
Advisory report

Student result (pilot) (5v.1.A.3)

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise the following catalyst(s):

- Catalase
- Fe³⁺
- MnO₂
- I⁻
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

This catalyst works really quick.

This data supports our conclusion as follows:

Measuring results.

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Our second argument that reinforces this advice is based on the following fact:

Catalase does not work.

This data supports our conclusion as follows:

Measuring results.

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Our third argument that reinforces this advice is based on the following fact:

MnO₂ works slowly.

This data supports our conclusion as follows:

Measuring results.

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:

Only in the tested environment.

Groep 5v.1.A:

Dit zijn de resultaten, we kwamen uit dat in ons geval ijzer het beste is, omdat die het hoogste temperatuurverschil heeft en dat is eigenlijk alles waar we naar hebben gekeken.

Ja, hoogste temperatuurverschil, maar je zegt ook dat deze snel werkt toch?

Ja ik bedoel hij begint snel en de temperatuur gaat ook snel omhoog, dus in dat opzicht snel.

En stopt de temperatuur dan ook snel met stijgen?

Ja, je zag die die van bruinsteen die kon nog de volledige tijd doorgaan, maar bij ijzer ging die, ik weet het niet precies, maar na twee minuten alweer dalen.

En je zegt bij enkele randvoorwaarden: 'alleen in dit milieu'?

Ja ik hoorde van een medeleerling iets dat katalase in een ander milieu heel goed zou werken, dus dat is de randvoorwaarde dat als je in dit milieu zit dat dit het best werkt. We hebben alleen deze gemeten.

Advisory report

Student result (pilot) (5v.1.B.1)

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise de following catalyst(s):

- Catalase
- Fe^{3+}
- MnO_2
- I^-
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

Potatoes do not function as a catalyst.

This data supports our conclusion as follows:

The temperature remains a flat line which indicates a flat course of events in the process.

The following (untested) assumption has been taken into account:

?

We can state with certainty that this substantiation is valid, because:

Our second argument that reinforces this advice is based on the following fact:

The rest did provide the expected graphs.

This data supports our conclusion as follows:

Do not use potatoes in the industry.

The following (untested) assumption has been taken into account:

Each catalyst was tested using the same experiment.

We can state with certainty that this substantiation is valid, because:

The experiment was performed correctly.

Our third argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:

No potatoes.

Advisory report

Student result (pilot) (5v.1.C.1)

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise the following catalyst(s):

- Catalase
- Fe³⁺
- MnO₂
- I⁻
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

It had the highest activation energy.

This data supports our conclusion as follows:

The highest measurement.

The following (untested) assumption has been taken into account:

With measuring errors.

We can state with certainty that this substantiation is valid, because:

The experiment has been done multiple times.

Our second argument that reinforces this advice is based on the following fact:

Catalase did not work.

This data supports our conclusion as follows:

The temperature did not increase.

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

In case of other project groups, catalase did also not work.

Our third argument that reinforces this advice is based on the following fact:

It is easy to replenish.

This data supports our conclusion as follows:

MnO₂ is easy to replenish.

The following (untested) assumption has been taken into account:

Because it is heterogeneous, so it can be replenished using only a filter.

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:

Only in the tested environment.

Groep 5v.1.C:

Jullie hebben gezegd: Bruinsteen is geschikt. Vanuit welke selectie?

Bruinsteen en katalase.

En jullie hebben gezegd, bruinsteen heeft de hoogste activeringsenergie. Dat vinden jullie het belangrijkste argument.

Naja, die andere daar konden we dus geen activeringsenergie van vinden en we dachten naja, deze heeft misschien een hoge activeringsenergie, maar hij doet tenminste nog wat. Die andere doet gewoon niet zoveel.

Maar eigenlijk hebben jullie dus als eerste argument gezegd, die ene die doet niks.

Ja.

Dan zouden we kunnen zeggen dat jullie het even moeten omwisselen, want jullie zeggen bij het tweede argument dat katalase niet werkt, maar nu doen jullie dat overkomen als jullie eerste en belangrijkste argument.

Ja.

