

Viscosity η



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AMERICAN MATERIAL RESEARCH LABORATORY
EXPERIMENT SUBMISSION DATE: MARCH 21 1955

PRIVATE

AMERICAN MATERIAL RESEARCH LABORATORY
EXPERIMENT APPROVAL DATE: DECEMBER 7 1955

Revision 2



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GDD Credits

Aidan Lawrence - Design & Writing Lead, GDD Editor, GDD Mastery, PowerPoint Template & Editing, Level Design, GDD revision 2.

Julio Gonzalez – Story, Level Design, Setting Aesthetic Coordinator, PowerPoint Designer & Author.

Phillip Gonzales - Level Design, Story Contributor, Aesthetics Contributor.

Zac Bogner – Level Design, Story Contributor, Control Documentation, Aesthetics Contributor.

Game Overview

Game Concept:

Viscosity is a first person physics puzzler that allows the player to immediately manipulate the state of a strange sample of scientific “matter”. Players will take the role of a scientist testing the marketability of this new matter sample, performing tests and puzzles utilizing the properties of two Newtonian matter states. The difference between this in-game sample of matter and a real-life non-Newtonian fluid is the ability to instantly change between states indefinitely, instead of a temporary state change.

Game Genre:

- Action
 - Physics Puzzle Game

Target Audience:

- Late teen
- Early Adult

Game World

Story:

1950s Professor Erwin Hoffmann has taken upon himself to help find a replacement to the overly abundant and hazardous insulation material, asbestos. As an employee of the American Material Research Laboratory, Hoffmann has always had ample scientific resources and facilities to experiment with in order to reach his goal of a new “super-safe insulation miracle substance.” Professor Hoffmann tirelessly tested many material combinations in pursuit of creating a perfectly stable sample of his ambitious new substance.

After months of mixing chemicals, writing equations, and a comically unfortunate gamma ray incident, Hoffmann had created a strange new composite material with very curious properties. This strange new material had the peculiar ability to swap between an exceedingly dense solid and a viscous, goopy liquid on command simply by being touched with Neoprene (a rubber most commonly used in laboratory gloves at the time). Hoffmann decided to name his exotic new material, “Viscosium”, due to the variable viscosity phenomenon he observed while handling it after its discovery.

Hoffmann determined that Viscosium was a revolutionary product that must reach the general public. While Viscosium was thoroughly researched by Hoffmann himself, he lacked any outside safety and practicality recognition. Through the A.M.R.L. material testing facilities, Professor Hoffmann has requested the attention of the labs’ accreditation committee to inspect the safety and marketability of Viscosium.

The A.M.R.L. Accreditation Committee was known to provide safety approval and coordinate investment capital solutions to inventors willing to subject their creations to rigorous and unorthodox testing methods.

After weeks of waiting, Hoffmann was finally granted an audience with the accreditation committee and was permitted access to the A.M.R.L testing facilities - but only on one condition...

He would be the one performing the demonstrations.

Characters:

Main Character:

- Professor Erwin Hoffmann:
 - Silent protagonist that the player will control in first person.

Location:

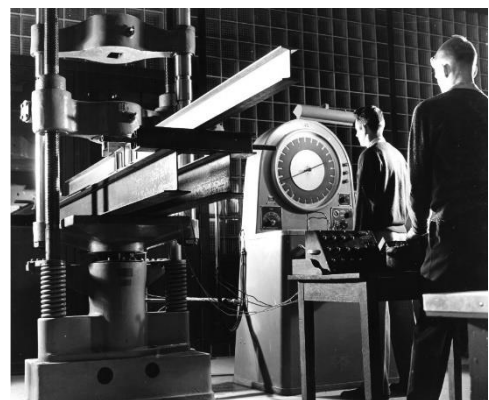
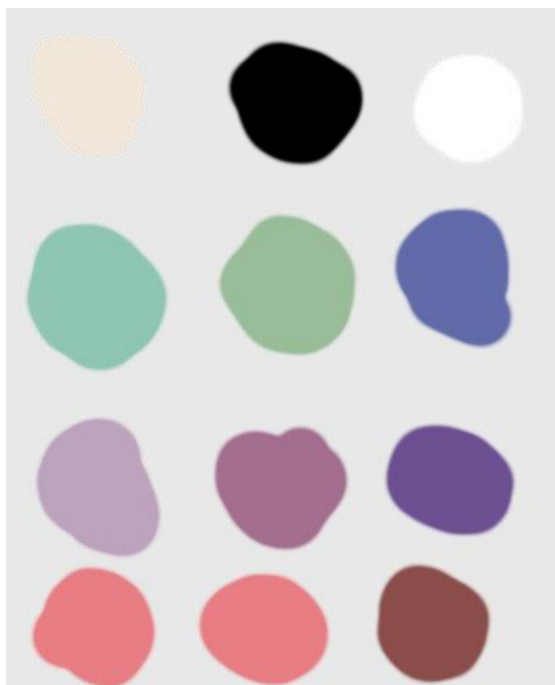
A.M.R.L. “American Material Research Laboratories”

