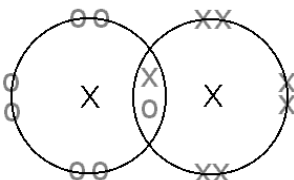
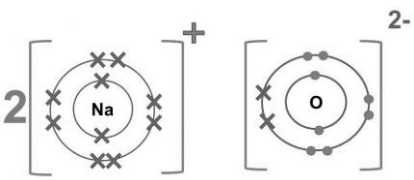




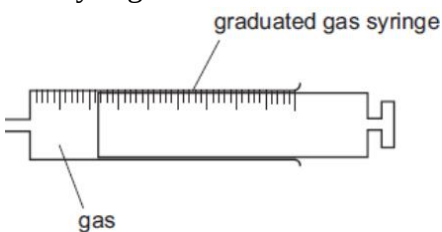
Annual Examinations for Secondary Schools 2022

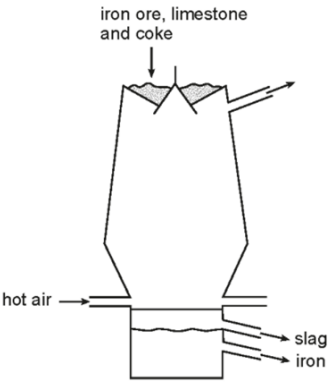
YEAR 11 CHEMISTRY MARKING SCHEME

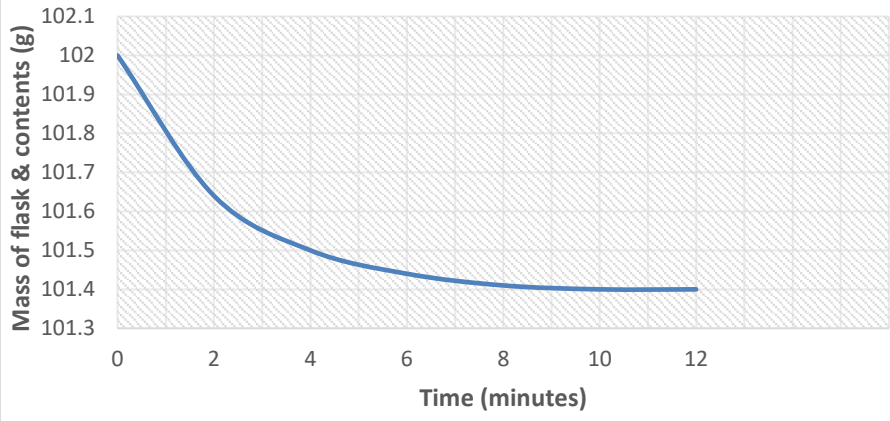
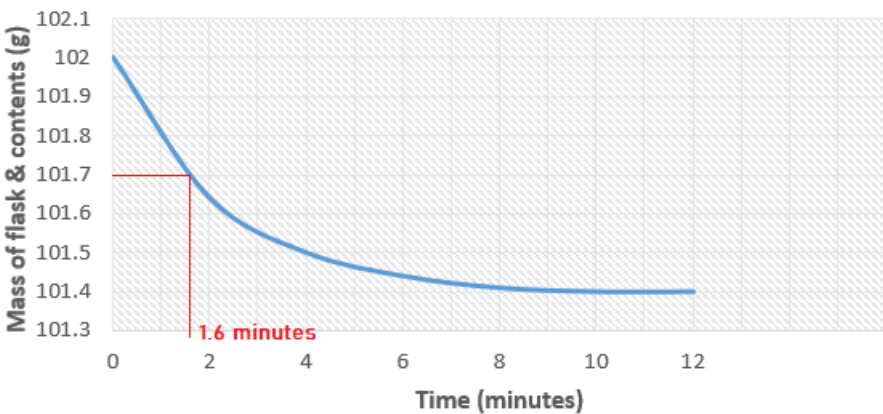
Item		Answer and guidelines	Marks
Section A			
1	a	17 – shows the atomic number (or number of protons) 35 or 37 – shows the atomic mass number (or number of protons + neutrons)	1 1
1	b	Different atoms of the same element with the same atomic number (or same number of protons) but different mass number (or different number of neutrons).	1 1
1	c	X-35 has 18 neutrons while X-37 has 20 neutrons. OR X-37 has 2 more neutrons than X-35.	1
1	d	The chemical behaviour of elements depends on their electron arrangement. Both isotopes have the same electron configuration (2, 8, 7).	1 1
1	e	$(75 \times 35) + (25 \times 37) = 3550$ $3550/100 = 35.5$	1 1
1	f	 <p>1 mark for drawing 2 overlapped atoms of X. 1 mark for showing shared electrons. 1 mark for correct number of unshared electrons. Accept touching atoms of X. Do not accept separated atoms of X joined with a circle.</p>	3
Total			12
2	a	i Fluorine	1
		ii Si	1
		iii Iron	1
Accept other suitable answers.			
2	b	 <p>1 mark for correct symbol of elements. 1 mark for showing charge for O. 1 mark for showing charge for Na. Accept if two ions of Na are correctly drawn instead of only one with a number '2' in front of it as shown.</p>	3
Total			6
3	a	Ba, Sr, Ca, Mg, Be	1