Advisory report

Student result (pilot) (5v.1.D.1)

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise the following catalyst(s):

- Catalase
- Fe³⁺
- MnO₂
- I⁻
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

MnO₂ is a slightly good catalyst, but not the best.

This data supports our conclusion as follows:

It shows the activation energy.

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

We tested the catalyst.

Our second argument that reinforces this advice is based on the following fact:

That the catalyst can be dangerous.

This data supports our conclusion as follows:

Safety requirements.

The following (untested) assumption has been taken into account:

That these safety requirements are correct.

We can state with certainty that this substantiation is valid, because:

These safety requirements are being used by everybody.

Our third argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:

We did not have the opportunity to test the other catalysts.

Groep 5v.1.D:

Jij had alleen gewerkt toch, alleen bruinsteen had je gedaan? En je zegt, dat is niet de beste?

Dat denk ik niet, maar ik heb geen bewijs. We hoorden dat de andere hoger gaan, maar daar hebben wij geen resultaten van.

Hoger qua?

Qua temperatuur.

Advisory report

Student result (pilot) (5v.1.E.1)

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise the following catalyst(s):

- Catalase
- Fe³⁺
- MnO₂
- I⁻
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

Activation energy.

This data supports our conclusion as follows:

The activation energy is low.

The following (untested) assumption has been taken into account:

Same environments.

We can state with certainty that this substantiation is valid, because:

We cannot tell for sure.

Our second argument that reinforces this advice is based on the following fact:

The temperature increased with many degrees.

This data supports our conclusion as follows:

Difference in degrees.

The following (untested) assumption has been taken into account:

Same environments.

We can state with certainty that this substantiation is valid, because:

We cannot tell for sure.

Our third argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:

The experiment was complex because the potatoes did not work.

Groep 5v.1.E/G:

E: Ik heb het niet helemaal ingevuld, maar we hadden die aardappel, omdat die niet werkte kon ik het niet echt bedenken. Dan was bruinsteen beter zegmaar, maar ik hoorde net van andere groepjes dat het temperatuurverschil bij ijzer nog veel groter was, dus ik denk dat die dan beter is. En hij ging ook sneller bij ijzer.

G: Ik moet ook zeggen dat wat jullie zeiden over die bruinsteen volgens mij was het niet een hele grote. Ik had een grotere temperatuurstijging verwacht. Ik weet niet wat het was, hoeveel graden was het, 15 graden ofzo? Dat is niet veel. En die biokatalysator dat was 5 graden ofzo dus dat was depressief.

Top, maar jullie benoemen als eerste argument dus de temperatuurstijging, maar eigenlijk had dat het tweede argument moeten zijn en hebben jullie als eerste argument dat katalase niet werkt.

Ja dat had ik eigenlijk neer moeten zetten, het werkt gewoon niet.

Advisory report**Student result (pilot) (5v.1.G.1)**

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise de following catalyst(s):

- Catalase
- Fe³⁺
- MnO₂
- I⁻
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

The increase in temperature.

This data supports our conclusion as follows:

Higher temperatures with biocatalyst.

The following (untested) assumption has been taken into account:

Both in same environments.

We can state with certainty that this substantiation is valid, because:

The data has been checked by doing a second experiment.

Our second argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Our third argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:

Advisory report**Student result (pilot) (5v.1.H.1)**

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise de following catalyst(s):

- Catalase
- Fe³⁺
- MnO₂
- I⁻
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

Activation energy.

This data supports our conclusion as follows:

I⁻ 40.017 J·mol⁻¹, Fe³⁺ 107.410 J·mol⁻¹.

The following (untested) assumption has been taken into account:

Catalase was invalid.

We can state with certainty that this substantiation is valid, because:

It is like so.

Our second argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Our third argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:

Advisory report

Student result (pilot) (5v.1.1.1)

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise the following catalyst(s):

- Catalase
- Fe³⁺
- MnO₂
- I⁻
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

Little energy necessary.

This data supports our conclusion as follows:

More sustainable because the activation energy was 3132 J·mol⁻¹ in relation to 13987 J·mol⁻¹ (MnO₂) and 66487 J·mol⁻¹ (I⁻).

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

We cannot tell for sure, because there was no duplo measurement.

Our second argument that reinforces this advice is based on the following fact:

Highly available.

