

Assessment Schedule – 2011**Science: Demonstrate understanding of aspects of acids and bases (90944)****Evidence Statement**

Question	Evidence	Achievement	Merit	Excellence
ONE (a)	<p>Description of ion An ion is an atom or group of atoms that has lost or gained electron(s) and therefore carries a charge / full outer shell / stable.</p> <p>Explanation of charges Sodium has 11 protons and electron arrangement of 2,8,1. Sodium has one electron in its outer shell, which it loses, so its outer shell is full (2,8) and it has a charge of +1, as it still has 11 protons (positive charges) and now has only 10 electrons (negative charges).</p> <p>Oxygen has 8 protons and electron arrangement of 2,6. Oxygen has 6 electrons in its outer shell, and so it gains two electrons, so its outer shell is full (2,8) and so has a charge -2, as it still has 8 protons (positive charges) and now has 10 electrons (negative charges).</p> <p>Evidence may come from diagrams</p>	<ul style="list-style-type: none"> • Describes an ion correctly. • Correctly gives the electron arrangements of sodium and oxygen ions. • States that sodium loses one electron and that oxygen gains two electrons when forming ions. • States charges on sodium and oxide ions. • Explains the charge on either sodium or oxygen in terms of electron arrangement AND atomic structure. 	<ul style="list-style-type: none"> • Explains the charge on both sodium and oxygen in terms of electron arrangement and atomic structure. • Explains that sodium and oxide ions have the same numbers of electrons, as Na has lost one, leaving 10 and oxygen has gained two, giving 10 and therefore the same arrangement. 	<ul style="list-style-type: none"> • Explains why the two ions have the same electron arrangement; achieve full outer shells by either gaining two electrons or losing one electron, and therefore having two more electrons than the number of protons or one less than the number of protons.
(b)	<p>Ratio of X ions to OH⁻ ions 1:3</p> <p>Charge of X Hydroxide ion has a charge of -1. Because there are three hydroxide ions overall, the total negative charge is -3. Therefore to form a neutral compound, X must have a charge of +3, as there is only one X ion in the formula. Therefore X loses three electrons to have a charge of +3.</p> <p>How to find group for X The only element between 11-18 that has three electrons in its valence shell is aluminium in group 13, OR it must be in group 13 to have three valence electrons.</p> <p>What is X? Aluminium.</p>	<ul style="list-style-type: none"> • Ratio of 1: 3 for X to (OH⁻) ions. • The total negative charge in (OH)₃ is -3. • States that X must have a positive charge, as hydroxide ions have a negative charge. • States X has a charge of +3. • States X is Aluminium (no explanation). 	<ul style="list-style-type: none"> • Hydroxide ion has a charge of -1. Because there are three hydroxide ions overall, the total negative charge is -3. • To form a neutral compound X must have charge of +3 to balance the -3 charge, so the compound is neutral overall. 	<ul style="list-style-type: none"> • Identifies X as aluminium. <p>AND</p> <ul style="list-style-type: none"> • Explains the balance of negative and positive charges in the ions in X(OH)₃ and how the periodic table shows that X must be in group 13 because it is the only element between 11 and 18 that has three valence electrons.

	Not achieved			Achievement		Achievement with Merit		Achievement with Excellence	
Q1	NØ = no evidence or no relevant evidence	N1 = one partially correct answer, eg one e ⁻ arrangement. e.g. an ion is an atom with a charge. e.g. electron arrangement of Na = 2,8,1.	N2 = 1 point from Achievement	A3 = 2 points	A4 = 3 points	M5 = 2 points	M6 = 3 points	E7 = 1 point	E8 = 2 points

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TWO (a)	Fizzing / bubbling occurs, marble chips decrease in size, heat is produced.	<ul style="list-style-type: none"> • ONE correct observation. 		
(b)	<p>Why mass decreases The marble chips decreases as one of the products is CO₂ gas. This gas escapes and so the mass of the flask and contents is reduced.</p> <p>What's happening As the reactant particles collide, they form product particles. As the reaction proceeds, there are fewer and fewer reactant particles left to collide and so the rate of reaction becomes slower.</p> <p>At the start (section X) of the reaction, more product particles are being formed, then more gas is being formed, therefore more gas escapes at first and so the mass of the flask and contents decreases more rapidly. At X, the rate of reaction is fast but decreasing with time.</p> <p>In section Y there are now fewer (less) reactants and so there are fewer collisions per second (unit time) and so less product is formed, ie less gas being released, so the mass does not decrease as rapidly. At Y, the rate of reaction is slow and slowing.</p> <p>In section Z the reaction has stopped, as one of the reactants (marble chips or HCl) has run out, so there are no particles left to react.</p>	<ul style="list-style-type: none"> • Mentions CO₂ / gas escaping. • Describes that when there are more collisions, a faster reaction occurs. • Correctly describes the rate of reaction at either X, Y or Z. • When there are more reactants there are more collisions. 	<ul style="list-style-type: none"> • Has the idea that as the reaction proceeds, CO₂ gas is released and so it escapes, meaning the overall mass is less. • Correctly explains the rate at X (fast), Y (slowing) and Z (stopped) linked to reactants or products. 	<ul style="list-style-type: none"> • Fully explains the rate of reaction at the three stages, AND has a link between the amount of particles colliding and reaction rate, so affecting the amount of CO₂ gas escaping.
(c)	When more concentrated acid is used, there are more acid particles in the same volume of the acid. Because of this, there are more particles to collide with the calcium carbonate. Because there are more to collide, the rate of reaction is faster.	<p>ONE of:</p> <ul style="list-style-type: none"> • More concentrated acid has more acid particles to react. <p>OR</p> <ul style="list-style-type: none"> • When there are more reactants there are more collisions. 	<ul style="list-style-type: none"> • Explains that there are more collisions due to more acid particles being present when the more concentrated acid is used, and hence the reaction rate is faster. 	<ul style="list-style-type: none"> • Explains why the reaction is faster, by linking the idea that there are more acid particles in the same unit volume available for collisions, and hence there will be more collisions, causing the faster reaction rate.