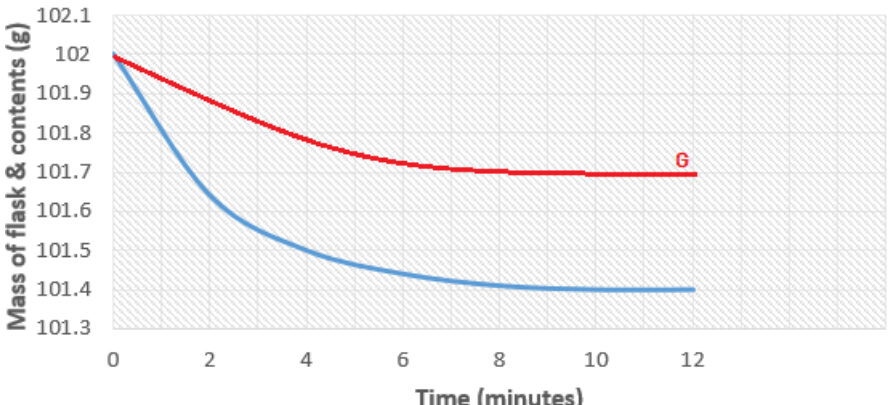
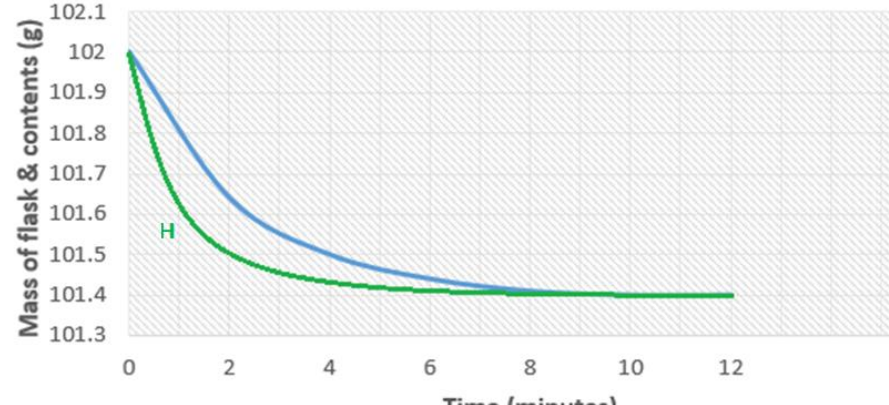
Item			Answer and guidelines	Marks
3	b		As more electron shells are added and atoms get bigger in size , outer shell electrons experience a decreased attraction pull by the positively charged nucleus and so are more easily lost when the metal reacts.	1
				1
3	c		$\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{H}_2$ <i>1 mark for formulae, 1 mark for balancing.</i>	2
3	d		Potassium is more reactive with water than calcium.	1
			Total	6
4	a		Solid A iodine	1
			Solid B zinc nitrate	1
			Solid C ammonium chloride	1
			Solid D copper(II) hydroxide	1
4	b		$\text{Ca(HCO}_3)_2 \rightarrow \text{CaCO}_3 + \text{CO}_2 + \text{H}_2\text{O}$ <i>1 mark for formulae, 1 mark for balancing.</i>	2
			Total	6
5	a	i	Any hydrogen chloride gas fumes present in the gaseous mixture dissolve in water and are trapped there.	1
		ii	Concentrated sulfuric acid is a drying agent and absorbs any water vapour present in the gaseous mixture.	1
		iii	Chlorine is denser than air.	1
5	b	i	$2\text{Br}^- + \text{Cl}_2 \rightarrow 2\text{Cl}^- + \text{Br}_2$ <i>1 mark for formulae, 1 mark for balancing.</i>	2
		ii	Chlorine is the most reactive, followed by bromine. Iodine is the least reactive.	1
			Total	6
6	a		$\text{Ag} \rightarrow \text{Ag}^+ + \text{e}^-$ <i>1 mark for formulae, 1 mark for balancing.</i>	2
6	b		$\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag}$ <i>1 mark for formulae, 1 mark for balancing.</i>	2
6	c		Oxygen	1
6	d		Purification of copper.	1
			Total	6
7	a		Hydrocarbons are compounds which are made up of carbon and hydrogen atoms only.	1
7	b		Propene is an alkene because it has a double bond between two of its carbon atoms.	1

