



engineers without borders uk

EWB Water for the World

Water Filter Activity

Objectives

1. To introduce students to the global issue of access to clean drinking water
2. To make students enthusiastic about technology and its role in human development

Subjects: Science,
Geography, Social Sciences

Time: 30-45 minutes

Materials

The following is a list of materials you need for this activity:

- 1 2-litre plastic bottle per group
- 1 cup of fine sand per group
- 1 cup of coarse sand per group
- 1 cup of fine gravel per group
- 1 cup of coarse gravel per group
- 1 cup of activated charcoal per group
- 1 cotton ball per group
- 1 transparent plastic cup per group
- 1 small piece (about 10 cm²) of cheese cloth per group
- 1 rubber band per group
- 1 plastic tray per group
- Monopoly money
- Photocopies of country profiles and instruction handouts

Here are some suggestions of where you can find the materials you need:

Material	Where to find it
2-litre plastic bottles	Recycling bins on recycling day
Buckets or plastic bins	Hardware store
Charcoal, activated	Aquarium store
Cheese cloth	Kitchen or car cleaning section of Canadian Tire
Cotton balls	Drug store or dollar store
Gravel (Coarse)	Hardware store in the garden section (e.g. Home Depot)
Gravel (Fine)	Hardware store in the construction section (beside cement)
Plastic cups	Grocery store
Rubber bands	Office supply store
Sand (Coarse)	Hardware store in the construction section (beside cement)
Sand (Fine)	Hardware store in the garden section

Advance Preparation

1. Prepare the materials.
 - Cut the bottoms off the 2L bottles so they are ready for making filters
 - Cut the cheese cloths into 10 cm² pieces
 - Breakdown the charcoal into granules with a hammer
 - Prepare “dirty water”; add approximately 2 tablespoons of soil or mud to 500-mL of water.
2. Assemble country packages.
 - Each group will receive a handout that includes a country profile, instructions on how to make the water filter, and an amount of Monopoly money based on the table below:

Country	Monopoly Money
United Kingdom	£300 (= 4 filters)
United States	£300 (= 4 filters)
Canada	£250 (= 3 filters)
Saudi Arabia	£200 (= 2 filters)
Ghana	£35
Cameroon	£25
Uganda	£15
Ethiopia	£10

Procedure

1. Put the filter materials in Ziploc bags in an easily accessible area at the front of the class (the “store”)
2. Explain the Challenge, the Rules and also Hint like crazy at strategy and co-operation.
3. **USE TEACHERS TO HELP YOU** to divide the students into working groups (4-5 students per group). Distribute a country package to each group.
4. Explain to the students that they are to make a water filter as outlined on their instructions sheet. They may purchase the materials they need from the “store” using the Monopoly money that they have been given. Only one person per group may buy materials at a time.
5. After about 20 minutes, have a short break (depends on how long you have, but say 5 minutes if have not got a formal one).
6. Use the break time to get students to prepare/think about a presentation on their filter and also to pour some clean water into the filters to get them working.
7. Post-break, have group come up to the front of the room, talk about what they started off with and what they did. Then let them demonstrate their water sample in front of everyone.
8. Follow-up the activity with a discussion on how the activity relates to the real world. Follow the slide and script provided.



engineers without borders uk



UNITED KINGDOM

General

Area:	244,820 km ²	Population:	59,834,300
		Urban:	80%
		Rural:	20%
Main Language:	English	Growth Rate:	0.4% per year

Water Resources

Rainfall:	1117.8mm	Total water use	
Total water withdrawals:	204 m ³ /cap/year	Domestic:	20%
		Industrial:	77%
		Agricultural:	3%

Health

Life expectancy:	Male: 82 years; Female: 85 years.
Infant mortality rate:	3.5 infant deaths/1000 live births

Literacy

Adult literacy:	>99% of population age 15 and above
-----------------	-------------------------------------

Economy

GDP per capita (PPP US\$)	\$30,900
---------------------------	----------

Overseas Development Assistance (Aid)

% of GDP	0.48%
----------	-------



engineers without borders uk



UNITED STATES

General

Area:	9,629,091 km ²	Population:	290,342,554
		Urban:	77.2%
		Rural:	22.8%
Main Language:	English	Growth Rate:	0.92% per year

Water Resources

Rainfall:	940 mm	Total water use	
Total water withdrawals:	1870 m ³ /cap/year	Domestic:	13%
		Industrial:	45%
		Agricultural:	42%

