

Topic
IB Test One Problems

1) A chemist decides to react 2.0 grams of VO with 5.75 grams of Fe_2O_3 to produce V_2O_5 and FeO. How many grams of V_2O_5 can be obtained?

2.18g V_2O_5

2) A sample of the poisonous compound nicotine extracted from cigarette smoke was found to contain 74.0% by weight of carbon, 8.65% by weight of hydrogen, and 17.3% by weight of nitrogen. What is the empirical formula of nicotine?

$\text{C}_5\text{H}_7\text{N}$

3) An impure sample of aluminum sulfate is analyzed by forming a precipitate of insoluble barium sulfate, by reacting aluminum sulfate with an excess of barium chloride. After washing and drying, 2.000g of BaSO_4 was obtained. If the original sample weighed 1.000g, what was the percent of aluminum sulfate in the sample?

97.73% $\text{Al}_2(\text{SO}_4)_3$

4) A compound with a formula M_3N contains 0.673 g of N per 1.00 gram of the metal M. What is the atomic weight of M? What element is M?

6.94g/mol \Rightarrow Li

5) A chemist reacts iron(III) sulfate with barium chloride and obtains barium sulfate and iron(III) chloride. From a mixture of 50.0g of iron(III)sulfate and 100.0g of barium chloride, how much iron(III)chloride can be produced?

40.6g FeCl_3

6) The element europium exists in nature as two isotopes: ^{151}Eu has a mass of 150.9196amu, and ^{153}Eu has a mass of 152.9209 amu. The average atomic mass of europium is 151.96 amu. Calculate the relative abundance of the two europium isotopes.

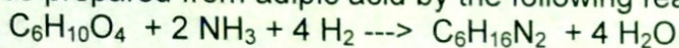
$^{151}\text{Eu} = 49.654\%$, $^{153}\text{Eu} = 50.346\%$

7) A compound containing only sulfur and nitrogen is 69.6% S by mass: the molecular mass is 184g/mol. What is the empirical and molecular formula for the compound?

Empirical formula = SN

molecular formula = S₄N₄

8) Hexamethylenediamine, C₆H₁₆N₂, is one of the starting materials for the production of nylon. It can be prepared from adipic acid by the following reaction:



a) What mass of Hexamethylenediamine can be produced from 1.00×10^3 g of adipic acid.

9.52×10^2 g

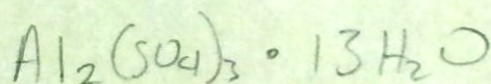
b) What is the percent yield if 765 grams of Hexamethylenediamine is made from 1.00×10^3 g of adipic acid?

80.4%

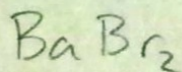
9) Given the data below calculate the formula for the hydrate of Al₂(SO₄)₃ · X H₂O.

DATA

Mass of empty dish	<u>28.64 g</u>
Mass of dish with hydrated compound	<u>47.64 g</u>
Mass of dish with anhydrous compound	<u>39.92g</u>



10) A salt contains only barium and one of the halide ions. A 0.158 g sample of the salt was dissolved in water, and an excess of sulfuric acid was added to form barium sulfate (BaSO₄), which was filtered, dried, and weighed. Its mass was found to be 0.124 g. What is the formula of the barium halide? (a halide ion is the ion of a halogen atom)



11) An unidentified organic compound X, containing only C, H, and O, was subjected to combustion analysis. When 228.4 mg of pure compound X was burned in excess oxygen, 627.4 mg of CO₂ and 171.2 mg of H₂O were obtained. Determine the simplest formula for the compound.

