**STAGE 2 NUTRITION**

**ASSESSMENT TYPE 1: Investigations Folio**

**Core Topic 1: Energy Content of Macronutrients**

**Purpose:**

This task provides you with the opportunity to work safely and collaboratively in a completion type practical in which you are provided with the method to investigate whether or not the energy released by burning food samples matches the energy data provided by nutrition panels.

**Description of Assessment:**

Provides a context for the investigation.

**Introduction**

By burning pieces of food, the chemical energy stored in molecular bonds is released as heat and light. The heat can be measured in units called **kilojoules**. The more kilojoules a food contains, the more heat is given off when burned. Foods high in kilojoules will release large amounts of energy. One gram of a protein will release fewer kilojoules than one gram of fat.

**Part A**

The formative part of this practical must be completed before beginning Part B. It provides opportunity to practise skills such as:

* setting up apparatus

The formative practical enables students to develop relevant skills for the assessment.

* securing food to spike
* lighting food
* recording temperature change
* assessing when food is extinguished
* calculating energy released
* recognising random and systematic errors
* evaluating the results and success of the practical.

**Part B**

a. Write your own investigation prediction indicating what you expect to discover about the amounts of energy that will be released from cheese and bacon balls compared with the amount of energy released by microwave popcorn when you have completed the practical. Your experience in the formative practical may assist you in this.

Part B b) enables students to work collaboratively as required in the subject outline.

b. Work in small groups and, using the method provided, complete the investigation using the method provided and record results from the investigation. Share your results with the other groups in the class.

**Part C**

Prepare an individual report on the practical investigation in which you:

Supports students at all levels to provide evidence against the specific features being assessed.

* identify the prediction you prepared before starting Part B
* attach the materials and method provided
* complete the tables of results attached, with raw data included in the appendices
* analyse and evaluate the data and procedures and include a discussion of possible errors, the reliability of the data, and with suggestions for improvement
* formulate a conclusion
* review safety and collaborative practices.

**Assessment Conditions:**

You work in a small group for Part A and Part B (the groups do not have to be the same for each part).

You need to prepare an individual report (Part C) which follows the guidelines provided at the end of the data section.

The report is due one week after the completion of the practical, you are able to submit one draft to the teacher for feedback during this time.

|  |  |  |
| --- | --- | --- |
| ***Learning Requirements*** | ***Assessment Design Criteria*** | ***Capabilities*** |
| 1. Identify and formulate questions, hypotheses, and purposes that guide nutrition investigations and their design 2. Design, safely conduct, and evaluate investigations, and apply knowledge and problem-solving skills to individual and collaborative practical tasks 3. Select and use evidence to analyse, compare, and evaluate strategies for the prevention and management of disorders related to diet and lifestyle, and to make recommendations for promoting good health 4. Communicate knowledge and understanding of nutrition using the terms and conventions of the language of nutrition to suit particular purposes and contexts 5. Critically evaluate and apply knowledge and understanding of nutrition to identify and explain decisions based on ethical, personal, social, environmental, and/or economic factors that influence the diet and lifestyle choices of individuals and communities 6. Demonstrate knowledge and understanding of, and respect for, varying cultural influences on diet and lifestyle decisions. | Investigation The specific features are as follows:   * + I1 Design of nutrition investigations.   + I2 Selection and acknowledgment of information about nutrition and issues in nutrition from different sources.   + I3 Manipulation of apparatus, equipment, and technological tools to implement safe and ethical investigation procedures.   + I4 The obtaining, recording, and display of findings of investigations using appropriate conventions and formats.  Analysis and Evaluation The specific features are as follows:   * + AE1 Analysis of data and concepts and their connections, to formulate conclusions and make relevant predictions.   + AE2 Evaluation of procedures, with suggestions for improvements.  Application The specific features are as follows:   * + A1 Application of nutrition concepts and evidence from investigations to solve problems and to promote good health in new and familiar contexts.   + A2 Use of appropriate nutrition terms and conventions.   + A3 Demonstration of skills in individual and collaborative work.  Knowledge and Understanding The specific features are as follows:   * + KU1 Demonstration of knowledge and understanding of nutrition concepts.   + KU2 Use of knowledge of nutrition to understand and explain issues related to diet, lifestyle, culture, and health.   + KU3 Communication of knowledge and understanding of nutrition in different contexts, using different formats. | Communication  Citizenship  Personal Development  Work  Learning |

