Student Name: Teacher:

Island School Science

Year 9

Our Planet

Student Booklet

(Revised June 2025)

Yr9 1a The Impact of Acid Rain on the Environment

Introduction:

Acid rain is a complex environmental problem that concerns many environmental and chemical engineers.

When engineers examine the acid rain damage to water, wildlife, forests, crops and structures, they consider the impact on human health. Engineers design many useful technologies that help industry reduce the amount of harmful pollutants released into our air.

Engineers also help to develop laws that prevent or limit factories and industries from burning fossil fuels (which release pollutants), or require them to minimise their pollutant output.

Aim:

To investigate the negative impact of acid rain on living and non-living matter.

Method:

1. Using the universal indicator and/or a pH probe measure the pH of the vinegar and the distilled water, and record it on their worksheets.
2. You must now use your scientific knowledge to date to make some predictions. If vinegar contains acid (ethanoic acid), then how will the items placed in vinegar change? If these items are placed in water, will they change in the same ways as in the vinegar?
3. Use masking tape and pens to label one jar/beaker "vinegar" and the other one "water."
4. Using an electric balance measure the mass of the leaf, paper clip and egg shell and record in the results table below.
5. Pour 100cm^3 vinegar into the vinegar jar. Place a paperclip, piece of eggshell and a green leaf in the vinegar. Put the lid on the container.
6. Pour 100cm^3 of distilled water into the water jar. Place a paperclip, piece of eggshell and a green leaf in the distilled water. Put the lid on the container.
7. Let the jars sit overnight on a windowsill or protected area.
8. The next day, remove the container lids. Observe any changes in the condition of the items in the jars. [You may need to come to the lab during a convenient time for your teacher to make these observations] Enter your initial observations in the results table provided.
9. **After one week**, look for more changes. Make observations again. Remove the paper clip, egg shell and leaf and measure the DRY mass of each. Record your mass readings in your results table.

Results and Analysis

Record in the table below your **predictions** (what you think will happen to each item). Next, record your **observations** (a detailed description of what *actually* happened to each item) after one day in each solution and after one week in each solution.

	Distilled Water [pH =]			Vinegar [pH =]		
	Predictions	Observations After 1 Day	After 1 Week	Predictions	Observations After 1 Day	After 1 Week
Eggshell						
Green Leaf						
Paperclip						

Acid:

Object	Mass in Day 1 (g)	Mass in Day 7 (g)	Change in Mass (g)
Leaf			
Eggshell			
Paperclip			

Water:

Object	Mass in Day 1 (g)	Mass in Day 7 (g)	Change in Mass (g)
Leaf			
Eggshell			
Paperclip			

Conclusion:

1. Describe what happened to the living items (the leaf and eggshell) tested in the acidic solution.

2. Do you think acid rain has this effect on all living things? Explain why or why not.

3. Describe what happened to the non-living item (paperclip) tested in the acidic solution.

4. Do you think acid rain has this effect on all non- living things? Explain why or why not.

5. Did any of the object's change in mass? Explain any changes.

6. Why is acid rain harmful to forests?

Acid Deposition

What Is Acid Deposition?

Acid deposition includes acid rain, snow, fog, humidity and dust with an acidity level lower than pH 5.6. Normal rain, which has a pH of about 5.6, is about 25 times more acidic than "pure," neutral water. The acidity results from the conversion of atmospheric carbon dioxide in water vapor to carbonic acid, a weak acid. Most acid precipitation has a pH between 4.6 and 5.6, but scientists occasionally have measured pH values in acid rain in the eastern U.S. as low as 2.1 and 3.0, which is about 10,000 to 80,000 times more acidic than pure water.

From Where Does It Come?

Nearly 95% of the acidity below pH 5.6 comes from atmospheric sulfur dioxide and nitrogen oxides, which are products of fossil fuel combustion. Acidified rainwater contains combinations of sulfuric and nitric acids that form when water vapor, and sulfur dioxide and nitrogen oxides react. Most of the acid deposition in the eastern U.S. is attributed to the release of large amounts of sulfur dioxide and, to a lesser extent, nitrogen oxides from big mid-western power plants that burn coal. Paper and wood pulp processing plants also contribute to sulfur dioxide pollution. In the U.S. and Canada, sulfur dioxide contributes much more to acid deposition than nitrogen oxides, which come mainly from automotive emissions, but over the next few decades, nitrogen oxides may catch up. Sulfur and nitrogen oxides may be transported by the wind in the atmosphere for many miles, crossing regional and international boundaries, before falling to Earth.

What Are Its Effects?

The effects of acid rain may not be immediately apparent. For example, at a glance, a lake might look clear and beautiful, but a closer look may reveal few living organisms. Some species of fish cannot reproduce in water with a pH of less than 5. Clams, snails, crayfish and other crustaceans, brook trout, walleyed pike and bullfrogs are especially sensitive to acidification. However, the detrimental impact of acidification to animal life is not necessarily caused directly by the acidity. Trace metals such as aluminum, mercury, manganese and cadmium, which are leached from sediment and rocks by the increased acidity, are toxic to life. Thus, the pH does not have to decrease very much before fish kills can occur. Because many insects cannot survive in strongly acidic streams and lakes, birds and mammals that depend on insects for food may suffer abnormally high mortality. Acidification also interrupts normal decomposition of dead plant and animal material in lakes and streams because many of the bacteria that assist in decomposition perish. Without the usual decomposition processes, dead material settles to the bottom, making the water look crystal clear.

The damaging effects of acid deposition on forests and other terrestrial systems are less well understood than on aquatic systems. Acid deposition can alter soil chemistry, nutrient availability and plant growth. In their weakened condition, trees and shrubs become vulnerable to insects, diseases and fungus infestations.

Although the Norwegians were the first to bring acid rain to the world's attention in the 1940s, one of the most severely impacted areas of the world is the industrialized Ruhr Valley in West Germany. There, white fir trees became defoliated and died in the early 1970s. Diseases in spruce and other sensitive conifers soon followed, and by 1985, the number of German trees visibly affected by acid deposition had risen to 52%. Forests in other parts of the world also display acid deposition damage. For example, the

dominant tree in Vermont's Green Mountains, the red spruce, is suffering severe mortality and parts of the mountain range have become denuded. Sugar maples all over the northeastern U.S. and Canada are declining. In the Shenandoah and Great Smokey Mountains of the southeastern U.S., spruce and fir are failing to reproduce and are dying. Pine also are impacted.

