



Lesson 5: The BioSand Filter

CURRICULUM CONNECTIONS:

Grade 6-8 Social Studies and Science

INSTRUCTIONAL METHODS:

- Optional Powerpoint Presentation
- Cartoons about the BioSand Filter,
- Colouring page with labels
- Game

ESTIMATED TIME: 90 minutes

KEY QUESTIONS/IDEAS:

- What is a BioSand Filter?
- What are the parts of the BioSand Filter?
- How does the BioSand Filter clean water?
- What are the 4 ways that the biolayer kills pathogens?

MATERIALS

Projector or TV for showing
Powerpoint and/or videos

Copies of Activity W8: The
BioSand Filter

Colouring markers or crayons

Copies of Activity W9 – The
Pathogen Game

4 Pawns and a die for each
group of 4

Question Cards cut out for
each group

Copies of Activity W10—Stories
from Africa

Part A: The Filter

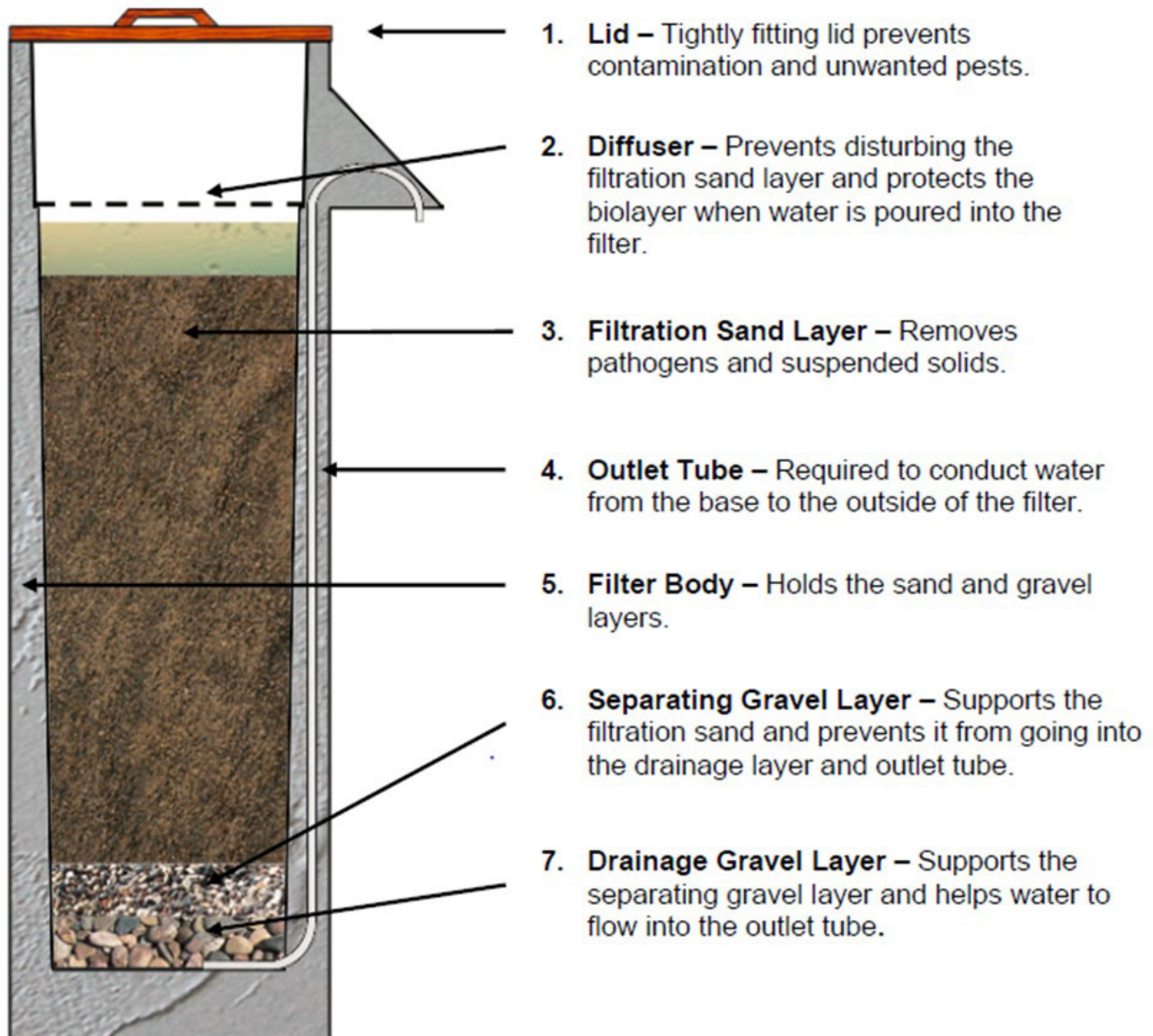
1. GETTING TO KNOW THE BIOSAND FILTER:

Give each student a copy of Activity W8 – The Biosand Filter.

2. STUDENTS LABELING:

Students label the parts of the filter and answer questions using information from the video:

[‘The Parts and Function of the BioSand Filter’](#)



Part B: Learn about the BSF using videos

WATCH VIDEOS:

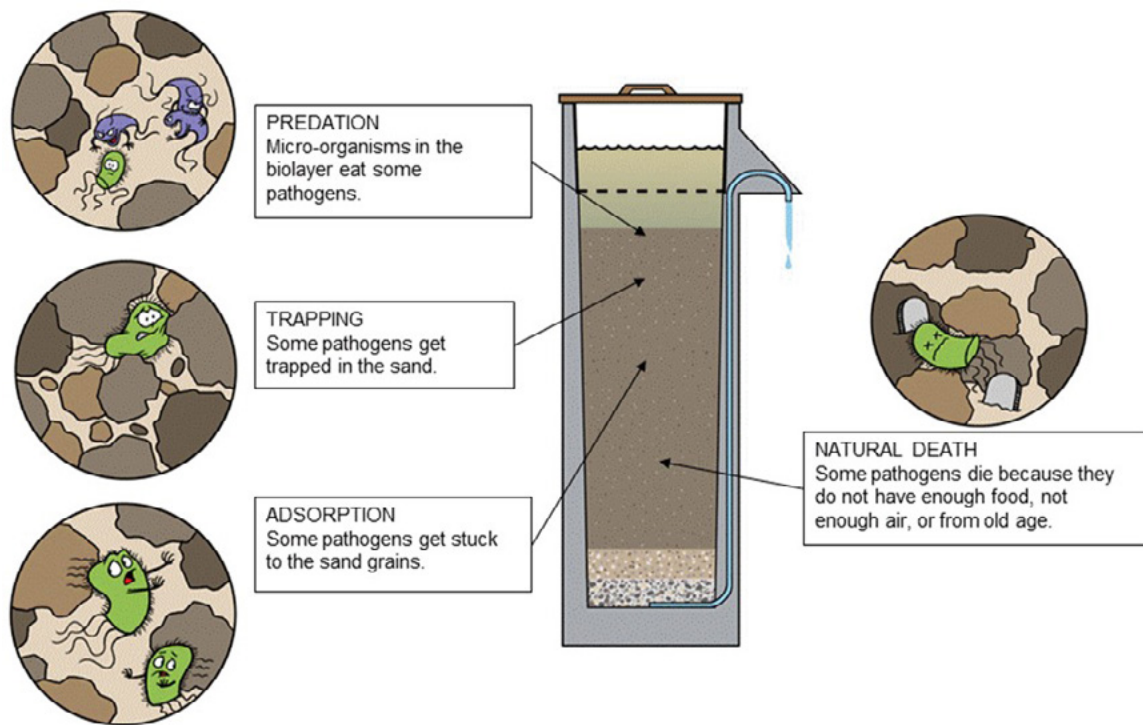
Watch videos used by CAWST (Centre for Affordable Water and Sanitation Technology) to teach owners of BSFs about the technology. Students answer questions on Activity W8—The BioSand Filter while watching videos.

- [How the BioSand Filter works](#)
- [How to use the BioSand Filter](#)
- [Source: Video by CAWST is licensed under CC BY-SA 4.0 / Adaptation](#)



Part C: The Biolayer

The Biolayer is a very important part of the BioSand Filter. The bacteria and organisms living in this layer are a large part of the filtration system. There are 4 main ways that the Biolayer kills pathogens. Introduce this to students by showing them this image or by explaining in words on the board.



