

KEY

Monday

Please read all the questions VERY carefully before answering. If you do not understand any question, please ask. Use the reverse side of the question paper as scratch. Use the periodic table and constant chart in the last page. No outside paper is allowed. Total points = $52 + (26 \times 3) = 78 + 52 = 130$

SHORT ANSWER. Please write the set-up equation first, then insert the raw data with units in the equation before doing your calculations. Points will be deducted if your answer is not clear.

- 1) A fictional element has three isotopes with their natural abundances shown as:

MASS (amu)	ABUNDANCE
22.1760	45.00%
23.1847	45.00%
24.1934	10.00%

Show your calculation to determine the atomic mass of the element. (8 pts.)

$$\begin{aligned} \text{Atomic Mass} &= M_1 N_1 + M_2 N_2 + M_3 N_3 = (22.1760 \text{ amu})(0.4500) \\ &+ (23.1847 \text{ amu})(0.4500) + (24.1934 \text{ amu})(0.1000) \\ &\approx \boxed{22.8317 \text{ amu}} \end{aligned}$$

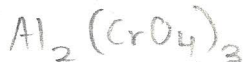
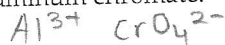
- 2) Calculate the number of atoms in 39.7 g iodine (Note the formula of Iodine). (6 pts.)

$$\begin{array}{c|c|c|c} 39.7 \text{ g I}_2 & 2 \text{ mol I}_2 & 2 \text{ mol I} & 6.02 \times 10^{23} \text{ atoms I} \\ \hline & 253.8 \text{ g I}_2 & 1 \text{ mol I}_2 & 1 \text{ mol I} \end{array}$$

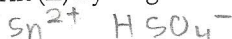
$$\approx \boxed{1.88 \times 10^{23} \text{ atoms I}}$$

- 3) Write the formula for (2 pts. each; Total 6 pts.):

(a) Aluminum chromate:



(b) Tin (II) hydrogen sulfate:



(c) Diiodine tetrasulfide:



- 4) Calculate the amount (in grams) of phosphorous in a 15.5 gram sample of diphosphorous pentoxide. (10 pts.)

Diphosphorous pentoxide: P_2O_5

$$\begin{array}{l|l|l|l} 15.5 \text{ g } P_2O_5 & 1 \text{ mol } P_2O_5 & 2 \text{ mol P} & 31.0 \text{ g P} \\ \hline & 142 \text{ g } P_2O_5 & 1 \text{ mol } P_2O_5 & 1 \text{ mol P} \end{array}$$

$\approx 6.77 \text{ g P.}$ ✓

- 5) An acid has 40% C, 6.7% H, 53.3% O and its molar mass is 60.05 g/mol. Show your calculation to find the molecular formula of the acid? (10 pts.)

Assume 100 g sample of acid. Then, the sample has 40 g C, 6.7 g H, and 53.3 g O.

$$\frac{40 \text{ g C}}{12 \text{ g C}} \approx 3.33 \text{ mol C} \quad \left\{ \begin{array}{l} \frac{6.7 \text{ g H}}{1.0 \text{ g H}} = 6.7 \text{ mol H} \end{array} \right.$$

$$\frac{53.3 \text{ g O}}{16.0 \text{ g O}} \approx 3.33 \text{ mol O} \quad \left. \begin{array}{l} \text{Mole Ratio} \approx 1 \text{ mol C} : 2 \text{ mol H} : 1 \text{ mol O} \\ \Rightarrow \text{Empirical formula: } CH_2O \end{array} \right\}$$

$$n = \frac{\text{Molar mass actual}}{\text{Molar mass empirical}} = \frac{60.05 \text{ g/mol}}{30 \text{ g/mol}} \approx 2 \quad \Rightarrow \text{Molecular Formula: } (CH_2O)_2 \Rightarrow C_2H_4O_2$$

- 6) Write the name next to the formula for (2 pts. each; Total 6 pts.):

(a) $Cu(HSO_3)_2$: Copper (II) Hydrogen Sulfite ✓

(b) $Cr_2(CrO_4)_3$: Chromium (III) Chromate ✓

(c) $Sr(BrO_4)_2$: Strontium perbromate ✓

- 7) If a mixture of salt and sand contained 45.9% salt then calculate the amount of sand present in 25.68 g of the mixture (6 pts.)

45.9% salt \Rightarrow 54.1% sand

$$\frac{25.68 \text{ g mixture}}{100 \text{ g mixture}} \times 54.1 \text{ g sand} \approx 13.89 \text{ g sand.}$$

