CREST AWARDS

BRONZE AWARD

MONITORING ACID RAIN

10H Typically 10 hours of project work
Recommended for 11-14 year olds

Practical project

Investigate air pollution levels by sampling rainwater and finding out about the causes of pollution in your local area.

#chemistry

#environment

#weather

HOW TO RUN CREST USING THIS ACTIVITY

Looking for some support? Find a mentor by contacting your local STEM Ambassador hub: **www.stem.org.uk/stem-ambassadors/local-stem-ambassador-hubs**

To use their project to achieve a CREST Bronze Award your students will need to:

- **Complete a minimum of 10 hours of project work**
- **Consider the broader impact of their project and demonstrate an innovative approach**
- **Complete the project workbook or short report in another medium**
- **Reflect on their work during the project using a student profile form**

Preparation

Ready to get going with CREST? Sign up for a CREST account here: **www.crestawards.org/sign-in**

Create a new Bronze Award project with the name(s) of the student(s) and the title of their project. If you don't have all the details, you can fill these in later!

Run the project

We have some super handy workbooks and profiles for your students to use when running a CREST Award. You can download these when you create your CREST account by following the link above.

Encourage your students to use the workbook or profile to plan and carry out their project, keeping a record of all their amazing progress.

Make sure you consider safety and risks!

Reflection

So, your students have been hard at work and completed their CREST project, but don't let this be the end of their learning. They should now fill in any remaining sections of their workbook. This is a chance for them to reflect on all the interesting things they've learnt and the invaluable skills they have used.

Enter your project for a CREST Bronze Award

Hard work deserves a reward! Celebrate and certify your student's achievements by entering their project for a CREST Bronze Award. Simply:

Log in to your CREST account at **www.crestawards.org/sign-in**

Select the project and upload a sample of the students' workbooks or other project evidence.

Check the participating students have met each of the criteria on the teacher assessment page.

Finally, complete the delivery and payment details to order your snazzy certificates.

Congratulations on completing CREST Bronze!

What next?

The scientific discovery doesn't need to end here. Students can have a go at the next level up – CREST Silver.

Don't keep all the fun to yourselves, encourage others to take part in CREST projects and share the wonder of science. For free ideas on how to get started, see **www.crestawards.org**

STUDENT BRIEF

BRONZE AWARD

Monitoring acid rain

In this project, you will monitor levels of atmospheric sulphur dioxide and rainfall acidity. Your results are likely to vary with different weather conditions. This may give you clues about the source(s) of the acid. You should spread your investigation over many months, so that you can compare results for both winter and summer.

Getting Started

Hopefully, the acid rain in your area will be very dilute. So, you need a method of measuring the small amounts and differences in acidity of your samples.

Comparing acidity: Compare the effects of dissolving carbon dioxide (CO_2), sulphur dioxide (SO_2), and nitrogen dioxide (NO_2) in water. Use a large volume of water and a slow stream of bubbles, so the concentration of dissolved gas increases only slowly. Find a way to monitor the changes in pH. Compare the amount of each gas produced by burning fuels with the effect each has on rain.

Investigate how the pH values of sulfuric acid and nitric acid change as they become more dilute. Start with an initial concentration of 1.0 mol dm^{-3} for each acid and gradually dilute them to known lower concentrations until the pH values rise above pH6. What happens if you keep on diluting? Why won't the pH rise above pH7?

Distinguishing between acids: Find out how to distinguish between sulfuric(VI) acid and nitric(V) acid. Devise a method to measure how much of each is present in samples of acid rain. Sulphur dioxide and nitrogen dioxide don't actually react with water to form sulfuric(VI) acid and nitric(V) acid. Find out what does happen.

Monitoring atmospheric sulphur dioxide and acid rain: Find out how sulphur dioxide levels are monitored. Design a method for measuring atmospheric sulphur dioxide in your school grounds. You will probably need to sample continuously for several days to collect measurable amounts.

Take measurements to investigate how weather conditions, such as rainfall and wind direction affect sulphur dioxide levels. Use weather forecasts to plan when to take your measurements.

Things to think about

Do your overall results suggest any particular local sources of this pollution? Remember, it isn't just power stations that produce sulphur dioxide and nitrogen oxides.

Investigate various methods of measuring acidities between pH4 and pH7, to decide which method is most accurate.

Useful Resources

Arrange a visit to an environmental monitoring site to see how the work is done.

The results:

Use your results to estimate the concentration of acid rain samples you collect later in the project. Decide a good way to display your results visually, so that sulphur dioxide levels and rain acidity can easily be compared. Is there a relationship between them? Are the results what you expected? Why? Do high sulphur dioxide levels and/or acid rain occur under particular weather conditions? Again, offer explanations for your observations.

STUDENT BRIEF

BRONZE AWARD

Health and Safety

Science project work is both dynamic and exciting but can also carry some risk. To avoid any accidents, make sure you stick to the following health and safety guidelines before getting started:

- find out if any of the materials, equipment or methods are hazardous;
- assess the risks (think about what could go wrong and how serious it might be);
- decide what you need to do to reduce any risks (such as wearing personal protective equipment, knowing how to deal with emergencies and so on);
- make sure your teacher agrees with your plan and risk assessment.

Sulfur dioxide is TOXIC and CORROSIVE and nitrogen dioxide is VERY TOXIC and CORROSIVE. Use a fume cupboard for these experiments – ask your teacher for help. Be aware, effects of these gases may not be immediately apparent – symptoms can be delayed

Sulfuric acid is an IRRITANT and nitric acid is CORROSIVE at these concentrations.

Remember other chemicals used may also be hazardous.

Remember!

Science isn't just about data. The most successful projects will demonstrate good communication skills and show original ideas that address a real-world problem.

Look at the world around you and consider all the innovative ways that you could address the challenge. Even if things go wrong, use this to show what you have learned. Don't forget to use the student profile form to help structure your project.