

- Task 4:** a) Discuss your results. What can you predict about the kinetics of respiration and fermentation?
- b) Try to connect your results with the graphics below (Fig. 3)! Do your results agree or disagree with those shown below?

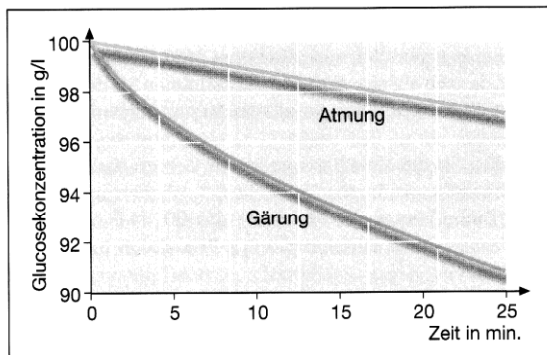


Fig. 3: Decline of glucose concentration in a yeast suspension under aerobic and anaerobic conditions.

Translation: Atmung: respiration;
Gärung: fermentation;
Glucosekonzentration: glucose concentration; Zeit in min: time in minutes

Expected answer: Answer the two tasks a) and b) with 2-4 sentences each.

- Task 5:** You would like to investigate the decline of glucose during your experiment yourself. The only equipment you find in your school is a blood sugar meter. How can you find out if this instrument can be used for that purpose? (No experiments have to be performed to solve this problem...)

Expected answer: 2-4 sentences.

List the references used according to the guidelines of SCHWEIZER JUGEND FORSCHT, <http://www.sjf.ch>.

Do not forget to add the activity list to your documentation! Each class needs to report which member was or is responsible for which portion or aspect of the work. Each person in the class must have participated at least once (during the entire competition) in the experimental portion.

Therefore, **take 3 digital photos per experiment** showing the class involvement. Place them next to the activity list in your documentation file.

Expected documentation and further information

- Create **a single** PDF file containing all your solutions, pictures, other documenting material and the activity list and name it, following strictly these conventions:

1. Number of class
(Find your class number in “Participant” where all the participating classes are presented).
2. Name of School
3. Name of class (same as on application form)
4. Number of experiment
5. Date (year/month/day)

→ Please use underlines instead of spaces!

Here is an example: **08_Kantonsschule_Muster_3b_Experiment1_20110222.pdf**

→ The size of the PDF file must not exceed 2 MB (4 pictures: about max. 500 KB per picture)!

- Scores

A maximum of 10 points is awarded for each experiment. Each question/task (1-5) is rated with a maximum of 2 points.

If the **references** are listed correctly (according to the guidelines of SCHWEIZER JUGEND FORSCHT) and the **layout** of the whole PDF file is satisfactory, there won't be a penalty on scores. If one of these two aspects is not solved sufficiently, you will receive one point less (for each aspect).

Example: If you solve the task 1-5 satisfactory (10 points), the layout is good, but the references are not listed correctly, you will only receive 9 points in the end (for one experiment).

| | |
|--------------------------------------|--------------------------|
| Closing date of experiment 3: | 02.05.2011, 18:00 |
|--------------------------------------|--------------------------|

Experiment 3: Conversion of energy – with and without oxygen

Task 1: The hypothesis for the CO₂ production

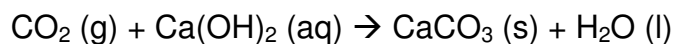
According to the chemical equation given in the introduction, yeast cells produce three times more CO₂ per glucose under aerobic conditions than under anaerobic conditions (Respiration: 6 CO₂ and 6 H₂O per glucose; Alcoholic Fermentation: 2 CO₂ and 2 C₂H₅OH per glucose).

Therefore our hypothesis is, that the yeast cells under respiratory conditions produce more CO₂ during the same period of time.

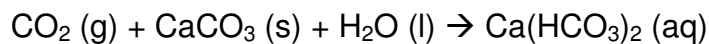
Task 2:

a) The change of pH during the experiment

The pH drops due to the concentration decrease of Ca(OH)₂ and over time due to the formation of hydrogen carbonat:



CO₂ in excess leads to the slow disappearance of the precipitate due to the formation of calcium hydrogen carbonat (1):

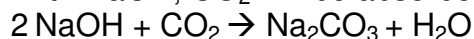


b) The purpose of the first wash-bottle

The purpose of the first wash-bottle, containing a Ca(OH)₂-solution, is to eliminate the CO₂ out of the air, so that all CaCO₃ precipitating in the second Ca(OH)₂ containing gas wash-bottle is caused by CO₂ produced during the experiment by the yeast cells (1).