Health

Life expectancy:	77.1 years
Infant mortality rate:	7 infant deaths/1000 live births

Literacy

Adult literacy:	>99% of population age 15 and above
-----------------	-------------------------------------

Economy

GDP per capita (PPP US\$)	\$31,872
---------------------------	----------

Overseas Development Assistance (Aid)

% of GDP	0.11%
----------	-------



engineers without borders uk



CANADA

General

Area:	9,976,140 km ²	Population:	32,207,000
		Urban:	79%
		Rural:	21%
Main Language:	English, French	Growth Rate:	0.94% per year

Water Resources

Rainfall:	From 250 mm in Yellowknife, NWT to 2415 mm in Prince Rupert, BC	Total water use
Total water withdrawals:	1601 m ³ /cap/year	Domestic: 18%
		Industrial: 76%
		Agricultural: 12%

Health

Life expectancy:	79.8 years
Infant mortality rate:	5 infant deaths/1000 live births

Literacy

Adult literacy:	>99% of population age 15 and above
-----------------	-------------------------------------

Economy

GDP per capita (PPP US\$)	\$26,251
---------------------------	----------

Overseas Development Assistance (Aid)

% of GDP	0.28%
----------	-------



engineers without borders uk

SAUDI ARABIA



General

Area:	2,149,690 km ²	Population:	27,019,731
		Urban:	95%
		Rural:	5%
Main Language:	Arabic	Growth Rate:	2.18% per year

Water Resources

Rainfall:	500 mm	Total water use	
Total water withdrawals:	1000 m ³ /cap/year	Domestic:	10%
		Industrial:	10%
		Agricultural:	80%

Health

Life expectancy:	75 years
Infant mortality rate:	13 infant deaths/1000 live births
Child mortality rate:	101 child deaths/1000 live births

Literacy

Adult literacy:	78.8% of population age 15 and above
-----------------	--------------------------------------

Economy

GDP per capita (PPP US\$)	\$12,900
---------------------------	----------



engineers without borders uk

GHANA



General

Area:	239,000 km ²	Population:	20,213,000
		Urban:	38%
		Rural:	62%
Main Language:	English	Growth Rate:	2.7% per year

Water Resources

Rainfall:	2,000 mm	Total water use	
Total water withdrawals:	35 m ³ /cap/year	Domestic:	35%
		Industrial:	13%
		Agricultural:	52%

Health

Life expectancy:	60 years
Infant mortality rate:	66 infant deaths/1000 live births
Child mortality rate:	101 child deaths/1000 live births

Literacy

Adult literacy:	70.3% of population age 15 and above
-----------------	--------------------------------------

Economy

GDP per capita (PPP US\$)	\$1,881
---------------------------	---------



engineers without borders uk

CAMEROON



General

Area:	475,000 km ²	Population:	15,085,000
		Urban:	49%
		Rural:	51%
Main Language:	French, English	Growth Rate:	2.7% per year

Water Resources

Rainfall:	3,000 mm	Total water use	
Total water withdrawals:	30 m ³ /cap/year	Domestic:	46%
		Industrial:	19%
		Agricultural:	35%

Health

Life expectancy:	54.7 years
Infant mortality rate:	74 infant deaths/1000 live births
Child mortality rate:	114 child deaths/1000 live births

Literacy

Adult literacy:	74.8% of population age 15 and above
-----------------	--------------------------------------

Economy

GDP per capita (PPP US\$)	\$1,573
---------------------------	---------



engineers without borders uk

UGANDA



General

Area:	241,000 km ²	Population:	21,778,000
		Urban:	14%
		Rural:	86%
Main Language:	English	Growth Rate:	2.8% per year

Water Resources

Rainfall:	1,180 mm	Total water use	
Total water withdrawals:	20 m ³ /cap/year	Domestic:	32%
		Industrial:	8%
		Agricultural:	60%

Health

Life expectancy:	39.6 years
Infant mortality rate:	107 infant deaths/1000 live births
Child mortality rate:	173 child deaths/1000 live births

Literacy

Adult literacy:	66.1% of population age 15 and above
-----------------	--------------------------------------

Economy

GDP per capita (PPP US\$)	\$1,167
---------------------------	---------



engineers without borders uk

ETHIOPIA



General

Area:	1,097,000 km ²	Population:	62,565,000
		Urban:	18%
		Rural:	82%
Main Language:	Amharic, English	Growth Rate:	2.5% per year

