

Criteria A: Planning

Inspiration:

For as long as I can remember I have loved the water, which has led me to becoming a swimmer. However, I am now at the point where no matter how hard I train, I can't continue to beat my 'personal bests.' Intense training every day has become frustrating and boring now that I don't see my desired results. Though, I don't want this negative mentality to take over my passion for swimming. I have decided to look at it from a different perspective. I am turning towards the science of swimming. I want to explore the physics and hydrodynamics of swimming and I aim for it to give me a deeper understanding. I heavily rely on my coach to help improve the way I swim. I don't understand why certain things are the way they are. With this project I want to expand my knowledge of the science behind swimming as it is the sport I love and want to continue to love.

Learning goal:

My learning goal is to understand the science behind swimming. Within this topic, I will focus on the hydrodynamics of swimming, looking at the following four forces; drag, lift, gravity, and buoyancy. This includes why swimmers wear certain pieces of equipment like the swim skin during competitions, why swimmers wear a swim cap and how swimmers swim efficiently. I will go into depth and learn about what type of energy is in swimming, and wave motion. Though, as I have been swimming for a while now, I have a basic understanding on this topic. I plan to reach a deep understanding on the hydrodynamics of swimming through textbooks, the internet, physicists and swim coaches.

Product goal:

To demonstrate my research, I will create a video abstract and I will write an informative document. The informative document will include concise information and relating images about my chosen topic. My video abstract will be a visual representation of me demonstrating the information within the informative document. My products are directed at high schoolers, parents, teachers, athletes and swimmers who are interested in science and swimming. The informative document and video abstract will be created digitally. I will create my video using Inshot and my informative document will be done using Canva.

Global context:

My project relates to 'scientific and technical innovation'. Personally, I want to learn the science behind swimming, specifically the hydrodynamics of swimming. I believe that gaining more knowledge on this topic will allow me to perform better in the pool.

I want to introduce and educate others on the science behind swimming. Many people enjoy swimming, yet many, including myself, don't understand how it works. Whether one swims doggy paddle in the pool, uses a pool noodle or swims freestyle there are many forces applied between the swimmer and the water. With my chosen global context and project, my goal is to do innovative research, and educate others on the science behind swimming.

Product success criteria

| Category | Criteria | Details | Evaluation |
|------------------------------|--|---|---|
| Aesthetics | Video abstract is appropriate length which keeps viewers engaged. | - 3- 4 minutes | -I decided on this criterion based on videos and informative documents that I have viewed in the past. This criterion is extremely important to keep viewers engaged and interested. -I evaluated through a questionnaire I sent to peers about aesthetics. |
| | Informative document is written with straightforward sentence construction. | - Written using everyday language | |
| | Both the video abstract and document include relevant images which are formatted adequately. | - Images are not too big or small and are related to the topic | |
| | Font size is easily readable. | - Font size is constant throughout and is size 12 | |
| | Video abstract is organized with clear descriptions. | - Table of content and short descriptions relevant to what is going on | |
| Function and Audience | After watching/ reading the viewer should learn something. | - Understand the science behind swimming and have a clear idea of how it works with my example | -This criterion is to ensure I am able to accurately get information across to the targeted target audience. -I evaluated through a questionnaire I sent to peers about function. |
| | Attracts target audience. | - Athletes, swimmers, scientists | |
| Content | Relevant information about the science behind swimming. | - Hydrodynamics of swimming; drag, thrust, gravity, and buoyancy | - These points make certain that my informative document and video contain relevant information with a logical structure which is easy for others to understand. I included points that are typically seen in essays. - I evaluated through a questionnaire I sent to peers about content. |
| | Relevant information about the technology and recent innovations. | - Information that is explained clearly about modern inventions | |
| | Content is written with correct English and is organized. | - No grammatical errors or spelling mistakes - Written in a way which is easy for the viewer to read, it does not cause them to lose interest or become confused | |

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|---------------------|--|--|--|
| Finalization | My product is finished on time. | - Done by January 5 th , 2023 | - This criterion ensures my product is done on time with time to spare which will allow me to make final touches if needed. The more people that see my product and are able to learn something, the better. |
| | My product is shared through social media. | - Shared by February 1 st , 2023, on TikTok and Instagram | |