PATHOGEN GAME: (ON ACTIVITY W9—{PATHOGEN GAME})

Have students play this game to review the parts and function of the BioSand Filter, as well as how the pathogens are killed in the filter.

Teacher's Note:

You will need 5-8 copies of the Pathogen Game (depending on your number of students). Each student should have a pawn and each group needs a die. The question cards will need to be cut out before class starts.

Part D: Advantages and Disadvantages of the BioSand Filter

1. Divide class into small groups of 3-4 people. Give each group one of the stories from Africa in Activity W10: Stories from Africa. Have students read the stories and take notes on what are the benefits of the BioSand Filter for the children in Africa.
2. Class Discussion: Start by brainstorming with the class what they think are the best parts (benefits) of a BSF in a developing country (from prior knowledge and reading stories). As the class comes up with ide-as, write on the board. Then share the other benefits listed below.

BENEFITS OF THE BIOSAND FILTER:

- Because the water is treated at the point of use, there is less risk of contamination during transport.
- Easy to use. Simply pour water in the top and it pushes out water that has passed through the sand layers. There's almost no waiting, no moving parts, no energy required, and nothing for the user to do but make sure a clean container is available for the improved water.
- There are no additional operating costs, so people are able to use it every time they need water.
- After filtering, the water tastes better, has less sedimentation, and cools as it passes through the sand. No other technology has these three quality improvements, and this is often stated by users as one of the finest attributes of the filter.
- Reduces incidents of diarrhea by up to 40 per cent.

Brainstorm:

Ask students what they think are the disadvantages or drawbacks of a BioSand Filter (from what they've learned today). Again brainstorm and write on the board. Ensure that all students have this information written down as they will use it for the next lesson.

THE DRAWBACKS OF BIOSAND FILTERS ARE:

- Very heavy, so putting them in place to operate takes a lot of effort.
- Not designed to be moved, so inappropriate for nomadic people.
- Do not filter out every pathogen.

Optional assignment or discussion:

Design a comparison study to discover the similarities between how wetlands and BioSand Filters improve contaminated water.



At A Glance:

Location: La Paz, El Salvador

Partner: Agua Viva (Living Water) – Since 2004

Project Budget (CDN):
\$191,000 Annual

Project Impact:

Rural villages have access to life-saving safe water through household BSFs and Samaritan Filters

700 homes with BSFs with 6,500 beneficiaries

2 schools with the Samaritan Filter, 550 students

Ken has been the Project Manager with Agua Viva since 2009 where he leads a team of seven men to serve rural El Salvadorans. He's respectfully and affectionately called 'Capitan' or "Captain" by his team. Quite an appropriate title because he once was the captain of a United States helicopter carrier with 3,000 personnel!

While stationed in El Salvador, Ken once received an SP Calendar with a picture of a young girl with a BioSand water Filter (BSF). He was glad to know that Samaritan's Purse was actively working in El Salvador and helping the poor. In his free time, he visited the project site and was convinced about the impact of the BSF. As he neared retirement, he and his wife Pamela asked the Lord to lead them. God kept them exactly where they were-El Salvador! Nearly 8 years later, Ken still says, "Every day is a joy to be here, I don't consider it work but rather a service."

During work week, Ken starts his day very early. At 3:30 am he makes coffee and spends time praying, reading, and memorizing God's Word. It's how the living water of God flows through him. Ken loves sharing God's Word and discipling people in Christ.

Once a week he takes a team of young adults to the local school where the team is installing a Samaritan Filter to conduct discipleship classes. In one school 420 students have a great time playing games, singing, learning and applying God's word in their lives. El Salvador is known as the murder capital of Latin America. Rampant gang activity is claiming the futures of many youth. Ken says, "I want the children and families to know that Life is much better, even now in Christ." He and the team press on, rain or shine, every day to serve and to share in the Name of Jesus.

MINISTRY MOMENT:

There are many people who support Samaritan's Purse Projects and want everyone to have safe water because Jesus asks us to love other people and take care of their needs. These Christians are giving impoverished people safe water to drink by helping them build BioSand Filters. These water filters are different from types we see in Canada – they are shaped like tall boxes, built with cement, and filled with sand and small rocks. The BioSand Filter uses a very special biological process designed by God to filter water and clean out all the bacteria and germs. After water flows through the sand and rocks, even brown smelly water comes out of the filter sparkling clear and safe to drink.