- A.M.R.L. Is a fictional location.

Look & Feel:

- **1950’s “Mid-Century Modern” style**
 - Angular designs with smoothed beveled edges
 - Color pallet that focuses more on shades of black and white.
 - Colors used are typically pastel shades of light blue, green, yellow, and salmon.
 - White as a primary scene color accented with pastel colors, black trims, or wood-grain flourishing.
- **Playable area will be inside large, semi-rectangular laboratories**
 - *Clean, but aging, sterile-themed environment filled with various scientific instruments.*
 - Aged glassware
 - Beakers, test-tubes, Erlenmeyer flasks, etc.
 - Filled with colorful substances to “trim” the white background of the laboratory
 - *Pastel painted heavy steel equipment*

- Valves, buttons, levers and other control mechanisms will be lightly distressed as if they have been heavily used for many years.
- Large, heavy, beige mainframe computers trimmed with black and white spindles hint at the technological timeframe the player is in.
- In contrast to the formal labware, any heavy machinery will often be grey iron and steel. Often rusted or in gritty condition.
- *Walls will mostly white and will be lightly textured with a simple dry-wall pattern.*
 - Accent colors and trims on the walls will be used to subtly “set-the-mood” of each scene
- *Environment lighting will play a critical role in setting the mood for each scene.*
 - Bright white and comfortably-lit levels often indicate that the player is safe, and nothing out-of-the ordinary is likely to happen.
 - Dim, grey levels send a foreboding message to the player. Dim lighting situations can be used to easily create dramatic scenes.
 - Areas of high color contrast and brightness will often be used to hint at puzzle solutions or proper objective paths. Contrast lighting can also be used as a tool to steer the direction of the player towards something important.



Gameplay & Mechanics

Core Mechanic:

- Players are given a sample of “Viscosium,” a strange new substance that has the ability to instantly change between a solid and a viscous liquid, indefinitely, on-command.
 - Players will use Viscosium as a tool to aid in physics-based puzzle situations.

Material Phases Explained:

Solid: Exhibited as a hard substance in the shape of a perfect cube. This solid block of Viscosium is massively dense, resilient to damage, and difficult to move around due to its high friction. The *Solid* state makes for great improvised platforms!

Liquid: Represented by a viscous, fluidly moving blob of Viscosium. The *Liquid* state has a much lower density than the *Solid* state. Due to its reduced friction, the *Liquid* state can be moved around easily and fit effortlessly into small spaces. The *Liquid* state is less resilient to damage compared to the *Solid* and can be easily destroyed in certain situations if the player neglects it.

Players may instantly transition between material phases by approaching the Viscosium sample and interacting with it.



**An early in-engine look at "Liquid Viscosium"*

Sub Mechanics:

Viscosium Sample Damage:

- Both the *Solid* and *Liquid* states have unique vulnerabilities that are present in playable areas.
- *Liquid* Viscosium is flammable and can be destroyed by fire.
- *Solid* Viscosium can be crushed and smashed if subjected to abrupt forces.

Environment Mechanics:

- Special surfaces throughout the game will immediately affect the Viscosium's state should the sample come in contact with them.
 - **High-energy surfaces**, marked with a bright orange texture, will cause the Viscosium sample to melt into the *liquid* state.
 - **Low-energy surfaces**, marked with a bright blue texture, will cause the Viscosium sample to freeze into the *solid* state.
- There are also **damaging surfaces** that will cause the player to instantly lose their sample of Viscosium and fail the puzzle.
 - **Fire** will immediately destroy any Viscosium in the *liquid* state. *Solid* Viscosium is not affected by fire.
 - **High Impact** surfaces, such as crushers and grinders, will destroy Viscosium samples in the *solid* state. *Liquid* Viscosium is not affected by crushing.

