Answers to questions on Empirical and molecular formulas

1.

Element	Amount / mol	Simplest ratio	Empirical formula
Cu	8.882/63.55 = 0.1398	0.1398/0.0699 = 2	Cu_2O
O	1.118/16.00 = 0.0699	0.0699/0.0699 = 1	

2.

Element	Amount / mol	Simplest ratio	Empirical formula
C	11.33/12.01 = 0.9434	0.9434/0.9434 = 1	
Na	43.38/22.99 = 1.887	1.887/0.9434 = 2	Na_2CO_3
O	45.29/16.00 = 2.831	2.831/0.9434 = 3	

3.

Element	Amount / mol	Simplest ratio	Empirical formula
C	92.24/12.01 = 7.680	7.680/7.680 = 1	CH
H	7.76/1.01 = 7.683	7.683/7.680 = 1	

Since M_r (78.12) = 6 x relative empirical mass (13.02) the molecular formula is C_6H_6.

4.

Element	Amount / mol	Simplest ratio	Empirical formula
C	60.00/12.01 = 4.996	4.996/2.220 = 2.25	
H	4.48/1.01 = 4.44	4.44/2.220 = 2.00	$C_9H_8O_4$
O	35.52/16.00 = 2.220	2.220/2.220 = 1.00	

Since M_r (180.17) = relative empirical mass so the molecular formula is $C_9H_8O_4$

5.

Element	Amount / mol	Simplest ratio	Empirical formula
C	71.38/12.01 = 5.943	5.943/1.189 = 5.00	
H	9.60/1.01 = 9.505	9.505/1.189 = 8.00	C_5H_8O
O	19.02/16.00 = 1.189	1.189/1.189 = 1.00	

6. i. Amounts: Mg = 5.867 ÷ 24.31 = 0.241 mol; O = (8.956 − 5.867) ÷ 16.00 = 0.193 mol.
Empirical formula is Mg_5O_4.

ii. *Any three from:*
Some of the product escaped during the combustion.
Not all the magnesium reacted.
The magnesium also reacted with the nitrogen in the air to form some magnesium nitride.
The crucible was not inert and was involved in the reaction.
The magnesium used was not pure.