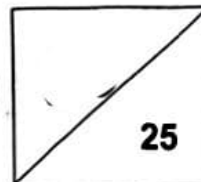


Catholic Junior College
2025 JC1 H2 Chemistry
Continual Assessment 1 (Term 2)
Mole Concept & Stoichiometry and Atomic Structure

(A)



Duration: 40 minutes

Name: _____ Class: 1T _____ Date: _____

1 Sulfur has four stable isotopes as shown in table below.

Relative isotopic mass of S	Percentage abundance / %
31.97	94.93
32.97	0.76
33.97	4.29
35.97	0.02

(a) Define the term *relative isotopic mass*.

..... [1]

(b) Use the data above to calculate the relative atomic mass of sulfur to two decimal places.

(c) A compound X, has the following composition by mass: C, 39.3%; H, 8.2%; S, 52.5%. [1]

Use the data above to calculate the empirical formula of X.

[2]

[Total: 4]

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- 2 Azomethane, $C_xH_yN_2$ exists as a gaseous compound in one of its forms and it can be decomposed to produce gases under certain conditions.

20 cm³ gaseous sample of $C_xH_yN_2$ was analysed using combustion with 200 cm³ of oxygen giving only CO_2 , N_2 and H_2O . 130 cm³ of oxygen was found to be unreacted.

The resultant gas mixture was cooled and passed through $NaOH(aq)$ and a further 40 cm³ reduction in volume occurred. All volumes are measured at 30 °C.

Write a balanced equation for the complete combustion of azomethane, $C_xH_yN_2$.

Calculate the volume of oxygen used and hence deduce the value of x and y .

[Total: 4]

3 (a) Chromium dioxide, CrO_2 , is highly conductive and magnetic, and can be used in data tape. When CrO_2 is dissolved in dilute inorganic acid, Cr^{3+} and $\text{Cr}_2\text{O}_7^{2-}$ are formed.

(i) State the oxidation number of chromium for the following:

	Cr^{3+}	CrO_2	$\text{Cr}_2\text{O}_7^{2-}$	[1]
oxidation no. of chromium				

(ii) Construct half-equations for the following:

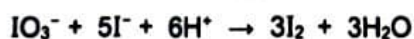
• reduction of CrO_2 to Cr^{3+} in acidic medium, [1]

• oxidation of CrO_2 to $\text{Cr}_2\text{O}_7^{2-}$ in acidic medium [1]

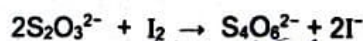
(iii) Hence, write a balanced overall equation for the reaction of CrO_2 in acid.

(b) Potassium iodate (V), KIO_3 tablets can be used to protect against accumulation of radioactive iodine due to emergency nuclear events.

In a method to determine the percentage purity of KIO_3 ($M_r = 214$) tablets, the following reaction is allowed to take place first with excess iodide.



The iodine, I_2 produced is determined by titration with thiosulfate, $\text{S}_2\text{O}_3^{2-}$.



When a 0.100g tablet was analysed using this method, 12.0 cm³ of 0.20 mol dm⁻³ of thiosulfate was used in the reaction.

(i) Deduce the stoichiometric relationship between KIO_3 and $\text{S}_2\text{O}_3^{2-}$ ions. [1]

(ii) Hence, calculate the number of moles of KIO_3 in a tablet and subsequently determine the percentage purity of the 0.100g the KIO_3 tablet. [2]

(d) (i) Write an equation, with state symbols, for the second ionisation energy of element A.

.....[1]

(ii) The first seven ionisation energies of element A are as follows:

ionisation energy/ kJ mol ⁻¹	1st	2nd	3rd	4th	5th	6th	7th
A	1310	3390	5320	7450	10989	13326	71330

Use the data to deduce the group number for element A.

[2]

.....[2]

(e) Arrange the size of the following isoelectronic ions in ascending order (smallest to largest).
Explain your answer.

[Total: 10]