How Do We Recognize It?

Particulate matter containing atmospheric sulfur dioxide and nitrogen oxide account for over 50% of the visibility problems in the eastern U.S. In the West, these particles have been blamed for reducing visibility in the Grand Canyon of the Colorado River and other areas. Acid deposition contributes to the corrosion of metals and the deterioration and soiling of the stone and paint on buildings, statues, and other structures of cultural significance.

How Do We Reduce Its Effects?

The U.S. federal government has undertaken a wide range of research programs, many through the National Acid Precipitation Assessment Program, to study the complex processes associated with acid rain. To measure acid deposition quantity and chemistry, scientists collect rainfall samples at monitoring stations throughout the U.S. Monitoring dry deposition such as acid dust is difficult and, consequently, has not been as extensive as that for wet deposition.

The Clean Air Act Amendments of 1990 established an Acid Rain Program to reduce emissions of sulfur dioxide and nitrogen oxides at the lowest cost to society. To achieve reductions of 10 million tons of sulfur dioxide by the year 2010, the Act requires a two-phase tightening of the restrictions placed on fossil-fuel-fired power plants. Phase I began in 1995 and affects 110 coal burning electric utilities in 21 mid-western and eastern states. Phase II began in 2000 and tightens annual emissions on the large plants and also sets restrictions on smaller, cleaner plants burning coal, oil and gas. To achieve reductions of 2 million tons of nitrogen oxides by 2000, the Act requires coal-fired utilities to install low-nitrogen-oxide technologies on their burners.

To reduce sulfur dioxide emissions, fossil fuel burning plants can burn low-sulfur coal, install flue-gas desulphurization equipment (scrubbers) and implement clean combustion technologies. Low-sulfur coal contains about 1% sulfur by weight and is found mainly in the western U.S. High-sulfur coal contains sulfur in excess of 3% and is geographically concentrated in the Appalachians where coal utilization is greatest. Scrubbers are effective at reducing air pollution, but the sludge they produce creates a disposal problem. Also, they are expensive to build and operate. Clean combustion technologies involve mixing fuels with compounds that react with sulfur and either collect it or convert it to a marketable product that does not enter the stack. Many of these innovative technologies have the added advantage of removing nitrogen oxides as well. Because emissions from motor vehicles are a major source of nitrogen oxides, catalytic converters are used to reduce nitrogen oxides from automotive sources.

Source: Project A.I.R.E., U.S. Environmental Protection Agency, http://www.epa.gov/region01/students/teacher/aire.html.

Causes/Reasons for deforestation	Effects/consequences of deforestation

Deforestation in the Amazon Rainforest

Introduction

Deforestation is the removal or clearing of a large area of trees. Deforestation may happen for several different reasons. One reason is to build homes, buildings, and factories for people to live and work in. Another reason is to make space for farming and agricultural activities. Sometimes people remove trees to make items from them, such as paper or furniture. Trees may be cut down to use as firewood. Many times deforestation is human-caused, but trees can also be cleared after a natural event, such as a tornado or fire.

When people remove trees from an area, they can use different techniques. One is called **clear-cutting**. People will cut every single tree in an area. Another way people may remove trees is called **slash-and-burn**. In the slash-and-burn technique, the trees are cut down and then burned. Sometimes this is done so that the ashes from the burned trees go into the soil, which provide nutrients for farm crops to grow in place of the trees.

There are several effects of deforestation. Deforestation is a type of **habitat destruction**, and can cause many animals to lose their homes. They have to find another place to live, or they will not survive. Some organisms may become **endangered** or even face **extinction**, if an area is completely destroyed. Deforestation can also lead to **erosion**. The roots of the trees help soil stay in place, and when the roots are gone, the soil becomes loose. It can move around, being carried by wind or water, causing murky rivers and lakes, or even landslides. Lastly, deforestation can lead to an increase in **greenhouse gases**. Trees take in greenhouse gases like carbon dioxide when they do **photosynthesis**. When the trees are gone, more greenhouse gases build up in the atmosphere and can contribute to **climate change**.

