1 Cognitive reasoning in the chemical sciences 1.6

1. For each of the following equations, create a table of the values of y for the pairs of values $x = 2$ and $x = 6$ and the pairs of values $x = 1$ and $x = 3$

   (a) $y = 5x$
   (b) $y = 2x^2$
   (c) $y = x^3$

2. For each of the above equations, when one triples x what happens to y? State this result as a proportionality relation.

3. For each of the following equations, state the quantity to which y is related by a proportionality relation and state the type of proportionality relation.

   (a) $y = 2kx$, where k constant.
   (b) $y = \frac{x}{2}$.
   (c) $y = \frac{k}{3x}$, where k is constant.
   (d) $y = x + 3$.
   (e) $y = 2kx + 3$, where k is constant.
   (f) $y = 2x^2$.
   (g) $y = -\frac{1}{2}x^2$
   (h) $y = (x - 3)^2$
   (i) $y = (x + 5)(x - 4)$

4. For each of these problems, what are the proportionality relations and what are the proportionality constants?

5. For each of the following pairs of concepts please state their proportionality relations.

   (a) mass of a piece of pure aluminium, m_{Al}, and volume of the same piece of pure aluminium, V_{Al}.
   (b) mass of some water, m_{H_2O}, and volume of the same water, V_{H_2O}.
   (c) p and T of an ideal gas if n and V are constant
   (d) distance travelled by a bullet in outerspace and time the bullet travels in outerspace.
   (e) number of moles of copper atoms in a sample, n, and number of copper atoms in the same sample.
   (f) mass of a rain drop of water and the number of moles of water in the same rain drop.
   (g) E_{trans} and n and v for an ideal gas.
   (h) E_{trans} and n and T for an ideal gas.
   (i) T and v for an ideal gas.

6. What are the proportionality constants for each of the above problems?