This data supports our conclusion as follows:

The reaction can take place more often, because it is more available.

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Our third argument that reinforces this advice is based on the following fact:

It is a reaction product.

This data supports our conclusion as follows:

Easier to replenish.

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:

It is harmful to your home. But it must be ensured that it can be recovered.

Groep 5v.1.1:

Jullie zeggen: ijzer. Vertel:

Nou dat had de laagste activeringsenergie, en de reactie verloopt het snelste, en we dachten ook nog dat hier het meest van beschikbaar was en makkelijkst terug te winnen. Er stond ook dat het een reactieproduct was van de reactie, in de bijlage.

Ja, nou jullie hebben er goed over nagedacht, en dat is eigenlijk ook direct al de volgorde zoals jullie hem zelf zouden zeggen? Dat de eerste het belangrijkste is, enzovoort.

Oh, dat hebben we niet per sé gedaan. Maar op zich die activeringsenergie, ja die staat bij ons wel op 1.

En jullie hebben geen duplometing gedaan, dus het zou kunnen zijn dat het niet klopt?

Ja.

Advisory report

Student result (5v.2.A.1)

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise the following catalyst(s):

- Catalase
- Fe³⁺
- MnO₂
- I⁻
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

The high activation energy.

This data supports our conclusion as follows:

With Fe³⁺ as catalyst, hydrogen peroxide is quickly converted.

The following (untested) assumption has been taken into account:

Fe³⁺ catalyzes the reaction process.

We can state with certainty that this substantiation is valid, because:

This was shown by the experiment.

Our second argument that reinforces this advice is based on the following fact:

Fe³⁺ is not harmful in water.

This data supports our conclusion as follows:

The water is safe.

The following (untested) assumption has been taken into account:

Fe³⁺ is not harmful in small amounts.

We can state with certainty that this substantiation is valid, because:

Not tested.

Our third argument that reinforces this advice is based on the following fact:

Fe³⁺ is not incredibly expensive.

This data supports our conclusion as follows:

Fe³⁺ is an economically suitable catalyst.

The following (untested) assumption has been taken into account:

This was found online.

We can state with certainty that this substantiation is valid, because:

Effective for the price.

Some preconditions that must be taken into account in this advice are:

Fluctuation in price and impurities in solution.

Groep 5v.2.A:

Welke verschillende soorten katalysatoren hebben jullie gebruikt.

Alles behalve de aardappel.

En jullie zeggen daarvan: ijzer is het beste, vertel, waarom?

De activeringsenergie is daarvan het hoogst.

Het laagst.

Het laagst, het hoogst/laagst jullie zijn in twijfel.

Het laagst, dus hij verlaagt de activeringsenergie het meest.

Oke, dus hier staat de hoge activeringsenergie. Maar jullie bedoelen eigenlijk, ijzer heeft de laagste activeringsenergie die jullie gemeten hebben, dus dit is de beste.

De reactie heeft de laagste activeringsenergie.

Ja. Verder is hij niet schadelijk in water zeggen jullie, was de rest dat wel?

Nou jodide in ieder geval wel, en bruinsteen niet maar bruinsteen had een positieve invloed op de activeringsenergie dus die was sowieso afgevallen.

En hadden jullie nog over stabiliteit nagedacht? En beschikbaarheid misschien.

Nou ijzer is wel beschikbaar in ieder geval.

Advisory report**Student result (5v.2.B.1)**

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise de following catalyst(s):

- Catalase*
 Fe³⁺
 MnO₂
 I⁻
 None of the above
 Otherwise

Our first argument that reinforces this advice is based on the following fact:

Low activation energy.

This data supports our conclusion as follows:

Works best.

The following (untested) assumption has been taken into account:

The lower the activation energy, the better.

We can state with certainty that this substantiation is valid, because:

Because we investigated it ourselves.

Our second argument that reinforces this advice is based on the following fact:

Cheap.

This data supports our conclusion as follows:

It is a potato.

The following (untested) assumption has been taken into account:

Cheap is good.

We can state with certainty that this substantiation is valid, because:

Cheap is best buy.

Our third argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

Veiligheid.