Water Resources

Rainfall:	865 mm	Total water use	
Total water withdrawals:	48 m ³ /cap/year	Domestic:	11%
		Industrial:	3%
		Agricultural:	86%

Health

Life expectancy:	43.3 years
Infant mortality rate:	115 infant deaths/1000 live births
Child mortality rate:	184 child deaths/1000 live births

Literacy

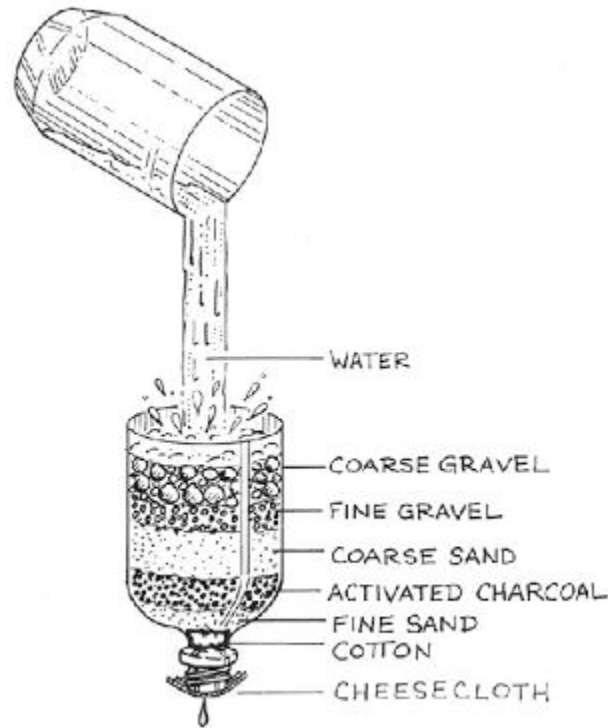
Adult literacy:	37.4% of population age 15 and above
-----------------	--------------------------------------

Economy

GDP per capita (PPP US\$)	\$628
---------------------------	-------

Instructions – United Kingdom

1. Loosely put a cotton plug in the neck of the cut bottle, then cover the neck of the bottle with a piece of cheese cloth. Secure it with a rubber band.
2. Pour a 1-cm layer of fine sand over the cotton plug, followed by activated charcoal, 1-cm of coarse sand, fine gravel, and coarse gravel.

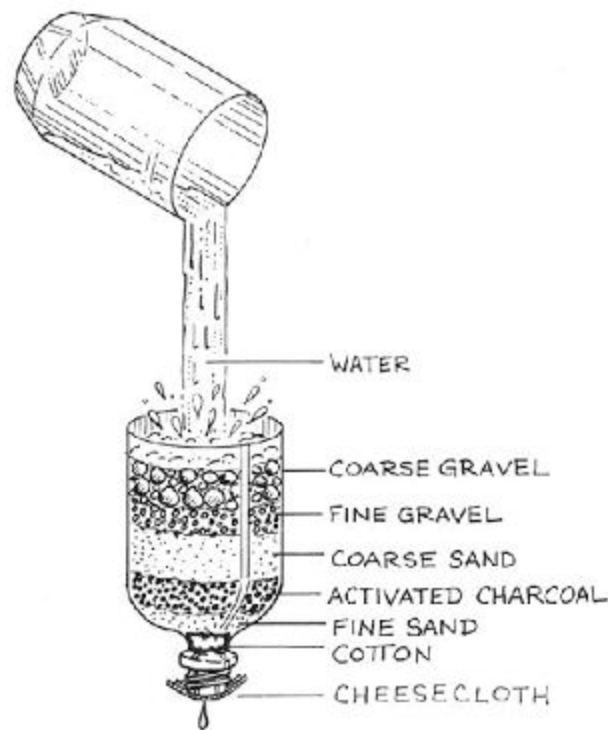


Cost of Materials

Activated Charcoal	£30/cup	Rubber Band	£2 each
Cheesecloth	£2/square	Sand, Coarse	£10/cup
Cotton	£1/ball	Sand, Fine	£10/cup
Gravel, Coarse	£5/cup		
Gravel, Fine	£5/cup	TOTAL	=

Instructions – United States

1. Loosely put a cotton plug in the neck of the cut bottle, then cover the neck of the bottle with a piece of cheese cloth. Secure it with a rubber band.
2. Pour a 1-cm layer of fine sand over the cotton plug, followed by activated charcoal, 1-cm of coarse sand, fine gravel, and coarse gravel.