	Not achieved			Achievement		Achievement with Merit		Achievement with Excellence	
Q2	NØ = no evidence or no relevant evidence	N1 = partially correct statement	N2 = 1 point from Achievement	A3 = 2 points	A4 = 3 points	M5 = 2 points	M6 = 3 points	E7 = 1 point	E8 = 2 points

Question	Evidence			Achievement		Merit		Excellence	
THREE	<p>Type of reaction Acid-Base reaction or neutralisation.</p> <p>Word Equation hydrochloric acid + magnesium oxide → magnesium chloride + water.</p> <p>Balanced Equation $2\text{HCl} + \text{MgO} \rightarrow \text{MgCl}_2 + \text{H}_2\text{O}$</p> <p>How to make it Add magnesium oxide to hydrochloric acid in a beaker. Heat slightly and pour this into an evaporating dish and leave somewhere warm (e.g. window sill) for a few days or heat over Bunsen to speed up the reaction, so that the water can evaporate, leaving magnesium chloride salt. Safe lab procedure would include dealing appropriately with chemicals such as HCl or the wearing of safety glasses.</p>			<ul style="list-style-type: none"> Identifies reaction type. Correct word equation. Correct symbol equation with one mistake in an ionic formula. Describes one stage correctly in the making of magnesium chloride. 		<ul style="list-style-type: none"> Correct symbol equation, but not balanced. Explains the two steps of reacting and evaporating in the making of magnesium chloride either in solution or as a solid 		<ul style="list-style-type: none"> Correctly balanced symbol equation. Fully discusses making magnesium chloride salt, either in solution or as a solid Discusses correct equipment or safe lab procedure for making MgCl_2 from MgO and HCl. 	
	Not achieved			Achievement		Achievement with Merit		Achievement with Excellence	
Q3	NØ = no evidence or no relevant evidence	N1 = partially correct, eg word equation without water	N2 = 1 point from Achievement	A3 = 2 points	A4 = 3 points	M5 = 1 points	M6 = 2 points	E7 = 2 points	E8 = 3 points

Question	Evidence			Achievement		Merit		Excellence	
FOUR	<p>Explanations When the solution is red, the pH is 1–2. The colour is due to a high concentration of H⁺ ions. When the solution is green, the solution is neutral pH 7 and the hydroxide ions have reacted with the hydrogen ions, forming water. When the solution is purple, the pH is 12–13 and there is a high concentration of hydroxide ions.</p> <p>Word equation Nitric acid + sodium hydroxide → sodium nitrate + water</p> <p>Balanced equation HNO₃ + NaOH → NaNO₃ + H₂O</p>			<ul style="list-style-type: none"> • Link TWO pHs values to colour (eg, red = acid, purple = base) • States when colour is green and the pH is 7 the solution is neutral. • States that the acid provides hydrogen ions. • States that the base provides hydroxide ions. • Correct word equation. 		<ul style="list-style-type: none"> • Explains that H⁺ and OH⁻ form water. • Explains that before sodium hydroxide is added, H⁺ ion concentration is high and once 20 mL of sodium hydroxide has been added the concentration of OH⁻ ions is high. • Correct symbol equation (not balanced). 		<ul style="list-style-type: none"> • Links the colour change to the pH by relating it to the ions that are present. • Shows that when 10mL of sodium hydroxide has been added the number of hydrogen ions are equal to hydroxide ions, water / neutral solution is formed. • Writes a balanced chemical reaction. 	
	Not achieved			Achievement		Achievement with Merit		Achievement with Excellence	
Q4	NØ = no evidence or no relevant evidence	N1 = 1 partially correct point	N2 = 1 point from Achievement	A3 = 2 points	A4 = 3 points	M5 = 2 points	M6 = 3 points	E7 = 2 points	E8 = 3 points

Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 9	10 – 18	19 – 24	25 – 32