By helping families in other countries in this way, we can share God's gift of safe drinking water with someone who does not have it. When people have safe water to drink, their lives are much better. People don't get sick or die from drinking contaminated water. They can wash their faces and make tea with clean, safe water. They can also wash their clothes in clean water and go to school more often because they are more healthy.

DISCUSSION QUESTIONS:

- Do you know of any verses in the Bible where God asks us to help other people?
- Can you think of any stories that Jesus told that were examples of helping and loving others?

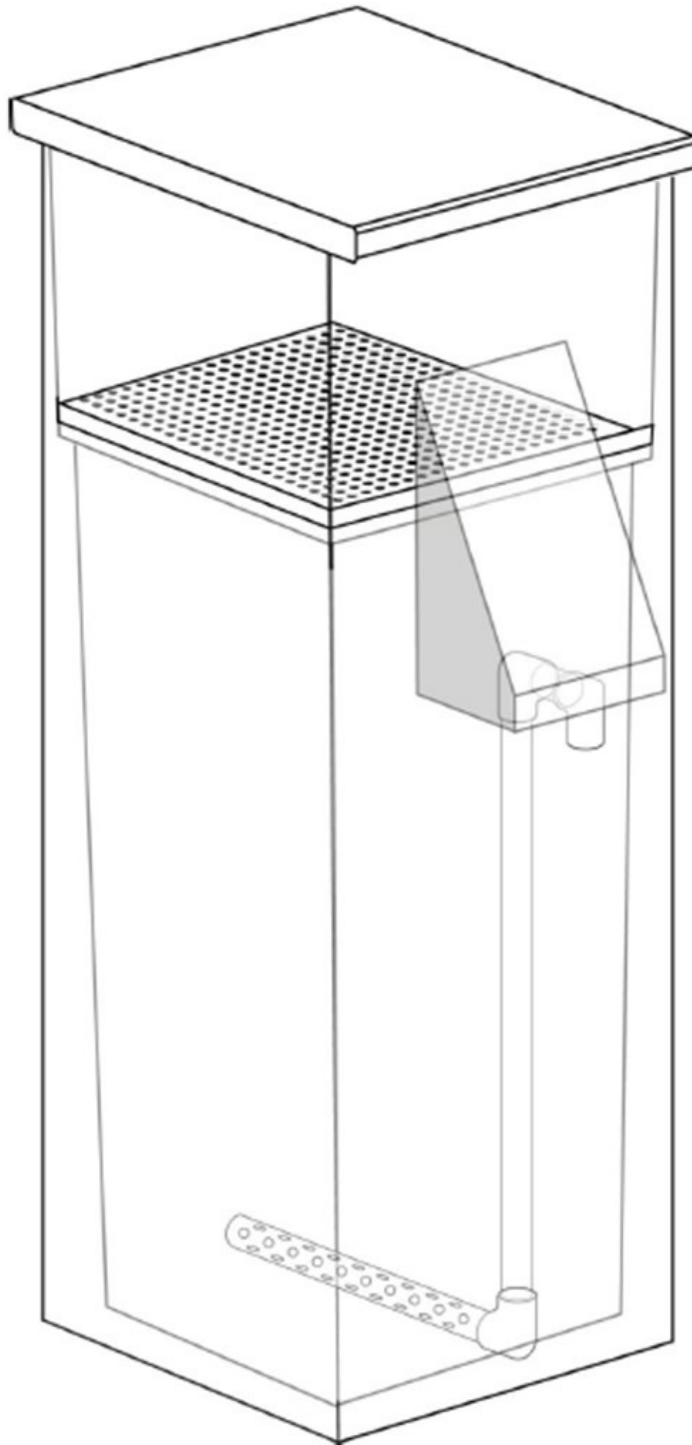
The Good Samaritan is a good example of a story that Jesus told to teach us about loving others and helping them. Read Luke 10:25-37 with the class. Some other good verses to discuss are Hebrews 13:16, John 15: 12, Luke 6:38, Matthew 5:42, Proverbs 19:17, and the story of the paralyzed man (Luke 5:17-26).

ACTIVITY:

Write a prayer asking God to show you how you can help people in your life. Think about people you know in your personal life or community and then think beyond that about the many people in the bigger world who have many needs. Ask God to open up your heart and mind to helping more people.