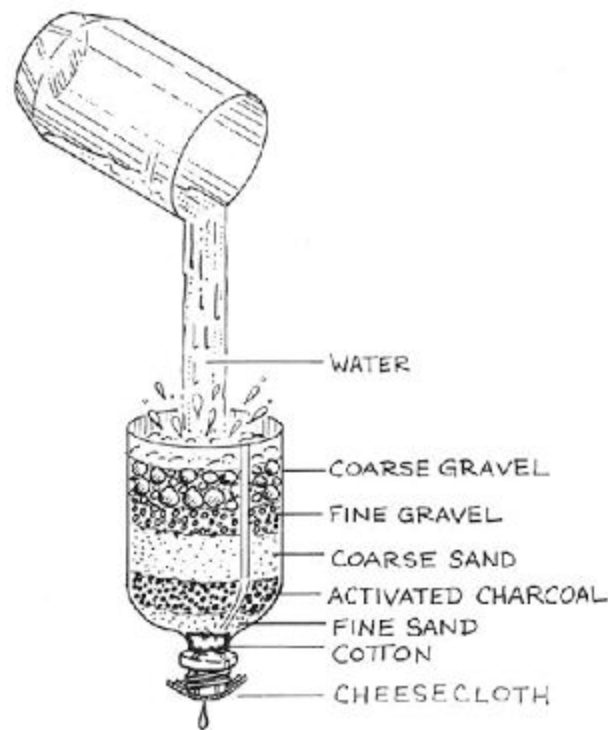


Cost of Materials

Activated Charcoal	£30/cup	Rubber Band	£2 each
Cheesecloth	£2/square	Sand, Coarse	£10/cup
Cotton	£1/ball	Sand, Fine	£10/cup
Gravel, Coarse	£5/cup		
Gravel, Fine	£5/cup	TOTAL	=

Instructions - Canada

1. Loosely put a cotton plug in the neck of the cut bottle, then cover the neck of the bottle with a piece of cheese cloth. Secure it with a rubber band.
2. Pour a 1-cm layer of fine sand over the cotton plug, followed by activated charcoal, 1-cm of coarse sand, fine gravel, and coarse gravel.

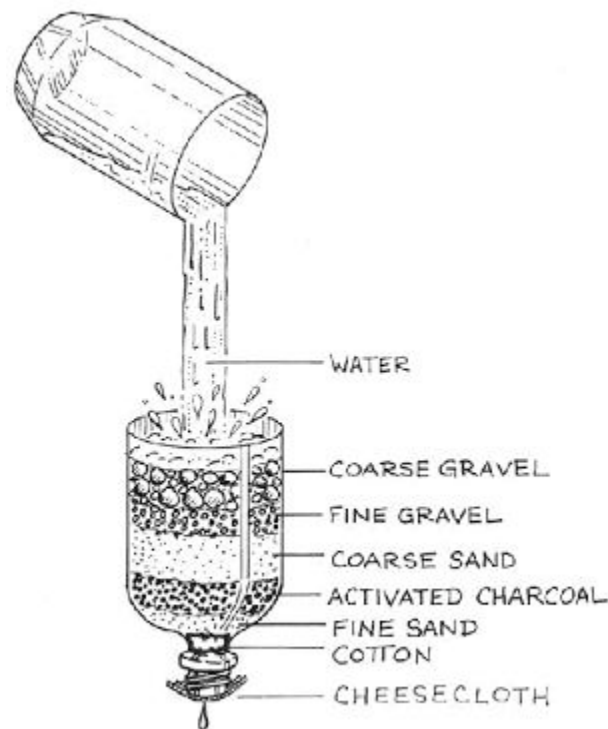


Cost of Materials

Activated Charcoal	£30/cup	Rubber Band	£2 each
Cheesecloth	£2/square	Sand, Coarse	£10/cup
Cotton	£1/ball	Sand, Fine	£10/cup
Gravel, Coarse	£5/cup		
Gravel, Fine	£5/cup	TOTAL	=

Instructions – Saudi Arabia

1. Loosely put a cotton plug in the neck of the cut bottle, then cover the neck of the bottle with a piece of cheese cloth. Secure with a rubber band.
2. Pour a 1-cm layer of coarse gravel over the cotton plug, followed by activated charcoal, 1-cm of coarse gravel, fine gravel, and 1-cm of coarse sand.

