C4.3 Pre-Unit Quiz: Quantitative Chemistry

Mark Scheme

Section A

Qu	Answer	Marks	Supporting information for fix-it tasks
1	A	1	Answering B suggests the misconception that CO_3 is an atom. *To fix it, ask students to write out which elements are present in $MgCO_3$.* Answering C suggests the misconception that the subscript number refers to all elements in the compound. *To fix it, reteach what the subscript numbers and the coefficients mean and then give students more practice questions to determine the numbers of atoms.*
2	C	1	Answering A suggests the misconception that because an aqueous solution is liquid, then the state symbol is (l). Answering B suggest the misconception that because solution starts with 's' the state symbol is (s). *To fix it, reteach the state symbols and then ask students to write out the state symbols in books. Then give them a symbol equation from Q2 and ask them to add in the state symbols.*
3	B	1	Answering A suggests the misconception that gases do not have mass. Answering C suggests a misconception that reactants have more mass than the products that they form. *To fix it reteach: The law of conservation of mass indicates that mass cannot be created or destroyed. The **total mass reactants = total mass products**, even if a gas is produced. Then give students examples of masses to calculate how much of x is produced to practice applying this.*
4	B	1	Answering A or C suggests a gap in knowledge about how salt compounds are derived from neutralisation reactions. To fix it, *reteach this by modelling how to deduce which metal reacts with what non-metal in a neutralisation reaction to form the salt.*
5	C	1	Answering A shows a gap in knowledge about when to convert units. *To fix it, model how A would be correct if the units were cm and not dm^3. Then give students similar practice questions to do.* Answering B shows a gap in knowledge about how to calculate concentration since this option is concentration/mass. *To fix it, reteach how to calculate concentration, focussing on how the units tell you what concentration is, i.e. 200 g in/per 1 dm^3 of volume. Then ask students to write out this question and label the mass, volume and then show how to calculate concentration i.e. 200/1.*
6	A	1	Answering B shows that the relative atomic masses have simply been added which suggests a gap in knowledge about the effect of the subscript number. *To fix it, remind students that the subscript number after an element symbol tells you how many*

			atoms of that element are in the formula. Then ask students to calculate the Mr of CO_3. Answering C shows a misconception that the number 2 applies to the whole formula which suggests a confusion of the subscript number with coefficients. *To fix it, reteach what these two numbers mean in a chemical formula and then ask students how many atoms of each element are in HCl, $MgCl_2$, H_2SO_4, $(NH_4)_3PO_4$.*
7	A	1	Answering B shows a gap in knowledge of the function of beakers since they are not designed for the accurate measurement of volume. *Show students a beaker and a measuring cylinder and highlight that a measuring cylinder has graduated markings to show volume, whereas beakers don't have that amount of detail. Ask students to compare the uses of measuring cylinders and beakers and explain why they are used that way.* Answering C shows a gap in knowledge of the function of evaporating since they are not designed for the accurate measurement of volume. *To fix it, demo an attempt to measure $10cm^3$ water in an evaporating dish and then use a measuring cylinder. Discuss with students which equipment can measure volume accurately and why.*
8	B	1	Answering A shows a misconception that the lowest number is simply the anomaly. *To fix it, reteach how to spot an anomaly using model data and then ask students to explain why there isn't an obvious anomaly in this data.* Answering C shows a gap in knowledge about precise results because these results vary around the mean so are not precise. *To fix it, reteach that precise results don't vary much around the mean then ask students to evaluate whether these results are precise or not.*
9	A	1	Answering B or C suggestions a confusion of the steps of the making salts practical, because evaporation and crystallisation would not allow insoluble copper carbonate to be separated. *To fix it, ask students to write a brief description for the purpose of each of these techniques.*
10	A	1	Answering B suggests a confusion between a hazard and a precaution. *To fix it, recap the difference between a hazard and the precaution to take to prevent the hazard from happening. Then ask students to write the hazard and a precaution for using glassware.* Answering C suggests a confusion between a hazard and a risk. *To fix it, recap the difference between a hazard and the risk of that hazard happening. Then ask students to write the hazard and the risk of using glassware.*
11	C	1	Answering A shows an incorrect conversion, although the student has correctly multiplied for the conversion. *To fix it, remind students that the difference between dm and cm is 1000 and then ask students to convert from dm to cm using many practice questions.*

			Answering B shows a misconception that you divide by 1000 to convert from dm to cm. *To fix it, reteach the order of magnitude of volumes from cm to dm and show that dm is 1000 greater than cm. then model how to do this calculation and then ask students to do a similar calculation showing all their workings.*
12	C	1	Answering A shows a misunderstanding of the use of the subscript outside the brackets – relating it to the PO_4 rather than the NH_4 inside the brackets. Answering B shows students do not understand that the number in subscript after the brackets relates to everything inside the brackets. Answering D shows the student added the subscripts 3 and 4 rather than multiplying. *To fix these issues, reteach what the subscript number means and how brackets affect the number of atoms. Then give more practice questions that include brackets.*
13	B	1	Answering A shows that the student has divided mass by volume to get concentration (and so uses the formula correctly), however has mistakenly converted the volume from cm^3 to dm^3. *To fix it, give students some similar calculations, with a mixture of questions requiring and not requiring unit conversions.* Answering C indicates that student has divided volume by mass instead of the other way around. *To fix it, reteach the equation and how to use this to get the value they need. Give students similar calculations to practise.*
14	B	1	Answering A shows a gap in knowledge about the difference between elements and compounds. To fix it, r*eteach the definitions of elements and compounds using examples. Then ask students to write out all the elements and all the compound from the quiz.* Answering C shows a gap in knowledge about the reactants needed to make copper sulfate. *To fix it, write out the symbol formulae for B and C to show that copper sulfate can only be produced from option B.*
15	C	1	Answering A suggests a gap in knowledge about balanced equations because there is no attempt to balance A. *to fix it, ask students to write out how many atoms of each element are in the reactants and the products and then explain why it is not balanced.* Answering B suggests a misconception that the subscript 3 in NH_3 applies to the N as well as the H. *to fix it, reteach what the coefficient and the subscript numbers mean and then give practice examples of compound formulae to deduce the number of types of atoms.*