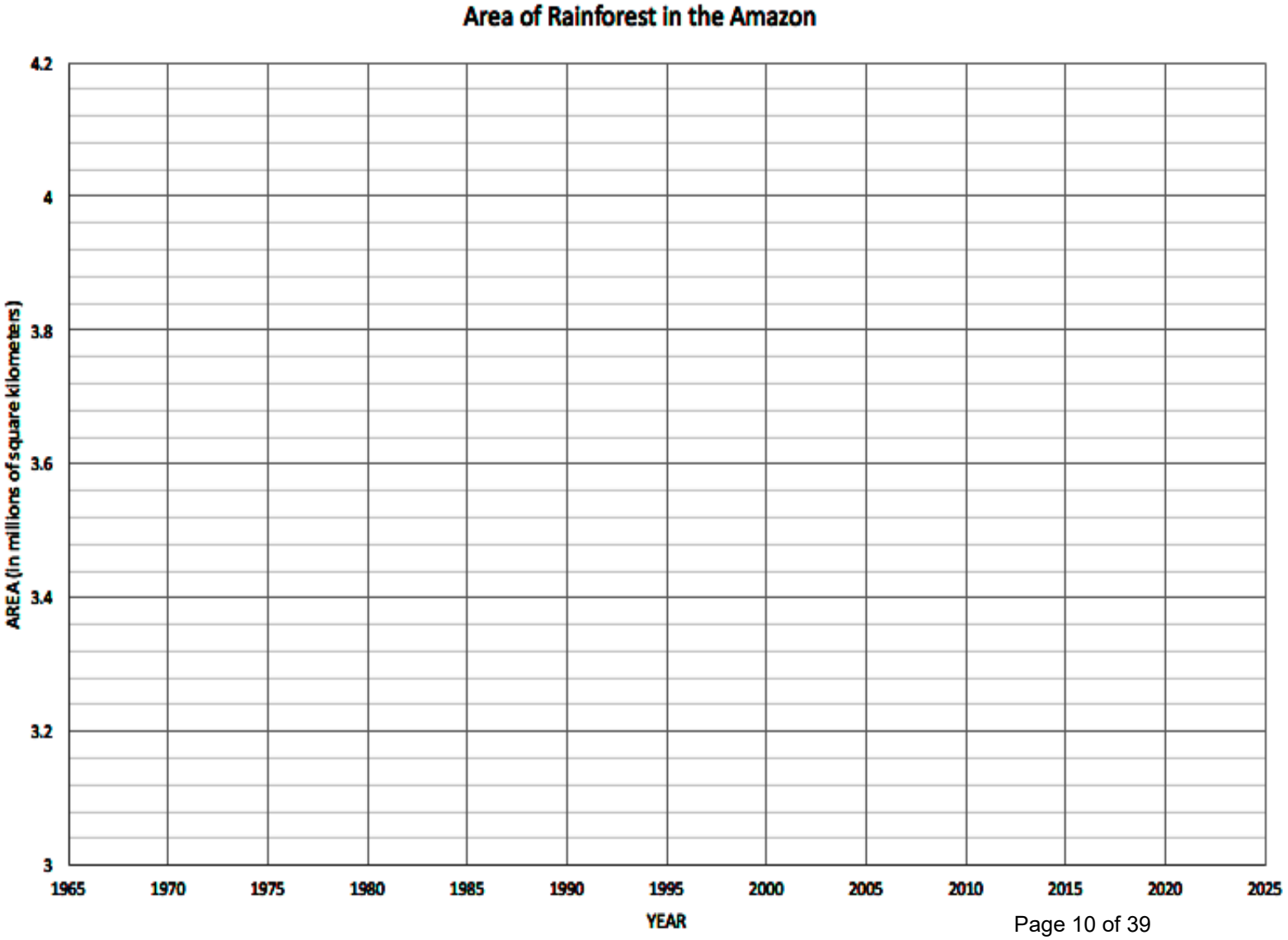
In this activity, we will investigate how the **Amazon Rainforest** has changed in size due to deforestation in the past 50 years. We will create a line graph of the changes over time of the amount of forested area.

Directions

The chart on the right shows the size of the Amazon rainforest, in millions of square kilometers. This means that in 1970, 4.1 million km^2, or 4,100,000 of rainforest area existed in the Amazon. The data is from Brazil's Institute for Space Research (INPE).

Plot a point on the graph for each year in the chart below. Then, using a straight edge, connect the dots from left to right to create a line graph.

Deforestation in the Amazon	
Year	**Size of Rainforest (in millions of km^2)**
1970	4.10
1977	3.96
1985	3.86
1990	3.80
1995	3.71
2000	3.60
2005	3.50
2010	3.43
2015	3.42
2019	3.38



Analysis and Conclusion

1. Describe the pattern you see in the graph.

2. What years does the graph decrease the slowest? Why do you think this happened?

3. Predict what you think will happen to the area of Amazon rainforest in the future. Will it increase, decrease, or stay the same? Justify your answer with reasoning.

4. In 1970, there were an estimated 120,000 jaguars in South and Central America. In 2014, there were estimated to be about 12,000 jaguars. Explain how this change in the jaguar population may have been affected by deforestation.

5. How can people help make a difference and **conserve** the rainforest, even when we don't live near it? Give at least two ideas.

Biodiversity

_____: a group of similar _____ that have similar characteristics to each other and can _____ with each other

-the _____ of different species in an area

Keystone Species

CAN BE PLANTS

-a species that influences the _____ of many other species in an ecosystem

Example: Bee

NO ONE KNOWS HOW MANY SPECIES HAVE NOT YET BEEN _____.

BIODIVERSITY CAN BE _____ OR POSITIVELY AFFECTED BY THE ACTIONS OF _____.

Economic Value

-many organisms provide people with _____ and supply raw _____ for clothing, medicine, and other products

-ecosystems provide _____ for people

Factors that Affect Biodiversity

1. _____
2. _____
3. _____
4. _____
5. _____
_____

CAUTION
Sea Turtle Nest
Do Not Disturb

Threatened Species

-species that could become _____ soon

Endangered Species

-species in danger of becoming _____ soon

SEA OTTERS

BIODIVERSITY _____ FROM PLACE TO PLACE ON EARTH.

WILD ORGANISMS ARE A SOURCE OF _____ AND RECREATION.

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PLANT & ANIMAL SPECIES DIVERSITY ON EARTH

There are many more species of _____ than of _____ or other _____ species.

Ecological Value

-all species in an ecosystem are _____ to one another

-species _____ on one another for food and shelter

-a change that affects one can affect _____

Biodiversity

CAN BE PLANTS

NO ONE KNOWS HOW MANY SPECIES HAVE NOT YET BEEN _____.

BIODIVERSITY CAN BE _____ OR POSITIVELY AFFECTED BY THE ACTIONS OF _____.

Economic Value

Factors that Affect Biodiversity

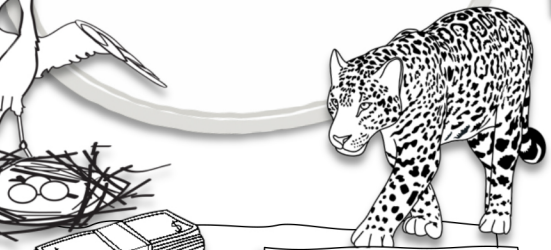
CAUTION
Sea Turtle Nest
Do Not Disturb

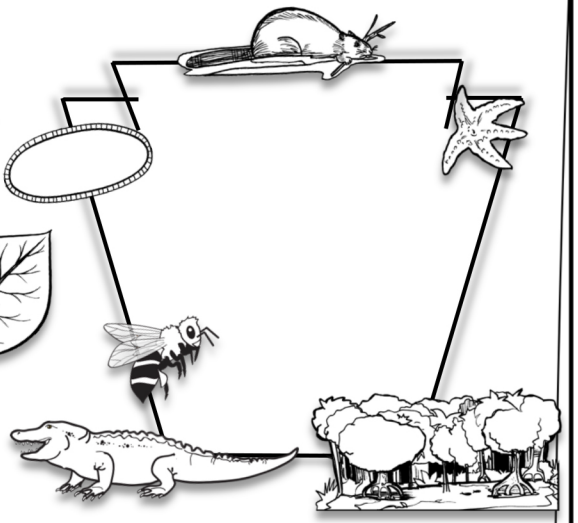
SEA OTTERS

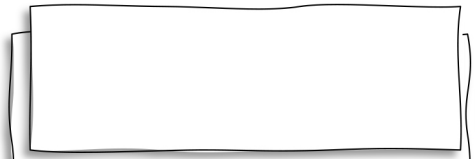
Ecological Value

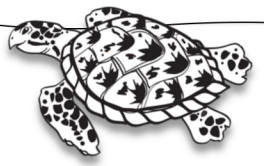
Plant & Animal Species Diversity on Earth

