Science Fair 24-25 Logbook

Dec 5: Began thinking about ideas for our project such as:

- **Option 1**: Creating a respirator to track the average person's carbon dioxide output
  - Link used: https://www.sciencebuddies.org/science-fair-projects/project-ideas/Zoo_p013/human-biology-health/exercise-changes-in-carbon-dioxide-output
- **Option 2**: Using machine learning to predict recurrence in brain cancer
  - Link used: https://www.sciencebuddies.org/science-fair-projects/project-ideas/ArtificialIntelligence_p020/artificial-intelligence/thyroid_cancer
- **Option 3**: Using machine learning to predict future water quality
  - Link used: https://www.sciencebuddies.org/science-fair-projects/project-ideas/ArtificialIntelligence_p019/artificial-intelligence/dissolved_oxygen

Dec 7: Chose the respiration idea for our project **(Option 1)**, worked on our proposal form

Dec 8: Finished our proposal form, getting ready to hand it in

- Link to proposal form: https://docs.google.com/document/d/1v0yDqnsSh02A5nk0McwsNUmU-fg1pLq2bxky9NvZJ-0/edit?tab=t.0

Dec 9: Our proposal received preliminary approval from Ms. Martin, our science teacher.

Dec 11: Turned in the proposal form officially after minor edits.

Dec 16: Received the bromothymol blue solution from Mr. Degelder (learning leader and grade 9 science teacher)

Dec 19: Created our digital slide presentation, no edits were made.

Dec 20-21: Added the following to the presentation:

- Table of Contents
- Testable Question: How does exercise affect the average person's carbon dioxide output?
- Hypothesis: If a person exercises, then their CO_2 output will increase, because the heart has to pump excess amounts of blood that saturates oxygen, which spreads around the body faster than normal. This is due to the body needing extra oxygen, for the muscles, ligaments and other body parts to function under stress. The blood returns to the lungs in a deoxygenated state, with the blood containing CO_2, which, through respiration, exits the body.
- Background Research:

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- **What is respiration?**
  - To put it simply, respiration is another term to describe breathing. In the process of respiration, we are moving gases in and out of our lungs. Specifically, respiration is inhaling oxygen (O_2) from the air around us, and thus expelling any unwanted carbon dioxide (CO_2) content from our lungs.
- **How do respiration and blood circulation relate?**
  - When a person breathes in, the oxygen in the air travels through the larynx, trachea and bronchi to the lungs. In order for the oxygen to reach organs, it travels via the bloodstream. The lungs and heart work together to exchange oxygen and carbon dioxide in the lungs from the blood. This process is called gas exchange. After deoxygenated blood exits the heart through the pulmonary artery, it travels to the lungs to get oxygen. After oxygen is replenished, it saturates the blood, and the blood enters the heart through the pulmonary vein. Blood oxygen saturation is measured as SP02%, with a level of 95-100% being ideal. This can indicate breathing rate as well. The oxygenated blood then travels away from the heart through the arteries, and returns to the heart in a deoxygenated state through the veins. The process then repeats. If breathing rate is higher, the process happens faster in order to provide ample oxygen amounts to all parts of the body. Information like SP02% and breaths per minute/heart rate can determine if a person is breathing and if their body's functioning correctly.

- Materials:
  - To create the respirator
    - 2 plastic water bottles
    - Tap water
    - Teaspoons (amount not set)
    - Scissors
    - Aerator Setup
    - Safety Valve
    - Plastic Straw
  - To do the experiment
    - Bromothymol blue solution(5ml per trial)
    - Notebook+Pencil
    - Lab partner- to record info

        - Stopwatch

- **Variables**
    - Independent (Manipulated) Variable: Whether the tested person(s) exercises or not ahead of breathing into the respirator.
    - Dependent (Responding) Variable: Amount of carbon dioxide (CO_2) output by the tested person before and after they exercise. We also analyze the possible implications of lower breathing and heart rates, as well as factors that can cause this.
    - Controlled (4): Same location, Same person (for each set of trials), Same amount of time exercising(1 minute per trial), Same type of pH strip used every trial.
- **Procedure**
    - Create our respirator (link used in bibliography)
    - Place 5 ml of the bromothymol blue solution into our water
    - The first tested person will breathe into the respirator without having done exercise, and their lab partner will keep track of how long it takes them to change the color of the water
    - Then, the lab partner will aerate the water using the oxygen aerator setup, sending it back to its original state
    - Repeat steps 2–4 three times, and record the results of each trial
    - After trial #3, make the tested person complete any form of aerobic exercise (push ups, jumping jacks, etc) for 1 minute.
    - Then, repeat steps 2-4 again, ensuring that the tested person completes exercise ahead of breathing into the respirator, while still recording the results of each trial.
    - Then, compare the tested person's times to change the colour of the water in the trials before and after they included the exercise. The less time it takes, the higher their breathing rate is, and thus their carbon dioxide output. This also means the person had to exert themselves more than usual.
- Began working on the **application** section.
- Personal Significance
    - **Why is this project important to us?**
        - **Shreyas**: This is important to me because it gives me a sense of hope for thousands across the world who don't have optimal health care access. Relatively simple medical devices like this can mean a lot to people who can't access or afford medical care, and