Product action plan

| Success Criteria | Task | How? | Due Date | Reflection | ATL Skills |
|----------------------|------------------------------------|---|---------------------------------|--|--|
| Content | Create research plan. | -Write down research questions - Find sources of information (websites/swim coaches) -Create list of important /most beneficial Sources | October 15 th , 2022 | Done on time. I started my research plan on September 1 st . It included guiding questions, websites, and sources of information I will be using. | Research skills, critical thinking |
| | Research about content of product. | -Begin research - Take notes -Organize notes -Cite sources -Don't plagiarize | November 1 st , 2022 | Done on time. I gained interesting information from my swim coach, other swim coaches and the internet. I took notes and organized them. I cited the sources, though I had a hard time trying to cite information I gained in real life. | Research skills, transfer, and critical thinking |
| Informative Document | Write draft. | -Write research in paragraphs | December 1 st , 2022 | Done late. It took longer than expected to write | Thinking, communication and self-management |

| | | | | | |
|----------------|--|---|----------------------------------|---|-----------------------------------|
| | | | | clear, concise paragraphs. | |
| | Come up with the format of informative document. | -Think about practical, fun design which keeps readers engaged | December 10 th , 2022 | Done on time. | Creative thinking |
| | Share on social media. | -Create a public social media account and share my informative document for people who are interested | February 1 st , 2023 | Not done. | Media literacy, self-management |
| Video abstract | Video clips. | -Make relevant clips | December 31 st , 2022 | Done late. Due to different circumstances filming my own videos took time and finding relevant clips from the internet was much harder than expected. | Thinking skills, self-management |
| | Find software to create full video abstract. | -Ask peers who are familiar with editing | January 5 th , 2023 | Done on time. Many people recommended Inshot. | Communication, collaboration |
| | Join all clips into one video using software. | -Watch YouTube videos to guide me through the process of combining all the clips. | January 6 th , 2023 | Done on time. | Critical thinking, media literacy |
| | Share on social media. | -Create a public social media account and share my video abstract for people who are interested | February 1 st , 2023 | Not done. | Self-management, thinking skills |

Criteria B: Applying Skills

Learning goal: *Understanding physics and hydrodynamics of swimming*

Achieving my learning goal – ATL Skills: Research and Organization

Research

To achieve my learning goal, I started with a research plan which included key questions and complementary questions which allowed me to go deeper and get more accurate information. My research plan also included potential sources. Research is the most important part of my project and having a thorough research plan made sure my research process flowed efficiently and in an organized manner.

Research plan:

Research Questions:

- How is swimming related to hydrodynamics?
- How are forces applied in swimming?
- How does the equipment used in swimming work in the water?
- Why do swimmers wear certain attire?

Complementary Questions:

Video abstract/ informative document

- How to format a video abstract/ informative document?
- How to edit a video?
- What is the best app to create informative documents?
- What keeps a viewer/ reader engaged?
- How long should my video abstract/ informative document be?
- What makes a video abstract/ document interesting?
- Which social media app is the most popular?

Content

- How is Newtons third law in effect in swimming?
- How does drag work in the water?
- What types of drag are present when swimming?
- How to minimize drag?
- How does thrust work in the water?
- How does lift work in the water?
- How to swim in the most efficient way?
- How does gravity work in the water?
- How does buoyancy work in the water?
- How do certain mechanisms used in swimming work?
- Why do swimmers wear swim caps?
- Why do swimmers wear swim skins during competitions?
- What is the difference between normal goggles and competition goggles?

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|---|--|
| Source # --: https://www.researchsquare.com/blog/making-a-great-video-abstract-examples-and-critique | An article that gives advice on how to write an engaging video abstract. It goes into depth on what a video abstract is and what kind of content should be included. This source provides an example of a good video abstract and gives tips on how to create a good one yourself. |
| Source # --: https://www.explainthatstuff.com/swimming-science.html | An article that talks about the science of swimming which goes into depth about the forces present in swimming, Newtons laws, and swimming efficiently. Advice on how to overcome such forces (to an extent) is provided. |
| Source # --: https://www.swimmingworldmagazine.com/news/an-explanation-of-how-tech-suits-benefit-swimmers/#:~:text=The%20study%20suggests%20that%20the | This source provides an in-depth explanation on how tech suits (skins) work in the water and how they make a swimmer faster. Multiple studies have been done to prove the validity of information. |
| Source # --: https://www.youtube.com/watch?v=ehTlwQV2JcY | A video regarding the three types of drag acting upon a swimmer, including comparisons to real-life situations such as an airplane in the sky. The video also mentions streamlining. |

This research plan was extremely helpful because it gave me an outline of the information I needed to gather. It allowed me to acquire reliable, required information. It also helped me find useful sources in order to complete my product. Using this research plan, I was able to find multiple primary sources, which were made by professional athletes, qualified coaches and engineers that I can reference in my product. I also found many secondary sources which allowed me to investigate further into my chosen topic, which were factual and very beneficial for my research. This research plan has given me a good foundation on which I can build off of for my product.