It would make sense to replace Ca(OH)₂ in the first bottle by concentrated NaOH as NaOH has a higher capacity for CO₂ absorption. As mentioned in task 2a) an excess of CO₂ leads to the formation of Ca(HCO₃)₂ and after a certain time no more CO₂ will be absorbed.

With NaOH, CO₂ will be absorbed according to the following equation:



and more CO₂ can be absorbed compared to Ca(OH)₂ (2).

Task 3: The experimental setup (Fig.1) and the results (Tab.1)

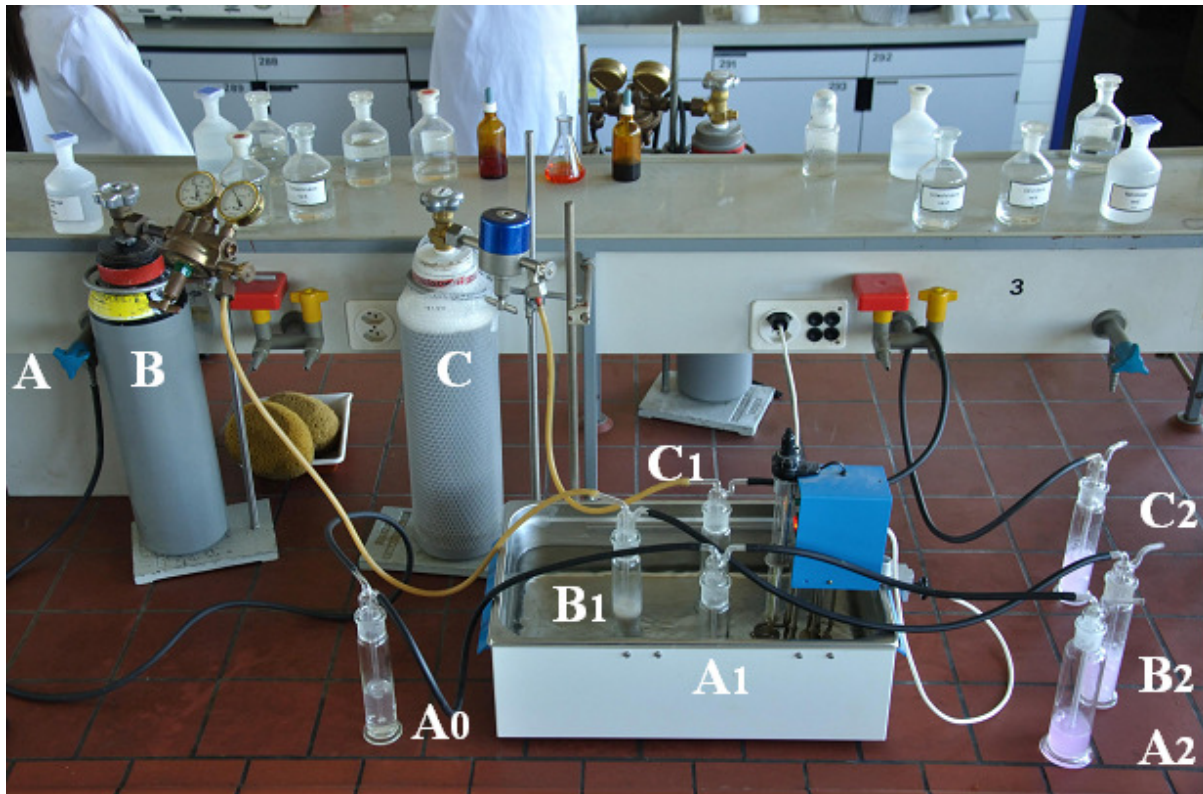


Fig. 1: Experimental setup to measure the production of CO₂ by yeast cells under aerobic and anaerobic conditions.

All equipment labelled with **A** correspond to experiment 1 (aerobic conditions), all equipment labelled with **B** correspond to experiment 2 (anaerobic conditions). As a control, we accomplished a third experiment with oxygen, which is labeled with **C** (results not shown, but comparable to aerobic conditions).