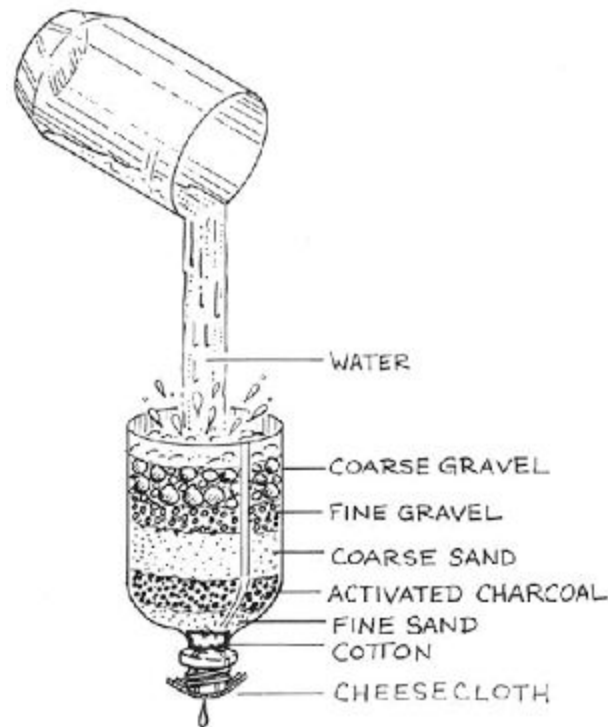


Cost of Materials

Activated Charcoal	£30/cup	Rubber Band	£2 each
Cheesecloth	£2/square	Sand, Coarse	£10/cup
Cotton	£1/ball	Sand, Fine	£10/cup
Gravel, Coarse	£5/cup		
Gravel, Fine	£5/cup	TOTAL	=

Instructions - Ghana

1. Put a cotton ball in the neck of the cut bottle, cover the neck of the bottle with a piece of cheese cloth secured with a rubber band.
2. Pour a 1-cm layer of fine sand over the cotton plug, followed by 1-cm of coarse sand, fine gravel, fine sand, and coarse gravel.

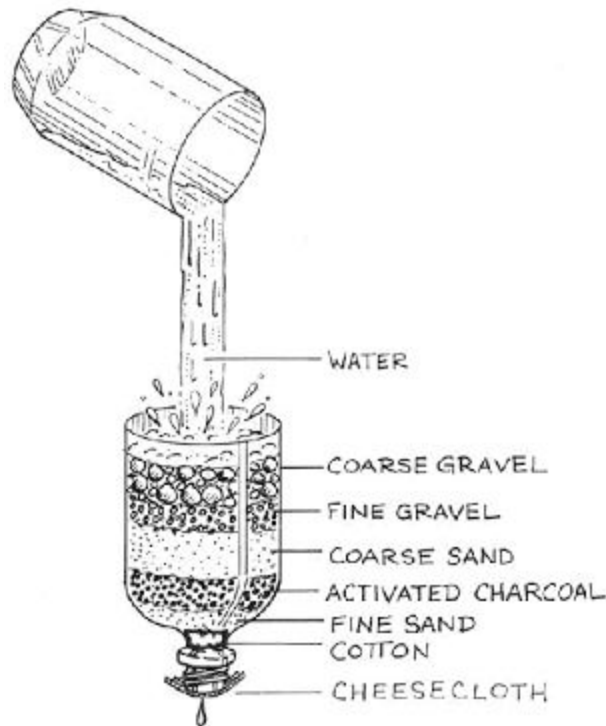


Cost of Materials

Activated Charcoal	£30/cup	Rubber Band	£2 each
Cheesecloth	£2/square	Sand, Coarse	£10/cup
Cotton	£1/ball	Sand, Fine	£10/cup
Gravel, Coarse	£5/cup		
Gravel, Fine	£5/cup	TOTAL	=

Instructions - Cameroon

1. Loosely put a rubber plug in the neck of the cut bottle, then secure the neck of the bottle with a piece of cheese cloth secured with a rubber band.
2. Add a 1-cm layer of fine sand below the cotton plug, followed by charcoal, 1-cm of coarse sand, fine gravel, coarse gravel.