it can tell them whether to seek help, whether that be at a family member, friend, doctor, or even the ER. My grandpa was diagnosed with dementia, and later pneumonia, and unfortunately didn't make it back home. A medical grade version of this could possibly show us the signs of reduced breathing, and we could've given him help sooner, to possibly reduce the effects and maybe save his life.

- **Navneeth:** This is important to me as I have a sibling who has asthma. From a personal view, I understand how completing different forms of exercise to a normal level may be difficult for some people who have this lung problem, but this respirator would make it so people would know what levels of exercise suit them, ensuring they do not overexert or physically challenge themselves any more than people who may not have these issues do.

Dec 30: We made our respirators which we would eventually utilise for our experiment and we also made some edits to our design in comparison to the design we saw in our link we based our project around. One of our primary changes to our respirator included not using clay to keep our safety valve stable, and to cover the lid of our bottles, rather cutting holes in our lid to ensure we can take our lid off of our respirator if needed instead of latching it on.

We also made quite a large change to our project by changing what we ended up measuring in our project. Our original plan was to make the person breathe into the respirator until they turned the water's colour into a light yellowish-green, but we decided that this was a tad illogical for a few reasons. First of all, from our ideas it would take a rather long time and use too much air for just one blow to change the water to this color, judging by how dark the bromothymol would be mixed in the water. This would require multiple blows, which may tamper the results as the more blows someone takes, the easier it may be for them to change the colour of the water faster than normal. So, we chose to make it so the person can only blow once for 15 seconds, so no untrue data may be used. Also, we believed measuring the time that it takes for the person to change the colour of the water would be difficult to measure CO2 output with, as we were unsure about how certain times taken would be able to be compared to other times easily. However, as stated in our next paragraph, color/pH levels are much easier to compare against one another.

Thus, we chose to instead measure 2 different things; the colour of the water, and its pH level after 60 seconds. We chose to measure the colour of the water just in case the pH levels weren't impacted by a person blowing CO2 into the water, as we believed that the colour of the water would provide an accurate representation to how much CO2 the person may have respirated. From our earlier research, the lighter the tone of the water, the more CO2 was respirated.

Navneeth made edits to a few sections, which are all highlighted below:

- **The PROCEDURE**
  1. Create our respirator (link used in bibliography for ideas, actual respirator in images)
  2. Place 5 ml of the bromothymol blue solution into the tap water
  3. The first tested person will breathe into the respirator without having done exercise, and their lab partner will check the color of the water 60 seconds after the tested person finishes breathing, and after 60 seconds they will check the PH levels of the water using PH strips.
  4. Then, the lab partner will aerate the water using the oxygen aerator setup, sending it back to its original state
  5. Repeat steps 3–4 three times, and record the results of each trial
  6. After trial #3, make the tested person complete any form of aerobic exercise(push ups, jumping jacks, etc) for 1 minute
  7. Then, repeat steps 3-4 again, ensuring that the tested person completes exercise ahead of breathing into the respirator, while still recording the results of each trial.
     - We will also be checking the person's heart rate before and after they exercise to see how heart rate affects their carbon dioxide output.
  8. Using the PH levels from the 3 trials the tested person did without exercising, and the 3 they did after exercising, we will average our data to determine whether the person emits more carbon dioxide without or with exercising. The higher the PH levels or the lighter the color of the water, the more carbon dioxide they respirated

Not in presentation- We also created a second respirator so both of us did not have to breathe into the same one to avoid contamination with our saliva.