A: compressed air tap

A0: gas wash bottle containing saturated calcium hydroxide solution

A1, B1, C1: gas wash bottle containing yeast suspension

A2, B2, C2: gas wash bottle containing calcium hydroxide solution with three drops of phenolphthalein

B: gas bottle filled with nitrogen

C: gas bottle filled with oxygen

Tab.1: Results of the experiments

| | compressed air Experiment 1 (A) aerobic conditions | N ₂ Experiment 2 (B) Anaerobic conditions |
|---------------|--|--|
| Cycle 1 | 21'21" | 14'30" |
| Cycle 2 | 15'25" | 11'07" |
| Cycle 3 | 16'37" | 12'30" |
| Average value | 17'48" | 12'42" |

Task 4:

a) Prediction about the kinetic of respiration and fermentation

In the fermentation reaction much more CO₂ is produced and glucose is used up much faster than in the respiration reaction. Therefore, and to our surprise, our hypothesis from task 1 is falsified.

The reason for the faster CO₂ production under anaerobic conditions is because yeast is able to get a lot more ATP out of one glucose molecule with respiration and therefore needs a lot more glucose for the same amount of ATP with fermentation and in conclusion that equals a higher CO₂ production: 18 times more glucose is used and 6 times more carbon dioxide is produced for the same amount of ATP (3):

Fermentation: For 36 ATP: 18 Glucose → 36 CO₂ + 36 C₂H₅OH

Respiration: For 36 ATP: 1 Glucose → 6 CO₂ + 6H₂O

b) Connection with the graphics

As visible in the given graph, in the fermentation process the glucose concentration decreases a lot faster than in the respiration process. This is in agreement with our result, where the faster CO₂ increase reflects the faster glucose decrease. The explanation for it is given under Task 4a). This phenomenon is known as pasteur-effect (4).

Task 5: Investigation of the glucose decline with a blood sugar meter

The measuring range of a regular blood sugar meter lies between 10-600 mg/dl (5) as the blood sugar range of a human should be between 60-140 mg/dl (6). In our yeast suspension the concentration of glucose is at the beginning of the experiment 10 000 mg/dl (15 g glucose in 150 ml water). So it is not possible to measure the concentration of glucose in the yeast suspension with a regular blood sugar meter.

Sources

- 1) Binnewies, Michael; Jäckel, Manfred; Willner, Helge et. al. 2004. Allgemeine und Anorganische Chemie. Spektrum Akademischer Verlag Heidelberg. Berlin. Page 410, 454
- 2) Wikipedia (2011). Atemkalk.
<http://de.wikipedia.org/wiki/Atemkalk> (27.04.2011)
- 3) Jaenicke, Joachim and Paul, Andreas (Hrsg.). 2004. Biologie Heute SII – entdecken. Schroedel. Braunschweig. Page 60-62
- 4) Wikipedia (2011). Pasteur-Effekt
<http://de.wikipedia.org/wiki/Pasteur-Effekt> (27.04.2011)
- 5) Müller, Florian (2010). Blutzuckermessgeräte auf einen Blick.
http://www.diabetiker-glueckstadt.de/downloads/blutzuckeruebersicht_d4.pdf
(27.04.2011)
- 6) Schäffler, Arne und Schmidt, Sabine. 1995. Mensch Körper Krankheit. Jungjohann Verlag. Ulm. Page 340

Activity list

All members of the class participated in the experiment. Altogether there were four groups and every group did the whole experiment.

The tasks were assigned to the following persons:

Task 1: Nesina Caderas, Priska Zuber, Alvin Duong, Alexandra Hrovat, Céline Bader

Task 2: Marc Felice, Adélaïde Le Bloc'h, Seraina Meister, Pascale Schlienger

Task 3: Milena Petignat, Xenia Griss, Isabel Haas, Selinda Ceylan

Task 4: Leonard Bongers, Alexandra Hrovat, Gustavo Prack, Nicolas Zipperer

Task 5: Niclas Kiss, Sarah Schnell, Martin Schweighoffer, Ivan Valli

Photographer: Milena Petignat

Activity List: Gustavo Prack

Layout: Jakob Mücke



Fig. 2: Niclas measuring 50ml of yeast suspension.



Fig. 4: Half of the class having fun after a successful experiment.