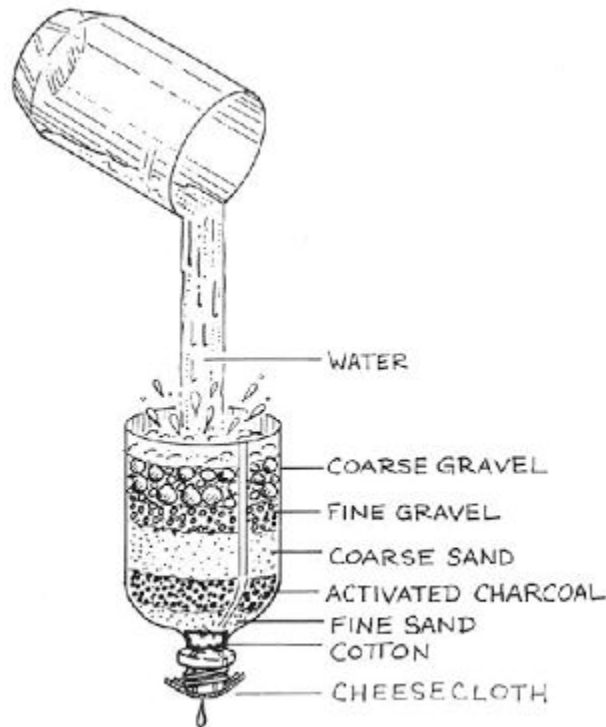


Cost of Materials

Activated Charcoal	£30/cup	Rubber Band	£2 each
Cheesecloth	£2/square	Sand, Coarse	£10/cup
Cotton	£1/ball	Sand, Fine	£10/cup
Gravel, Coarse	£5/cup		
Gravel, Fine	£5/cup	TOTAL	=

Instructions - Uganda

1. Put a cotton ball in the neck of the cut plastic bottle, then place a piece of cheese cloth over the neck of the bottle and secure it with a rubber band.
2. Pour a 1-cup of fine sand over the cotton ball plug, followed by 1-cm of fine gravel, and coarse sand.

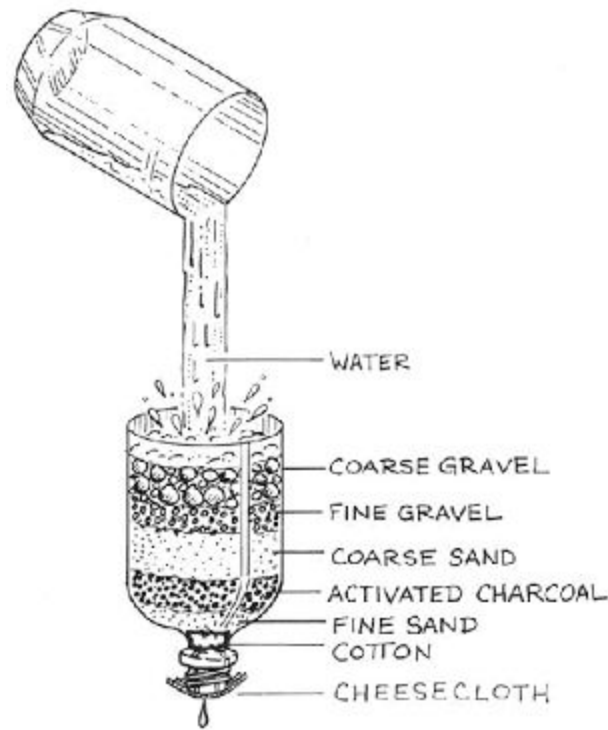


Cost of Materials

Activated Charcoal	£30/cup	Rubber Band	£2 each
Cheesecloth	£2/square	Sand, Coarse	£10/cup
Cotton	£1/ball	Sand, Fine	£10/cup
Gravel, Coarse	£5/cup		
Gravel, Fine	£5/cup	TOTAL	=

Instructions - Ethiopia

1. Loosely pack the material in the bucket cut in half, cover the top of the bucket with a piece of cloth of the same size as the bucket. Add a layer of fine cotton wool, followed by a layer of charcoal, a layer of coarse gravel, a layer of fine gravel, a layer of coarse sand, a layer of fine sand, a layer of cotton wool, and a layer of cheese cloth.
2. Pour a 5-cm layer of fine cotton wool, followed by a layer of charcoal, a layer of coarse gravel, a layer of fine gravel, a layer of coarse sand, a layer of fine sand, a layer of cotton wool, and a layer of cheese cloth.



Cost of Materials

Activated Charcoal	£30/cup	Rubber Band	£2 each
Cheesecloth	£2/square	Sand, Coarse	£10/cup
Cotton	£1/ball	Sand, Fine	£10/cup
Gravel, Coarse	£5/cup		
Gravel, Fine	£5/cup	TOTAL	=