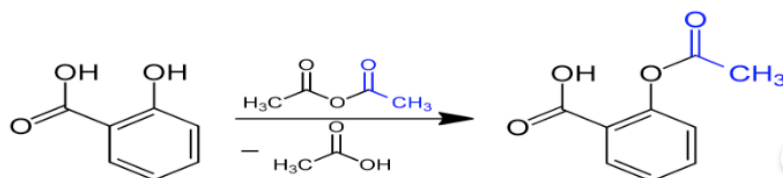


1. A compound contains 76% iodine and 24% oxygen. Calculate the empirical formula of the compound.

2. An organic compound X containing only carbon, hydrogen and oxygen was analyzed gravimetrically. When completely combusted in air, 1.568g of the compound X produced 3.136g of carbon dioxide and 1.283g of water. The molar mass of compound X is 87.9 g mol^{-1} . (The relative atomic mass of C: 12.01, H: 1.01, O: 16.00)
Determine the empirical formula and molecular formula of the organic compound.

3. Aspirin, one of the most widely used drugs in the world, can be prepared according to the equation given below.



- (a) A student reacted some salicylic acid with excess ethanoic anhydride. Impure solid aspirin was obtained by filtering the reaction mixture. Pure aspirin was obtained by recrystallization. The following table shows the data recorded by the student.

Mass of salicylic acid used	$3.15 \pm 0.02 \text{ g}$
Mass of pure aspirin obtained	$2.50 \pm 0.02 \text{ g}$

- (i) Determine the amount, in mol, of salicylic acid, C₆H₄(OH)COOH, used

(ii) Calculate the theoretical yield, in g, of aspirin, $\text{C}_6\text{H}_4(\text{OCOCH}_3)\text{COOH}$.

(iii) Determine the percentage yield of pure aspirin.

(iv) Another student repeated the experiment and obtained an experimental yield of 150 %. The teacher checked the calculations and found no errors. Comment on the result.

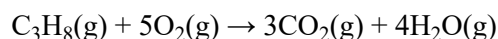
4. (i) Write an equation for the reaction between hydrochloric acid and calcium carbonate.

(2)

(ii) Determine the volume of 1.50 mol dm^{-3} hydrochloric acid that would react with exactly 1.25 g of calcium carbonate.

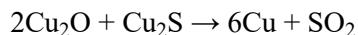
- (iii) Calculate the volume of carbon dioxide, measured at 273 K and 1.01×10^5 Pa, which would be produced when 1.25 g of calcium carbonate reacts completely with the hydrochloric acid.

5. Propane and oxygen react according to the following equation.



Calculate the volume of carbon dioxide and water vapour produced and the volume of oxygen remaining, when 20.0 dm^3 of propane reacts with 120.0 dm^3 of oxygen. All gas volumes are measured at the same temperature and pressure.

6. Copper metal may be produced by the reaction of copper (I) oxide and copper (I) sulfide according to the below equation.



A mixture of 10.0 kg of copper (I) oxide and 5.00 kg of copper (I) sulfide was heated until no further reaction occurred.

- (a) Determine the limiting reagent in this reaction, showing your working.

- (b) Calculate the maximum mass of copper that could be obtained from these masses of reactants.

7. The relative molecular mass of aluminium chloride is 267 and its composition by mass is 20.3% Al and 79.7% chlorine. Determine the empirical and molecular formulas of aluminium chloride.