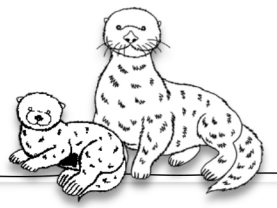
Biodiversity

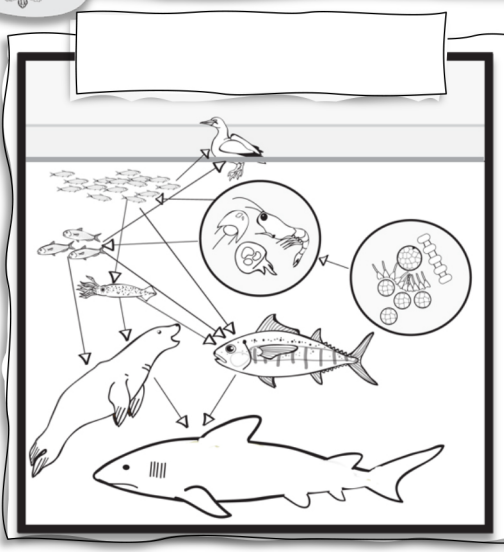


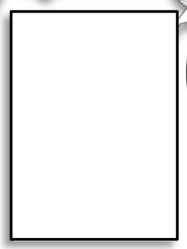


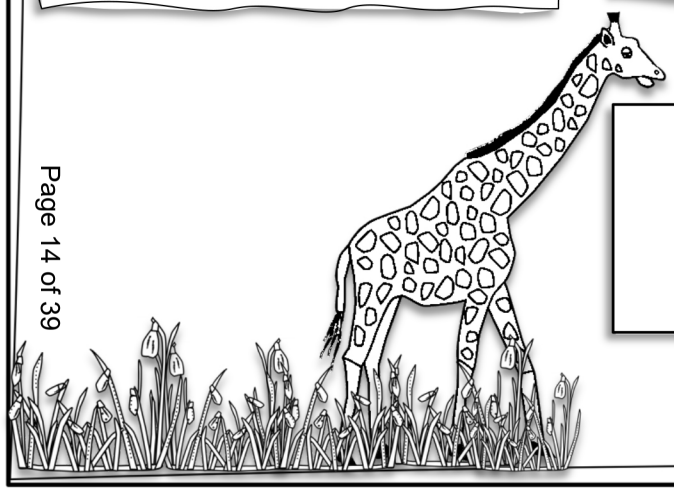




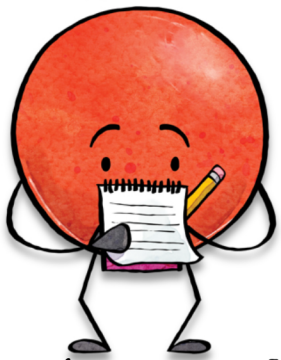








Understanding Checkpoint



Biodiversity

Name _____ Date _____ Period _____

1. Biodiversity is the variety of different _____ in an area.

2. The number of known species is about _____ million.

   a. 17
   b. 1.7
   c. 10.7
   d. 11.7

3. A sea otter is critical to the functioning of the ecosystem in which it lives. It affects the survival and abundance of many other species in its community.

   It is a(n) _____ species.

   a. keystone
   b. endangered
   c. threatened
   d. unknown

4. Which organisms on Earth have the most species named?

   a. plants
   b. animals
   c. bacteria
   d. insects

5. Organisms have _____ value.

   a. ecological
   b. economic
   c. recreational
   d. all of these

6. When there are no individuals of a certain species left anywhere on Earth, they are considered

   a. endangered. b. extinct.
   c. threatened. d. keystones.

7. Organisms provide people with jobs and the things they need to live; that gives them _____ value.

   a. economic b. ecological
   c. recreational d. niche

8. This factor affects biodiversity:

   a. climate
   b. size of the area
   c. genetic diversity
   d. all of these

9. True or False: All species in an ecosystem are connected.

10. True or False: People have no influence on biodiversity.

What if the other species could talk back?

What if the species could talk? What if it is no longer a monologue but a dialogue? What if our dwindling species put us in a courtroom and ask- 'What are you doing?'
We have shown our incompetence and incapability in understanding their presence, plight, and plea. Today, you have a unique opportunity to express their viewpoint in the first person. You have the responsibility of representing them, and hopefully, you would give them a voice that will make a difference, even if just a little.

1. Work in groups of 3-4
2. Discuss the case history a critically endangered species
3. Research before you choose, look up species from different kingdoms (not just animals and not just mammals)
4. Explore the link below to find various species:https://www.iucnredlist.org/
5. You are a family representing the species of your choice
6. Prepare an emotive speech to show the plight of your species, pressures you are facing, the ecological significant role you play
7. You are presenting your case to a jury (teacher), the jury will choose ONLY one species that could be conserved as funding is an issue
8. Why should your species be conserved?
9. You will have 5 minutes to present your case
10. The jury might ask you specific questions before making their decision so make sure that you have done good research

Include all of the following in your role play

- Name and description of the species
- Its ecological role
- Pressures (ecological, socio-political and economic) contributing to its IUCN threatened the status
- The species' ecological roles and the possible consequences of their disappearance should be considered
- You will need to know the ecological, political and economic pressures that caused or are causing the degradation of the chosen area, and the consequent threat to biodiversity

How will you present your research?

