LOGBOOK
I have finished my report and will hand it in tomorrow. The results I found were quite interesting with the eggshells being the most effective material in removing oil from the soil followed by the coffee grounds. My results also raised a lot of new questions for future investigations which sound interesting too. While my investigation is due tomorrow, I will continue my investigation as I want to see whether to trends I have observed stay the same or not.

Yesterday I did my fourth and final check on the seedlings. I took photos and measurements which I have added to my data from other checks in my report. Based on average seedling height, the seedlings that grew in the soil with eggshells were almost as tall as the ones in the control. I did not expect this result in the given time frame as I thought that since eggshells take several years to decompose, they therefore wouldn't release as many nutrients in the given time frame. I also found it surprising that the banana peels, which I had hypothesised to be the most effective, were actually the least effective.

I did another fortnightly check of my seedlings today. I noted down the heights of each seedling, the number of seedlings in each pot and I took photos of each plot to use when evaluating the surface area of the leaves on each seedling. Through my data I have noticed that the banana peels have begun to act less efficiently as many seedlings have died and those that have survived have not grown very much. I am quite sure this is not due to the position of the pots as I rotate the pots quite frequently to avoid my results being affected by this.

I think this trend may be because the banana peels may have remediated the soil too much and created levels of nitrogen, potassium and/or phosphorous that are too high for the seedlings. This may also be because the banana peels are quite large and may obstruct the growing roots of the plants and stop water from flowing through the soil well. I have also noticed that while both of the other bioremediators act quite efficiently, one has a higher average seedling height and the other has seedlings with more leaves and leaves with a larger surface area.

I'm not sure why this may be but it may be related to drainage and root obstruction, as mentioned in the banana peels, as one of the bioremediators is quite a bit larger than the other. I will need to do some research into what affects the leaf area and height of plants. The trend in the control seedlings and the seedlings grown in the soil with only oil added are quite consistent with many tall seedlings with many leaves growing in the control and very few, short seedlings growing in the soil with only oil added. After taking down my observations I watered each plant with around 15mL of water.
Friday, June 24th, 2016
I did my second check of the seedlings today after my first check two weeks ago. So far the results I have observed indicate that banana peels and coffee grounds are more effective at bioremediation than egg shells. However, this is based on the amount of seedlings that are growing in both trials not the height of the seedlings. When based on seedling height the efficiency of the bioremediators varies. Most seedling grown in the egg shells are below 2cm. This may be because the substance added makes it difficult for the seedlings to grow their roots easily. I also watered each plant with 15mL of tap water and covered them all with a towel to protect from the cold weather and wind.

Sunday, June 5th, 2016
Last night and all of today there has been severe winds and rain which I think may have killed most of my seedlings. I moved my seedlings under more shade at around 4am this morning however I was away the whole day today so I wasn't able to protect the seedlings further from the weather. Unfortunately, this has probably set me back several weeks meaning if I re-germinate seedlings I won't be able to observe them for as long. I will try to continue with this experiment however I may need to consider other possible SRP ideas.

(update: I checked my seedlings the following morning and was surprised to find that they had all survived! Even if this has affected their growth, I can still compare the growth of seedlings in the oil contaminated samples to the control)

Thursday, June 2nd, 2016
Yesterday I planted the seedlings I germinated. I am now considering constructing a type of greenhouse to protect my seedlings from the winter weather at the moment.

Thursday, May 26th, 2016
I have begun to germinate my seeds. By doing this outside of my soil I can ensure that all seeds I plant are viable and that I am testing the growth of the actual plant, not the effects of the oil on the seed. Next Wednesday I will plant these seedlings and observe their growth over a period of another 2 weeks.

Thursday, May 19th, 2016
Yesterday I mixed all the substances into the soil and I will add the seedlings in two weeks to evaluate the effectiveness of the bioremediators.

Monday, May 16th, 2016
Today I finally began my experiment as I arrived home from a trip overseas. I moved my weighed out soil samples into pots and poured 7mL of oil over each. The substances I am adding have all been weighed and bagged separately so they will be ready to add tomorrow after I have given the oil time to be absorbed.
Saturday, April 30th, 2016
I changed my experimental design today. My dad came over today and told me that all the bags of soil came from different locations so they have different properties. I didn’t know this when I put my soil into containers a few days ago since my dad wasn’t there so now we are thinking to evenly combine all the soil and divide it again so all the soil is the same. My dad also pointed out that soil testing in laboratories is very expensive and with 13 samples it would cost several thousand dollars. So now I am thinking to test the amount of oil remaining by observing how well seedlings grow or how well seeds germinate in polluted soil and bioremediated soil since plants would not grow in heavily contaminated oil.

Friday, April 29th, 2016
I collected my banana peels today and came home and sliced them up which will make them decompose more quickly. My dad also came home with some petrol so I can begin to contaminate my soil once I get the measuring cylinders I require. I’m still not sure whether I should conduct three trials with the 4 different substances of the same concentration or with different concentrations. I feel like different concentrations would be more interesting however I don’t think I have enough equipment/resources to do 3 different concentrations. The major issue for me at the moment is getting access to a soil testing laboratory.

Thursday, April 28th, 2016
After school today I went to my local Boost Juice store, since all of my calls hadn’t been answered, and asked if they could put aside their leftover banana peels for me. The manager kindly allowed my some which I will collect tomorrow after school. This means I will be able to get started with my experiment really soon! The only major issue I have is with where I will do my soil testing as all the laboratories I have emailed have not replied. I’m also thinking to do three repeat trials with all of my different substances instead of 3 different amounts since this would make it more reliable. Also, I need to find where I can get measuring cylinders and scales since a lot of my measurements will require more accurate methods of measurement.