- **Our Materials**

  - 2 plastic water bottles
  - Tap water(167 ml per bottle)

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- Scissors
- Aerator Setup
- Safety Valve
- Plastic Straw(not needed)
- Clay removed(not needed)
- Teaspoon removed(not needed)

To do the experiment

- Bromothymol blue solution(5ml in total per respirator)
- Notebook+Pencil
- Lab partner- to record info
- Stopwatch
- PH strips(new)
- Watches with heart rate monitoring (different watches with each person.)

Added images of our respirators and aerator to our **Images** section

January 3: Trials successfully completed, data collected on our primary collection document.

We made edits to the following sections in the following sections of our presentation:

- **The DATA and OBSERVATIONS**

  - **Bromothymol initial pH level**
  - pH = 7-ish. The pH strips we used only gave approximations for each level so we were unable to find out the exact decimal point pH level.
  - We discovered that bromothymol works best in fluids with 6.0 to 7.6 pH, and is used in fluids with a pH level of 7. The colour also changes depending on that pH level. Bromothymol blue turns yellow in solutions with pH < 6.5, green between 6.5 - 7.2 and blue at pH > 7.2.

  Finished all of our tables of data(in our presentation)

  - **pH Averages**
    Navneeth (without exercise) - 7.3
    Shreyas (without exercise) - 7
    Navneeth (with exercise) - 7

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Shreyas (with exercise) - 7

- **Not in presentation**- Note that while the ph levels didn't change much before and after exercise, this doesn't mean that the amount of CO^2 respirated did not change as well, as evident in the fact that the water color did change quite a lot before and after exercise.
- <u>**The CONCLUSION**</u>

    - Our hypothesis was **correct**, as after exercising, the person's CO^2 output grew **higher** than when they did not exercise. This is further backed up by the fact that in the trials we completed **without** exercise, the water colour was generally rather **dark/blue** with **not much change** to the starting colour, implicating that **not a lot** of carbon dioxide was respirated by the person. However, after **exercising** the color of the water was generally really **green** and much **lighter** than it was at the start. This means that **more** carbon dioxide was respirated than normal. This also means that **more** oxygen was needed than normal for the person's body parts, as indicated in our hypothesis.
    - Another thing to note is the fact that as a person's CO^2 output **increases** after exercise, their heart rate increases as well. This is because the heart needs to pump **more blood** to the body to aid with **tiring muscles**, working almost simultaneously with the **respiratory system** to achieve this.

- <u>**Sources of ERROR**</u>
    - The bromothymol blue solution we used was prepared with tap water, not the recommended distilled water or sodium hydroxide. This is because it was prepared at our school and they didn't have distilled water, and sodium hydroxide was not able to be prepared before we left for winter break. This may have affected the results due to the water not being free of impurities, which may cause contamination to the bromothymol-water solution.
    - We made 2 respirators to speed up the testing process. Each of them were made as similarly as possible, though there may still be discrepancies between the two leading to some different/odd data while respirating. However, during our experiment any such problems were luckily avoided.

- Immediately before and after aeration, we had the bottle caps on our respirators open, potentially leading to gases escaping which may have affected our results in some ways. This excess air loss may also allow other things to enter our respirator, impacting our bromothymol-water solution as a result. There was also a tube at the top of the respirator to act as a vent; but while letting gas flow while respirating, it may have let foreign gases in as well which may have caused harm to our bromothymol-water solution.

January 4:

We added information to the following sections:

- **Images**- We added images of the respirators before and during trials, as well as pictures of aeration, the actual aerator, and the bromothymol blue solution we received from Mr. DeGelder.
- **Sources of Error**- we added the following:
    - The bromothymol blue solution we used was prepared with tap water, not the recommended distilled water or sodium hydroxide. This is because it was prepared at our school and they didn't have distilled water, and sodium hydroxide was not able to be prepared before we left for winter break. This may have affected the results due to the water not being free of impurities, which may cause contamination to the bromothymol-water solution.
    - We made 2 respirators to speed up the testing process. Each of them were made as similarly as possible, though there may still be discrepancies between the two leading to some different/odd data while respirating. However, during our experiment any such problems were luckily avoided.
    - Immediately before and after aeration, we had the bottle caps on our respirators open, potentially leading to gases escaping which may have affected our results in some ways. This excess air loss may also allow other things to enter our respirator, impacting our bromothymol-water solution as a result. There was also a tube at the top of the respirator to act as a vent; while letting gas flow while respirating, it may have let foreign gases in as well which may have caused harm to our bromothymol-water solution.