The following (untested) assumption has been taken into account:

Potatoes are edible.

We can state with certainty that this substantiation is valid, because:

Safe.

Some preconditions that must be taken into account in this advice are:

Do not be allergic.

Advisory report**Student result (5v.2.C.1)**

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise de following catalyst(s):

- Catalase*
 Fe³⁺
 MnO₂
 I⁻
 None of the above
 Otherwise

Our first argument that reinforces this advice is based on the following fact:

The activation energy is lower when using Fe³⁺ as a catalyst.

This data supports our conclusion as follows:

103.190,449 J·mol⁻¹ (the experimental activation energy of Fe³⁺, red.) is lower than

290.025 J·mol⁻¹ (the experimental activation energy of catalase, red.).

The following (untested) assumption has been taken into account:

The catalyst has caused the activation energy to drop.

We can state with certainty that this substantiation is valid, because:

The experiment was performed twice.

Our second argument that reinforces this advice is based on the following fact:

Easy availability of Fe³⁺.

This data supports our conclusion as follows:

Easy to mine.

The following (untested) assumption has been taken into account:

The mines remain open.

We can state with certainty that this substantiation is valid, because:

Our third argument that reinforces this advice is based on the following fact:

Fe³⁺ is not toxic in small amounts.

This data supports our conclusion as follows:

Data from Binas (science reference book, red.).

The following (untested) assumption has been taken into account:

Accurate information in Binas.

We can state with certainty that this substantiation is valid, because:

The Binas book is scientifically recognized.

Some preconditions that must be taken into account in this advice are:

This research should be repeated.

Advisory report**Student result (5v.2.D.1)**

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise de following catalyst(s):

- Catalase
- Fe^{3+}
- MnO_2
- I^-
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

The activation energy is lowest when using Fe^{3+} as a catalyst.

This data supports our conclusion as follows:

The lower the activation energy, the less energy is required for the reaction to take place.

The following (untested) assumption has been taken into account:
?

We can state with certainty that this substantiation is valid, because:
We tested every catalyst under the same circumstances.

Our second argument that reinforces this advice is based on the following fact:

How quick the temperature increased during the experiment.

This data supports our conclusion as follows:

The temperature increased the quickest when using Fe^{3+} , so that is the best catalyst.

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:
We also tested this using other catalysts.

Our third argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:

Advisory report**Student result (5v.2.E.1)**

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise de following catalyst(s):

- Catalase
- Fe^{3+}
- MnO_2
- I^-
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

We only have the data of MnO_2 and I^- and this was the best.

This data supports our conclusion as follows:
Bigger activation energy.

The following (untested) assumption has been taken into account:
The data is correct.

We can state with certainty that this substantiation is valid, because:
We do not know if the data is correct.

Our second argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Our third argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:
We have not enough data from classmates/group partners.

Advisory report

Student result (5v.2.F.1)

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise the following catalyst(s):

- Catalase
- Fe³⁺
- MnO₂
- I⁻
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

Both have a fast activation energy.

This data supports our conclusion as follows:

It accelerates the reaction quite well.

The following (untested) assumption has been taken into account:

Is unharmed when ingested.

We can state with certainty that this substantiation is valid, because:

It was found on the internet.

Our second argument that reinforces this advice is based on the following fact:

It is super cheap.

This data supports our conclusion as follows:

It is easy to obtain.

The following (untested) assumption has been taken into account:

Potatoes are not harmful.

We can state with certainty that this substantiation is valid, because:

Internet.

Our third argument that reinforces this advice is based on the following fact:

It is safe.

This data supports our conclusion as follows:

It does not need to be filtered.

The following (untested) assumption has been taken into account:

They are potatoes.

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:

Groep 5v.2.F:

Wat voor advies?

Katalase

Dus katalase is het beste, en jullie hebben het getest met?

Bruinsteen, katalase en jood

Bruinsteen, katalase en jodide?

Ik heb jood opgeschreven, maar het is dus jodide?

Ja jood is I₂ en jodide is I⁻.

Dus het is I⁻ en geen I₂?

Inderdaad, en allebei hebben ze een snelle activeringsenergie, wat is allebei in deze?

