Summary
This 3D printed surface is the geometrical representation of the Perfect Gas Equation of State from Classical Thermodynamics. It shows the coordinates of all the equilibrium points accessible to a gas made of small, distant and non-interacting molecules, in terms of its three average thermodynamic coordinates: Temperature, Pressure and Volume.

Overview and Background
The surface was generated by the following equation:

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P* = T* / V*   ,
```

with P, *T* and V* the non-dimensional Pressure, Temperature and Volume of the gas respectively, with:

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P* = P / P_ref
V* = V / V_ref
T* = n R T / (P_ref V_ref)
```

with n the number of moles in the gas volume and R the Perfect Gas Constant.
In the printed volume, the parametric domains for P, T and V are:

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0  <  P*  <  5
0  <  V*  <  1
0  <  T*  <  1
```

A video dedicated to this 3D printed piece and its use with students can be found in my YouTube Channel, La Physique avec les Mains (https://www.youtube.com/channel/UCO6Mecxua_W7SR-KwNwyRdw).

Lesson Plan and Activity
The printed surface gives access to a "physical" and "sensorial" view of what is otherwise merely an abstract equation in the mind of students. Simply touching and manipulating the printed piece, in relation to the underlying formula, yields a deeper understanding and a better memorisation of what the equation stands for.
As a more advanced exercise, students are given laser pointers equipped with small lenses that distort the laser beam into a laser plane. By appropriately orienting the laser plane with respect to the printed surface, students may make iso-lines visible, such as isothermal curves, isobaric curves and isochoric curves.
By relying on the graduations present on the base of the piece, and with the help of a second laser plane, more complex iso-lines can be constructed point by point, by triangulation. For instance, students can be asked to construct and draw a few isentropic curves directly on the piece's surface.

Materials Needed
None in principle.
A means to produce laser plane allows to explore the printed surface in great depths. This can be achieved by relying on cylindrical lenses, on a series of parallel, small optic fibres placed perpendicular to the laser beam, or on a diffraction grating.