**Design Practical Investigation**

Refer pages 8 and 9 of the 2021 Subject Outline for both Stage 1 and Stage 2 Nutrition.

Performance standard: **IAE1**

Designing a practical investigation from a question with **Justification**

**DESIGN guidelines**

**The design write-up is suggested to be approximately 3 A4 pages in length.**

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|  | **Design**  Scientific methods enable systematic investigation to obtain measurable evidence.  Students should provide evidence of how well they have achieved the following student learning’s. | Teacher check and comments.  (related to performance standards) |
| **IAE1**  **KA2**  **KA4**  (written in the impersonal **present** tense when designing/ but **past** tense when writing the report) | **Design investigations**, including:   * A hypothesis or inquiry question * Types of variables * Dependent * Independent * Factors held constant (how and why they are controlled and justify) * Factors that may not be able to be controlled (and why not and justify) * Materials required (justify choice of materials and equipment) * The procedure to be followed (where appropriate justify choices of procedure) * The type and amount of data to be collected (SI units, how many tests to be conducted: sample size) * Table to record the data from the investigation * Identification of ethical and safety considerations.   -- Risk factors, safety concerns and  -- Ethical considerations   * Identification of management of potential risks and hazards | Justification can be stated in note form, in a different colour, perhaps in a text box, so that it is straight forward to follow the actual design. |

**Possible process**

**Part A:** Students must individually design a practical investigation with justification (it is not a group effort) from the question/topic provided by the teacher.

**Note:** Designs that just modify existing methods are not a true indication of a students ability in designing investigations.

In small groups students can then select a design they want to conduct.

**Part B:** Students conduct the chosen design, collate data, draw up tables and graphs and write an individual report.

Alternately the teacher can provide the students with an investigation the class is to conduct, collate etc and write an individual report.

**Design and Practical ideas (Starting points/ideas)**

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| **Topic** | **Manipulation practical** | **Design questions** |
| **Topic 1**  Macro/micro nutrients  Digestion  Diet related disease  Life cycle | Macronutrients present in foods  Micronutrients present in foods – Vitamin C levels  Nutritional energy values of foods  Digestion of food  Digestion of simple and complex carbohydrates and release of blood glucose into blood stream (diabetes)  Absorption of iron in varying pH | All proteins have the same energy value  The more processed a food the quicker glucose is released into the blood stream **(Glucose)**  With an increase in acidity the greater the absorption of iron  Scott’s diet was the problem |
|  | How effective are digestive enzymes?  How effective are the consumption of vitamins and minerals effective against micronutrient deficiency diseases? |
| **Topic 2**  Microbes  Additives  Diagnostic tools  Educational aids  Advertising  Sociology of food | Diagnostic tools in assessing individual’s health – BMI  Sensory analysis tests of foods  Chemo-receptors, sugar and bliss point | Not all diagnostic tools are effective in assessing the health of an individual (Diagnostic tools)  With an increase in sucrose concentration the greater the preference for consumption of a food **(Bliss point)** |
|  | How effective are diagnostic tools in measuring general health of an individual?  How to test the bliss point ?  Is there a bliss point?  The bliss point is fake? |
| **Topic 3**  Food systems  Processing  Food innovations  New foods  Food waste | Carbon footprint of foods | Fresh fruit and vegetables have a lower carbon footprint than processed foods  The greater the processing the greater the loss of micronutrients  Food trends result in greater environmental damage |
|  | Reducing food miles will minimise food waste |

**Planning and mapping their ideas**

Lotus square to organise ideas and determine the independent, dependent and controlled variables.

Should help in designing the methods.

**Rubric guideline to assist student/teacher**

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|  | **Statement levels** |  | **E** | **D** | **C** | **B** | **A** |
| Insufficient evidence | Student at this level completes the basic sections of a designed investigation | | Student at this level can make links between sections of the designed investigation | Student at this level makes clear links between sections of the designed investigation | Student at this level designs a detailed and relevant investigation with clear justifications |
| **Design** | **Designs an investigation** | | | | | | |
| **States a hypothesis, independent and dependent variable** | Insufficient evidence | States a clear aim for investigation, writes a hypothesis | Hypothesis is relevant to the aim and the biological background information | Writes a hypothesis as an IF and THEN statement (prediction) | Accurately identifies the independent, and dependant variables | States a clear and accurate prediction of what results will support the hypothesis  Hypothesis explicitly linked to the method |
| **Identify the controlled and uncontrolled variables** | Insufficient evidence | Attempts to identify the relevant variables for the experimental design | Accurately identifies the relevant controlled and uncontrolled variables | States the variables that are held constant (controlled) and explains why and how they are controlled | States the variables that may not be held constant (uncontrolled) and explains why they may not be controlled | Clearly justifies why or why not the variables can be held constant |
| **Materials and Method provided** | Insufficient evidence | Prepares an outline of a method with required materials | Describes how results are being collected and measured (units) | Has specified relevant SI units and sample size | Design is a coherent and detail method relevant to the hypothesis | Justifies choice of materials, equipment and method where appropriate |
| **Constructs table to record data** | Insufficient evidence | Attempts to construct table to present data collected | Constructs table to present data collected | Constructed table has appropriate rows for independent variable and columns for dependent variable with headings | Constructed table accounts for sample size and an averages column | Constructed table has all the correct conventions and format |
| **Safety audit**  **Identifying any risk** | Insufficient evidence | Identifies risks | Identifies risks and outlines strategies to reduce risks with reference to personal protection |  | Outlines strategies to reduce risks with reference to disposal of waste material | Conducts experiment in accordance with safety protocols |
| **Communication** | **Uses scientific language** | Insufficient evidence | Language is informal in the personal tense | Language is formal in the impersonal tense | Uses relevant scientific terminology | Uses scientific terminology specific to the concept being investigated | Information is presented sequentially according to scientific conventions |
| **Marks** | **I or 0** | **1-3** | **4-6** | **7-9** | **10-12** | **13-15** |