Ja, ik had ze eerst allebei aangevinkt, maar toen kwam ik erachter dat jodide eigenlijk best wel kut is.

Oh, en waarom was dat?

Omdat het moeilijk te filteren was, dat hoorde ik van mijn groepsgenoten, en het is al giftig bij aanraking dus als het moeilijk eruit te halen is en het is giftig dan kan je het moeilijk gebruiken.

Dus toen hebben jullie gezegd we doen alleen katalase?

Ja.

En jullie geven aan dat ze een snelle activeringsenergie hebben? Hoe zat dat met die activeringsenergie? Hadden jullie die gemeten?

Katalase 56000 ofzo, volgens mij. En de bruinsteen hadden minder, dus dat was de snelste van de drie.

En hebben jullie nog randvoorwaarden? Iets waar je bij aardappelrasp rekening mee moet houden op grote schaal?

Nee want het was namelijk heel goedkoop en is gewoon eetbaar in principe.

Maar qua temperatuur en misschien de pH waar dat in zit?

Dat maakt allemaal niks uit.

Oké, dankjewel.

Maar is het echt aardappel dan?

Nou het leuke is, er zit dus niet echt 1 vast juist antwoord in.

Dus het is maar net hoe je het verwoord?

Het is maar niet hoe je het verwoord. Wat ik wel zie, en dat vind ik interessant, jullie zeggen 'wij kiezen degene met de hoogste activeringsenergie. Maar hoe hoger de activeringsenergie, hoe meer energie je dus nodig hebt om over die barrière heen te komen. Dus eigenlijk hebben jullie daar dus een klein misverstand opgebouwd voor jezelf, en dat vind ik niet erg, want daar doe ik mijn onderzoek over, maar als jullie dit met de toets gaan doen dan moet je dus weten: hoe hoger de activeringsenergie hoe langzamer de reactie is.

Maar wij hebben dus gegevens doorgekregen die helemaal niet kloppen gewoon.

Want, vertel..

Uit de gegevens die we hebben gekregen, is katalase het beste, maar we weten gewoon eigenlijk dat het niet zo is, omdat die niet de laagste activeringsenergie heeft, maar uit de gegevens blijkt dat wel.

Dus jullie hebben gemeten dat dat wel zo is?

Ja ik heb heel veel doorgekrast want we hebben 6x andere dingen gekregen.

Oké, maar jullie zeggen dus we hebben gegevens gekregen, daaruit blijkt dat katalase de laagste activeringsenergie heeft, dus die kiezen we. Maar je bent niet zo te spreken over je keuze.

Ja, bij katalase zagen we bijna geen reactie.

Precies, dus de gegevens liegen niet, die zeggen katalase werkt het beste, maar qua betrouwbaarheid weet je eigenlijk niet of jullie meting betrouwbaar was.

Advisory report

Student result (5v.2.G.1)

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise the following catalyst(s):

- Catalase
- Fe³⁺
- MnO₂
- I⁻
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

The activation energy is lowest with catalase.

This data supports our conclusion as follows:

The catalyst with the lowest activation energy is most suitable.

The following (untested) assumption has been taken into account:

We did the measurements and calculations ourselves (these measurements could be wrong).

We can state with certainty that this substantiation is valid, because:

The lower the activation energy, the more suitable the catalyst is for mass production.

Our second argument that reinforces this advice is based on the following fact:

The catalyst is safe.

This data supports our conclusion as follows:

Catalase is found in potatoes among other things and barely has any safety risks.

The following (untested) assumption has been taken into account:

The data comes from a reliable website.

We can state with certainty that this substantiation is valid, because:

The safer the catalyst the better.

Our third argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:

Groep 5v.2.G:

Welke drie katalysatoren hebben jullie onderzocht?

Bruinsteen, katalase en jodide.

En uit die set zeggen jullie, bruinsteen is het beste.

Ja

En de drie dingen die jullie zeggen.. Het belangrijkste de temperatuur komt..

Ja temperatuur activeringsenergie ofzo.

De temperatuur of de activeringsenergie?

De activeringsenergie.

Hier staat wel iets over temperatuur.

Ja dat hadden bij jodide, dat was fout. Maar wat we wilden zeggen was de activeringsenergie.

