

Assessment Schedule – 2012

Science: Demonstrate understanding of aspects of acids and bases (90944)

Evidence Statement

Question	Evidence					Achievement		Merit		Excellence	
ONE (a)	Atom	Atomic No	Electron arrangement of atom	Electron arrangement of ion	Ion symbol	<ul style="list-style-type: none"> Correctly gives the electron arrangements of two ions OR two atoms Shows that calcium loses two electrons and that both fluorine and chlorine gain one electron when forming ions. States charges on three ions. Explains the charge on one ion in terms of electron arrangement AND atomic structure. F and Cl are in same group. 	<ul style="list-style-type: none"> Explains the charge on two ions in terms of electron arrangement and atomic structure. Explains that calcium and chloride ions have the same numbers of electrons, as Ca has lost two electrons and chlorine has gained one electron. Explains that chlorine and fluorine ions both have the same charge as they have both gained one electron as they are in the same group 17 of the periodic table. 	<ul style="list-style-type: none"> Explains why two ions have the same electron arrangement: achieve full outer shells by Ca losing two electrons, Cl gaining one electron and therefore having the same number of electrons and therefore the same configuration of 2,8,8. Explains why two ions have the same charge: Because they are both in group 17 they both have 7 valence electrons and therefore both need to gain one electron to achieve a full outer shell. They both now have one more electron than protons and so therefore both have charges of negative one. Explains why two ions have the same configuration but a different charge as while both ions have the same number of electrons, calcium now has two more protons than electrons and chloride ion has one more electron than protons. 			
(b) and (c)	Ca	20	2,8,8,2	2,8,8	Ca ²⁺						
	F	9	2,7	2,8	F ⁻						
	Cl	17	2,8,7	2,8,8	Cl ⁻						
	<p>Explanation of charges</p> <p>F has 9 protons and electron arrangement of 2,7. Cl has 17 protons and an electron arrangement of 2,8,7. Both atoms are in group 17 of the periodic table as they both have 7 electrons in the valence shell. Both atoms gain one electron to have a full outer shell. For F ion the electron arrangement is 2,8, and for Cl ion it is 2,8,8.</p> <p>F has a charge of -1 as it now has 10 electrons (-) and 9 protons (+). Cl has a charge of -1 as it now has 18 electrons (-) and 17 protons (+).</p> <p>Ca has 20 protons and electron arrangement of 2,8,8,2. Ca has two electrons in its outer shell, which it loses, so its new outer shell is full (2,8,8) and it has a charge of +2, as it still has 20 protons (+) and now has only 18 electrons (-). Therefore Ca and Cl ions now both have the same electron configuration of 2,8,8.</p>										
	Not achieved					Achievement		Achievement with Merit		Achievement with Excellence	
Q1	NØ – no response or no relevant evidence	N1 – 1 point	N2 – 2 points	A3 – 3 points	A4 – 4 points	M5 – 2 points	M6 – 3 points	E7 – 2 points	E8 – 3 points		

Question	Evidence			Achievement		Merit		Excellence	
<p>TWO</p> <p>(a)</p> <p>(b)</p> <p>(c)</p>	<p>How to make it Mix the two solutions together, then take the resulting solution and put it in an evaporating dish. It could be heated using a Bunsen burner or left somewhere warm for a few days. The water would evaporate off leaving behind the neutral salt sodium nitrate.</p> <p>The solution will be neutral when red and blue litmus papers both stay the same colour. When blue paper changes to red the solution is acidic. When red paper changes to blue the solution is basic.</p> <p>Word Equation nitric acid + sodium carbonate → sodium nitrate + water + carbon dioxide.</p> <p>Balanced Equation $2\text{HNO}_3 + \text{Na}_2\text{CO}_3 \rightarrow 2\text{NaNO}_3 + \text{H}_2\text{O} + \text{CO}_2$</p>			<ul style="list-style-type: none"> • Correct word equation. • Correct symbol equation with one mistake in ionic formula. • Describes one step in the making of the neutral salt. • CO₂ gas / bubbles produced. • Adding acid to the carbonate until it just stops fizzing. • Red litmus turns blue in base OR blue litmus turns red in acid. • Litmus stays the same colour in water / neutral. 		<ul style="list-style-type: none"> • Correct symbol equation but not balanced. • Explains two steps, ie mixes the two solutions and then leaves or heats to form salt. • Either red or blue litmus stays the same colour in neutral solution. • CO₂ gas / bubbles produced, leaving NaNO₃ in water. 		<ul style="list-style-type: none"> • Correct balanced symbol equation. • Explanation that shows the mixing to form sodium nitrate then heating to remove water or leaving somewhere warm to remove water, which leaves behind sodium nitrate. • Explains the use of both colours of litmus paper to identify a neutral salt (red stays red, blue stays blue). 	
	Not Achieved			Achievement		Achievement with Merit		Achievement with Excellence	
Q2	NØ – no response or no relevant evidence	N1 – one reactant formula	N2 – 1 point	A3 – 2 points	A4 – 3 points	M5 – 2 points	M6 – 3 points	E7 – 2 points	E8 – 3 points

