#### ISMG EXPLAINED – Research Investigation (Assessment Item No. 3)

The table below outlines the four separate marks that will be awarded to different parts of your research investigation.

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| **Criterion** | **Marks** |
| Research and planning | **6** |
| Analysis and interpretation | **6** |
| Conclusion and evaluation | **6** |
| Communication | **2** |
| **Total** | **20** |

##### Criterion: Communication

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| **The student work has the following characteristics:** | **Marks** |
| * effective communication of understandings and research findings, arguments and conclusions about properties and structure of materials, or chemical reactions (reactants products and energy change), or rates of chemical reactions demonstrated by   + **fluent and concise use of scientific language and representations**   The term “scientific language and interpretations” is very broad and applies to all your writing. However, it will generally also be specific for any scientific terms and theory that you include – especially things like chemical formula or equations (use subscripts and superscripts). Some scientific terms have very specific meaning in science that is different to their everyday meaning – as an example, the terms weight and mass are commonly misused in everyday language (weight is measured in newtons, not kilograms), so do not make these mistakes in your response.  Use the TEEL technique for paragraphs to show fluency, and ensure that paragraphs within each heading are linked together by using common words. Do not change topic within a paragraph – stick to your topic sentence.  To show concise, simply be specific and do not repeat arguments (to make a point). Avoid putting in information or argument that is not directly connected to your research question.   * + **appropriate use of genre conventions**   This is a very holistic judgement by your teacher, but avoid some basic errors. The most obvious error is using any persuasive or “common” language (wrong genre), or writing in a sensationalist style such as a newspaper report. Less obvious errors include   * not labelling (or poorly labelling) diagrams and tables * not including units in your table headings (units should be in the header row of the table not the other rows) * using informal language and personal pronouns * Changing tense – past tense used to be the standard and it is still generally recommended.   + **acknowledgment of sources of information through appropriate use of referencing** **conventions**.   Use in-text referencing and the Harvard style for your reference list. In your reference list, include only the sources for which you have an in-text reference (otherwise it becomes a bibliography). | 2 |

##### Criterion: Research and planning

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| **The student work has the following characteristics:** | **Marks** |
| * informed application of understanding of the properties and structure of materials, or chemical reactions (reactants products and energy change), or rates of chemical reactions demonstrated by a * **considered rationale identifying clear development of the research question from the claim**   Begins with a discussion/explanation/interpretation of the claim, and identifies how the specific terms of the research question have evolved (gradual progression) from the claim statement.  Means a careful (concise) and deliberate (no extra stuff, all on topic, and sequential development of ideas) discussion of the relevant theory   * effective and efficient investigation of phenomena associated with properties and structure of materials, or chemical reactions (reactants products and energy change), or rates of chemical reactions demonstrated by   + **a specific and relevant research question**   Is a narrowing of the claim statement and still covers (is relevant to) the topics listed in the bulleted point above the criteria.  Has terms within the research question that have clearly defined limits (not general or broad).   * + **selection of sufficient and relevant sources.**   Each source has data that is used to support or contradict your research question and the source offers the fullest and latest evidence in that scientific area. As a general rule check with your teacher if your sources are over 10 years old.  It is difficulty to state a minimum number of sources to be “sufficient”. It is recommended that you have more than one data source and no more than five. More importantly, the data you have must cover the scope of the research question. If it does not, you do not have sufficient sources. If you have only one data source you could include a statement as to why you think there is limited sources available. | 5–6 |

##### Criterion: Analysis and interpretation

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| **The student work has the following characteristics:** | **Marks** |
| * systematic and effective analysis of qualitative data and/or quantitative data within the sources about properties and structure of materials, or chemical reactions (reactants products and energy change), or rates of chemical reactions demonstrated by   + **the identification of sufficient and relevant evidence**   The data in your source must obviously relate directly to the research question, or you need to provide an argument as to how it relates to the research question  There is enough or adequate data used in your arguments to cover the scope of the research question and it is used to cover the scope.   * + **thorough identification of relevant trends, patterns or relationships**   All relevant trends, patterns or relationships are identified within the data with attention to detail. It would help if you began with the most significant or obvious identifications and worked towards those which may be less significant or obvious.   * + **thorough and appropriate identification of limitations of evidence**   All limitations of the data are identified with attention to detail. It would help if you began with the most significant or obvious identifications and worked towards those which may be less significant or obvious.  All relevant rends, patterns or relationships are identified within the data with attention to detail. It would help if you began with the most significant or obvious identifications and worked towards those which may be less significant or obvious.   * insightful interpretation of research evidence about properties and structure of materials, or Chemical reactions (reactants products and energy change), or Rates of Chemical reactions demonstrated by * **justified scientific argument/s.**   Each identification is supported with logical reasoning and scientific evidence (your data or reference to other scientific study). What does this mean?  If you look at the first 3 criteria above, they all contains the term “identification of”. This last criterion is assessing that you have clearly explained how you made those identifications. In your explaination, you should be using the data itself or some other scientific theory (or study) to justify your identification. If you use a scientific theory or study, you should include a reference to it. | 5–6 |

##### Criterion: Conclusion and evaluation

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| **The student work has the following characteristics:** | **Marks** |
| * insightful interpretation of research evidence about properties and structure of materials, or chemical reactions (reactants products and energy change), or rates of chemical reactions demonstrated by * **justified conclusion/s linked to the research question**   Make decisions that clearly link the data to the research question AND support these with sound and logical reasoning. Note that you can make only one conclusion if you wish, however do this only if one conclusion is all that is possible to make. If there are other obvious conclusions and you do not state them then you risk losing marks here.  The next three criteria all cover making conclusions that may not strictly be covered by the data you have in your sources, so you have some flexibility here.  Use your data to make conclusions which clearly support or contradict your research question   * critical evaluation of the research processes, claims and conclusions about properties and structure of materials, or chemical reactions (reactants products and energy change), or rates of chemical reactions demonstrated by   + **insightful discussion of the quality of evidence**   You need to show an understanding of how the quality of the data/evidence relates to the validity of the conclusions about your research question. The simplest way to do this is to explain how the limitations of the data/evidence impacts the scope or the validity of your conclusions. If your data/evidence has allowed you to make valid conclusions about your research question, you should explain the aspects of the data which allowed this. This analysis must be consistent with your previous identifications of the limitations of your evidence.   * + **extrapolation of credible findings of the research to the claim**   You must show how at least one of your (most valid) conclusions can be extended beyond the scope of the research question to the broader context of the claim statement.   * + **suggested improvements and extensions to the investigation that are considered and relevant to the claim.**   There are two ways to suggest improvements AND extensions (you must do both). The first is to look at the data in your sources. Can you suggest more data sets were collected (greater range of data) or more trial conducted for each data set? These are improvements, and only do this if appropriate, do not use this as a fall back option. The second is to suggest a new research topic. This is an improvement if the new target is within the scope of your sources, and an extension if it is outside the scope of your sources. You should explain it in those terms.  The improvements and extensions must clearly link to the quality of the evidence discussed earlier. They can relate to the claim statement so you are not limited by the scope of your research question. | 5–6 |