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    - The pH strips we used only gave an approximate reading (pH level of 1, 2, 3 etc.) instead of a result with a decimal attached. This is unavoidable but it would've been nice to get a decimal reading so we can round it up or down depending on what is likely to make more sense depending on the trial. For example, if the pH strip showed up as a 6 and we assumed it was around 6.0-6.1, but it was a 6.9, and that could be a false call and possibly skewing our results
- **Bibliography:**

    - https://www.sciencemadness.org/smwiki/index.php/Bromothymol_blue.
    - Accessed 4 January 2025.
    - "Bromothymol blue." Wikipedia, https://en.wikipedia.org/wiki/Bromothymol_blue. Accessed 4 January 2025.
    - Science Buddies. "Effects of Exercise: Changes in Carbon Dioxide Output." Science Buddies, 1 May 2021, https://www.sciencebuddies.org/science-fair-projects/project-ideas/Zoo_p013/human-biology-health/exercise-changes-in-carbon-dioxide-output. Accessed 5 December 2024. (this was the source of the actual experiment idea so huge credit here!)
    - Notes we took in class, and general knowledge.

- **Acknowledgements**

Jan 7:

Shreyas added information to the following sections **(new info highlighted)**

- **Application:**
    - He realized that we hadn't yet included specific ways to improve this design for real-world use, so he started thinking about ideas and adding them to the presentation.
- He also tweaked some other slides to add some info about the pH and other issues we encountered.
- Tweaked slides, for clarity.
- **Sources of Error**- He made some minor edits to the points below for clarity:
    - Immediately **before and after aeration**, we had the **bottle caps** on our respirators **open**, potentially leading to gases **escaping** which may have affected our results in some ways. This excess **air loss** may also allow foreign **gases, particles** and/or **substances** to enter our respirator,

impacting our bromothymol-water solution as a result. There was also a **tube** at the top of the respirator to act as a **vent**; while letting gas flow while **respirating**, it may have let **foreign** gases in as well, which may have caused **adverse** effects to the bromothymol-water solution as well. This is **unavoidable** due to the lid needing to be open for us to get **measurements** such as **pH** and a **colour** reading.
    - The bromothymol blue solution we used was prepared with **tap water**, not the recommended **distilled water** or **sodium hydroxide**. This is because it was prepared at our school and they didn't have distilled water, and sodium hydroxide was not able to be prepared before we left for winter break. This may have affected the results due to the water **not being free** of **impurities**, which may cause **contamination** to the bromothymol-water solution. This also affects our ability to test the **pH** of the solution, due to it being made of tap water.
- He finished the application section- see below.
- **Application-complete section:**
    - **Why is this experiment important?**
        - This experiment is important, as different people may do the same types of exercises, but it's important to consider their external and internal circumstances to make sure they're not over-exerting themselves.
        - This experiment demonstrates that, as when a person has a poor medical status or lung issues, comparing their carbon dioxide output to the average person may demonstrate contrasting amounts, regardless of the exercise they are doing being the exact same. Thus, they may have to adjust their daily exercising/workouts to match their body's capabilities.
        - Some people may also have a condition known as exercise induced asthma, but they may only know they have this condition after testing their oxygen and carbon dioxide levels before and after exercising, and this may also lead them to begin modifying their workouts/exercises if symptoms are noticed.
    - **Where/how could this respirator be used (in the real world)?**
        - While this respirator is basic and lacks 100% accuracy, a device like this could be used more to help people keep a good exercise routine by understanding their limitations.
        - In an age where technology is growing and people gain a lot of exercise ideas from the internet, this respirator could be improved

        upon, being used as a device to track people's general carbon dioxide (CO2) output and ensure they are not over-exerting themselves through exercise.
        - This is especially useful for people who may be having long-standing lung issues, as they may feel like they should exercise at the same level as some people without these issues affecting them. However, consistent use of an enhanced version of this device could allow these people to modify these workouts to keep their CO2 levels/SPO2% levels at a safe, controllable amount.
    - **How exactly can this design be improved for use in the real-world?**
        - Obviously this is a **simple** design, so as of now, it **isn't** as **accurate** as it could be. However, there are ways that this design could've been **improved**, to show more **precise** results. The bromothymol already is a good chemical, due to its **reactivity** to CO^2, but, through lots of **lab-controlled testing**, specific **HEX** or **RGB** colour codes could correspond to **varying** amounts of respiration activity. We know that the **greener** the bromothymol, the **better respiration** a person experiences, but all possible colours between the dark blue and yellow could be linked to different **degrees** of respiration normalcy (i.e. the teal colour would be considered **normal** after a minute of cardio exercise). One way to view this is, considering green is generally accepted as a **positive/good** colour while yellow is generally a **warning** colour, the colour of the bromothymol can be seen as a **traffic light**, with blue meaning either the person hasn't respirated **long** enough, or that they're experiencing a **shortness of breath.**
        - As for the actual design, the respirator is currently made in a **bottle**, however it can be made in a larger **container** with **power** operation and a **built in aerator** with some form of **AI** to detect when the bromothymol is at its **original** state. This allows for **efficiency** as well as use outside of science experiments.
- As of now, we're planning to record our final video to explain our respirator's design and finish our presentation on the 11th of January, but we'll make some minor edits to the slides when need be. We'll mention those below if our changes grow significant.