- You will bring props
- You will dress up as your species, be creative (dress code applies)
- Give a named ecosystem where your species comes from
- You will give a first-person account of what the species has faced or is currently facing
- You will be engaged in a maximum 5-minute long speech/ dialogue amongst your group members that cover the points mentioned above
- You will submit the written speech with APA in-text and works cited

Assessment Criteria:
-Research shown by your speech works cited and in-text referencing
-Creative thinking skills in the usage of props
-Critical Thinking skills

David Attenborough: A Life on Our Planet

1. What human disaster happened in the city of Chernobyl in 1986?

2. How old is Sir David Attenborough?

3. What was the world population in 1937?

4. What percentage (%) of species were wiped out when a meteor crashed into the Earth, killing all of the dinosaurs?

5. By 1954, what percentage (%) of wildlife was remaining?

6. What does the word 'Serengeti' mean?

7. In what year was the Apollo 8 mission launched?

8. Which ocean animals were being hunted in the 1970s?

9. By how much had Borneo's rainforest decreased by the end of the 20th century?

10. Up to how many species of tree are there in a small patch of rainforest?

11. What colour did all of the coral turn?

12. What change happened in the ocean to cause coral to turn this colour?

13. In the last 40 years, what percentage (%) of the summer sea ice in the Arctic has been reduced by?

14. How many trees do we cut down each year?

15. What is the Earth's population in 2020?

16. How many people are estimated to be on Earth by 2100?

17. In which country is the world's largest solar farm?

18. How did people on the island of Palau respond when their fish stocks decreased?

19. How could many humans change their diets to make it more sustainable?

20. Which greenhouse gas do trees absorb from our atmosphere?

21. What has happened to the city of Chernobyl since it was evacuated 30 years ago?

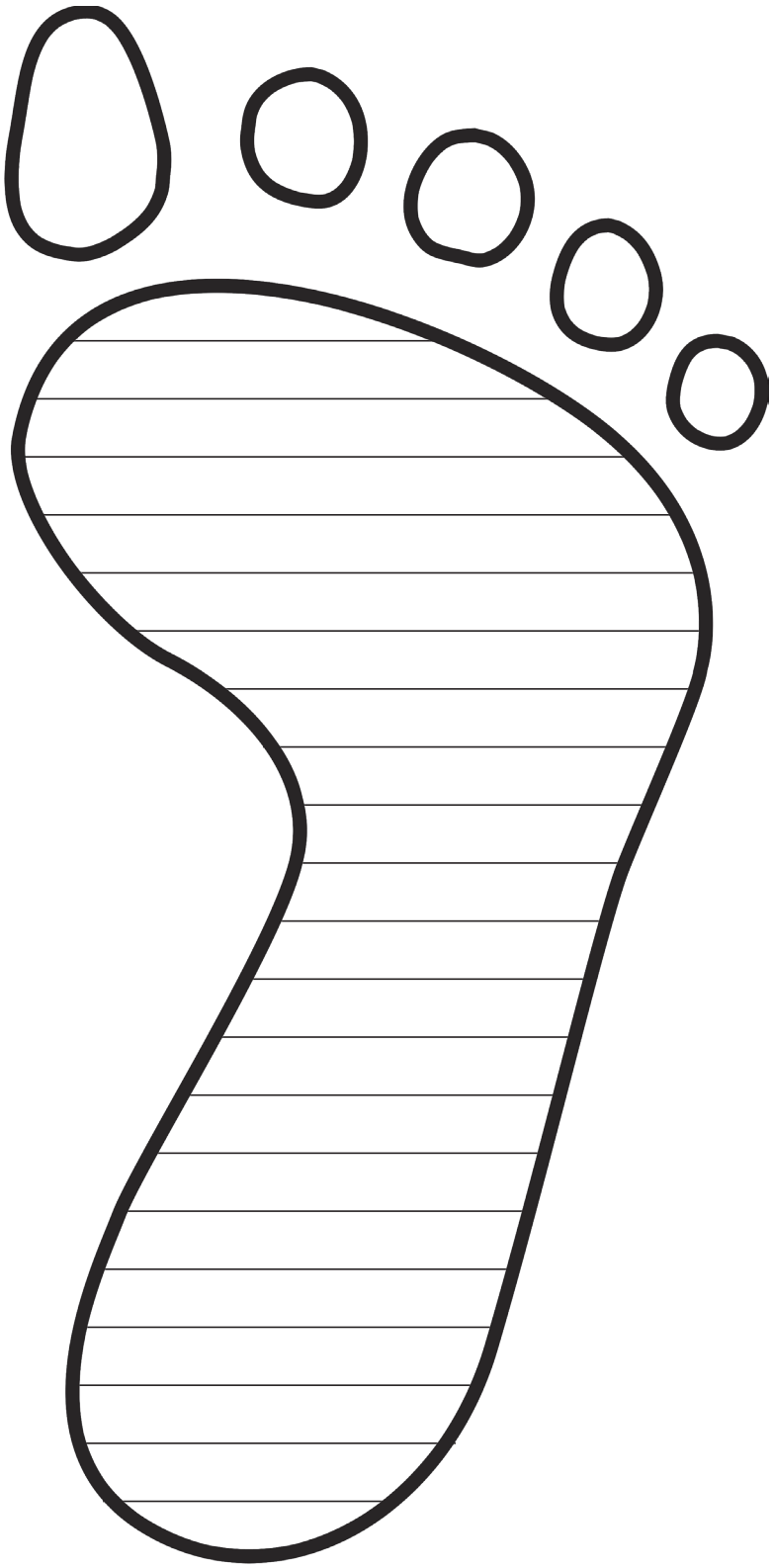
22. Look at all of the words in the box below and circle/highlight all of the emotions which you felt whilst watching 'David Attenborough: A Life on Our Planet'.

