**Fudgeous Rocks**

**Problem**: What happens to substances during igneous rock (fudge) formation?

**Research**: Refer to Chapter 4, Section 2 (pgs 98-101) in your text to review information about igneous rocks. **Igneous rock forms in a 3 step process, melting, cooling, and crystalizing.** A continued rise in temperature can eventually melt any rock until it is molten **(called magma).** When the molten rock cools it forms an igneous rock. The cooling rate creates small or large **crystals**.

**Hypothesis**: **10 pts.**

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**Ingredients:**

* 1 1/2 cups granulated sugar
* 2/3 cup (5 fl.-oz. can) [NESTLÉ® CARNATION® Evaporated Milk](http://www.verybestbaking.com/products/carnation/evap/default.aspx)
* 2 tablespoons butter or margarine
* 1/4 teaspoon salt
* 2 cups miniature marshmallows
* 1 1/2 cups (9 oz.) [NESTLÉ® TOLL HOUSE® Semi-Sweet Chocolate Morsels](http://www.verybestbaking.com/products/tollhouse/morsels.aspx)
* 1 teaspoon vanilla extract

**Procedure: 10 pts.**

1. **LINE** 8-inch-square baking pan with foil.
2. **COMBINE** sugar, evaporated milk, butter and salt in medium, heavy-duty saucepan.
3. **Melt & Boil**, stirring constantly, for 4 to 5 minutes.
4. **Remove** from heat.
5. **STIR** in marshmallows, chocolate morsels, and vanilla extract. Stir vigorously for 1 minute, or until marshmallows are melted. Increase heating by putting on lid. **Release the pressure!** Pour into prepared baking pan.
6. **COOl:** Refrigerate for 2 hours or overnight until firm. Lift from pan; remove foil. Cut into 48 pieces.
7. **Observe crystallization.**

**Data: Chart 30 pts. Questions 20 pts.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Independent Variable (x)** |  |  | **Dependent Variable**  **(y)** | |
| **Ingredient** | **Physical Properties**  (include the phase of matter) | **Earth Ingredient**  (what real substance **under** the surface of the earth does this ingredient remind you of) | **Final Observation**  (what did the ingredient look like in the end)  Did it change? HOW did it change?  (YES or NO) **(disappear? melt? include color and phase)** | |
| **sugar** |  |  |  |  |
| **evaporated milk** |  |  |  |  |
| **butter** |  |  |  |  |
| **marshmallows** |  |  |  |  |
| **chocolate morsels** |  |  |  |  |

1. What three (3) geological processes form igneous rock?
2. List the substances that melted.
3. What is the texture of the final fudge specimen? ***(circle one)***

**coarse-grained (rough) OR fine-grained (smooth)**

1. What determined this texture? What type of igneous rock formation is this?

**Conclusion:** Complete the following framed paragraph with key tech terms from the investigation **30 pts.**

**In the Fudgeous Rocks investigation we were able to investigate the formation of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_rocks. During this type of rock formation, minerals go through a three step geological process: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The minerals eventually melt together creating a molten material called \_\_\_\_\_\_\_\_\_\_\_\_\_\_. Not all of the ingredients (minerals) melt or cool at the same rate. After the molten rock cools it forms an igneous rock. If the rock (fudge) cools slowly, the texture is \_\_\_\_\_\_\_\_\_\_\_\_\_ and if it cools quickly the texture of the rock (fudge) will be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. This texture is created from the formation of either large or small \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

 