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Jan 11:

On this day, we made a major development in our project, realizing how our first experiment didn't provide accurate-enough information as we were just tracking the colour of the water 60 seconds after the person breathed into the respirator. The water was usually at a teal/green colour after this time but we realized it always did this simply because, due to us waiting so long, the water would always change colour. Also, generally, human eyes generally aren't the best at tracking exact colour, so we generally could only make approximations.

Thus, we started a second experiment, and in this one we instead made the person breathe into the respirator for an indefinite period of time, until they changed the colour of the bromothymol/water solution in the respirator to a certain colour. We also used distilled water for one of our respirators this time, and we were rather surprised that the water was so acidic it turned the bromothymol blue solution the colour yellow. We believed the data for this experiment was much more accurate than the first experiment, as we used time, which provides accurate and precise representations of a person's Co2 output rather than colour. However, we still had multiple sources of error which we added to our sources of error.

Note: While we did make a second experiment, we still also kept our first experiment and its data in our presentation for further learning, and to demonstrate how much we improved on it in our second experiment in so many ways.

After we finished our second experiment and collected data, we attempted to create a video to wrap up our experiment, but we realized we had quite a few errors so we chose to edit our presentation, planning to complete our video a few days after.

Now, here's what we added to our presentation on January 11:

The Observations:

After our first experiment, we realized a lot of things could be changed to improve our experiment, such as measuring how long it takes to change the water to a certain colour, while also testing whether distilled or tap water would be more accurate.

We filled one respirator with tap water and the other with distilled water. For the tap water respirator, we noticed the starting colour was teal, and the distilled water respirator starting colour was yellow, as opposed to the deep blue of the first experiment. We'll explain some of our theories for why this could be later.

We conducted another set of trials and the data is on the following slides.

The Data:
We added the data of our second experiment on the slideshow in table form, similar to how we structured it for our first experiment.

We added the following information:

During our second experiment, we noticed multiple things, such as:

- The starting colors of the bromothymol in our respirators were different from our first experiment.
- Distilled water generally changes color faster than tap.

We believed that the starting colors of our respirators being different could be because of 2 reasons.

- In our respirator with distilled water, we noticed that the distilled water we used contained ozone, an acidic solution, moving our water's pH level down to 6 from 7, where it had been for the majority of our last experiment
- The bromothymol we got from Mr. DeGelder may have aged, which could have affected its colour. Further evidence of this is proved that when we placed the bromothymol in our respirators this time, it was noticeably green and we had to mix it a lot to make it into the teal colour we need.

The Conclusion**(new info is highlighted)**:

Our hypothesis was **correct**, as after exercising, the person's CO^2 output grew **higher** than when they did not exercise. We believed this was because in the trials we completed during our **first experiment**, generally the water was rather **dark** and **blue without exercise**, while it was more **light** and **green when we did exercise**, proving they **exhaled more CO2 than normal** after exercising. However, we realized this **data** could be a bit **mistaken**, due to the fact that our **perception of colour** may have been **incorrect**. Thus, we also gained **data** from our **second experiment,** where we measured how **long** it took the tested person **to change** the water to a certain **colour** (**teal-green for tap water, pale-golden yellow for distilled water**), and proved our **hypothesis**. Generally it took **less time** for the person to **change** the water **colour after exercising** than before (barring a few minor discrepancies).