Relaxed	Amazed	Awe	Delighted	Engaged	Enthusiastic	Excited
Happy	Inspired	Passionate	Angry	Annoyed	Frustrated	Proud
Accepting	Caring	Empathy	Safe	Fascinated	Interested	Sad
Despair	Disappointed	Heartbroken		Hopeless	Lonely	Confused
Empty	Indifferent	Embarrassed		Shame	Ashamed	Afraid
Frightened	Hesitant	Nervous	Worried	Helpless	Appreciative	
Delighted	Fortunate	Guilt	Regret	Hopeful	Encouraged	

Carbon Footprint

Your carbon footprint is the amount of greenhouse gases you produce. These gases are produced by things such as using electricity, driving cars and eating food that has been grown hundreds of miles away.

Write down ways you can lower your carbon footprint.



9 OP 5a Rising Sea Levels Mind Map

1. Your teacher will show you the following videos to introduce the impact of rising sea levels on the earth.

   Rising Sea Levels
   Greenhouse Gases
   Rising Sea Levels from Space

2. In **groups** you must address the following:
   - Link between an increase in temperature and sea levels
   - Urban impact from rising sea levels
   - Issues with salt water mixing with freshwater
   - Ice melting and sea levels
   - Greenhouse gases

3. Using A3 paper provided by your teacher, create a **'Mindmap'** of your group's ideas and elect a group leader to share your ideas from your mind map with all other students in your class.

9 OP 5b Modelling Melting of Polar Ice Caps

Aim:

Have you ever noticed that if you leave an ice cube out on the kitchen counter and come back to check on it in a while, you find a puddle?

The same thing happens to ice in nature — if the temperature gets warm enough, the ice melts. In this science activity, you will explore what happens to sea levels if the ice at the North Pole melts, or if the ice at the South Pole melts.

Does melting ice at either cap contribute to a rise in sea levels? It is an especially important question for the millions of people who enjoy living along the coasts of the world.

Procedure

1. Put one cup of Play-Doh or modelling clay into one of the clear containers. This container will be a model of the South Pole, with the mound representing the continent of Antarctica. Use a butter knife to scrape around the sides of the measuring cup, if necessary. Make the top of the dough flat and level. Leave some space between the sides of the dough and the wall of the container all around, so that you can add water later.
2. Take your model of the South Pole and carefully add around ¼ cup of water around the sides of the dough, so that the water level comes up about one-third to half of the way up the dough mound. The water represents the ocean.
3. Place two ice cubes on top of the dough, lightly pressing them down into the dough. Immediately mark the water level on the side of the container with the permanent marker or colored tape. The ice cubes represent the southern polar ice sheet in this model of the South Pole.

What do you think will happen as the ice cubes melt?

4. Take the second, clear container and fill it about one-third to half full of tap water. The water represents the ocean. Add two ice cubes to the container and immediately mark the water level on the side of the container with colored tape or a permanent marker. This container is a model of the North Pole, where the ice cubes represent the floating northern polar ice cap.

What do you think will happen as the ice cubes melt?

5. Allow the ice in your models to melt in a place where they will not be disturbed. Keep an eye on the ice cubes in the South Pole model to make sure they stay balanced on the dough, and that the water from these melted ice cubes is able to drain off of the dough.
Once the ice has completely melted, check the water level in each container again.

Has the water level risen in any of the containers? If it has, why do you think this is and what do you think the implications are for changes in sea level in the real world?

Conclusion:

From your observations draw a scientific conclusion that links your laboratory investigation to the real world issue of polar ice caps melting. Be as scientific as you can in your discussion !

9 OP 5c Polar Ice Caps - Extension

Analysing Sea Level Rise

Use the satellite data graphs at Sea Level | Vital Signs – Climate Change to answer the questions below. (Note: To obtain exact data points, place your mouse on the section of the graph you would like to examine.)

1. What is the source of the data for each graph?

2. Which years are covered by each graph?

3. Is one graph a better representation of global sea levels than the other? Why or why not?

4. By approximately how many millimetres did sea level rise between:

a) 1910 and 1930?

b) 1930 and 1950?

5. What is the approximate average rate of increase of sea level rise between 1900 and 2000?

6. By how many millimetres did sea level rise between the first measurement obtained in January 1993 and the first measurement obtained in January 2013?

7. What is the approximate rate of sea level rise between January 1993 and present?

Examine the line graph for average global temperature at http://climate.nasa.gov/vitalsigns/global-temperature and use it to answer the questions below.

8. By how much did the average global temperature change, and did it increase or decrease between 1910 and 1930?

How about between 1930 and 1950?

9. Compare your answers to question number 8 with your answers to question number 4. Can you offer an explanation for the correlation or lack thereof?

10.What is the approximate average global temperature rise per year from the first measurement taken in 1880 to present?

9 OP 6a Modelling Oil Spills and Clean Up of Spills

Aim:

Essential question: What are the effects of both the spill and the cleanup? What can we, as humans, do to avoid these problems in the future?

In this practical activity you will create a model habitat, complete with living organisms, which will suffer an oil spill. They will then test different tools to try to clean their habitat as best as possible.

Procedure:

1. Using the equipment that has been provided, you must use the rocks to form an island that rises out of the water in the tub.
2. Next, add “plants” (sticks and lettuce or moss) and “animals” (feathers). Some can be on the land, but most should be in the water. Make sure you are taking turns building the island so everyone participates!
3. Next pour the oil into the tub, spreading over the island, water and habitat items.

Observe and discuss: How is each material reacting with the oil? Record their observations in the results table below.

4. Use each cleaning tool to remove, or barricade, oil from the rocks, water and habitat items. Make notes about how each tool works in your results table below.

