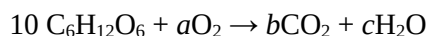


Augmented matrices

1. You are burning 10 moles of sugar, and you note that the reaction is



This gives us three equations:

$$\begin{array}{ll} \text{Carbon:} & 6 \times 10 = b \\ \text{Hydrogen:} & 12 \times 10 = 2c \\ \text{Oxygen:} & 6 \times 10 + 2a = 2b + c \end{array}$$

Write these in the standard format for a system of linear equations and then write down the corresponding augmented matrix. Preferably, the columns of the matrix component correspond to a , b and c , respectively.

2. You are applying four lasers to a single small particle. One laser is pointing in the direction $\begin{pmatrix} -12.2 \\ 0 \\ 0 \end{pmatrix}$

towards the particle at the origin, and providing a force of 12.2 nN in that direction. There are three other lasers, all of which are located approximately at the corners of a tetrahedron (see <https://en.wikipedia.org/wiki/Tetrahedron>) pointing towards the origin. The three vectors are approximately normalized, and the scalar that they will be multiplied by represents the nanonewtons of force required to perfectly balance the force of the three lasers. Write down the augmented matrix that represents the resulting system of three unknowns,

$$\begin{pmatrix} 0.3222 \\ -0.8256 \\ 0.4632 \end{pmatrix}, \begin{pmatrix} 0.3413 \\ 0.8130 \\ 0.4717 \end{pmatrix} \text{ and } \begin{pmatrix} 0.3489 \\ 0.0100 \\ -0.9371 \end{pmatrix}.$$

That is, you will have $a\mathbf{v}_1 + b\mathbf{v}_2 + c\mathbf{v}_3 + \begin{pmatrix} -12.2 \\ 0 \\ 0 \end{pmatrix} = \mathbf{0}$.