Miscellaneous Dynamics:

- **Vacuum Tubes** can suck-up *liquid* Viscosium and transport it to new level sections. *Solid* Viscosium is too heavy to be affected by vacuum tubes. Vacuum tubes will not directly affect the player (i.e. suck them up.).
- **Viscosium Can Glow in the Dark!**

Physics:

For the most part, *Viscosity* will feature standard Newtonian physics. With the exception of the "Viscosium" sample, most in-game physics simulations will emulate real-life.

- **Gravity**
 - 9.8 m/s²
- **Friction**
 - World friction between objects will be influenced by variable “physics material” components added to interactive rigidbodies.
- **Collision Interactions**
 - Collision will be handled by the PhysX engine and will emulate the real-world by not allowing objects to “phase” through each other.
 - Objects that perform real-time collision-based movements will use the rigidbody solver component.
 - Objects that will not move, but are still interacted with by the player (i.e. walls), will utilize colliders that best fit its shape.
 - Objects that are out-of-reach or are not intended for the player to interact with them will not be assigned a collider or rigidbody solver.
- **Specialty Interactions**
 - Liquid Viscosium matter sample will use a heavily modified “Interactive Cloth” system.
 - Collision is approximated by sphere colliders that calculate the mesh renderer center and position themselves accordingly.
 - Primary sphere collider envelops the entire object.
 - Secondary sphere collider has a smaller radius and is used to approximate collision interactions near the center of the liquid.
 - Both colliders are set as “triggers”.
- **Mass and Drag**
 - Handled by the rigidbody solver component.

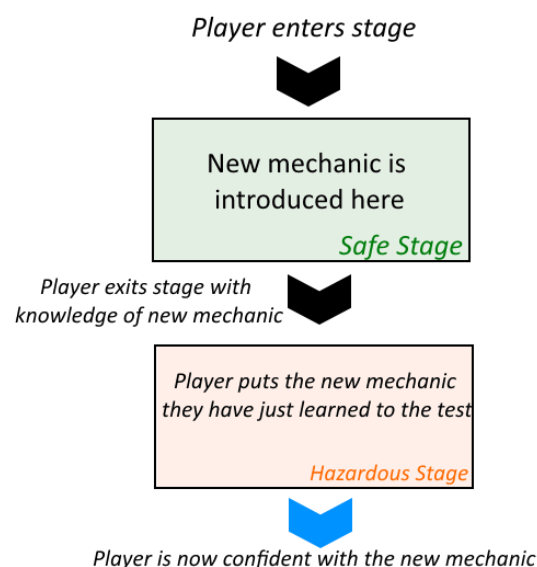
Progression Overview:

Players will follow an **instruction/execution** level design philosophy. Any time a new mechanic is introduced, the player is taught through gameplay in a simple “tutorial-esque” stage. In this learning stage, the player is given a safe environment to fail and

learn the introduced mechanics at their own pace. After the instruction stage, the next stage will feature a puzzle that will test what the player has learned, as well as mixing in previously learned mechanics to provide a highly dynamic and rewarding experience. The goal of instruction/execution level design is to teach the player indirectly through gameplay instead of holding their hand and physically reading back directions. As the player progresses, puzzles will quickly become more challenging. Previously learned mechanics from past stages will begin to accumulate in later levels.

Puzzle Structure & Level Design:

- **Level design is structured around “module-based” stages**
 - Small rooms that contain a single puzzle and objective.
 - Player will use the matter sample as a tool to navigate throughout the stage and reach their objective.
- **Stage Objective**
 - Players will be required to deposit their matter sample into a designated area at the end of each stage.
 - “Designated area” refers to a chute somewhere in the stage that will “transport” the matter sample into the next testing area. This is the main objective for the player and serves as an endpoint for each stage.
 - After reaching the chute and depositing the matter sample, the stage will end. Players will then be quickly moved to the next stage where they may be facing the next puzzle.