5. After testing each tool, discuss your observations about the tool as a group.

Results:

Use this table to record how the habitat materials interact with the oil.						
Material	Water	Rock	Feather	Stick	Fur	Plants
Reaction with Oil						

Use this table to evaluate each of the cleaning tools.				
Cleaning Tool	Pros	Cons	What habitat material does it clean the best?	What effect does it have on the environment?
String				
Sponge				
Cotton Ball				
Spoon				
Dish Soap				
Eyedropper				

Conclusion and Analysis:

1. What happened to the land and habitat items when the oil spilled?

2. How did your group use the different tools? Why?

3. Which tools worked best for cleanup? Why?

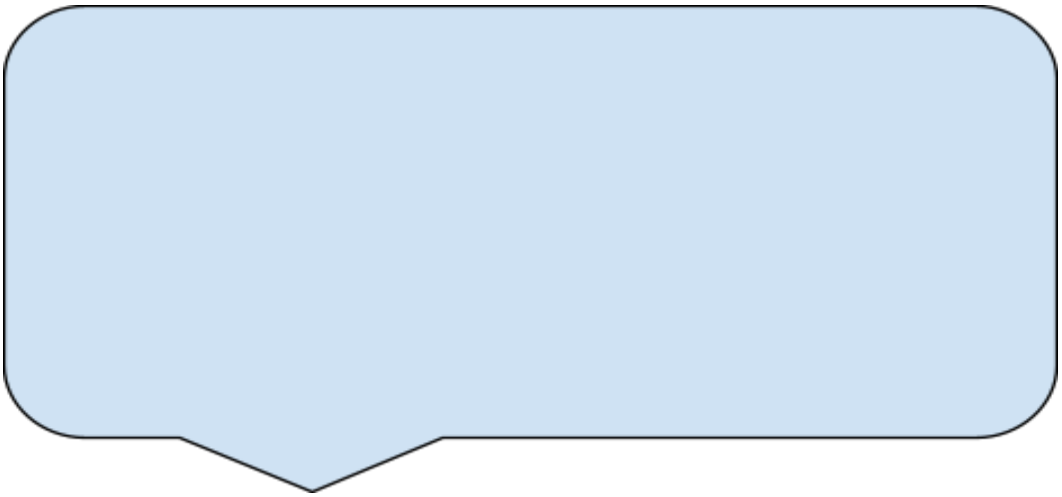
4. What was the hardest material in your habitat to get the oil off of? Why do you think this is?

5. What does this tell us about real world oil spills? What are some other ways we could clean up oil spills?

6. Is there anything else we can do to minimise the impact of oil spills?

9 OP 6b Oil Spills - Tweet to Raise Awareness

Imagine the oil spill has just happened! Write a tweet to raise awareness of the issue…..
Use less than 140 characters.



Improved water sources vs. GDP per capita, 2015

An improved drinking water source includes piped water on premises and other sources (public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, and rainwater collection). GDP per capita is measured in constant 2011 international-$.

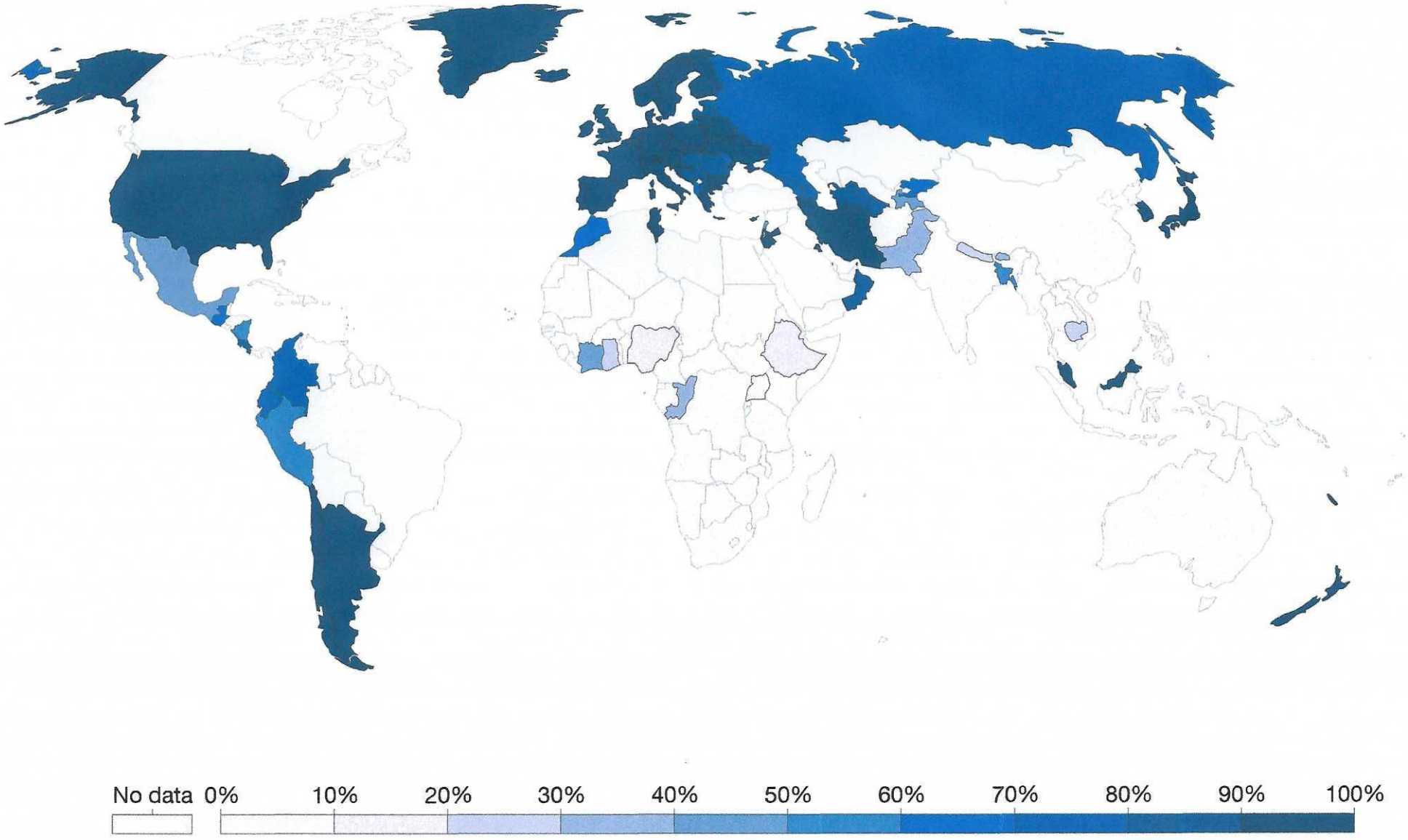
Our World in Data

Source: World Bank

Share of the population using safely managed drinking water, 2015

A safely managed drinking water service is defined as one located on premises, available when needed and free from contamination.