Tuesday, April 26th, 2016
I forgot to write an update a few days ago but on Saturday (2 days ago) I divided all the containers into 13 different containers each containing 640g. Yesterday I but the eggshells, fish bones and used coffee grounds that I have collected in an oven after we used it to cook something else so that the residual heat could help to sterilise them so I can ground up the samples and add them to the soil. I’ve left the soil to air-dry for at least 24 hours so now I need to get some oil from the petrol station but I have to wait until either of my parents has time to take me.

Meanwhile I’m trying to decide whether the amounts of oil and bioremediators I’m planning to add could create a substantial result. Currently I’m thinking to add 1% oil (around 7mL) since many previous experiments have added 0.5-2%. For my
bioremediators I’m thinking to add 5%, 10% and 15% to different samples to demonstrate how different amounts could be more/less efficient but this could mean the results will not be reliable since I only have 13 samples so I wouldn’t be able to repeat trials to show that any trends are constant.

Friday, April 22nd, 2016
My dad recently went on a field trip where he managed to collect the amount of soil I needed for this experiment. The benefit of this was that the soil had already been professionally analysed by his team. My collection of eggshells and used coffee grounds has progressed well. Unfortunately, all the smoothie stores I have called have hung up so I still do not have a source for banana peels. I have emailed several universities and companies asking for general information and access to their testing equipment but none have replied in the last week so I’m not sure how I will proceed with testing the soil. Since none of the companies I contacted for access to oil have returned my emails I am thinking to purchase a portable fuel tank and fill it with petrol from a gas station.

Wednesday, April 13th, 2016
I have started researching and collecting the equipment/materials I need. So far I’ve collected a good amount of egg shells and a little bit of used coffee ground. Also, after doing some research I’ve decided to buy the fish meal since with the time constraints and my available equipment it would be a lot more reasonable and collecting so many fish bones would be quite difficult. For the banana peels, I’m considering contacting local cafes or smoothie places to ask for their leftover peels.

I’ve asked my dad where I could get soil and he’s looking into at work. It would be helpful if the soil I collect has been analysed before so I have available soil nutrient information. I’m also having difficulty with where I can get oil to contaminate the soil. Originally I wanted crude oil but it (as well as lots of other oils) are not readily available to the public.

Monday, April 4th, 2016
After discussion with my dad, who studies soil and climate change, I have decided that I would like to do my SRP on a topic related to soil and possible solutions to soil pollution. I decided on this because I would have access to most of the equipment required since it would be related to my dad’s work and because pollution, especially soil pollution, is a major issue.

After doing some research I discovered the idea of bioremediation which is the process of solving environmental issues, like soil pollution, with naturally occurring organisms, in particular microbes like bacteria, fungi and archaea. Soil pollution can be as a result of many factors but I decided to investigate oil pollution since it is a lot easier to measure and to conduct as an experiment.

I am thinking to do a comparison between four bioremediators: seaweed, coffee grounds, bone meal and alfalfa. I’ve chosen these bioremediators as they’re all known to improve nutrients in the soil, especially nitrogen and phosphorous which are
essential in stimulating microbes to efficiently degrade contaminants in soil. At the moment I’m having difficulty finding a name for my project since I’m not sure how I could classify the bioremediators into one general group for the title. Also, I’m currently researching ways to measure take measurements for my projects, for instance: soil nutrient availability, the microbes present in the soil and several other soil health aspects.

Saturday, February 27th, 2016

**SRP IDEAS**

- A recyclable balloon that doesn’t become thinner after inflation/deflation
- Blinds that go down when they detect too much UV
- A device (accelerometer) that attaches to walkers and provides pain relief to user based on movements and environment
- Shoes that convert energy from walking to power that can be used to charge phones
- Does pollution in rivers effect soil quality in surrounding soil?
- A straw like machine that sucks off egg shells so you don’t have to peel it
- Machine that helps people with osteoporosis get out of vehicles easily
- A water bottle that changes colour based on how dirty the water is (what bacteria is in it)
- What is the air quality of basement car parks? What chemicals are in the air? (a vent to clean the air)
- Does ocean acidity effect how fast oysters reproduce?
- A hand towel that changes colour as you wipe your hands based on how much bacteria is still left
- Why does melted cheese get thicker once it has cooled? How do you stop this?
- Why does paper become wrinkled/bumpy when dried after wet? (paper that doesn’t do this)
- Does a spider’s diet affect the quality of its web?
- Compact, portable ultrasound machine
- Program that uses computer camera to examine shape of eyes and shows prescription needed
- Do brain training apps really work?
- Invention that helps disabled people get out of cars easily
- How can you unburn toast?
- Portable toaster/sandwich press (possibly powered by solar energy)
- Car windows that absorb sun rays for energy
- Paint that can be removed when dried (erasable paint)
- When do you have to re-apply sunscreen for full effectiveness and how does the time of re-application change between different brands?
- How does ocean acidification effect fish eggs?
- A wheelchair/walker/bike that brings wheel up/down when it detects ledges
- Where are all the ladybugs?
- Something that stops fire spreading (e.g. on paper)
- Hearing aid in the shape of ear plugs that can be controlled via mobile device
- What encourages yeast in sourdough to grow quickly?
- Life jackets that prevent hypothermia
- Car keys that check alcohol levels and only opens the car if levels are low
- Glass or straw that detects if drink is spiked and changes colour to show drinker
- Straw that tells alcohol levels by sending data to device
- Does soil PH effect earthworms?