ACTIVITY W8 - THE BIOSAND FILTER – COLOURING PAGE

Watch Video “The Parts and Functions of The BioSand Filter”. Colour and label the parts of the filter.



WHILE WATCHING “THE PARTS AND FUNCTION OF THE BIOSAND FILTER” VIDEO, ANSWER THE FOLLOWING QUESTIONS:

1. What does the lid protect the filter from?
2. What is the diffuser and why is it important?
3. What is the standing water at the top of the filter called and how high should it be?
4. What does the sand of the filter do?
5. Why does the filter need gravel at the bottom?

ANSWER THE FOLLOWING QUESTIONS WHILE WATCHING THE VIDEO “HOW THE BIOSAND FILTER WORKS”.

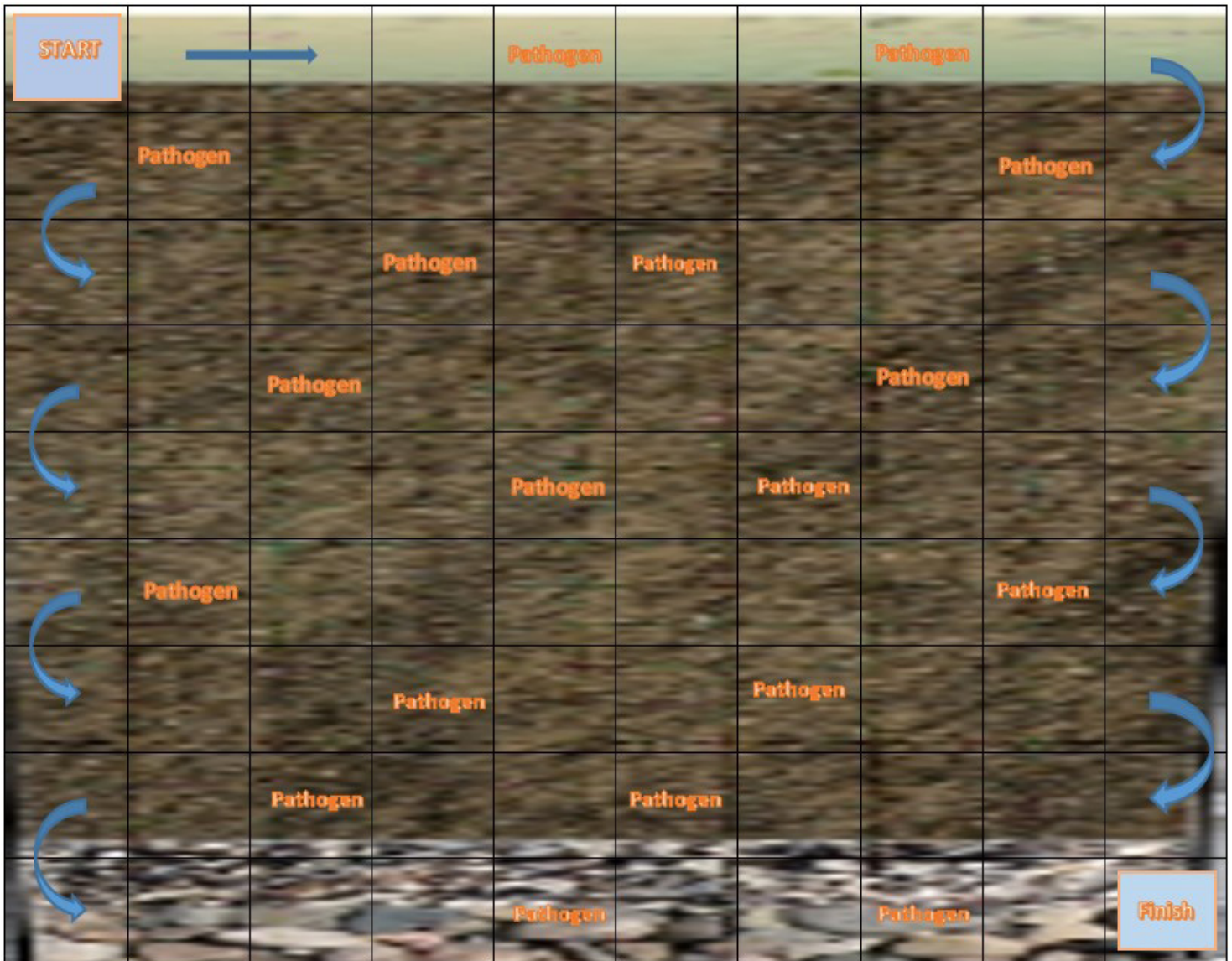
6. What are three different ways that the BioSand Filter cleans pathogens from water?
7. How long does it take for the BioSand Filter to start working optimally?