**TABle AND GRAPHING guidelines**

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| --- | --- |
| **Results**  (any written description is done is in the impersonal **past** tense) | An actual record of your results. Includes data presented as a table, in graphs, labelled diagrams and annotation describing the pattern of results.  **Tables include:**   * Heading. * Labelled columns and rows. * Units of measurements recorded. * Independent variable in first column. * Dependant variable in subsequent columns.   **Graphs include:**   * Heading * Labelled x and y axis * Constant scale for each axis, (change in scale should have a break line). * Independent variable is on the X axis. * Dependent variable is on the Y axis. * Key/legend if there is more than one line in the graph. * ONLY the AVERGAE is plotted. * Correct graph used to plot the results (line, column or pie). * Reasonable sized graph. * Accurately plotted points **(line of best fit).**   **Diagrams include:**   * Drawn in pencil * Labelled * Clear straight lines * Large in size (quarter to one third of the page). |

**BIOLOGY PRACTICAL ASESSMENT TABLE (drafting and/or marking) 1500 words (yr12) and 1000 words (yr11)**

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|  | **Report headings and Intended Student Learnings**  In their laboratory work and their written report, students should provide evidence of how well they have achieved the following student learning’s. | Teacher check and comments.  (related to performance standards) |
| **IAE1**  **KA2** | **Design**  Design a method and justify the experimental design, with table to collate data. | **Not part of the word count**  Approx. 3 pages in length |
| **Introduction**  **IAE1,**  **KA1,**  **KA4**  (written in the impersonal) | * State the purpose of the investigation or experiment. * State the key ideas or relevant nutritional background information * State the testable hypothesis (aim). * Formulate a question for the investigation. * Suggest possible investigations to test the question and make a prediction. | **(approx. 100 words and approx. 75 words when discussing hypothesis, independent, dependent, controlled and uncontrolled variables)** |
| **Materials and methods**  **IAE1**  **KA2**  (Must be in the report write up,  written in the impersonal **past** tense when in the report  but **present** tense when designing/ deconstruction) | A step by step plan of how to conduct the practical in past tense. This includes:   * Each step was numbered * Describe the steps of the investigation or procedure (in past tense) and justify (if relevant) * Include any alterations that occurred when the experiment was carried out on the day and justify (if relevant) * Identify and classify variables (independent and dependent variables) * Identify any factors that are deliberately held constant (controlled variables) and justify * Identify variables that could not be controlled and explain why * Identify type and amount of data that will be collected * State how the data was collected (method and/or equipment used) and measured (units and how many significant figures). * Specified the sample size * Collect data using measurements that can be reproduced consistently. * Select an instrument of appropriate resolution (number of significant figures) * Construct a relevant table to collate group and class (if relevant) data | **Not part of the word count** |
| **Results**  **IAE2**  **KA4**  (any written description is done is in the impersonal **past** tense) | An actual record of your results. Includes data presented as a table, in graphs, labelled diagrams and annotation describing the pattern of results.   * Record and analyse observations * Use measurements to an appropriate number of significant figures * Distinguish between quantitative and qualitative evidence * Record careful and honest observations * Use a table to present the data (*use averages to graph data*) * Plot a graph of dependent variable verses independent variable * Draw a line of best fit through a series of points on a graph | **The actual tables or graphs are not part of the word count**  **Note written description below tables and graphs are part of the word count** |
| **Discussion**  **IAE3**  **KA1**  **IAE4**  **KA1**  (written in impersonal **past** tense) | **Analysis of the results of investigation (approx. 300 to 400 words)**  Analysis of data including:   * Identification and discussion of trends, patterns and relationships * Referred to data in table or graphs   **Critical evaluation of procedures and data (approx. 600 to 700 words)**  Identify sources of uncertainty of the results including:   * Random and systematic errors   Evaluation reliability, accuracy, and validity or results, by discussing factors including:   * Sample size. * Random error * Systematic error * improvements | Demonstrate knowledge and understanding of the nutrition  Use scatter in the graph to determine random errors  Use ‘true value’ if known to determine systematic errors  Determine which results are ‘most accurate’  Consider the importance of replication of the method and repetition of experiment |
| **Conclusion**  **IAE3**  **KA4**  (written in impersonal **past** tense) | Conclusions can be formulated that **relate to the hypothesis or inquiry question**   * Select and use evidence and scientific understanding to make and justify your conclusion * Recognise the limitations and how to improve outcomes of the experiment * Recognise the results of some investigation may not lead to definitive conclusions | **(approx. 100 words)**  Write a conclusion that is based on the results of an investigation. |
| **Communication**  **IAE1**  **IAE2**  **KA1**  **KA4** | **Effective scientific communication** is clear and concise.   * Communicate to specific audiences and for specific purposes using (practical report): * appropriate language (written in impersonal past tense and a practical report) * terminology (Nutritional, scientific and experimental design terminology) * conventions (appropriate SI units, symbols, construction of appropriately labelled tables and graphs, drawing of graphs with linear, non-linear, or lines of best fit (trend line), use of significant figures) * Communication of knowledge and understanding of nutrition * Use language and graphics concisely to present information | Did research scientific article or experiments  Does reference and/or footnote if relevant  Provides a bibliography or reference list if relevant |
| **Bibliography/**  **Reference list** | **e.g. Harvard system,**  Sources correctly cited | **Not part of the word count** |