Science 9 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Measuring Volume**

Objective: to accurately measure the volume of samples of matter using direct and indirect

 measuring techniques

**Part I: Measuring the Volume of Regularly Shaped Solids (e.g cubes and rectangular prisms)**

The volume of a regularly shaped solid may be determined by using a ruler to accurately measure its length, width and height. These three measurements are then **multiplied** together resulting in the volume of the solid.

Note: The units must be the same for all three measurements.

Example:

* Show all work for each of the following volume calculations. Include the formula used.
* Include units in all answers.
* Round off all answers to the nearest whole number.

1. Determine the volume of the cube provided. (2 marks)

2. Determine the volume of two of the wood blocks provided. Indicate the number of the block

 selected.

a. wood block #\_\_\_\_\_\_\_\_ (2 marks)

b. wood block #\_\_\_\_\_\_\_\_ (2 marks)

Part 1 Questions

1. Identify two other items which could be measured using this method. (1 mark)

2. Is this method a direct or indirect measurement of volume? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 (1 mark)

**Part II: Measuring the Volume of Liquids**

The volume of a liquid may be measured directly using a graduated cylinder. To determine the volume of a liquid, pour the sample into a graduated cylinder and read the scale of numbers on the side. The measurement is to be taken at **eye level**, on a **flat surface** at the bottom of the curved surface of the liquid called the **meniscus.** The measurement is read in milliliters.

* Estimate the volume of each of the liquids in the graduated cylinder.
* Accurately measure the volume of each liquid using the techniques described above.
* Record your estimates and measurements in the table below.
* All measurements should be taken to the first uncertain (estimated) digit.

Table 1: Determining the Volume of Four Unknown Liquids

|  |  |  |
| --- | --- | --- |
| **Liquid** | **Estimated Volume (mL)** | **Measured Volume (mL)** |
| Red |  |  |
| Blue |  |  |
| Green |  |  |
| Yellow |  |  |

Part 2 Questions

1. State three techniques important to the accurate measurement of volume using a

 graduated cylinder. (3 marks)

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(iii)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. What is the meniscus? What part of the meniscus should be read? (2 marks)

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 3. Is this method a direct or indirect measurement of volume? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 (1 mark)

4. Give two examples of matter ,other than liquids, that can be measured using this technique.

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5. Suppose your largest graduated cylinder is not large enough to measure the volume of a

 liquid sample. How would you measure the volume of this liquid sample? (Note: You only

 have one graduated cylinder.) (2 marks)

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**Part III: Measuring the Volume of Irregularly Shaped Solids**

You have now measured the volume of regularly shaped solids and liquids using two different techniques.

Challenge:

(i) To design a procedure to measure the volume of an irregularly shaped solid

(ii) To determine the volume of an irregularly shaped solid using the procedure designed

Materials Provided:

Rocks (irregularly shaped solids)

Graduated Cylinders

Beakers

Eye droppers

Rulers

1. Using the materials provided (note: it is not necessary to use **all** materials), design a

 procedure to accurately measure the volume of an irregularly shaped solid.

2. Record the steps of your procedure on a separate sheet of lined paper. Be specific and

 clear in your instructions.

3. Test your procedure by following the steps written out. Edit your procedure as needed.

4. Exchange procedures with another group. Follow the group's procedure as written to

 determine the volume of a rock.

5. Provide constructive feedback on the form provided. Indicate strengths and weaknesses of

 the procedure.

Part 3 Questions

1. Explain why using a ruler and multiplying the three dimensions together would not result in

 an accurate measurement of volume for a rock. (1 mark)

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2. Explain why irregularly shaped solids, such as a rock, cannot be measured in the same way

 as liquids. (1 mark)

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3. Is the method used to measure the volume of a rock a direct or indirect measurement of

 volume? (1 mark)

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Conclusion:

What is volume?

Distinguish between the three methods of volume performed in this activity. (Include the techniques involved and types of matter which can be measured using each method.)

(10 marks)

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Part III: Determining the Volume of an Irregularly Shaped Solid (e.g. rock) Feedback Form.

**Strengths**: Identify the positives of the procedure designed to measure the volume of a rock.

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**Weaknesses**: What were the problems encountered? How could this procedure be improved?

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