) = \dfrac{1}{4}6$	multiplication property of equality
$\dfrac{1}{4}(4x) = \dfrac{6}{4}$	arithmetic
$\left(\dfrac{1}{4}4\right)x = \dfrac{6}{4}$	associativity of multiplication
$1x = \dfrac{6}{4}$	inverse property of multiplication
$x = \dfrac{6}{4}$	identity property of multiplication
$x = \dfrac{3}{2}$	arithmetic