A container with 100.0 mL of water has 15.0 grams of glucose ($C_6H_{12}O_6$) dissolved in it. When yeast is added to the solution, ethyl alcohol (or ethanol, C_2H_5OH) and carbon dioxide are produced, according to the following chemical reaction:

a) Write out the unbalanced chemical equation for this reaction.

Ans. $C_6H_{12}O_6\ (aq) \xrightarrow{yeast} C_2H_5OH\ (aq) + CO_2\ (g)$

b) Balance this chemical reaction.

Ans. $C_6H_{12}O_6\ (aq) \rightarrow 2\ C_2H_5OH\ (aq) + 2\ CO_2\ (g)$

c) What is the molar mass for glucose, ethanol and carbon dioxide respectively?

Ans. $C_6H_{12}O_6$:

Element	Atomic Mass	# of Atoms	Net Molar Mass
C	12.01	6	72.06
H	1.008	12	12.096
O	16.00	6	96.00
		Molar Mass →	180.16

C_2H_5OH:

Element	Atomic Mass	# of Atoms	Net Molar Mass
C	12.01	2	24.02
H	1.008	6	6.048
O	16.00	1	16.00
		Molar Mass →	46.07

CO_2:

Element	Atomic Mass	# of Atoms	Net Molar Mass
C	12.01	1	12.01
O	16.00	2	32.00
		Molar Mass →	44.01

d) How many moles of glucose are in the water before the yeast is added?

Ans.

$$\#\ mol\ of\ C_6H_{12}O_6 = \left(\frac{15.0\ g\ C_6H_{12}O_6}{1}\right)\left(\frac{1\ mol\ C_6H_{12}O_6}{180.16\ g\ C_6H_{12}O_6}\right) = 8.33x10^{-2}\ mol\ C_6H_{12}O_6$$

e) How many moles of ethanol are produced when this reaction runs to completion?

$$\#\ mol\ of\ C_2H_5OH = \left(\frac{8.33x10^{-2}\ mol\ C_6H_{12}O_6}{1}\right)\left(\frac{2\ C_2H_5OH}{1\ C_6H_{12}O_6}\right) = 1.67x10^{-1}\ mol\ C_2H_5OH$$

f) How many grams of ethanol are produced in the completed reaction?

$$\#\ grams\ of\ C_2H_5OH = \left(\frac{1.67x10^{-1}\ mol\ C_2H_5OH}{1}\right)\left(\frac{46.07\ g\ C_2H_5OH}{1\ mol\ C_2H_5OH}\right) = 7.69\ g\ C_2H_5OH$$

g) How many grams of carbon dioxide are produced in the completed reaction?

Ans. # grams of CO_2 = 15.0 g – 7.69 g = 7.3 g CO_2

Or, alternative solution (*note the rounding error…*):

$$\#\ grams\ of\ CO_2 = \left(\frac{1.67x10^{-1}\ mol\ CO_2}{1}\right)\left(\frac{44.01\ g\ CO_2}{1\ mol\ CO_2}\right) = 7.35\ g\ CO_2$$