Also, we noticed some other **interesting** things while completing the **second experiment**. First, we made the **revelation** that **bromothymol** may **age,** as when we **placed it** into our **tap water**, it turned a light shade of **teal**, and in the distilled water it turned evidently **yellow**, but during our **first experiment**, the water colour was generally in the **dark** shades of **blue**. This may have affected the results of our second experiment, but we are unsure. (more theories in sources of error)

Sources of Error:

- Something we noticed during our second experiment was that the bromothymol in combination with the water in the respirator wasn't blue, rather, it was teal for tap water (green before we mixed it) and yellow for distilled water. This could be due to the fact that our bromothymol had aged, because there was a week between our first and second experiments. This could also be due to the fact that we used different water (the water was a week newer so it may have been processed differently by the City's water treatment facilities), and the fact that we used ozonated distilled water for one of the trials, meaning that the acidity was naturally a bit higher. In combination, these factors changed the way we thought about bromothymol, and we believe that this trial ended up being necessary to gain more knowledge about the way water, bromothymol and CO^2 work with each other

.

January 13:

Today we had a major update about the dates needed to submit our science fair project from Mr. DeGelder, and how the earlier we submit it, the better. Due to this, we realized we had to make our video ASAP, planning to make it either on January 14 or 15, and submit our entire project on one of these days as well. We'll mention when we make our video and submit all the created parts of our experiment to d2l.

Over the last little while, we've also started the Ethics and Due Care paper form, though Mr. DeGelder said we wouldn't need to turn it in on paper. We're still working to finish both this form and 2C Informed Consent for ourselves.

January 14:
On this day, we recorded our final videos for submission for the 2024-25 science fair.

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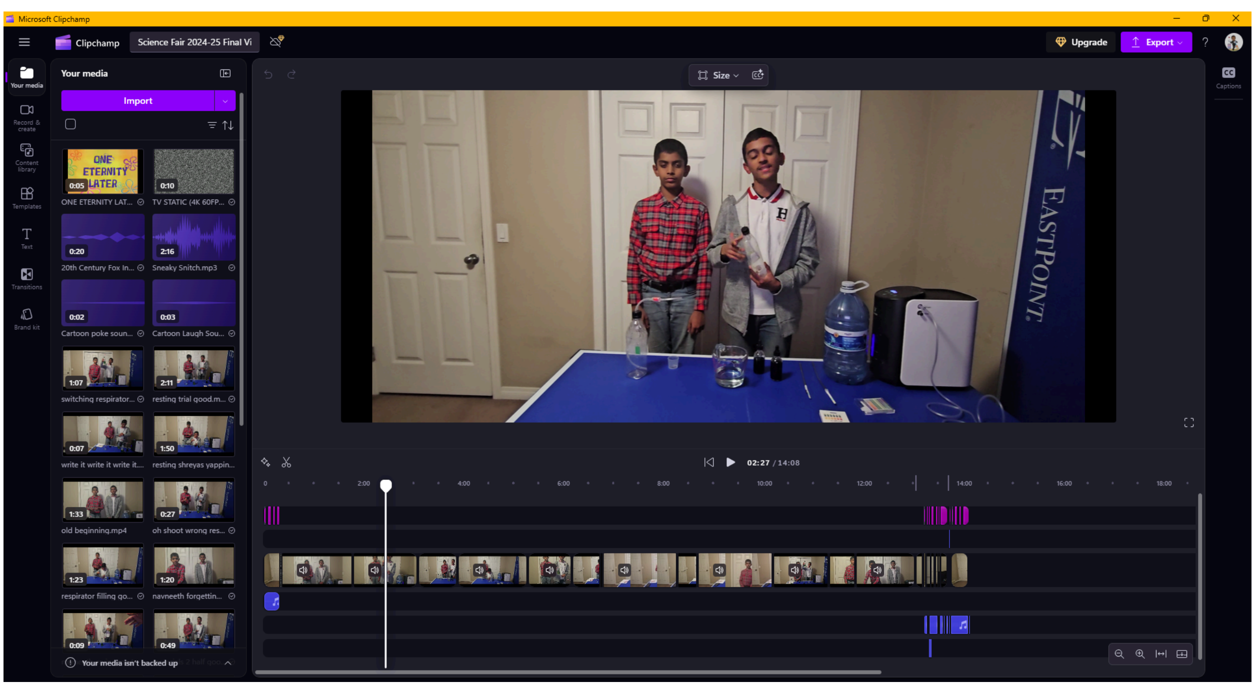
The text below is typed by Navneeth(me):
Due to the majority of our information for our experiment being found in both our slideshow and here in the logbook, we chose to not cover a lot of already talked about information in our video. Instead, we chose to explain the materials+setup of our project and respirators in greater detail, making it so Shreyas did 2 live demo trials. Both of these trials were measured in the 2nd experiment's style of tracking time to change colour as we believed that this provided more accurate and better information than our first experiment ever would. However, in one of our respirators we used tap water and Shreyas rested ahead of breathing into it, while in the other one, Shreyas exercised ahead of breathing into it, and it contained distilled water. Also, in our video we covered our application and sources of error. One really interesting thing we particularly noticed from when we first put the bromothymol into the water today in this video, rather than turning green like it did in our second experiment, it turned a rather dark shade of blue. This seemed to contradict our earlier theory of bromothymol blue aging, as this blue colour was rather reminiscent of the colour of the water during our very first experiment, over 2 weeks ago. Tomorrow, we're planning to start editing our video and polishing it up, before uploading our entire project(logbook, slides, and the video), to the science fair d2l shell.

January 15:

Today I (Shreyas) began editing our final video. I've attached some screenshots below mainly for my own memory but I thought it would be a nice touch to add them here.



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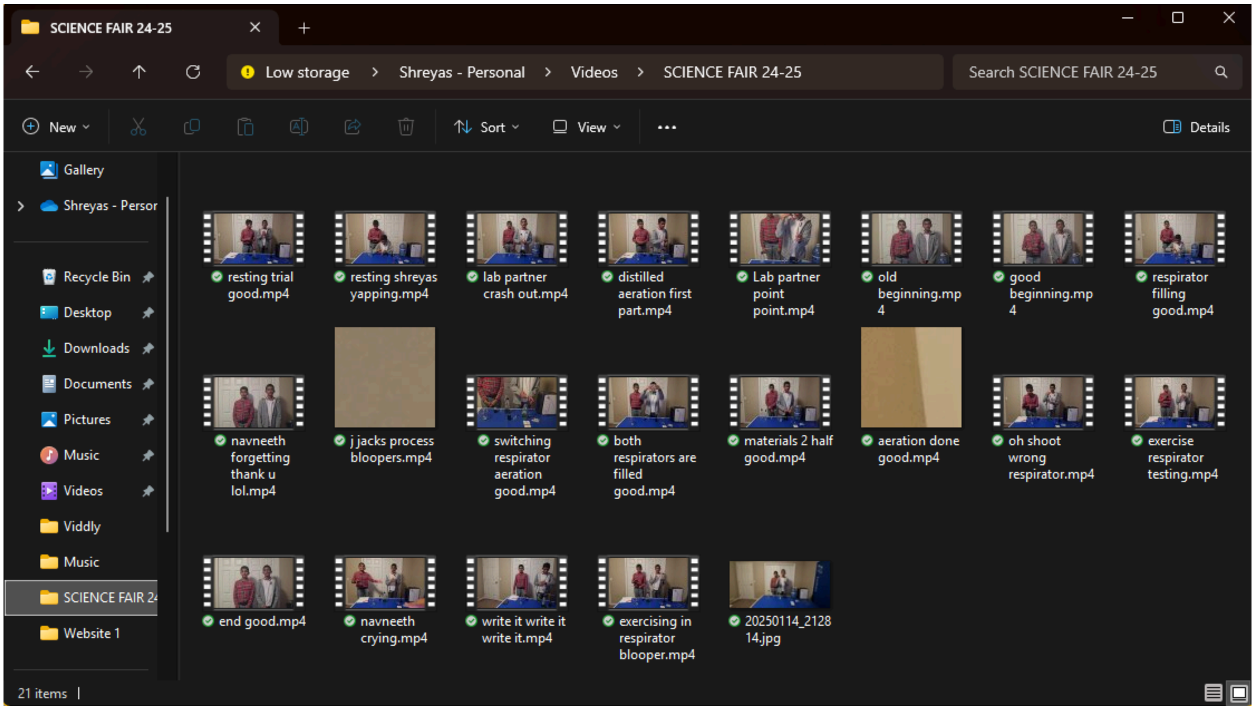
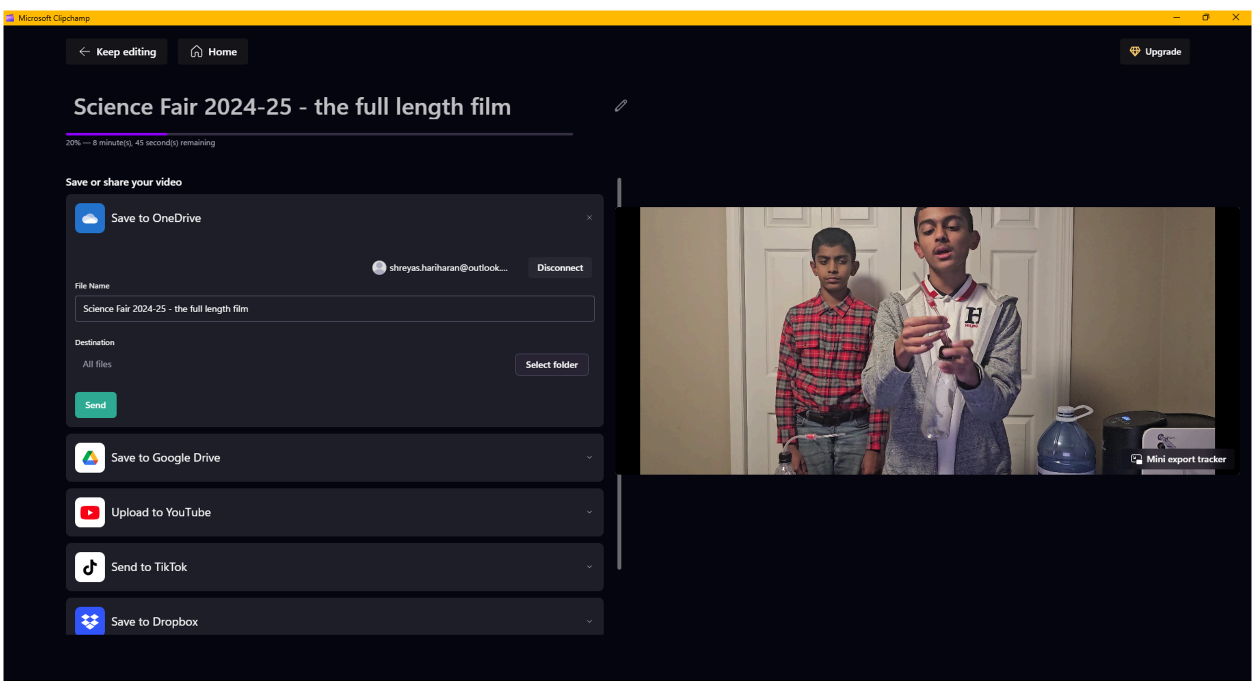


January 16:
This morning, after sending the video to Navneeth, we decided to split the video in half, with the first part being the experiment and the second part being bloopers, instead of one large file.



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January 17:
Today I (Shreyas) finally finished the editing of the videos, and we're now confident we're ready to submit!

January 18:
As we prepare for submission, today Navneeth started a new document that briefly explains the layout of our submission folder. I (Shreyas) also made some minor changes to the slides for clarity.

I also made a new folder containing everything we need to submit, including the videos, logbook and slide presentation. We can hopefully get this sent by later today but if not, we'll get it done before Monday, January 20.

January 19:
On this day, me(Navneeth) and Shreyas were put on the cysf platform, and we input our basic project information and ethics and due care form on there for approval.

January 20:
Our ethics and due care form was approved for our project, and we were able to input our scientific method information onto the platform. We put all our information on there today, knowing we had time to edit it if needed.

January 20-February 11:
While waiting to know if our project was approved, we made minor edits to our presentation and notes to improve clarity.

February 11:
On this day, our science teacher notified us that we had made the CYSF, so we created another slideshow presentation specifically containing information that we were going to put on our trifold

February 13:
We decided we were also going to input our data from our experiments into google sheets, and create graphs using this data.

Notes(Not in presentation): We only made graphs for our second experiment, as the data from our first experiment was difficult to put into graph form, and when we made circle graphs that represented our first experiment we found the data we got didn't accurately help us support our hypothesis for our project as well. However, we could make graphs much easier for our second experiment as the time values from this experiment are quantitative, and thus easily able to be put in bar graph form.

These graphs also supported our hypothesis, as our graphs while resting had rather high times around 17-20 seconds to change water colour, while our exercise trials took only around 13-16 seconds, which proved that we exhaled/respirated more carbon dioxide after exercising than before, changing the water colour faster than normal due to the excess carbon dioxide levels we breathed into the respirator causing the bromothymol-water solution’s ph levels, and thus colour easier than without physical activity.

Also, these graphs demonstrated how distilled water took a shorter time to change colour than tap water, and we believe this happened because while the distilled water respirator only had to change through a couple shades of yellow, our tap water respirator had to change all the way from teal to deep green, and these colours have multiple more shades between them.