ANSWER THE FOLLOWING QUESTIONS WHILE WATCHING VIDEO “HOW TO USE THE BIOSAND FILTER”.

8. How much water does the reservoir hold?
9. Never put _____ into the reservoir.
10. It is very important that the container that the water filters into is _____.
11. How many times a day should a filter be used (should one pour water in)?

ACTIVITY W9: THE PATHOGEN GAME:

To play this game you will need a die, a pawn for each player, a small cube or chip for each pathogen square and a set of question/answer cards (included in handout). The game starts with a player rolling the die. Starting at the START square, the player moves his/her pawn (following the arrows) the number of squares indicated by the die. If a pawn lands on a Pathogen, the person must answer a question from the question cards. If they answer correctly, the pathogen is killed and the person gets to keep that pathogen. The object of the game is to kill as many pathogens as possible.



<p>Question: What is it called when micro-organisms in the biolayer eat pathogens?</p> <p>Answer: Predation</p>	<p>Fill in the blank: Some pathogens get killed by getting _____ in the sand.</p> <p>Answer: Trapped</p>	<p>Question: What is it called when pathogens get stuck to the sand grains?</p> <p>Answer: Adsorption</p>
<p>Question: What is it called when pathogens die because they do not have enough food, or air or from old age</p> <p>Answer: Natural Death</p>	<p>Question: What is the name of the part of the BSF that kills the pathogens?</p> <p>Answer: The Biolayer</p>	<p>Question: Why does the BSF need a lid?</p> <p>Answer: To keep out contamination and pests</p>
<p>Question: What is the diffuser used for?</p> <p>Answer: Prevents sand and biolayer from being disturbed when water is poured into filter</p>	<p>Question: What is the filter body made of?</p> <p>Answer: Usually concrete, but some are also made of plastic</p>	<p>Question: How high should the standing water at the top of the BSF be?</p> <p>Answer: 5 cm</p>
<p>Question: What is the function of the separating gravel layer?</p> <p>Answer: To support the filtration sand and keep it from getting to the intake tube.</p>	<p>Question: What are the two types of gravel called?</p> <p>Answer: Separating gravel layer and Drainage gravel layer</p>	<p>Question: How many days does it take for a new BSF to grow its biolayer?</p> <p>Answer: 30 Days</p>
<p>Fill in the Blank: Water from the same _____ must be used each time the BSF is filled.</p> <p>Answer: Source</p>	<p>Question: How long must the BSF rest between filtering a bucket of water?</p> <p>Answer: Several Hours</p>	<p>Question: What are three ways to disinfect the water after it has been filtered by the BSF?</p> <p>Answer: Chlorine, SODIS and Boiling</p>
<p>Fill in the Blanks: It is important to filter the water into a _____.</p> <p>Answer: clean storage container</p>	<p>Question: What are two ways that the BSF makes water cleaner?</p> <p>Answer: filters pathogens like protozoa, bacteria and worms, takes away cloudiness or silt, makes water taste better</p>	<p>Question: What are two ways that the BSF makes water cleaner?</p> <p>Answer: filters pathogens like protozoa, bacteria and worms, takes away cloudiness or silt, makes water taste better</p>

ACTIVITY W10: STORIES FROM AFRICA

These stories are fictionalized accounts based on the real lives of children in the developing world.

Ethiopia

Who: Ayana (aah-yana), 10 year-old girl

Where: Amhara region, Ethiopia

My older sister and I put our buckets into the river. I can hardly wait for them to fill so we can walk to school. I wasn't at school for long time, even though I love school. I was sick again – my belly hurt really bad. I couldn't do anything or stand up. I just lay on my mat on the floor with sweat dripping off me.

My sister would sometimes help me out of our hut to get some fresh air. "Ayana," she would say, "you must get better. Be strong."