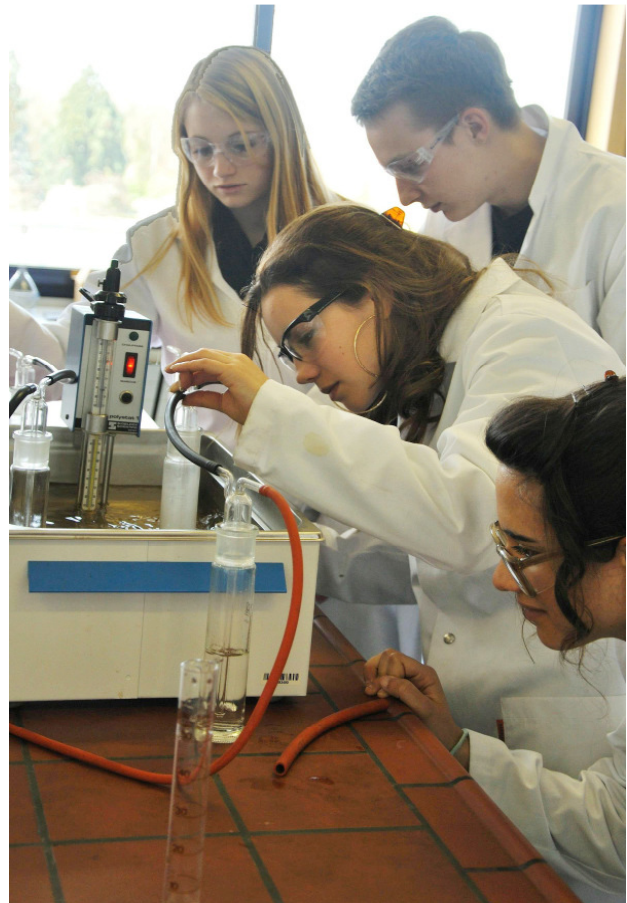


Fig. 3: A group assembling the bottles for the experiment.

Schwarzenbach Sarah

Von: scienceonthemove (simplyscience)
Gesendet: Montag, 16. Mai 2011 11:07
An: jakob mücke
Cc: Sacha Glardon (sacha.glardon@edubs.ch)
Betreff: Science on the Move: announcement of the top 10 classes

Wichtigkeit: Hoch

Dear team leader and students of the Class 4c of Gymnasium Bäumlhof Basel

CONGRATULATIONS

You have reached the second round of the nation wide class competition "Science on the Move"! Compliment!

Thanks to very hard work on the three experiments in the first part, your class has reached a position among the top 10 rated classes.

Now, you are cordially invited to the second part of the competition.

It will take place on **Friday**, the **10th of June 2011** at **Roche** in **Basel**.

On site, the individual classes will each have **5 minutes** assigned for a **live presentation** on stage. How this time is used is up to the individual class.

The objective is to link your experiences during the first phase of the competition as imaginatively and convincingly as possible with the subject of the competition "Science on the Move".

What highs and lows did you go through? What made you satisfied or glad? What stressed or baffled you? How did you experience teamwork while experimenting? How did you organize yourselves? How did your parents, your teachers and the school administration react to your activities? How were you able to motivate the whole class? How can you correlate these experiences with the title of the competition "Science on the Move"? The teams are encouraged to be creative! Music, literature, poetry slam, a discussion theatre, show, or straight forward presentation... anything goes. However, personal delivery is required. Home-made videos are welcome, but may only be a *part* of the presentation. It is up to the class to determine how many people from their class will participate on stage during Phase 2. The presentations will be judged by a specially assembled **expert jury** consisting of **5 people representing science, industry and teaching**. The winner class will be selected after the presentations.

What we now need from you is a **confirmation** that your class will **definitively** participate on the 10th of June 2011 on Basel. It will be a **full-day event**.

Please send us a **confirmation e-mail until Wednesday evening, the 18th May 2011 at 18:00!** Two days from today!!!

After we have received the confirmation e-mail from you, all further information about travelling to Basel, time schedule, location and so on will follow.

If you have any further questions, please do not hesitate to send us a message to scienceonthemove@simplyscience.ch or call our hotline: +41 44 368 17 46 (MON-FRI 9 am - 5 pm)

Thanks a lot, best regards and have a good day!

Your SimplyScience Team,
Sarah Schwarzenbach

PS: The top 10 rated classes will be published on our website this afternoon!



Schwarzenbach Sarah

Von: scienceonthemove (simplyscience)
Gesendet: Donnerstag, 19. Mai 2011 10:58
An: jakob mücke
Cc: Sacha Glardon (sacha.glardon@edubs.ch)
Betreff: Information about the final event on 10.06.2011
Anlagen: SchoolName_ClassName_List.xls; Diagram_Auditorium.pdf; SiteMap_Roche_Basel.gif

Wichtigkeit: Hoch

Dear team leaders and students of **class 4c** of the **Gymnasium Bäumlhof, Basel**

Thank you for your confirmation of participation on the 10.06.2011! We are really looking forward to this day and we are very curious and excited about your presentations.

This E-mail is very important and contains a lot of information about the final event of "Science on the Move" Friday, 10.06.2011.