Movements and Actions:

- **Player Movement**
 - Players can jump by pressing the SPACE key.
 - The player will be able to navigate the world in three-dimensions using axis-based controls (W, A, S, D, Arrow keys, etc.)
 - The player will be able to rotate their camera using their mouse.
- **World Interaction**
 - Players will have an “interaction key” (defaulted to the E key and MOUSE LEFT)
 - Nearing an interactive object will change the color of the centered crosshair marker on the players screen.
 - The player may interface with any interactive object that they are directly looking at and in range of.
 - Interactive objects can include: buttons, levers, and various other environment props.
- **Goal Interaction**
 - The player is required to deposit their matter sample to an end-of-level designated area.
 - As soon as the matter sample enters this designated area, regardless of state, the level will be completed successfully.

Viscosium-Specific Interactions:

- **Solid Viscosium**
 - Is resilient to fire and can keep the player safe from high-temperature hazards.
- **Liquid Viscosium**
 - “Conducts electricity” in liquid switch bowls. Essentially the same as floor buttons, but can only be activated by liquid viscosium.

User Interface Overview:

In-Game User Interface

- Minimal amount of on-screen elements.
- Simplistic crosshair that will be negatively colored against the background pixels.
- Small, stylish, unobtrusive dialogue boxes that will only be used to display primitive information to the player.
 - Primitive information includes: Prompting control schemes, subtle hints at new mechanics, etc.

Main Title Menu

- Stylized menu with a *Viscosity* logo in the upper center of the screen.
 - Menu items will be against the lower left corner with a black transparent backing.
 - Menu items include:
 - New Game
 - Continue
 - Quit
- Background of the title screen will show a small scene illustrating the “lead-up area” to the first stage.
- *Viscosity* will open with a small cut-scene.

Pausing the Game

- The pause menu can be accessed in-game by pressing the ESCAPE key.
- The pause menu will darken the current main camera view and display a large “PAUSED” logo.
 - Pause menu items include:
 - Resume
 - Restart Stage
 - Main Menu
 - Quit

- The pause menu also features a subtle Viscosity symbol (η) in the bottom right corner of the screen.

In-Game Prompting

- When the player encounters a situation that mandates on-screen instructions (such as learning the control scheme of the game), a small, black-boxed prompt will appear at the bottom of the screen.
 - This prompt will be small, and have a character limit of 32.
 - It will be solid white text on a rectangular, translucent, black backing.
 - Black backing will expand and contract depending on the character count of the prompt text.
 - Prompts will be located on the bottom center of the screen.

Control Scheme:

- **Movement:**
 - Key Input: Axis Based:
 - 'W' to navigate in the forward 'Z' axis.
 - 'S' to translate backwards in the 'Z' axis.
 - 'A' to move left in the 'X' axis.
 - 'D' to move right in the 'X' axis.
 - SPACE to jump
- **Camera:**
 - Camera rotation based on mouse movement. Standard first person control scheme.

Interaction:

Interaction key defaults to the E key and MOUSE LEFT.

Level Design Overview

Stage 1:

Stage 1 is designed to passively teach the player the controls and core mechanics of Viscosity through gameplay within a safe environment.

Major Level Features:

- There will be one large cube of Viscosium lowered into the play area by a crane descending from the ceiling.
- The goal will be in-sight of the player at all times while facing forward and will be placed behind an impenetrable glass wall.
- There will be a single door along with an opening in the glass wall that is too small for the solid Viscosium sample to fit through.
- On the other side of the wall opening, there is a liquid-activated switch that will open the door and let the player progress towards the goal.

Solution:

- Player enters stage and moves viscosium sample towards wall opening.
- Player transforms Viscosium sample to liquid.
- Liquid is moved into the wall opening and eventually lands inside the liquid switch.
- The door will now swing open, allowing the player to progress and deposit their Viscosium sample into the objective port.

Stage 2:

Designed to teach players about the volatility of Viscosium depending on its current state. This level *can* destroy the Viscosium sample and “kill” the player.

Major Level Features:

- Conveyor belt that leads to a temporarily restricted area with a clearly visible button behind it.

- Large “crushers” that will fall on to the Viscosium sample and destroy any *solid* materials.
- A liquid-activated switch that will prevent the crushers from falling and allow the player to progress.
- A fire trap that will burn the player and any *liquid* materials.
- Behind the fire trap is the deposit chute needed to finish the level.