Our World in Data



Year 9 Environmental Science Lesson 7a

Source: WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP)

Filtering Contaminated Water

Introduction:

In this experiment you will filter three water samples with different "contaminant" (food colour) concentrations using three different filter types

1) powdered activated carbon
2) granular activated carbon
3) no carbon filter

Once you have completed the filtration, you will assess the effectiveness of each method by looking at the colour change of your samples. You are given 3 samples of water:

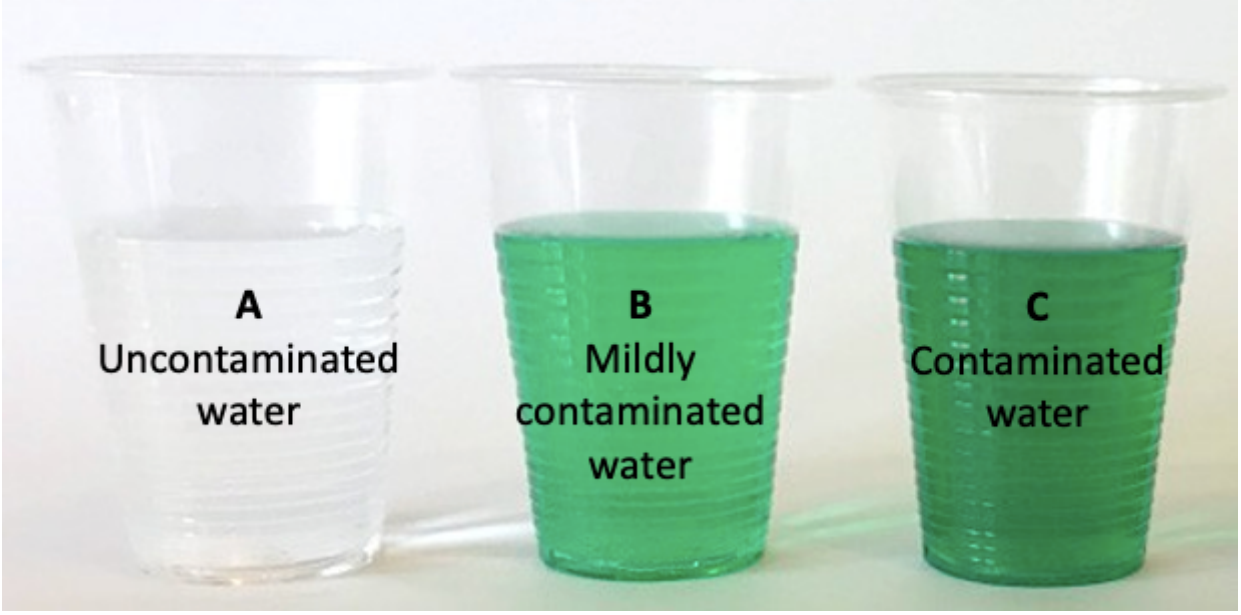


Image showing three samples with different concentrations of "contaminant" (green food colouring)

Method:

1. Label three 250 cm^3 beakers 1, 2 and 3.
2. Place 3 coffee filters over each beaker and secure them with an elastic band.
3. Measure 3 g of powdered activated carbon in a weighing boat on an electronic balance and pour the powder into the filter paper on beaker 1.
4. Measure 3 g of granulated activated carbon in a weighing boat on an electronic balance and pour the granules into the filter paper on beaker 2.
5. The filter paper on beaker 3 should not have anything added.
6. Use a measuring cylinder to measure 100 cm^3 of solution A and pour it into beakers 1, 2 and 3.
7. Allow the solution to filter and write your observations of the filtrate in the results table.
8. Repeat each step with solution B and C.

Results table:

Write your observations in the table below. Use terms such as: no change, slightly paler, almost colourless, colourless.

Filter Type	Observations		
	A uncontaminated	B mildly contaminated	C very contaminated
Powdered carbon			
Granulated carbon			
No carbon			

Analysis and Conclusion:

Which filter type was best at removing the food dye?

Explain why.

Investigating Wind Turbines
Results, analysis and conclusions

Angle of turbine blade (Degrees)	Potential difference (Volts)
Flat	
10	
20	
30	
40	
50	

Now draw a line graph to show the output:

X axis is what was changed (angle of turbine blade – independent variable)

Y axis is what was measured (potential difference produced – dependant variable)

Which angle gave the highest potential difference?

_____
_____

How does the angle alter the speed at which the turbine rotates (indicated by the potential difference)?

_____
_____
_____
_____

Now I have found out which is the best angle to put the blades at, other variables I could investigate include:

_____
_____
_____
_____

MYP Science
Practical Report Template

Names of Everyone in Group	Form:

UNIT:	Our Planet
Investigation Title:	

Criterion B - Inquiring and Designing

Research Question

(What are you trying to find out?)

Background Scientific Information and Hypothesis

(What do you think will happen and why?)

Variables

Independent *(What will change and how will you change it?)*	
Dependent *(What will you measure to gather results?)*	
Control *(What variables will you keep the same to make it a fair test? How will you keep the variables constant?)*	

Apparatus Set-up

(Draw a labeled diagram of the assembled apparatus that you will use. Write the name of any equipment not shown in the diagram)

Method

(Write a step by step account of how you conduct your experiment – the method must be DETAILED).
Add as many steps as you need to.

1.

2.

3.

4.

5.

Safety

(How will you make sure your method is safe?)

Reliability

(What will you do to ensure your results are reliable?)

Criterion C - Processing and Evaluating

Results

Raw Data

Observations

(What changes did you notice as the experiment was conducted, e.g. colour change, bubbles, heat change?)

Graphing Results

You should draw a graph of your results and attach it to this report.

Analysis of Graph

(What did your results show? Are there any trends or patterns in your results? Can you give an example of a pattern or trend from your results? Are there any anomalies in your results?)

Conclusion and Evaluation

Scientific Conclusion and Explanation of Results

(Summarize what your results show. How well does this support your hypothesis ? Can you explain your results using scientific knowledge?)

Evaluation of Scientific Method and Results

(How reliable were your results? How well did your investigation answer the research question? What went well with your method?

(Were there any problems or parts of your investigation that were not very accurate or could have been done better?)

Issue with justification	Suggested SCIENTIFIC Improvement