It is always important to test the validity of used sources. In order to prove that the sources I used were reliable I used the CRAAP method. This ensured that the sources I used were credible. This method helped identify the reliable sources which I can use in the product.

| | |
|-----------|---|
| | CRAAP source evaluation Source: <i>National Science Foundation. "Missy Franklin and Fluid Dynamics."</i> www.youtube.com , 22 July 2021, https://www.youtube.com/watch?v=ehTlwQV2JcY |
| Currency | This video was published on July 22, 2021. It is a newly published video which contains current discoveries and information with recent evidence to support such claims. Modern technology is referenced, giving me accurate examples and information. |
| Relevance | This video relates to my topic and answers some of my research questions. The video discusses the basics of fluid dynamics. It introduces the 3 types of drag force on a |

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| | swimmer and thrust (propulsive force) and streamlining. The video contained examples of how swimming is similar to other real-life situations. This source provided me with the most helpful information and answers compared to other sources I have viewed; however, it does not answer all of my research questions from my research plan. |
| Authority | The National Science Foundation published this video. The National Science Foundation is a government agency based in the United States which supports research and education for science and engineering. Featured in this video are Timothy Wei who is the dean of the College of Engineering at the University of the Nebraska Lincoln and swimmer Missy Franklin, who is a 5-time Olympic medalist. |
| Accuracy | This video is part of a nine-video series on the science of the summer Olympics. This series partnered with the National Science Foundation, NBC Learn, and NBC Sports, whom they give credit to. They also gave credit to the speakers apart of this specific video. The information provided is backed up with examples and is clearly explained. Throughout the video professional language is used in an unbiased manner. |
| Purpose | This video was created purely to educate others. The information is solely facts with the purpose to inform others on the hydrodynamics of swimming. It goes into detail on the different forces acted upon a swimmer in the water and explains how it works. The intended audience of this source are swimmers who want to have a deeper understanding of how swimming works. |

The CRAAP evaluation method made sure the sources I was using were reliable. Below is evidence of the information I have gathered, using sources that have been evaluated and using the questions in my research plan. Doing these steps before writing the content for my product made the process much easier.

Evidence of information collected

Kinetic energy is defined as the "energy which a body possesses by virtue of being in motion" (Oxford Languages). In other words it is mass travelling at a certain velocity. Kinetic energy formula is $K.E. = 1/2 m v^2$. In swimming, initially the swimmer has potential energy in the muscles which propels the swimmer forward. The kinetic energy is the movement of the swimmer through the water. Ultimately, the swimmer will stop as all of the energy would have transferred into the water.

The kinetic energy available to the swimmer is made up of positive and negative kinetic energy. The positive type of kinetic energy is created when the swimmer kicks their legs and moves their arms in a straight line through the pool which propels them through the water. There is also negative kinetic energy in the water. This is when kinetic energy is created by ineffectual movement and decreases the positive kinetic energy. When this happens, and all the negative kinetic energy is added up, it significantly decreases the amount of positive kinetic energy created by the swimmer. This reduces the forward velocity (SwimSwam).

Newton's third law states that for every action, there is an equal in magnitude but opposite in direction reaction. Newton's third law is often present in swimming. For example, when a swimmer pushes off the wall, the swimmer accelerates in the opposite direction (Khan Academy). Another example is when swimming any specific stroke. When swimming any of

the 4 main strokes the swimmer's hands pull the water backwards. The water then exerts an equal and opposite reaction and pushes the swimmer forward.