Solution:

- Players must transform their Viscosium sample to a liquid and place it on the “crusher conveyor belt” in order to avoid losing their sample.
- The liquid will travel into the restricted area and trigger a liquid switch, stopping the crusher, and allowing the player to progress.
- During the fire trap section, players must transform their sample back into a solid to prevent the fire from destroying the Viscosium.
- Players will then block the fire trap with the solid Viscosium sample and navigate around it.
- After the fire trap, players will recover their Viscosium sample and deposit it into the level-ending chute.

Stage 3:

A dangerous, somewhat more complicated stage that makes the player aware of vacuum tubes and emphasizes energy surfaces as probable hazards.

Major Level Features:

- The stage will begin a glass wall with two vacuum tubes. Each tube goes over the wall and leads to a unique event.
 - One tube will lead to a water trap (“bottomless” pit)
 - One tube will activate a liquid switch behind the wall.
- Once the first liquid switch is activated, the glass wall will lower, allowing the player to progress to the next section and reclaim their Viscosium sample.

- In the next section, there is a high energy surface bridge that spans a large pit filled with water in the floor. The bridge is saturated in fire from jets adjacent to it.
- Preceding the bridge is another liquid switch that will switch-off the fire, so long as the liquid sample remains inside.
- After the player crosses the bridge, they will find a single button that activates a vacuum tube that will retrieve their liquid sample from the other side of the bridge and re-instantiate the fire.
- After the player retrieves their sample for the final time, they may deposit it into the final chute at the end of the stage.

Solution:

- Player must place their liquid sample of viscosium underneath the correct vacuum tube leading to the liquid switch on the other end of the glass barrier.
- After the liquid switch has been triggered, the player is free to cross over the lowered glass wall
- Players must now move their sample of Viscosium to the next liquid switch to prevent being burned by the fire bridge.
- Once the liquid switch has been pressed, players may cross the bridge without any fear of being burned.
- After players have crossed the bridge, they may retrieve their liquid sample by pressing the vacuum tube switch located near the end of the bridge. The vacuum tube above the liquid switch will activate and transport the sample to the player.
- The player may now deposit their sample in to the end-level chute.

Stage 4:

Designed to be the final stage in *Viscosity*. Stage 4 is the longest level in *Viscosity* and features every previously-learned mechanic and dynamic along with a few new puzzle elements.

Major Level Features:

- In Stage 4, the player will *not* immediately receive their matter sample. Instead, it is placed atop an inaccessible platform.
- The sample rests on a togglable energy surface set to “low” by default. As a result, the matter sample stays idle as a solid.
- Next to the sample is a vacuum tube that leads directly to the energy surface toggle switch next to the player.
- There is one more energy surface placed next to the lip of the upper level that allows players to use the solid matter sample as a step to help them reach the next area.
- Once on the upper level, the player will notice two large vertical gears turning towards a closed off area with a vacuum tube opening. Players will also notice that the gear system, along with the lights within the stage are powered by a heavy generator mounted on the ceiling.
- This vacuum tube behind the gears is always-on and leads towards a glass-cased liquid switch.
- Once the liquid switch is triggered, the generator will be released from its mount and fall towards the wall adjacent to it.
- The generator will be suspended by its cabling and will hurdle towards a destructible wall. In the process of falling, power will be cut to the stage and the level will become dark. The generator will blow through the wall adjacent to it and the glass encased liquid switch will lower its walls.
- Players will now progress through the next section of the level in near darkness with only their glowing sample of Viscosium to help them navigate through the stage.
- Players must now find three togglable floor buttons in near complete darkness to open a large emergency exit and end the game.

Solution:

- The player enters the stage and moves toward the energy surface toggle switch. The player will toggle the energy surface to “high” mode to melt the Viscosium sample.
- After the Viscosium sample has been melted into a liquid, the active vacuum tube will transport the Viscosium sample directly to the player.
- Once the Viscosium sample has been retrieved, the players must transport it to the second energy surface to their right.
- Players can now use the solid Viscosium as a stepping stone to reach the upper ledge by using the elevated position of the energy surface.
- Once the player is on the upper level, they must transform their Viscosium sample back into a liquid and activate the vacuum tube above them by standing on the toggle button near their feet. The player should now have character and sample on the second level of the stage.
- Players must now place their liquid Viscosium between the two moving grinder gears. The two moving gears will transport the Viscosium towards the opening of a vacuum tube. The vacuum tube will lead into the closed-off glass case that contains a liquid-activated switch.
- Once the switch has been activated, the generator will be released from its ceiling mount and smash through the wall in front of it.
- After the generator has completed its cinematic sequence, players may retrieve their Viscosium sample from the demolished glass enclosure and continue into the now darkened stage.
- Players will walk through the smashed wall and find themselves in a pseudo-maze that contains three toggle buttons.
- Once the player has found their way through the dark maze with their glowing Viscosium sample and have activated all of the buttons, the final “huge emergency exit door” will open dramatically and flood light into the playing area.
- Once the player passes through the door, the entire game is complete.