**Information for PART B**

Table 1: Energy and Macronutrient Content of Popcorn and Cheese and Bacon Balls

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **All Nutrient Values are per 100g Edible Portion (EP)** | | | | | | |
| **Food  Item** | **Energy (kJ)** | **Protein (g)** | **Fat (total) (g)** | **Fat (saturated) (g)** | **Carbohydrate (g)** | **Sugars (g)** | **Sodium (mg)** |
| Microwave Popcorn | **1920** | **9.0** | **24.8** | **8.0** | **41.9** | **3.5** | **1300** |
| Cheese & Bacon balls | **2310** | **6.0** | **33.7** | **16.8** | **54.9** | **3.2** | **966** |

Using the information contained in Table 1 write a suitable investigation prediction below:

**Investigation Prediction:**

**Introduction**

Energy content is an important property of food. The energy your body needs for physical activities and thinking comes from the food you eat. Energy content is the amount of heat produced by the burning of 1 gram of a substance, and is measured in joules per gram (J/g).

You can determine energy content by burning a portion of food and capturing the heat released to a known mass of water in a calorimeter. If you measure the initial and final temperatures, the energy released can be calculated using the equation:

Q = m x △T x Cp

Where:

Q = heat energy absorbed (in J),

m = mass (in g),

△T = change in temperature (in °C),

Cp= specific heat capacity (4.185 J/g°C for water).

**Note:** Dividing the resulting energy value by grams of food burned gives the energy content (in J/g).

**Equipment and Materials List:**

* thermometer
* retort stand clamps (x1)
* burette clamp (to hold needle)
* electronic scales
* measuring cylinder (100 mL)

The method and the detailed materials list support students to complete the investigation successfully.

* cardboard lid calorimeter (metal can)
* popcorn (x6 )
* cheese and bacon balls (x6 )
* alfoil
* matches
* mounted needle.

**CAUTION:** *Do not eat or drink in the laboratory.*

**Procedure: (work in pairs or maximum of three).**

1. Obtain and wear goggles/aprons.

Retort Stand

Thermometer

Cardboard lid

Calorimeter

Calorimeter

Mounted  
needle

Food Sample

Clamp

Al Foil

Cardboard lid

2. Place ***2*** popcorn (or ***2*** cheese balls) on a mounted needle.

3. Find and record the initial mass of the popcorn, alfoil and mounted needle in grams using the electronic scales.

4. Set up the apparatus as shown in the diagram.

5. The top of the food sample  
*should be approximately 2 cm below the bottom*  
of the calorimeter.

6. Place about 50.0 mL of cold water into the calorimeter.

7. Record the initial temperature of the water.

8. Light the food sample directly under the center of the calorimeter using matches (it may take 2 matches).   
**CAUTION:** *Keep hair and clothing away from open flame.*

9. Allow the water to be heated until the food sample stops burning. Keep stirring the water until the temperature stops rising. The thermometer should not touch the bottom of the calorimeter.  
Record this final temperature.

10. Determine the final mass of the food residue, alfoil and mounted needle in grams using the electronic scales.

11. Wash and dry the calorimeter (ie remove any soot etc).

**CAUTION:** *The calorimeter could be hot and the remains of the burnt food are extremely hot. Place remains of burnt biscuit in cold water container.*

12. Repeat the procedure for the second and third sample of food.

**Note:** Use a new 50.0 mL portion of cold water for each sample.

13. Repeat Steps 1-12 for the cheese balls

14. When you are done, place burned food, used matches, and partly-burned matches in the container supplied by the teacher and clean up the work bench.

Results:

**Table 2: Raw Data: Combustion of Popcorn and Cheese Balls.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Food Combusted** | **Microwave Popcorn** | | | **Cheese / Bacon Balls** | | |
| **Trial** | **1** | **2** | **3** | **1** | **2** | **3**  Step-by-step recording of data guides student through complex calculations. |
| Mass of food, alfoil & mounted needle (initial) (g) |  |  |  |  |  |  |
| Mass of food, alfoil & mounted needle (final) (g) |  |  |  |  |  |  |
| Mass of Food combusted (g) |  |  |  |  |  |  |
| Mass of water (g) **[m]** |  |  |  |  |  |  |
| Initial water temperature (°C) tinitial |  |  |  |  |  |  |
| Final water temperature (°C) tfinal |  |  |  |  |  |  |
| Temperature Change (°C) **[**△**T]** |  |  |  |  |  |  |

**Processing the Data**

1. Calculate the mass of the food sample combusted. See Table 2 values.

2. Calculate change in water temperature **(**△**T)** for each sample, by subtracting the initial temperature from the final temperature (△**T** = tfinal – tinitial).

3. Use the formula below to convert your raw data into kJ / 100g of food combusted.

Energy per 100 g = = *kJ per*

*100 g food combusted where:*

m = mass of the water heated (in g),  
△T = change in temperature (in °C),  
Cp = specific heat capacity (4.185 J/g°C for water).

4. Record your results below:

Table 3: Processed Data / Group Table 4: Class data – Mean / Group

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Food 1 : Popcorn** | |  | **Student Group** | **Mean Energy100g (kJ)** | |
| **Student Group** | **Energy released per 100g (kJ)** |  | **Popcorn** | **Ch / Bacon Balls** |
|  | 1 |  |  |
| Trial 1 |  |  | 2 |  |  |
| Trial 2 |  |  | 3 |  |  |
| Trial 3 |  |  | 4 |  |  |
| Total |  |  | 5 |  |  |
| **Mean** |  |  | 6 |  |  |
|  |  |  | 7 |  |  |
|  | |  | 8 |  |  |
|  | |  | 9 |  |  |
|  | |  | 10 |  |  |
| **Food 2 : Cheese and Bacon Balls** | |  | 11 |  |  |
| **Student Group** | **Energy released per 100g (kJ)** |  | 12 |  |  |
|  | 13 |  |  |
| Trial 1 |  |  | 14 |  |  |
| Trial 2 |  |  | 15 |  |  |
| Trial 3 |  |  | 16 |  |  |
| Total |  |  | 17 |  |  |
| **Mean** |  |  | **Class Mean** |  |  |

**Part C (Summative Assessment – Individual work)**

**Submit practical write up in the following format**:

a. Investigation prediction

Teacher signature enables verification of accuracy of data obtained by student. **(Investigation)**

b. Materials – attach the list provided

c. Method – attach the method provided

d. Submit tables of results using appropriate conventions (Raw data as an appendix – teacher signature required).

e. Discussion of results including:

* data analysis
* strengths and weaknesses
* reliability of the practical, including identifying random and systematic errors
* suggested improvements

1. Draw a conclusion and formulate logical explanations regarding your results.
2. Write a brief comment about how effectively your group worked together and relevant aspects of safety.

**Additional comments**

* Teacher observation during the implementation of the investigation, together with the student’s own review, enables assessment of safety and manipulation of apparatus **(Investigation)** and collaboration **(Application).**
* Evidence from this investigation contributes to an overall assessment for the Investigations Folio of a student’s use of appropriate nutrition terms and conventions **(Application)** and the communication of knowledge and understanding of nutrition in different contexts, using different formats **(Knowledge and Understanding).**

Performance Standards for Stage 2 Nutrition

|  | Investigation | Analysis and Evaluation | Application | Knowledge and Understanding |
| --- | --- | --- | --- | --- |
| A | Designs logical, coherent, and detailed nutrition investigations.  Critically and logically selects and consistently and appropriately acknowledges information about nutrition and issues in nutrition from a range of sources.  Manipulates apparatus, equipment, and technological tools carefully and highly effectively to implement well-organised safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using appropriate conventions and formats accurately and highly effectively. | Critically and systematically analyses data and their connections with concepts, to formulate logical and perceptive conclusions and make relevant predictions.  Logically evaluates procedures and suggests a range of appropriate improvements. | Applies nutrition concepts and evidence from investigations to suggest solutions to complex problems and to promote good health in new and familiar contexts.  Uses appropriate nutrition terms and conventions highly effectively.  Demonstrates initiative in applying constructive and focused individual and collaborative work skills. | Consistently demonstrates a deep and broad knowledge and understanding of a range of nutrition concepts.  Uses knowledge of nutrition perceptively and logically to understand and explain issues related to diet, lifestyle, culture, and health.  Uses a variety of formats to communicate knowledge and understanding of nutrition in different contexts coherently and highly effectively. |
| B | Designs well-considered and clear nutrition investigations.  Logically selects and appropriately acknowledges information about nutrition and issues in nutrition from different sources.  Manipulates apparatus, equipment, and technological tools carefully and mostly effectively to implement organised safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using appropriate conventions and formats mostly accurately and effectively. | Analyses data and their connections with concepts, to formulate generally appropriate conclusions and make simple predictions, with some relevance.  Evaluates procedures and suggests some appropriate improvements. | Applies nutrition concepts and evidence from investigations to suggest solutions to problems and to promote good health in new and familiar contexts.  Uses appropriate nutrition terms and conventions effectively.  Applies mostly constructive and focused individual and collaborative work skills. | Demonstrates some depth and breadth of knowledge and understanding of a range of nutrition concepts.  Uses knowledge of nutrition logically to understand and explain issues related to diet, lifestyle, culture, and health.  Uses a variety of formats to communicate knowledge and understanding of nutrition in different contexts coherently and effectively. |
| C | Designs considered and generally clear nutrition investigations.  Selects with some focus, and mostly appropriately acknowledges, information about nutrition and issues in nutrition.  Manipulates apparatus, equipment, and technological tools generally carefully and effectively to implement safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using generally appropriate conventions and formats with some errors but generally accurately and effectively. | Analyses data and their connections with concepts, to formulate generally appropriate conclusions and make simple predictions, with some relevance.  Evaluates some procedures in nutrition and suggests some improvements that are generally appropriate. | Applies nutrition concepts and evidence from investigations to suggest some solutions to basic problems and to promote good health in new or familiar contexts.  Uses generally appropriate nutrition terms and conventions with some general effectiveness.  Applies generally constructive individual and collaborative work skills. | Demonstrates knowledge and understanding of a general range of nutrition concepts.  Uses knowledge of nutrition with some logic to understand and explain one or more issues related to diet, lifestyle, culture, and health.  Uses different formats to communicate knowledge and understanding of nutrition in different contexts with some general effectiveness. |
| D | Prepares the outline of a nutrition investigation.  Selects and may partly acknowledge one or more sources of information about nutrition or an issue in nutrition.  Uses apparatus, equipment, and technological tools with inconsistent care and effectiveness and attempts to implement safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using conventions and formats inconsistently, with occasional accuracy and effectiveness. | Describes basic connections between some data and concepts, and attempts to formulate a conclusion and make a simple prediction that may be relevant  For some procedures, identifies improvements that may be made. | Applies some evidence to describe some basic problems and identify one or more simple solutions, or to promote good health, in familiar contexts.  Attempts to use some nutrition terms and conventions that may be appropriate.  Attempts individual work inconsistently, and contributes superficially to aspects of collaborative work. | Demonstrates some basic knowledge and partial understanding of nutrition concepts.  Identifies and explains some nutrition information that is relevant to one or more issues related to diet, lifestyle, culture, and health.  Communicates basic information about nutrition to others, using one or more formats. |
| E | Identifies a simple procedure for a nutrition investigation.  Identifies a source of information about nutrition or an issue in nutrition.  Attempts to use apparatus, equipment, and technological tools with limited effectiveness or attention to safe or ethical investigation procedures.  Attempts to record and display some descriptive information about an investigation, with limited accuracy or effectiveness. | Attempts to connect data with concepts, formulate a conclusion, and make a prediction.  Acknowledges the need for improvements in one or more procedures. | Identifies a basic problem and attempts to identify a solution or promote good health in a familiar context.  Uses some nutrition terms or conventions.  Shows emerging skills in individual and collaborative work. | Demonstrates some limited recognition and awareness of nutrition concepts.  Shows an emerging understanding of an issue related to diet, lifestyle, culture, and health.  Attempts to communicate information about nutrition. |