En was dat significant, zegmaar het beste van de rest?

Ja, ongeveer keer anderhalf.

En een hoge activeringsenergie? Deze was hoger dan de rest.

Nee lager. Nee wacht even, zij hebben het uitgewerkt wij hadden geen laptop. Het was de hoogste waarde in ieder geval. Dus dat betekent het beste, beste activeringsenergie.

Ja dat vond ik dus ook vaag, want dat is was ik gevraagd had aan hun en zij zeiden van wel maar ik dacht, hoe lager de activeringsenergie hoe beter, dacht ik.

Normaal gesproken zou dat ook het geval zijn.

Maar het gekke was, bij katalase was die het laagste maar daar vond geen reactie plaats.

Nee, dus daar zou dan waarschijnlijk in de meting toch iets fout zijn gegaan.

Maar dat is die waarde hè, die waarde is niet hetzelfde als de activeringsenergie.

Jawel

Maar de vraag is hoe betrouwbaar was die meting, want je had waarschijnlijk maar 4 goede meetpunten die door de hele set berekeningen heen zijn gekomen.

Ja, niet betrouwbaar dus. En het was katalase van aardappelrasp en geen pure katalase.

Precies, dat is een hele goeie. Maar jullie zeggen dus nu, bruinsteen is het beste want die heeft de hoogste activeringsenergie, maar jij komt daar nu op terug. Jij zegt, dat is niet waar.

Ja dat dachten wij ook, maar.

Ja klopt, alleen, nu is het lastiger, want één van onze metingen is niet goed.

Dus, moeten jullie dan nog iets aanpassen dan?

Ja, dan wel.

Maar we weten dan niet welke dan wel het beste is.

Jawel katalase, want katalase is ook veilig.

Dat zijn allemaal dingen die mee kunnen spelen, en er is niet één goed antwoord hoor, maar wat jullie nu hebben ingevuld daar hebben jullie een fout in gevonden, dus doe het even opnieuw.

Advisory report

Student result (5v.2.H.2)

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise the following catalyst(s):

- Catalase
- Fe³⁺
- MnO₂
- I⁻
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

The activation energy.

This data supports our conclusion as follows:

I⁻ as catalyst decreases the activation energy the most.

The following (untested) assumption has been taken into account:

That working with this catalyst is not too difficult in terms of safety.

We can state with certainty that this substantiation is valid, because:

Our second argument that reinforces this advice is based on the following fact:

The price of the catalyst.

This data supports our conclusion as follows:

Amongst the three tested catalysts, I⁻ is available for the lowest price per kilogram.

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Our third argument that reinforces this advice is based on the following fact:

The stability of the catalyst.

This data supports our conclusion as follows:

The reaction process remained unviolent and was continuous.

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:

Safety and recovery.

Groep 5v.2.H:

Jullie komen het inleveren?

Nou niet helemaal, we hadden eigenlijk eerst een vraag. We waren er namelijk allebei de eerste les niet. Dus dat is al echt geweldig, dus dit hebben we allemaal niet. Wij hebben wel de activeringsenergie uitgerekend en dat was eigenlijk ons enige argument.

Ja dat is het enige waar jullie tijd voor hadden om dat te onderzoeken, want de rest was in les 1 vooraf.

En dan hebben we alleen katalase of Fe³⁺.

Dus jullie hebben de keuze gemaakt tussen katalase of Fe³⁺ en dan zeggen jullie bij Fe³⁺ is er een veel lagere activeringsenergie. Want wat hadden jullie bij katalase gemeten?

290025 bij katalase, bij die andere 103000.

Dat is netjes experimenteel bepaald, hoe zeker zijn jullie van die test?

Die van ijzer was vrij duidelijk, die was snel op de hoogste temperatuur.

En jullie geven aan dat die in duplo is getest, wat bedoelen jullie daarmee?

Dat andere groepjes ook ongeveer het zelfde hebben bij ijzer.

En ten tweede makkelijke verkrijgbaarheid en niet giftig in kleine hoeveelheden.

Advisory report**Student result (5v.2.I.1)**

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise de following catalyst(s):

- Catalase
- Fe³⁺
- MnO₂
- I⁻
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

Low activation energy.

