School of Science and Technology, Singapore
2023 Secondary 3 Chemistry
Class Test 2
Marking Scheme

Section A

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
D	B	B	C	A	D	B	A	B	A

Section B

Question	Accepted Answers	Marks
1a	magnesium	1
b	silicon	1
c	sulfur/chlorine/ phosphorus	1
d	phosphorus	1
e	chlorine	1

<table>
<tr><td>2a</td><td>
<table>
<tr><td></td><td>C</td><td>F</td><td>Cl</td></tr>
<tr><td>% by mass</td><td>8.7</td><td>13.8</td><td>77.5</td></tr>
<tr><td>A_r</td><td>12</td><td>19</td><td>35.5</td></tr>
<tr><td>no. of moles (calculation shown)</td><td>8.7/12
= 0.725</td><td>13.8/19
= 0.72631</td><td>77.5/35.5
= 2.18309</td></tr>
<tr><td>ratio (calculation shown)</td><td>0.725/0.725
=1</td><td>0.72631/0.725
=1.001
≈1</td><td>2.18309/0.725
= 3.01
≈3</td></tr>
</table>
Empirical Formula: $CFCl_3$
</td><td>1
1
1</td></tr>
<tr><td>2b(i)</td><td>sharing of electrons between C and F is correct
sharing of electrons between C and Cl is correct</td><td>1
1</td></tr>
<tr><td>2b(ii)</td><td>$CCl_4 + 2HF \rightarrow CF_2Cl_2 + 2HCl$</td><td>1</td></tr>
<tr><td>2b(iii)</td><td>no. of mol of HF
= 10/20
= 0.5 mol

no. of mol of CCl_4
= 36/24
=1.5 mol

Based on molar ratio, HF is the limiting reactant.

mass of of CF_2Cl_2
= 0.5/2 x [12+(19)(2) + (35.5)(2)]
= 0.25 x 121
= 30.25
= 30.3 g (to 3 sf)</td><td>1

1

1

1(answer with units)</td></tr>
</table>

3a	1. Fill a✓ burette with (dilute) sulfuric acid. Note the initial burette reading, V_1 cm^3. 2. ✓Pipette (25.0 cm^3)of potassium hydroxide solution into a conical flask. 3. Add ✓a few drops of suitable named indicator (e.g. methyl orange) to the solution in conical flask. 4. Add the ✓acid from the burette (slowly), ✓swirling the conical flask, until the ✓indicator changes colour. (e.g. red to orange) Record the final burette reading, V_2 cm^3. 5. Determine the ✓volume of (dilute) sulfuric acid required for complete neutralisation of potassium hydroxide solution. 6. ✓Repeat the titration without adding the indicator. Add $V_2 - V_1$ cm^3 of the acid into 25.0 cm^3 of potassium hydroxide solution into a conical flask.	7-8 ✓ : 4m 5-6 ✓ : 3m 3-4✓ : 2m 2 ✓ : 1m 1 ✓ : 0m
3b	carbon dioxide will be formed from this reaction, as an acidic oxide/, it will lower(affect) the pH of the resultant solution/, requiring greater volume of potassium carbonate to neutralise sulfuric acid.	1
4a	C is a giant covalent molecular structure as it has very high melting and boiling points. F comprises of simple covalent/discrete molecule/structure as it has low melting and boiling points. C and F are unable to conduct electricity in its solid and liquid states, as there are no mobile charged carriers (ions/electrons)in its structure.	1 1
b	Nitric acid is a strong acid, thus it (completely) ionises/dissociates to form 0.01 mol / dm^3 of hydrogen ions.	1 1

	Nitrous acid is a weak acid, it (partially) ionises/dissociates to form less hydrogen ions of concentration 4.50×10^{-6} 0.0004 mol / dm^3	
c(i)	reactivity of metal : A is unreactive while B is a reactive metal. No gas was produced when A reacted with both acids. basicity of acid: twice the volume of gas was produced when B reacted with sulfuric acid compared to nitric acid, though same concentration and volume of acid were used.	1[factor] 1[explanation]
c(ii)	10.0 cm^3 ; ethanoic acid and nitric acid are monobasic acids/, thus the stoichiometric ratio of the acids and gas produced will be the same, resulting in the same volume of gas produced.	1 1
(d)	Lesser volume of gas produced when E reacts with sulfuric acid compared to D; E forms an insoluble substance which prevents the reaction to go into completion. However, the product formed from the reaction between D and sulfuric acid is soluble, allowing the reaction to go into completion.	1 1