Drag is the force which acts opposite of the motion of an object. In swimming, the drag force is the resistance of the water on the swimmer. Swimmers face three types of drag when swimming, which includes frictional drag, pressure drag, and wave drag. Frictional drag is the drag between the water and surface. The water next to the swimmer flows in the direction the swimmer is moving, and the water that isn't flowing in the direction of the swimmer flows in the opposite direction which makes it hard to move forward. Pressure drag is the resistance caused due to different pressure distributed to different parts of the swimmer's body. The highest pressure is on their top of the body because the swimmer's head breaks through the water first. The lowest pressure is on the back. This force pushes back the swimmer because of the difference in pressure. The last drag force which a swimmer encounters is the wave drag. Wave drag happens because as a swimmer moves forward there is some water that is pushed in front of the swimmer which causes a barrier, and the swimmer has to swim over-top it. This barrier is known as the wave barrier (National Science Foundation). There must be a force which pushes the swimmer forward in order to balance the drag force. This force is called the thrust force. Force is a vector quantity meaning it has both magnitude and direction. When a swimmer moves their arms and kicks their legs the swimmer creates the thrust force which lets them move (Real World Physics Problems). In freestyle, the thrust force is predominantly created by the swimmers arms which include the hand, forearm and upper arm. The swimmers legs thrust the swimmer to move forward and also help the body stay in a streamlined position to reduce drag. The magnitude of the thrust is dependent on how fast the swimmers arms and legs move (NASA).

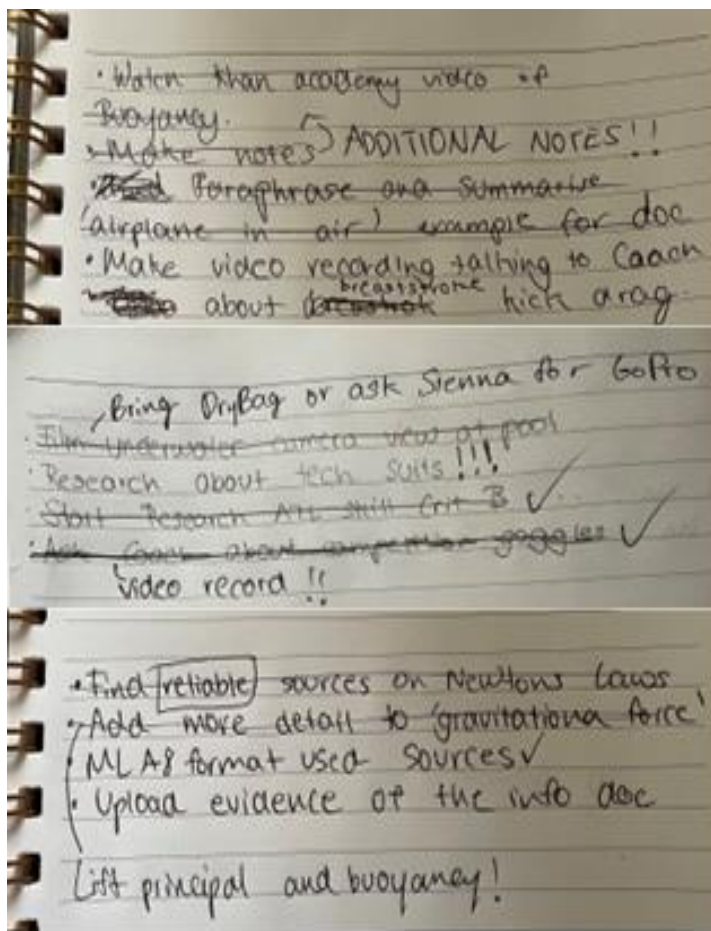
As mentioned above, one of the types of drag is wave drag which is the resistance caused by turbulence on the surface of the water. However, does wave motion affect the swimmer? It depends. This is known as the wake effect. The "wake" is the water that goes to the side of the swimmer. If the swimmer is able to find the correct position relative to the swimmer in front, it can be beneficial. This is because the swimmer in front can create a current in favor of the swimmer. Wave motion can also be a disadvantage to the swimmer because if the swimmer is not timed properly they would need to tackle the waves. This can cause the swimmer to lose speed and even control. The faster the swimmer swims the more "wake" there is. In a pool, the swimmers who swim on the outside lanes are affected by the wake. There is rebound turbulence which bounces off walls and onto the swimmer, whether it be an advantage or not. Having said that, modern pools have been designed to be as fair as possible. They are constructed so that the outer lanes are slightly wider than the rest of the lanes. This minimizes the rebound turbulence reflecting off the walls. Another new design are the lane ropes. The new style of lane ropes are anti-wave discs which break down the waves created in the pool. They waves are absorbed and the lane ropes provide a strong barrier. Lastly, pools are now three-meters deep rather than two- meters. This reduces the significance of the disturbance in the pool (BBC, Jon Rudd).

Trying to find reliable resources with the necessary information developed my research skills. I spent a lot of time going through many different sources to find ones which would be beneficial for me. I predominantly

worked on my information literacy skills. I had to constantly find and evaluate the information I had found and then communicate this information into my product. This step was very important for my learning and product goal. It allowed me to explore further into my topic and verify my current understanding on my chosen topic.

Organization

Throughout this project to achieve my learning goal, I have utilized multiple ATL skills. During the research stage, I applied my organizational skills through using a research plan and many to-do lists. These skills ensured a smooth research process. Before beginning any research, I created a plan to ensure I would cover everything and do it over a longer period of time and not cramming everything into one night. It also ensured that I fully understood the concept of my topic and that I used reliable sources. It helped me not get overwhelmed and it gave me an idea of where to start which was very beneficial to staying organized throughout this process. Also, I often created to-do lists. Although I had an overall plan, it was quite broad. I created many to-do lists which ensured I was on top of everything and not missing any tasks. My to-do lists were done in my process journal and having constant track of everything I had completed and important tasks that needed to be done helped me manage this step of the project.



PP research plan

Narrow down research topics

- What is swimming
- Science of swimming
- What happens in water
- Physics of swimming
- Hydrodynamics of swimming
- How to swim faster
- Swimming efficiently

Find reliable sources

- University published
- Well-known sources (Khan academy, Byju's)
- Ask coach, physics teacher

Start with basics

- Understand concept of hydrodynamics
- Brief understanding of physics in water
- Find commonly used key terms
- Watch videos to see visual interpretation
- Make simple notes to confirm understanding

Information for product

- Research about forces (drag, thrust) - find real-life examples, how it happens in the water, what swimmers do to prevent/enhance it. More forces present? DO RESEARCH
- Other science involved? Newtons laws? Additional principles?
- Research for any formulas
- Find more in-depth sources
- Ensure validity
- Talk to coaches
- Talk to dads' friend Lucas (physicist) for additional information
- Try and contact professional swimmers for information (National team swimmers, FINA swimmers?)

ADD ALL INFORMATION TO INFO BANK. DECIDE WHAT INFORMATION IS USEFUL/LESS FROM THERE.
DO NOT LET ANY INFO GO.

- Paraphrase all info and create scripts, paragraphs and summarize information
- Add to document and video

Product goal: *Create video abstract and informative document about the hydrodynamics of swimming*

Achieving my product goal – ATL Skills: Communication and Thinking

After completing my research, I began working on my product. Whilst creating my product the two main ATL skills I used were communication and thinking skills.

Throughout this process I gathered lots of information. I was continuously communicating as I did a lot of paraphrasing and structuring my research into paragraphs, summaries, scripts and finally into my final product to share with my audience. I was constantly organizing and depicting valuable information. When I was writing my informative document and creating my video, I kept in mind who my target audience was and what the purpose of my products were. With my audience in mind, I ensured that the way I communicated my findings was thorough and comprehensible. I also communicated with my friends and family for feedback. This made sure that I was communicating clearly in my product. I implemented this feedback into my product, and it gave me an insight into what my audience would think of my product. The photos below show an example of me

arranging and structuring a paragraph to make sure it is direct and that it fits my product for my audience and feedback responses from friends and family.

Original paragraph (BAD PARAGRAPH)

The other forces that aren't drag and thrust are buoyancy and gravity which are present between the water and swimmer. Gravity exists on all objects in the universe, and it pushes the swimmer down. The two forces are opposite because buoyancy keeps the swimmer on the water. Because it keeps the swimmer on top of the water it allows the swimmer to float. It 'lifts' the object. Both of the forces affect the swimmer a lot in the water. Buoyancy acts through the Center of Buoyancy. Buoyancy has to pass through this because there is the same amount of pressure on both sides of the swimmer. Pressure on both sides of the swimmer are equal in magnitude, but opposite in direction which allows the body to float on top of the water as they are able to cancel each other out (Center of Buoyancy: Definition & Formula, Study). 'Lift' is based on a principle that states that any object that is suspended in a fluid is acted upon by an upward buoyant force equal to the weight of the fluid that is displaced by the object.

Final paragraph (GOOD PARAGRAPH)

The gravitational force in swimming is the downward force which depends on the mass of the swimmer. Buoyancy force is when the water pushes the swimmer upwards which has a value that is proportional to the volume of water that is displaced by the swimmer. For a swimmer to stay on top of the water, the buoyancy force has to be equal in magnitude to the gravitational force (Wired). The buoyancy force 'lifts' the object. This lift principal is based on Archimedes' principle which states that any object (regardless of its shape) that is suspended in a fluid (such as water), is acted upon by an upward buoyant force equal to the weight of the fluid that is displaced by the object. Additionally, the buoyancy force acts through the Center of Buoyancy. The center of buoyancy relates to the center of the object. For a body to maintain its orientation the buoyancy force must pass through the center of the body. The center of buoyancy is the 'centroid of the immersed part of a ship or other floating body,' (Oxford Languages). This is necessary because the pressure on both sides of the swimmer are equal in magnitude, but opposite in direction which allows the body to float on top of the water as they are able to cancel each other out (Center of Buoyancy: Definition & Formula, Study).

Hello,
Generally you're paragraphs are well structured (follows the PEEL structure) and most of the time understandable and very well explained on the hydrodynamics and physics of swimming. However one way you could improve is by providing more pictures or illustrations to further convey your reasonings in the document, this will not only grab the readers attention but also understand the complexity of swimming in a simple manner. Another way you could improve is by you're introduction paragraph less detailed and more simple and conscise, as it is kinda confusing. 🙌

Hey, it's really well done. You explained Newtons laws and the drag force really clearly and in a lot of depth but I think you could add a lot more about the thrust force. You could go more into what exactly the thrust force is and maybe even compare thrust in swimming to thrust in another real life situation. Also, your conclusion is quite wordy so I would change that. Other than that very nice ! :)

To achieve my product goal, I had to use my thinking skills. To achieve my product, I used my critical thinking skills. I needed to have a deep understanding of my chosen topic so that I would be easily able to communicate with my audience. At times it was hard to understand certain pieces of information as it was explaining things at a different level than what I was able to comprehend. To solve this issue, I started off with very simple physics classes such as kinetic energy and Newton's laws which helped me further understand my chosen topic. After fully understanding the basic concepts, I slowly progressed to more complex explanations and information. I was consistently revising the new information I gathered, and with my findings I drew my own conclusions. With the relevant information I found, I formulated my own arguments and conclusions. I gathered information from many sources including my swim coaches, physicists, online sources, my swim mates and from my own experiments in the water. I wanted my product to have a wide variety of reliable information and to do so I was constantly revisiting these steps. Whilst working on my product I also used my creative thinking skills. I brainstormed many ideas for my video abstract and informative document. I attempted to have a common theme between my two products.

NEWTON'S LAWS OF MOTION

*** 1st (The Law of Inertia)** \rightarrow If $\vec{F}_{net} = 0 \rightarrow$ It will be at rest if it is initially at rest or it will be moving at a constant velocity if it is moving at a constant velocity initially.

(net force (the vector sum of all force) acting on an object)

i) $U=0$
 $F_1 = 6N$ (left), $F_2 = 5N$ (right), $F_3 = 1N$ (right)
 \rightarrow object is stationary after 3 force are applied. then $\vec{F}_{net} = 0$
 $F_2 = 1N$

ii) mass $m = 70kg$
 $g = 10m/s^2$
 $F_{air resistance} = 700N$
 $mg = 70 \cdot 10 = 700N$
 $F_{air resistance} = ? N$
 \rightarrow object is falling down with a constant velocity $\Rightarrow \vec{F}_{net} = 0$

The 2nd Law of Newton $\rightarrow \vec{F}_{net} \neq 0 \rightarrow$ There is a net force acting on the object.

$$\vec{F}_{net} = m \cdot \vec{a}$$

net force $[kg \cdot m/s^2]$ = mass $[kg]$ \times acceleration $[m/s^2]$

for all cases friction is ignored

1kg, $U=0$, $F_1=5N$, $F_2=2N$
 $\vec{F}_{net} = 3N = m \cdot a$
 $3N = 1kg \cdot a$
 $a = 3m/s^2$
 It will accelerate with $3m/s^2$

1kg, $U=10m/s$, $F_1=5N$, $F_2=2N$
 $\vec{F}_{net} = 3N = 1kg \cdot a$
 $3N = 1kg \cdot a$
 $a = 3m/s^2$
 It will speed up.

1kg, $U=10m/s$, $F_1=5N$, $F_2=2N$
 $\vec{F}_{net} = -3N = 1kg \cdot a$
 $-3N = 1kg \cdot a$
 $a = -3m/s^2$
 It will slow down.

Newton's 2nd LAW

$$\vec{F}_{net} = m \cdot \vec{a}$$

$[kg \cdot m/s^2]$ $[kg]$ $[m/s^2]$

newton [N]

$\vec{F}_{net} =$ [the sum of the forces in the direction of motion] - [the sum of the forces in opposite direction of motion]

1) $U=0$
 $4N$ (left), $5N$ (right), $3N$ (right)
 $\vec{F}_{net} = +4N = 2kg \cdot \vec{a}$
 $\vec{a} = +2m/s^2$
 It starts to accelerate uniformly at constant rate.

2) $U=10m/s$
 $5N$ (left), $3N$ (left), $10N$ (right)
 $\vec{F}_{net} = +2N$
 $+2N = 2kg \cdot \vec{a} \rightarrow \vec{a} = +1m/s^2$
 It will accelerate uniformly with a constant rate.

3) $U=10m/s$
 $6N$ (left), $4N$ (left), $7N$ (right)
 $\vec{F}_{net} = -3N$
 $-3N = 2kg \cdot \vec{a} \rightarrow \vec{a} = -1.5m/s^2$
 It will decelerate uniformly with a constant rate.

Newton's 3rd LAW:

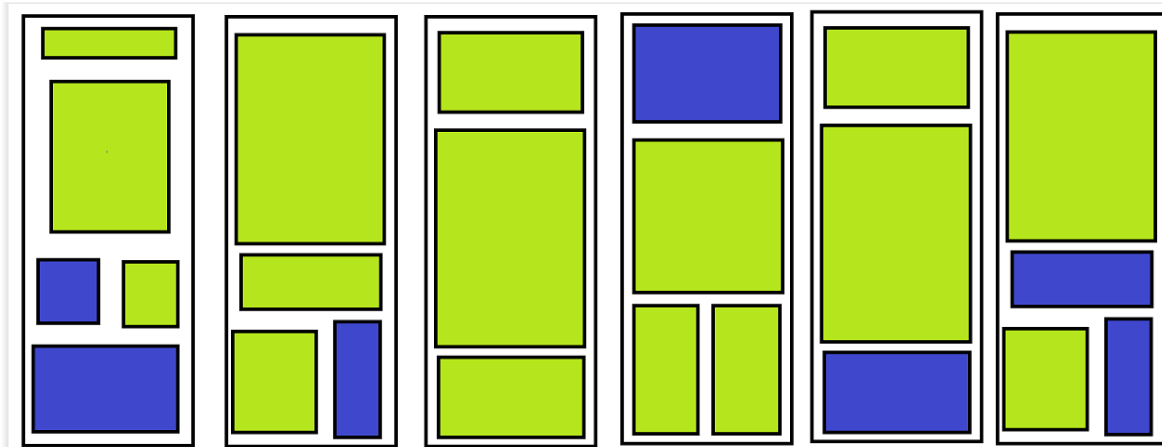
They are not applied on the same body

ACTION REACTION

Every action has EQUAL $\Rightarrow |\vec{F}_{action}| = |\vec{F}_{reaction}|$
 (in magnitude) OPPOSITE $\Rightarrow \vec{F}_{action} = -\vec{F}_{reaction}$
 (in direction) Reaction.

\vec{F}_1 : the action force by A on B.
 \vec{F}_2 : the reaction force by B on A.

These are notes from my physics class in which I learnt about Newton's Laws. This gave me a good foundation which allowed me to develop further and explore how these laws are used in swimming.