This data supports our conclusion as follows:

Activation energy = 56746 J·mol⁻¹.

The following (untested) assumption has been taken into account:

The lower the activation energy, the better.

We can state with certainty that this substantiation is valid, because:

It can be concluded from our research.

Our second argument that reinforces this advice is based on the following fact:

Cheap.

This data supports our conclusion as follows:

1 kg potatoes = € 1,69.

The following (untested) assumption has been taken into account:

Cheap is good.

We can state with certainty that this substantiation is valid, because:

It stands on the Albert Heijn website.

Our third argument that reinforces this advice is based on the following fact:

Safety.

This data supports our conclusion as follows:

Potatoes are fairly safe.

The following (untested) assumption has been taken into account:

Potatoes do not have any safety advice.

We can state with certainty that this substantiation is valid, because:

Safe is good.

Some preconditions that must be taken into account in this advice are:

Difficult to replenish.

Advisory report**Student result (5v.3.A.2)**

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise de following catalyst(s):

- Catalase
- Fe³⁺
- MnO₂
- I⁻
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

Safety.

This data supports our conclusion as follows:

Least safety precautions.

The following (untested) assumption has been taken into account:

It can be used safely.

We can state with certainty that this substantiation is valid, because:

This can be found on the internet.

Our second argument that reinforces this advice is based on the following fact:

Good/much available.

This data supports our conclusion as follows:

Potatoes are available anywhere.

The following (untested) assumption has been taken into account:

Available anywhere.

We can state with certainty that this substantiation is valid, because:

We can check this ourselves, for example in a grocery store.

Our third argument that reinforces this advice is based on the following fact:

Low activation energy.

This data supports our conclusion as follows:

Calculation excel.

The following (untested) assumption has been taken into account:

Measured in experiment.

We can state with certainty that this substantiation is valid, because:

The data is correct.

Some preconditions that must be taken into account in this advice are:

The activation energy is not the lowest.

Advisory report**Student result (5v.3.C.1)**

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise de following catalyst(s):

- Catalase
- Fe^{3+}
- MnO_2
- I^-
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

Fe^{3+} has the highest activation energy.

This data supports our conclusion as follows:

The activation energy of Fe^{3+} is $94477 \text{ J}\cdot\text{mol}^{-1}$.

The following (untested) assumption has been taken into account:

Some different measurements.

We can state with certainty that this substantiation is valid, because:

We measured both experiments twice.

Our second argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Our third argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:

Advisory report**Student result (5v.3.D.1)**

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise de following catalyst(s):

- Catalase
- Fe^{3+}
- MnO_2
- I^-
- None of the above
- Otherwise

Our first argument that reinforces this advice is based on the following fact:

Stability.

This data supports our conclusion as follows:

It is the most stable.

The following (untested) assumption has been taken into account:

That Fe^{3+} is less stable.

We can state with certainty that this substantiation is valid, because:

Our second argument that reinforces this advice is based on the following fact:

Activation energy.

This data supports our conclusion as follows:

Lowest activation energy.

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Our third argument that reinforces this advice is based on the following fact:

Availability.

This data supports our conclusion as follows:

It is well available.

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:

Advisory report

Student result (5v.3.E.1)

The goal of this study was writing an advisory report about which catalyst is suitable in the decomposition of hydrogen peroxide. Based on the performed research, we advise de following catalyst(s):

- Catalase*
- Fe³⁺*
- MnO₂*
- I⁻*
- None of the above*
- Otherwise*

Our first argument that reinforces this advice is based on the following fact:

40.433 J·mol⁻¹ activation energy.

This data supports our conclusion as follows:

The activation energy is lowest in case of I⁻.

The following (untested) assumption has been taken into account:

The fact that something weird happened with the measurement of MnO₂, to such extent that the activation energy was -34.278 J·mol⁻¹.

We can state with certainty that this substantiation is valid, because:

The activation energy is the main focus when investigating catalysts.

Our second argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Our third argument that reinforces this advice is based on the following fact:

This data supports our conclusion as follows:

The following (untested) assumption has been taken into account:

We can state with certainty that this substantiation is valid, because:

Some preconditions that must be taken into account in this advice are:
