**ENERGY FROM FOOD – Burning Foods**

**Background**

Food contains chemical energy stored in the form of carbohydrates, fats and proteins. The amount of energy stored in the food depends on the way it is stored. Fats have a higher energy density than proteins and carbohydrates but the energy is not as easily accessible. The energy from carbohydrates can be easily estimated by combusting the food source and measuring the heat energy produced.

**Aim**

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**Hypothesis**

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| Source of risk | What amount of harm could it cause? (circle) | Safety precautions taken | If an incident occurred what should I do? |
|  | Minor  Significant  major |  |  |
|  | Minor  Significant  major |  |  |

**Materials**

Thermometer

* Chips/various food sources
* Balance
* Metal baskets with handle
* Retort stand and clamp
* Heat insulating can
* Heat mat
* Test tubes
* Thermometer
* 50ml measuring cylinder
* Test tube holder/tongs

Calorimeter

* Matches & tapers
* PPE – safety glasses

Food

* Bunsen burner

**Method**

* 1. Use the measuring cylinder to measure exactly 50 ml of water into the calorimeter.
  2. Use the thermometer to measure the initial temperature of the water **NB:** **do not rest thermometer on bottom of test tube when measuring temperature**
  3. Weigh chip/piece of cracker/peanut
  4. Slot food into paperclip/basket
  5. Light the food with a Bunsen burner. As soon as it catches fire, hold it about 2cm underneath the calorimeter.
  6. When the food stops burning measure the final temperature of the water with the thermometer

**NB:** **do not rest thermometer on bottom of test tube when measuring temperature**

* 1. Record results in table
  2. Repeat steps 1 – 7 with different masses of the same food

**NB:** **Use fresh water for each chip/food item to ensure accurate temperature changes are recorded, rinse the test tube to ensure it is cool, not warm.**

Table 1: Raw data

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| Mass of Food Source (g) | Mass of water in Calorimeter (g) | Trials | | | Q (Quantity of heat)  ***= mass of water in g x 4.18 x Δ temp***  (J) | Uncertainty in Q  **(Max – Min)/2**  (J) |
| Initial temp  (°C) | Final temp  (°C) | Change  in temp  (°C) |
|  | 50 |  |  |  |  |  |
|  | 50 |  |  |  |  |  |
|  | 50 |  |  |  |  |  |
|  | 50 |  |  |  |  |  |
|  | 50 |  |  |  |  |  |
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Table 2

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| Mass of Food Source (g) | Uncertainty in mass (g) | Q  (J) | Uncertainty in Q  (use the average you calculated in table 1 for each value) | Energy content of Food  ***= Q / mass of food***  (J/g) | Uncertainty in Energy content  (J/g) |
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| Average energy content of food = | | | |  |  |

**Graph 1**: Temperature change versus mass

Draw a graph of the **mass of the food** as the horizontal axis and **temperature** as the vertical axis. Plot error bars onto your data.

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**Discussion**

1. Draw lines of best fit, maximum slope and minimum slope onto graph 2.
2. Estimate the uncertainty of the slope of the line of best fit.

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1. The slope of graph 2 is the temp change (Δ temp) per 1 g of the food. Estimate the change in temperature you would have measured if you had burnt 50 grams of food.

(*Extension Q – assuming you ate 50 g of the food, and it underwent cellular respiration (which is a combustion reaction), what temperature increase would you expect in your body - assuming you weight 60 kg and you are 75% water*)

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1. Compare the energy content(s) you have calculated in table 2, to the energy in 100 g of the food from the packaging. Describe the size of the difference in these values.

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1. Were there any problems with the investigation? If so, suggest how these problems could be fixed.

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