This is an example of a design I created for my informative document. **TEXT.** **IMAGE.**

Criteria C: Reflecting

Impact of the project on myself

This project has changed my life in ways I could not have ever imagined. Initially, I believed this project would help me purely with swimming. I thought that using this opportunity would help me perform better in the pool and teach me new things about my biggest passion. And, in many ways, this project did this for me. I learnt a lot about the science behind swimming, and in the end, it improved the quality of my swimming. Learning about the four important forces, swimming equipment, energy and wave motion, helped me gain a wider understanding of swimming and why things are the way they are. Though, as I reflect, this project has not only helped me in the water it has helped me in other ways too. I was able to meet so many new people who are passionate about science and swimming as well. I have made many new life-long friends. It has also helped me develop essential life skills. I've improved my research skills, communication skills, problem-solving skills, the list goes on. This project taught me a lot about myself too. I am now aware that I need to work on my self-management skills as this was a challenge for me throughout this journey. I now also know that I need to communicate with others more. Throughout most of this project, I didn't talk to anyone about it. I did almost everything on my own and figured out everything by myself which turned out to be incredibly stressful and tiring and it made me slightly resent the project. However, I came to the realization that it's good to talk to friends, family and teachers about this project. Having guidance and support from others makes it so much more enjoyable. I am glad that eventually I recognized that doing it on your own isn't always great. This is one of the biggest lessons I learnt throughout the personal project.

My product

My final product was an informative document and video abstract about the physics and hydrodynamics of swimming. The informative document went into depth about the science, technology, and modern innovations. The video abstract briefly covered these topics. It included video clips of me swimming in which I was visually showing the information provided.

| Success Criteria | Was it met? | How? |
|---|-------------|--|
| Video is appropriate length which keeps viewers engaged. | Yes | My video was 3 minutes and 57 seconds. Typically, informative videos that range from 3-4 minutes ensure the audience don't get bored but still gain information which I agree with from my experience. According to people at the exhibition, the video is interesting throughout. |
| Informative document is written with straightforward sentence construction | No | In order to explain certain concepts using more difficult vocabulary was needed. Nonetheless, I tried my best to include definitions when necessary. I tried to write clearly but sometimes I had unusual sentence construction. |
| Both the video and document include relevant images which are formatted adequately. | Yes | My video and document contain images relevant to the subtopic I am explaining. Most of the images I used were pictures I took which allowed me to elaborate on the images. I formatted the pictures, so the more important ones were larger, though I ensured the images didn't take away all the attention from the text. |
| Font size is easily readable. | Yes | I used the font Cormorant Garamond Me, size 13 with line spacing of 1.4. According to friends, parents and grandparents it is easy on the eyes. The font used for informative documents typically ranges from size 12-14. |
| Video abstract is organized with clear descriptions. | No | There wasn't a written table of content. However, in the audio of me speaking I mentioned what I would be talking about. There were short written descriptions for a few subtopics I talked about, but not all of them. |
| After watching/reading the viewer should learn something. | Yes | At my booth, I had my video playing and document. Additionally, I provided the people who stopped at my booth with fun facts. I received feedback from many people during my exhibition and I received lots of positive feedback saying they learnt something new. |
| Attracts target audience. | Yes | During the exhibition, I had my video abstract and document on display. Many people who came to my booth were interested in the video where I was swimming. I talked to competitive swimmers and athletes such as football and basket players. Additionally, many parents I talked to were in the science field. There were also a few adults who were pilots and could relate to the hydrodynamics aspect of my presentation. |
| Relevant information about the science behind swimming. | Yes | I provided information about many topics that fall under the science of swimming. For example, Newton's Laws, forces between the water and the swimmer, kinetic energy and wave motion. The information was on both the informative document and video abstract. |
| Relevant information about the technology and recent innovations. | Yes | I explained the basics of the technology and recent innovations used in swimming. I then went into detail and explained further. I discussed the cap, goggles, tech suit, |

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| | | equipment used during training, and the modern Olympic pool including depth, lane ropes and lanes. |
| Content is written with correct English and is organized. | Yes | I organized my information into subtopics and divided it into relevant paragraphs. I got my work peer- checked by native speakers. |
| My product is finished on time. | No | I spent a lot more time than anticipated on research. I started writing my document and creating my video abstract much later than expected, which resulted in me having to work on my product past the due date. |
| My product is shared through social media. | No | I didn't get the opportunity to share it on social media. Instead, I could have shared my product with students at school. |

Conclusion

In the end, I am happy with how my product turned out. However, I believe that if I managed my time better throughout this project, I would have been more successful with the final product. All in all, this project was a beneficial learning experience and taught me many life-long skills. This project gave me the opportunity to explore my passion and global context which I will continue to do in the future.