Item			Answer and guidelines	Marks
7	c		$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}=\text{C} \\ \quad \quad \\ \text{H} \quad \quad \text{H} \end{array} $ Propene	1
			$ \begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{C}\equiv\text{C}-\text{H} \\ \\ \text{H} \end{array} $ Propyne	1
7	d		$\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$ <i>1 mark for formulae, 1 mark for balancing</i>	2
			Total	6
8	a		In a dynamic equilibrium the rate of the forward reaction is equal to the rate of the backward reaction.	1
8	b		The reaction must occur in a closed container.	1
8	c	i	Decrease	1
8		ii	Increase	1
8	d		A catalyst does not affect the equilibrium position. / No change.	1
8	e		Ammonium sulfate or ammonium nitrate. <i>Accept other valid ammonium salts.</i>	1
			Total	6
9	a	i	White, hydrated.	1
		ii	White, soluble, (aluminium / zinc), yellow.	2
		iii	Yellow, lilac.	1
9	b		$\text{Ag}^+ + \text{Br}^- \rightarrow \text{AgBr}$ <i>1 mark for formulae, 1 mark for balancing.</i>	2
			Total	6
Section B				
10	a		$\text{H}_2\text{SO}_4(\text{aq}) + 2\text{KOH}(\text{aq}) \rightarrow \text{K}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$ <i>1 mark for chemical formulae</i> <i>1 mark for balancing</i> <i>1 mark for state symbols</i>	3

Item			Answer and guidelines	Marks
10	b		<ol style="list-style-type: none"> 1. All glassware is washed with distilled water while taking care to finally rinse the burette with potassium hydroxide solution while the pipette is rinsed with sulfuric acid solution. 2. The burette is placed securely on a stand and clamp and is filled up to the 0 cm³ mark with potassium hydroxide solution. 3. Using a volumetric pipette and pipette filler, 25 cm³ of the acid is transferred to a conical flask. Three such conical flasks are prepared. 4. A couple of drops of indicator are put in each conical flask and the contents swirled. 5. The alkali is run slowly from the burette into the conical flask while swirling, until there is a colour change which indicates that neutralization has occurred. The volume is noted from the burette. 6. The first titration is a rough titration and then titrations are repeated accurately until at least 2 concordant results are obtained. <p style="text-align: right;"><i>1 mark for each step.</i></p>	6
10	c			1
10	d		<p>Moles of KOH: 2 moles in 1000 cm³ ? in 30 cm³ $(2 \times 30) / 1000 = \mathbf{0.06 \text{ moles of KOH}}$</p> <p>Ratio H₂SO₄: KOH = 1:2 therefore $0.06/2 = \mathbf{0.03 \text{ moles of acid}}$</p> <p>Concentration of acid: 0.03 moles in 25 cm³ ? in 1000 cm³ $(0.03 \times 1000) / 25 = \mathbf{1.2 \text{ mol dm}^{-3}}$</p> <p style="text-align: right;"><i>Allow follow through.</i></p>	1 1 1
10	e		Sulfuric acid is a strong acid because it ionises completely in solution.	1 1
10	f	i	<p>Gas syringe</p> 	1 1