Question	Evidence			Achievement		Merit		Excellence	
THREE (a) (b)(c)(d)	<p>Equations Sulfuric acid + sodium hydroxide → sodium sulfate + water $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$</p> <p>Explanations Beaker one (acid) The solution would be red to start with as the pH would be 1–2. The ions present in solution would be H^+. The pH would be low as there is a high number of H^+ ions present. As NaOH is added the solution would go orange, then yellow, then green. When the solution is orange and yellow the pH is still less than 7 as there are still more H^+ than OH^- ions. When the solution becomes green the amount of OH^- ions added (from the NaOH) cancel out the H^+ ions from the sulfuric acid and form water in a neutralisation reaction. At this stage the pH would be 7. As more NaOH is added the solution then becomes blue and then purple. When the solution is blue the pH is 8 -11 as there are now more OH^- ions present than H^+ ions. When it becomes purple the pH is 13 – 14 as there are now many more OH^- ions present than H^+ ions.</p> <p>Beaker two (water) The solution is green initially as water contains equal numbers of H^+ and OH^- ions and is pH 7. As NaOH is added, the solution would become blue (pH 8 - 11) and then purple (pH 13 – 14). Because the water was neutral to start with, as more OH^- ions are added, the solution becomes more basic as the OH^- ions are immediately in excess.</p>			<ul style="list-style-type: none"> Describes three correct colours in either beaker in correct order as NaOH is added. Link two pH values to colour other than pH = 7. States when colour is green and the pH is 7 the solution is neutral. States that the acid / H_2SO_4 provides hydrogen ions. States that the base / NaOH provides hydroxide ions. Correct word equation OR Correct symbol equation with one mistake in ionic formula. Beaker one is red, beaker two is green. 		<ul style="list-style-type: none"> Explains that H^+ and OH^- form water. Correct symbol equation but not balanced. States that pH < 7 is acidic and pH > 7 is basic and links one pH value to colour other than pH = 7 Explains that before any NaOH is added to beaker one that H^+ are in excess, and as more NaOH is added the concentration of OH^- increases until OH^- ions are in excess OR Explains in beaker two that the solution is neutral as H^+ and OH^- ions are equal, and that as NaOH is added OH^- ions are in excess. 		<ul style="list-style-type: none"> Correctly balanced symbol equation. Links the colour change to the pH by relating it to the ions that are present in beaker one. Links the colour change to the pH by relating it to the ions that are present in beaker two. 	
	Not Achieved			Achievement		Achievement with Merit		Achievement with Excellence	
Q3	NØ = no response or no relevant evidence	N1 = 1 point	N2 = 2 points	A3 = 3 points	A4 = 4 points	M5 = 2 points	M6 = 3 points	E7 = 2 points	E8 = 3 points

Question	Evidence			Achievement		Merit		Excellence	
FOUR	<p>The reaction is faster at the higher temperature, because the H⁺ ions have more kinetic energy, and therefore are moving faster. When they are moving faster, there will be more collisions, and more of these collisions will be effective, as the particles will collide with more energy.</p> <p>Line B represents the faster reaction, as it is steeper at the start. This represents the reaction carried out at 40°C.</p> <p>Both lines become horizontal at the same point on the Y-axis, as this is when both reactions have finished, ie one of the reactants has been completely used up and therefore no more gas is produced. Both finished with same amount of gas produced, as both reactions had the same amount of reactants to start with.</p>			<ul style="list-style-type: none"> Line B represents the reaction at 40°C. States that Line B is faster, as it is steeper. Horizontal line indicates reactant used up. Horizontal line indicates no more gas is being produced. Horizontal line indicates reaction is finished. At higher temperatures reactants move faster OR there are more collisions. Both lines are horizontal as both reactions produce the same volume of gas. 		<ul style="list-style-type: none"> Explain that a horizontal line indicates two of each reaction is finished / one of the reactants has been used up / no more gas is produced. Explains from graph that the rate of reaction of A and B are different but the same volume of gas is produced. When there is a higher temperature, the reactants move faster, and therefore there are more collisions. 		<ul style="list-style-type: none"> Links each reaction being finished when the line becomes horizontal, as one (or more) of the reactants have been used up and therefore no more gas is produced. Explains from graph that the rate of reaction of A and B are different but the same volume of gas is produced as in both reactions there was the same amount of reactants at the start. The reaction is faster at the higher temperature, because the H⁺ ions have more kinetic energy / move faster. When they are moving faster, there will be more collisions and more of these collisions will be effective, as the particles will collide with more energy OR more collisions per unit of time. 	
	Not achieved			Achievement		Achievement with Merit		Achievement with Excellence	
Q4	NØ – no response or no relevant evidence	N1 – 1 point	N2 – 2 points	A3 – 3 points	A4 – 4 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 – 8	9 – 16	17 – 24	25 – 32