**Learning & Teaching Resources**

**for Science (S1-3) Curriculum (2017)**

**Unit 2 Water**

**Water Purification and
Making Water Treatment Work Model**

**Student Version**

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*(Developed by Hong Kong Association for Science and Mathematics Education)*

**Learning Objectives**

After the activities, you are able to:

* understand the processes and functions of sedimentation and filtration;
* perform fair tests to find out the suitable materials for filtration; and
* design and make a model of water treatment work.

**Activity 1：Investigating the methods of sedimentation and filtration**

**(A) Sedimentation**

Sedimentation could remove denser insoluble substances. In sedimentation, impurities denser than water will sink to the bottom and the water above the sediments will become relatively clear.

**Investigative Experiment I：The effect of alum in sedimentation**

Someone mentioned that by adding alum into water, the effect of sedimentation could be improved. Now, you are going to conduct a fair test to investigate the effect of alum on sedimentation.

**Question:**

Will the effectiveness of sedimentation be better if alum is added to the polluted water?

**Hypothesis:**

Adding alum to the polluted water can speed up the sinking of impurities and the water above the sediments will become relatively clear.

**Experiment:**

Design an experiment to prove your hypothesis using the materials and apparatus below.

**Materials and Apparatus:**

* Alum about 2 to 3 g
* Beaker (250 cm3) 2
* Glass rod 2
* Polluted water 2 cups
* Spatula 1

**Safety precautions:**

* Wearing safety goggles
* Washing hands thoroughly with liquid soap after the experiment

List the variables of the experiment in the table below:

|  |  |
| --- | --- |
| Independent variable(Variable to be changed) |  |
| Dependent variable(Variable to be measured) |  |
| Control variables(Variables to be kept constant) |  |

**Design of experiment:**

Draw and label the experimental design of Experiment I in the space below:

|  |
| --- |
| **Design of Experiment** |
|  |  |

**Results:**

Record the results of the experiment in the table below:

|  |  |
| --- | --- |
| Experiment | Observation  |
| With alum added |  |
| Without alum added |  |

**Conclusion:**

1. Our hypothesis is □ supported □ rejected

2. We found that

**Discussion question:**

1. Can sedimentation remove all impurities in the polluted water? Why?

**(B) Filtration**

Insoluble substances of different sizes could be removed by filtration, even for those of small size and with low density. The filtration device could be built using different filter materials packing into some layers, of which there are holes of different sizes. When the polluted water passes through the holes in the device, insoluble impurities with size larger than the small holes would be blocked and stayed as residues on the filter layers. The filtrate obtained by filtration is more clear than that obtained by sedimentation.

**Investigative Experiment II：The filter performance of different filter materials**

Some filter materials are provided in the laboratory, including coarse sand, fine sand, gravel, etc. Your task is to design an experiment to investigate the filter performance of two types of filter material by fair tests.

**Question:**

Which filter material would be more effective in filtering?

**Hypothesis:**

A finer filter material is more effective in filtering.

**Experiment:**

Design an experiment to prove the hypothesis using the materials and apparatus below.

**Materials and Apparatus:**

* Beaker (250 cm3) 2
* Filter materials 2 sets of different filter materials
* Funnel 2
* Gauze (for supporting filter material) 2
* Polluted water 2 cups
* Stand and Clamp 2

**Safety precautions:**

* Wearing safety goggles
* Washing hands thoroughly with liquid soap after experiment

List the variables of the experiment in the table below:

|  |  |
| --- | --- |
| Independent variable(Variable to be changed) |  |
| Dependent variable(Variable to be measured) |  |
| Control variables(Variables to be kept constant) |   |

**Experimental set-ups:**

Draw and label the experimental set-ups of Experiment II in the space below:

Two types of filter material for the experiment:

Filter material A:\_\_\_\_\_\_\_\_\_\_\_\_\_

Filter material B:\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| Experimental set-up – Filter material A | Experimental set-up –Filter material B |

**Results:**

Record the results of the experiment in the space below:

|  |  |
| --- | --- |
| **Experiment** | **Observation** |
| **Using filter material A for filtration** |  |
| **Using filter material B for filtration** |  |

**Conclusion:**

The filtrate of filter material is more clear than that of filter material .

Therefore, filter material gives a better filter performance.

**Discussion questions:**

1. Based on the results from all groups in class, which filter material is most effective in filtering polluted water?

1. Explain your answer in discussion question 1.

**Activity 2：Design and make a water treatment work**

**Materials and apparatus:**

* Filter materials On demand
	+ - Activated carbon
		- Coarse sand
		- Filter cotton
		- Filter paper
* Fine sand
* Beakers (250 cm3) 2
* Plastic box 1
* Scissors 2
* Plastic sheets Several
* Mesh wire 1

**Safety precautions:**

* Wearing safety goggles
* Washing hands thoroughly with liquid soap after the activity

**Design and make a water treatment work:**

Discuss with your classmates to design a model of water treatment work and draw your design on the next page. You should take the following points into consideration.

1. The model should be able to store sufficient volume of water.
2. The inlet and outlet of the model should be placed at appropriate positions so that water could flow to the outlet automatically. You need to seek help from laboratory technician for drilling the outlet.
3. The rate of water flow should be moderate.
4. You should ensure that filter materials will not get into the filtrate.

**Design of the water treatment work model:**

**Activity 3：Sharing the experience of the making and testing processes of**

**the water treatment work model**

Take photos or videos during the making and testing processes of the water treatment work model. Present your work to teacher and classmates.

1. Test results

 Volume of filtrate: \_\_\_\_\_\_\_\_\_\_ cm3

 Filtering time: \_\_\_\_\_\_\_\_\_\_ s

 Calculate the rate of filtration: \_\_\_\_\_\_\_\_\_\_ cm3 / s

2. Photos or video clips may be included in the presentation:

* Name and group photo of team members
* A photo of the model of water treatment work
* Photos or video clips for illustrating the process of making the model
* Photos or video clips for illustrating the process of the model testing
* Photos for comparing polluted water and filtrate
* Some videos for illustrating the process of sedimentation in the model
* Some videos for illustrating the process of filtration in the model

3. Are you satisfied with the effect and rate of filtration of your water treatment work model? Are there any further improvements you could make?

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