Item			Answer and guidelines	Marks
		ii	Hydrogen gas is produced. It can be identified as it burns with a squeaky 'pop'.	1 1
			Total	20
11	a		They form coloured compounds, they and their compounds act as catalysts, and they can occur in more than one oxidation state. <i>Any two of.</i>	1 1
11	b		Haematite	1
11	c		 <p><i>2 marks for diagram 2 marks for labels</i></p>	4
11	d		$\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ <i>1 mark for formulae, 1 mark for balancing</i>	2
11	e		The iron in Fe_2O_3 has an oxidation state of +3 and becomes elemental iron with an oxidation state of 0, while the oxidation state of carbon changes from +2 in CO to +4 in CO_2 .	1 1
11	f		Water and oxygen. <i>Do not accept water or oxygen only.</i>	1
11	g		Plastic coating. It works by not allowing the iron to come in contact with water or oxygen. <i>Accept other methods of rust prevention and relevant explanation.</i>	1 1
11	h	i	Green	1
		ii	An oxidizing agent brings about oxidation while it is itself reduced.	1
		iii	$\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + \text{e}$ <i>1 mark for formulae, 1 mark for balancing</i>	2
		iv	The Fe^{2+} ions are oxidized by oxygen in the air to form brown Fe^{3+} ions.	1 1
			Total	20

Item			Answer and guidelines	Marks
12	a		<p>Mass of flask & contents (g) with time (minutes)</p>  <p><i>1 mark for correct axis, 1 mark for correct use of scale, 3 marks for correct points plotted, 1 mark for correct drawing of graph.</i></p>	6
12	b		$2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ <i>1 mark for formulae, 1 mark for balancing.</i>	2
12	c		$102.00 - 101.40 = \underline{\underline{0.60 \text{ g}}}$	1
12	d		10 minutes	1
12	e		<p>Half the amount of CO_2 produced = $0.60/2 = 0.30 \text{ g}$. This corresponds to a total mass of $101.40 + 0.30 = 101.70 \text{ g}$ From the graph, a total mass of 101.70 corresponds to <u>1.6 minutes</u> $\pm 0.1 \text{ min}$. (see graph below).</p> <p>Mass of flask & contents (g) with time (minutes)</p> 	2
12	f		<p>Half the time in part (d) is $10/2 = 5$ minutes. However, the first half of CO_2 produced (0.30 g) is evolved in just 1.6 minutes from the start of the reaction. This shows that the rate of reaction is higher at the start and then slows down with time. This happens because at the start there is the maximum number of peroxide particles present so the number of successful collisions with the catalyst is very high. With time, as the amount of products increases, the amount of peroxide particles decreases, and so does the number of collisions with the catalyst. Hence, the rate of reaction also decreases with time.</p>	1 1

Item			Answer and guidelines	Marks
12	g		<p>Mass of flask & contents (g) with time (minutes)</p>  <p>Accept any sketch that shows a lower rate and lower amount of product.</p>	2
12	h		<p>Since the concentration of the peroxide solution used is half (1.0 mol/dm^3) that used in the original experiment (2.0 mol/dm^3), then half the amount of O_2 will be produced (0.30 g) and hence the final total mass of the flask should be 101.70 g. The rate of reaction would also be slower since there are half the number of peroxide particles colliding with the catalyst particles.</p> <p>Accept any explanation that correctly explains lower rate of reaction without giving specific figures.</p>	1
12	i		<p>Mass of flask & contents (g) with time (minutes)</p>  <p>Accept any sketch that shows a higher rate and same amount of product.</p>	2
12	j		Increased surface area of catalyst.	1
Total				20