Ending Viscosity:

Players who have finished *Viscosity* will be rewarded with a nice closing sequence that briefly outlines “what happens next” as Viscosium becomes approved for public use. Players will be thanked for playing and a credits page will follow.

Audio Design

Tools:

- **Unity 4.6 Integrated FMOD**
 - Easy to implement 3D and 2D audio sources.
 - Scripting API and components are already integrated into Unity 4.6.
- **Audacity & Audio Tool**
 - Open-source audio editors and mixers.
- **BFXR**
 - Open-source sound processor that generates public domain sound effects to be used as an audio base for more complex sound effects.
- **NGUI**
 - A full-scale user interface Unity plugin that allows for easy and scalable on-screen graphics.
- **Plastic SCM**
 - A “large file and binary-friendly” version control system.

Ambiance Overview:

- **Sound Profile**
 - Smooth and soft in peaceful areas.
 - Grinding and heavy in more intense areas.
- **Soundtrack**
 - Smooth, futuristic synth to provide an artistic contrast with the “mid-century modern” style aesthetic of the game.

- Audio volume levels can be modified to create a sense of emphasis or muted to hint towards a more “serious” atmosphere.

Event Sounds:

- **Player is given a “rewarding sound” for every large level milestone completed.**
 - Short, strong, and punchy harmonic chord with a small percussive jingle at the beginning.
- **Players taking damage**
 - Interacting with fire (or any other hot surface), will result in a sharp “hissing” or “sizzling” sound.
 - Players that have been crushed will hear a large, heavy, metallic **BAM!**

Monetization

There are currently no plans to sell this version of *Viscosity*. Instead, *Viscosity* will be released for every PC platform (that is supported) for free. *Viscosity* will be available for download immediately on www.aidanlawrence.com.

Viscosity source code will be released under the Creative Commons Attribution NonCommercial 4.0 International License.

Technical Overview

Engine:

- **Unity 4.6.3**
 - Unity 4.6.3 features the “Interactive Cloth” component necessary create our core mechanic.
 - This “Interactive Cloth” component is how *Viscosity* will represent the *Liquid* state of matter.
 - Unity 4.6.3 also features a fully-fledged physics engine, *PhysX*.
 - 3D Audio is also handled by built-in Unity middleware, *FMOD*.

- Rendering pipeline be Direct3D 11

Programming:

- **C# compiled with MONO**
 - **Code Practices**
 - All major classes, variables, structs, functions, etc. will have proper, contextual names using the camel-case convention.
 - Descriptive comments on major blocks of code are mandatory.
 - Third-party Javascript may feature an appearance in *Viscosity*, but is generally unadvised.
- **Version Control**
 - Handled by PlasticSCM.
 - Dedicated *PlasticSCM* server hosted by team member: Aidan Lawrence.
 - *Team No Fun Allowed* was granted a 4 member *PlasticSCM* team license for one year.

Graphics:

- **Rendered using Direct3D 11.0**
- ***Viscosity* will only support 16:9 aspect ratios**

Hardware Requirements:

- ***Viscosity* is a PC-only title**
 - **Supported Operating Systems:**
 - Windows XP+, Mac OS X 10.7+, Ubuntu 10.10+, SteamOS+
 - **Minimum System Requirements**
 - Quad-Core CPU running at 1.8 GHz or higher
 - Nvidia GTX 660
 - 4GB RAM
 - 1GB of free storage space
 - **Recommended System Requirements**
 - Quad-Core CPU running at 3.5 GHz or higher
 - Nvidia GTX 670 or better
 - 8GB RAM

- 1GB of free storage space