Thankfully, I am better now, so I can go to school, but my mother is worried about my baby brother, Zeke. He has been sick for a long time. He lies on his mat like I did. He makes noises like a small kitten. Someone in our family is always sick. When my mother is sick, she can't work on the farm. If my mother can't work on the farm, we have no food to eat. Mostly, we kids are sick. I know why our bellies hurt so much. The river water we drink makes us sick. It's brown and smells like cows. The mud taste makes me want to spit it out. But it's the only water we have.

My friend Miriam lives in another village down the river. People from Samaritan's Purse helped the village build tall cement boxes called "water filters." Miriam's father helped build a filter for her family. When Miriam pours the river water into the top of the filter, it comes out safe and clear – like rain on your tongue.

Samaritan's Purse taught Miriam and her family ways to not get sick – to only drink water that has been poured through the filter, not going to the bathroom in the bushes and always washing their hands. They also taught Miriam's family about Jesus.

Miriam's family changed after getting the water filter. Miriam doesn't get sick or miss school. Her father and mother are strong and work in the fields every day. Her baby brother is not sick. I want a filter for my family. I hope Samaritan's Purse comes to my village, too.

ACTIVITY W10: STORIES FROM AFRICA

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Liberia

Who: Famata (fah-mata), seven-year-old girl

Where: Bopolu county, Liberia

I haven't lived in my village for very long. We used to live in a big, noisy city, but one day we began a long trip into the jungle. My mama told me we were going to our old home, a village very far away. I had never been there before because of the war in our country. "Now the fighting is over and it's safe for us, Famata," said mama. "We can go back to our real home."

Bad men had burned down our old house, so my father built us a new one out of trees, mud and cow dung. We covered the roof with branches and leaves. Now, my job is to help carry water and feed the goats. I like our village; lots of families have come back and all the kids I play with feel safe, too.

The best part is our water filters. People called Samaritan's Purse came to the village and helped us build tall cement boxes filled with sand and rocks. When mama pours the water from the creek inside, it comes out the spout tasting good. We had never tasted water so good.

The people from Samaritan's Purse told us to always pour our water through the filter, and put clean buckets under the spout, and it would help stop our runny stomachs. Before, most everyone had runny stomachs and sometimes the kids in the village were so sick their parents would have to take them in a wheelbarrow to the hospital far away, because we have no cars.

Even my father carries filter water to the field each day, so he doesn't have to drink straight from the creek. Because of the water filters, I never get a runny stomach and no more kids have to go to the hospital in a wheelbarrow.

The water filter makes us feel very fine – we are so happy to have it.

ACTIVITY W10: STORIES FROM AFRICA

These stories are fictionalized accounts based on the real lives of children in the developing world.

Niger

Who: Miriamma, 10-year-old girl

Where: Firgoune, Niger

Miriamma is making changes in her family and her village and she is helping them live healthier. Miriamma lives in Firgoune, which is on an island in a river. She goes to school and spends most of her spare time helping out at home. Her mother and father are often busy working in the fields, trying to grow enough food for the family to eat.

Miriamma cooks meals, looks after her younger brothers and sisters, and hauls water from the river to her home in a big bucket on her head. Young girls like Miriamma are hard workers and have very important roles in their families.

Besides these duties, Miriamma volunteers every week to attend health and hygiene classes at school. In these classes, she learns how to fight bad germs by washing her hands with soap, how to use a toilet dug in the ground, why it's important to drink and clean herself with safe water, why she should cover food to keep flies away, and the importance of sleeping under a mosquito net to keep away insects that could bite and give her malaria.

Many children die from diarrhea and malaria, so these classes are important for saving lives. In Firgoune, the only source of water is the river, which is polluted and can cause diarrhea.

Miriamma also learned about Oral Re-hydration Solution. This mixture of water, sugar, and salt is easy to make at home and is very important for people who are sick with diarrhea. Drinking the solution helps you from getting too dehydrated when you have diarrhea and it can save people's lives.

Miriamma was able to share those lessons with her family. She knew having safe water wasn't enough to make her family as healthy as possible. So those lessons were very useful when the family began using a BioSand Filter in 2007. It was their first source of safe water and it is still helping to reduce sickness in her family.

As a result of her courage and excitement about what she was learning, Miriamma's one small voice was able to help improve the health of her family.