Assessment Schedule – 2018

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

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	Both atoms have the same number of valence electrons, which determines the group (1). The period is determined by the number of electron shells. Li has 2 electron shells so is found in Period 2; Na has 3 electron shells so is found in Period 3.	• Both atoms have the same number of valence electrons. OR Both atoms can form a 1+ ion/ lose 1electron • Li and Na have different numbers of electron shells.	• Explains that Li and Na are in different periods due to numbers of shells – Li 2, Na 3, but the same group due to number of outer electrons /having 1 electron/forming 1+ ions	
(b)	Na has 11 protons and electron arrangement of 2,8,1. F has 9 protons and electron arrangement of 2,7. Both atoms need to gain or lose electrons to have a full outer shell and become stable. Na loses one electron to form Na+ ion which has a charge of +1 as it now has 10 negative electrons and 11 positive protons. F gains 1 electron to form F^- ion which has a charge of –1 as it now has 10 negative electrons and 9 positive protons. Therefore, Na and F ions now both have the same electron arrangement of 2,8.	• Correctly gives the electron arrangement of both atoms OR both ions. • Shows that sodium loses one electron AND fluorine gains one electron. • Explains the charge on one ion in terms of electronic arrangement AND atomic structure. • Full outer shells are stable. • Defines ion, e.g. an ion is an atom that gains or loses electrons to get a full outer shell.	• Explains that sodium and fluoride ions have the same electron configuration 2,8, as sodium has lost one electron to get a full outer shell, and fluorine has gained one electron to get a full outer shell.	• Explains why the two ions have the same electronic arrangement: *achieve full outer shells by Na losing one electron, F gaining one electron and therefore having the same electron arrangement of 2, 8.* AND Explains why two ions have the same arrangement but a different charge: *sodium ion is Na+ as now has one more proton than electrons and fluoride ion is F- as now has one more electron than protons.*
(c)	Magnesium loses 2 electrons to end up with a charge of +2. Fluorine will gain only one electron to have a charge of –1. As Mg reacts, it loses the 2 electrons in its outer shell; one to each F atom to fill their outer shells. In order to have a neutral compound, one magnesium ion is needed to cancel out the charge on two fluoride ions with a combined charge of –2.	• States that overall an ionic compound has no charge, so the charges must cancel out. OR States that the +2 charge on the magnesium ion cancels out/balances the two –1 charges on the fluoride ions. • Magnesium needs to lose 2 electrons	• Explains that since the Mg needs to lose 2 electrons, one Mg will react with 2 F as the F only need 1 electron each for full shells • Explains that because the magnesium ion has a charge of +2 and the fluoride ion has a charge of –1, the ratio of magnesium ions to fluoride ions is 1:2, so forming a neutral compound overall.	• Fully explains the ratio of ions in magnesium fluoride, including electrons gained by 2 fluorine atoms equals the electrons lost by 1 magnesium AND the charge on Mg balances the charge on the 2 Fs.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response or no relevant evidence.	ONE Achievement point.	TWO Achievement points.	THREE Achievement points.	FOUR Achievement points.	TWO Merit points.	THREE Merit points.	ONE Excellence point.	TWO Excellence points.

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	Neutralisation reaction / acid-base.	• Correct type of reaction.		
(b)	potassium hydroxide + sulfuric acid → potassium sulfate + water $2KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$	• Correct word equation	• Correct symbol equation but unbalanced.	• Fully balanced symbol equation.
(c)	*In discussion accept H^+ or H_3O^+.* As the H_2SO_4 is added, the KOH is being neutralised until water is formed. When no H_2SO_4 is added, the solution is purple and has pH 13–14 because there is an excess of OH^- ions. While the H_2SO_4 is being added, the solution becomes blue with a pH of 8–10. There is still an excess of OH^- ions, but not as big. When the numbers of H^+ and OH^- ions are equal, the solution is neutralised, green and the pH is 7. As more H_2SO_4 is added, the solution becomes yellow pH of 4–5. There is a small excess of H^+ ions but not as big. As more H_2SO_4 is added, the solution becomes red with a pH of 1–2. There is a significant excess of H^+ ions.	• Describes two correct colours in correct order as H_2SO_4 is added (other than purple). • Links two pH values to correct colour. • Identifies that OH^- ions are neutralised as H^+ ions are added. • At pH7 /green/neutral, - acid and base cancel out. OR $H^+ = OH^-$ at pH 7.	• Explains that before any H_2SO_4 is added, the OH^- ions are in excess, and as more H_2SO_4 is added, the concentration of H^+ ions increases until H^+ ions are in excess. • Explains that once a sufficient number of H^+ ions have been added to neutralise all the OH^- ions(to form water), the pH equals 7. • Links all UI colours (red, yellow / orange, green, blue/purple) to EITHER correct pH values OR relative concentrations of ions present.	• Fully explains and links the colour changes to the changing pH, relative concentration of H^+ ions and OH^- ions present, and neutralisation reaction occurring (pH 7 when $H^+ = OH^-$ and neutral substances/water made).

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No response or no relevant evidence.	ONE Achievement point.	TWO Achievement points.	THREE Achievement points.	FOUR Achievement points.	TWO Merit points.	THREE Merit points.	TWO Excellence points with minor omission from (c)	TWO Excellence points.

Q	Evidence	Achievement	Merit	Excellence
THREE (a)	Magnesium carbonate + nitric acid → magnesium nitrate + water + carbon dioxide $MgCO_3 + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2O + CO_2$	• Correct word equation.	• Correct symbol equation, but unbalanced.	• Fully balanced symbol equation.
(b)(i)	One of the products is carbon dioxide gas. The gas escapes, and so the mass of the flask and its contents decreases.	• Gas escapes.	• CO_2 gas is lost, (so the overall mass decreases).	
(ii)	When reactant particles collide successfully, they form product particles. As the reaction progresses, the number of reactant particles decreases, the frequency of successful collisions decreases, leading to a slower rate of reaction. **Section A:** There are more reactant particles, so more collisions per second. More product particles are being formed, including more gas, so more gas escapes and the mass decreases quickly. **Section B:** There are fewer reactant particles, so fewer successful collisions per second and so less product is being made, so the mass decreases less quickly. **Section C:** The reaction has stopped as one of the reactants has been used up, so there are no more collisions between reacting particles.	• Describes rate in ONE section • Links number OR concentration of reactant particles present to number of collisions.	• Explains rate in TWO sections linked to reactants or products and particle collisions, e.g.: *A: There are many reactant particles, so more collisions.* *B: Reaction is slowing as there are fewer particles to collide.* *C: Reaction has stopped as there are no more reactant particles to collide*	• Full explanation of rate in each stage including a link between number of particles available to collide AND reaction rate and so the mass of the flask/volume of carbon dioxide gas escaping.
(c)	As the temperature of the nitric acid increases, the particles move faster and have more (kinetic) energy. There are more collisions per second between the acid and the carbonate particles due to higher speed, and more of these collisions have enough energy to cause a reaction. Therefore, increasing the temperature will cause more successful collisions per second, and the reaction will occur faster.	• *Increasing* temperature causes more (frequent) collisions OR particles have more energy/move faster OR converse. • Reaction occurs when particles collide successfully. OR More (successful) collisions per second cause a faster rate of reaction (or from above).	• Explains that the higher the temperature, the more frequent collisions are due to higher speed of particles. OR The more frequent collisions are due to greater energy / force for reaction. OR The equivalent for lower temperature.	• Fully explains that increased temperature leads to faster particles colliding more often AND more energetic particles, so more successful collisions between the (carbonate and acid) particles, and so a faster rate of reaction. OR Converse lower temp.

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No response or no relevant evidence.	ONE Achievement point.	TWO Achievement points.	THREE Achievement points.	FOUR Achievement points.	TWO Merit points.	THREE Merit points.	TWO Excellence points.	THREE Excellence points (can have minor omissions)

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 6	7 – 13	14 – 19	20 – 24