SECTION A

Answer ALL the questions in this section in the spaces provided.

1. A student was asked to make some copper(II) sulfate pentahydrate ($CuSO_4 \cdot 5H_2O$) by reacting copper(II) oxide (CuO) with sulfuric acid (H_2SO_4).

(a) Calculate the molar mass of copper(II) sulfate pentahydrate. [2]

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(b) Ca

lculate the amount (in mol) of copper(II) sulfate pentahydrate in a 10.0 g sample. [2]

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…….

(c) Ca

lculate the mass of copper(II) oxide needed to make this 10.0 g sample. [3]

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2.

(a) Nicotine, a component of tobacco, is composed of C, H, and N. A 5.250mg sample of nicotine was combusted, producing 14.242 mg of CO_2 and 4.083 mg of H_2O. What is the empirical formula for nicotine? [4]

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(b) If the substance has a molar mass of 160 g, what is its molecular formula? [2]

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…….

3.

(a) Define the terms *atomic number* and *mass number* [4]

Atomic number: …….

…….

Mass number: …….

…….

(b) For **each** of the species shown in the table, state the number of each subatomic particle present. [3]

Species	Protons	Neutron	Electrons
$^{14}_{6}C$			
$^{19}_{9}F^{-}$			
$^{40}_{20}Ca^{2+}$			

(c) State, if any, the difference between Ca^{2+}, Ca, and Calcium-21. [4]

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SECTION B

Answer only ONE of the questions in this section. You may use the blank sheets provided. Be sure to put your name on all pages.

4. a. A carbon atom has a mass number of 12 and an atomic number of 6. Define the underlined terms and draw a diagram showing clearly the arrangement of the fundamental particles in this carbon atom. [6]

b. For each of the species listed below, state the number of protons, neutrons and electrons, and give the electronic configurations:

[6]

c. For the three elements Na, K, and Cl, state, with a reason in each case, which pair is in the same group and which pair is in the same period of the Periodic Table. (The fact that the periodic table shows them that way is not a good reason.) [4]

d. In addition to there is another naturally occurring isotope of chlorine with a mass number of 37. If the relative atomic mass of chlorine is 35.5, state and explain which isotope is the more abundant. [4]

i. [1]

b. Sketch and name the shape of each of the following molecules:

i. SiH_4 [2]

ii. PH_3 [2]

c. State the bond angle in SiH_4 and explain why the bond angle in PH_3 is less than in SiH_4. [2]