**Lesvoorbereidingsformulier SSI les volgens 5E-model**

# Algemeen

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| Klas: VWO 4 | Lesuur: 80 min | Lokaal: | Datum: 22/05/2024 |
| Onderwerp: PHYSICS | | | |

# *DOELEN:* Wat en Waarom

### Leerdoelen

**Kennis leerdoelen**

* After the lesson, the student can explain the working of a gas boiler
* After the lesson, the student can explain the working of a heat pump
* After the lesson, the student can mention the advantages of using a heat pump instead of a gas boiler.
* After the lesson, the student can state the new standards of heating from 2026 in the Netherlands.
* After the lesson, the student can compare two electrical appliances
* After the lesson, the student can differentiate between effiency and COP

**Vaardigheid leerdoelen**

* After the lesson, the student can calculate how much energy a device consumes.
* After the lesson, the student can calculate the cost when using a HR gas boiler and a heat pump.

### Relevantie van de leerstof (kerndoelen/eindtermen en betekenis voor leeringen)

* The new standards for heating from 2026 in the Netherlands is being discussed at the moment. In order to tell why (or why should not) should we replace the gas boilers with heat pumps, we should essentialy know how much energy is consumed by a gas boiler and a heat pump.
* It’s also important to know the advantages of using heat pump in climate fight.

# *LERENDEN:* Mogelijkheden en beperkingen

### Aandachtspunten m.b.t. beginsituatie (leerling kenmerken en contextfactoren):

* The neccessary prior knowledge like heat, thermal effects and law of conservation of energy is a must to understand the working of a gas boiler and heat pump.
* The topic requires the clear understanding how heat tranfers in two different heating systems to compare its working.
* The topic includes calculations in order to find out the energy consumed by each heating system and compare the cost when using a gas boiler and a heat pump. It might be difficult for some students as it involves a few conversions between energy units.
* Since the it’s todays topic, it might be interesting for the students to know further in the topic. Still some of them may not be interested in a socio scientific issue. And it requires discussion to get the topic introduced. Students may not respond well in the beginning itself, which can put the teacher in a difficult spot. Also the group discussion may not be hundered percent fruitful as all the group members may not be equally interested and there can be difference in opinion. In total, class room can be a bit noisy as the discussions take place in between.
* As a teacher, it is an opportunity to understand your student’s behaviour and working in a group, interest and view on a SSI. I think, after a few SSI classes, physics teacher can handle this type of a class well.Also it’s an opportunity for the teacher to gain more knowledge in these type of topics and connect physics with issues that we face in life.

# Onderwijsaanpak

*Welke van de 5E fasen komen in deze les aan bod? Wat zijn de verbanden en wisselwerkingen tussen deze fasen onderling en de fasen die in andere lessen aan bod komen?*

* *All the 5E phases such as engagement, exploration, explanation, elaboration and evaluation are covered in this lesson. The 5E phases in the lesson are based on the topic heat, the transfer of heat and enegy which was learned in the previous units. The connection betwwen the previous unit and the topic is established by asking asking questiong about it in the engagement phase in the beginning of the lesson.*

*Beschrijf per fase de aanpak (vb, didactische werkvormen, onderwijsleermiddelen, verbale/ visuele stimuli, representaties, lesmaterialen, groepsindeling, lokaalopstelling)*

* *Engagement – instruction and interaction are used to gain the attention of the class in this phase.In order to support the approach, ppt, video and white board are used in the class.*
* *Exploration – a number of 4-students group is made to explore the answers to the work sheet. And the exploration based on the worksheet is evaluated by the direct questions on the powerpoint presentation.*
* *Explanation -the working of a gas boiler and a heat pump, efficiency and COP and how to calculate enery consumed by each heating system and compare the cost when using gas boiler and heat pump are instructed with the help of ppt and white board to the whole class.*
* *Elaboration – the worksheet to calculate the energy consumed by each heating system and the cost when using gas boiler and heat pump is given out to the same 4-students group. They can also refer to the ppt that is displayed as well as the calculations explained by the teacher on the white board.*
* *Evaluation – the worksheet answers were discussed for the entire class as part of evaluation. Also interaction can be possible to discuss the evaluation questions displaced on the ppt. Therefore, views on the topic “ Shall we replace gas boilers with heat pump?” by different groups can be presented to the class.*

*Onderbouw je keuzes en leg uit hoe je aanpak het realiseren van de leerdoelen ondersteunt en hoe je tegemoet aan de mogelijkheden en beperkingen van de beginsituatie.*

* I think it’s best to go for 5E phase to deal with a socio scientific issue like “ Shall we replace gas boilers with heat pumps?”. The student participation is very important here. Therefore the above approach is the most suited one according to me. Since it’s a current issue and the on going discussion and news regarding the topic makes it familiar for the students. Therefore, it creates interest in students to explore further about it. Since there can be students with no interest in such topics, it might be a bit difficult to get it started, but the interaction, video, group discussion and work sheets keep the students engaged and learning is effective. 5E approach helps in achieving the learning objective as it ensures that a holistic participation from the students.

# *Toetsen*

Hoe kom je (tijdens de les) achter het leerresultaat (begrip of verwarring van je leerlingen) m.b.t. de leerdoelen?

Work sheets can find out the learning outcomes to a great extent. Work sheet helps students in mentioning the advantages of using heat pumps instead of gas boiler clearly. Also students know the new standards of heating from 2026. Work sheet problem shows whether the students learned to calculate and compare the energy consumption by a gas boiler and a heat pump.

**Short Reflection**

Based on my current experience and the feedback I received from 22/05/2024, I would like to conduct only one group discussion on “ shall we replace gas boilers with heat pumps?”. The answer can be yes or no based on their perspective. The same group can further research into the topic and present their perspective ( or their findings) in the coming lessons. The worksheet to calculate the energy consumed by HR gas boiler and heat pump and the cost when using each heating system will be given to each individual student instead of group, which will ensure that every student will pay attention to the explanation. Also, those students who are curious about the topic can further investigate the energy consumption for houses in the entire Netherlands and the required cost for different type of heating .