Please read it very carefully, provide us the requested information and let us know if any questions should come up or if something is not clear!

Following points need to be considered and thought about:

1. What to wear and what to bring

- Dress: smart-casual

- bring "Your Science on the Move" - T-shirts (for possible photograph, no need to wear)

- bring your teacher and your class ☺

2. Travel to Basel

- Please inform us if you will be travelling by a private bus or by public transport!. Please take note that the cost of travel to the final event is the responsibility of the school class.

- Parking:

If your class will arrive with a private bus, please let us know as we need to organize a parking space.

- Train/tram/bus schedule:

If you will travel by public transport, we can help you to find a convenient train/tram/bus connection from your home town to Roche in Basel (It takes 10 minutes to get from Basel SBB to Roche).

3. Arrival at Roche, Basel

- Time of arrival:

The classes will arrive one after another at Roche in Basel depending on the duration of their journey. According to a planned schedule, the earliest class will arrive at 07:40 and latest class will arrive at 09:00. Please see below for your time assignment.

| | |
|---------|--------------------|
| School: | Gymnasium Bäumlhof |
|---------|--------------------|

| | |
|--|--------------|
| Class: | 4c |
| Time of arrival at Roche: | 07:40 |
| Time to be on stage for technical check: | 08:10 |

- Registration:

Upon your arrival at Roche, please come to **Porte 52** to register (please find a site map in the attachment). Once there, the **team leader** will receive identification badges to distribute among the students. You will also get further information regarding next steps and the plan for the day.

4. Location/stage/materials/technical check/presentations

- Location/stage:

The final event will take place at Roche, Bau 71, in the Auditorium (for diagram & dimensions, please see attachment). The presentations will be held on stage.

- Equipment available: up to 8 microphones
 Beamer on stage with rear projection on a 2x3 m screen
 Music, light, etc. -> please contact us if you have any special requests or

further questions!

- Technical check:

Between 08:00 and 09:30, every class gets the chance to do a 5-minute-technical-check on stage to see if everything works fine.

- Presentations on site:

The individual classes will each have 5 minutes assigned for a live presentation on stage. All in all, 15 minutes are calculated per class: 5 minutes for presentation (not more – we will have a time keeper), 5 minutes for jury questions, 5 minutes for change of classes on stage.

- Presentation - preparation:

The objective of the presentation is to link your experiences during the first phase of the competition as imaginatively and convincingly as possible with the subject of the competition "Science on the Move".

What highs and lows did you go through? What made you satisfied or glad? What stressed or baffled you? How did you experience teamwork while experimenting? How did you organize yourselves? How did your parents, your teachers and the school administration react to your activities? How were you able to motivate the whole class? How can you correlate these experiences with the title of the competition "Science on the Move"? The teams are encouraged to be creative! Music, literature, poetry slam, a discussion theatre, show, or straight forward presentation... anything goes. However, personal delivery is required. Home-made videos are welcome, but may only be a *part* of the presentation. It is up to the class to determine how many people from their class will participate on stage during this final event.

If you use a PowerPoint presentation, a home-made video, music or anything else of technical nature, the material must arrive not later than on Monday evening, 06.06.2011. Send it either by E-mail or Swiss post:

E-Mail: If the size of the file does not exceed 5 MB, send it by e-mail to scienceonthemove@simplyscience.ch until **Monday** evening, **by 23:59, 06.06.2011 at the latest**.

Swiss post: Otherwise you need to send it by Swiss post on a CD/DVD.
The parcel must arrive in our office **not later than on Monday, 06.06.2011.**

Please send the parcel to:
SimplyScience Stiftung
Nordstrasse 15
Postfach 1826
CH-8021 Zürich

5. The jury

- The presentations will be judged by an expert jury comprised of 5 people representing science and teaching.

- The jury will listen to the presentations and rate them according to the following criteria:

I Content, relevance with respect to the issue, pertinence

Is the presentation directly connected with the issue? Are the aspects addressed relevant?

Does it highlight what is truly exciting about Life Sciences?

II Creativity, Level

Did the presentation engage? Is it ingenious? Is it thoughtful? Was it thought-provoking?

III Persuasive power, enthusiasm, dedication

How convincing was the presentation? How much passion and dedication is exhibited? How strong is the team's- will to win this competition?

- Scores:

All the 3 criteria will be judged equally.

The materials submitted by the 10 best classes during Phase I will be available (without the actual scores) to all jury members as reference.

Please be aware that the points you were given in phase 1 (the experimental part of the competition) are taken along into phase 2 (the final event) and will be added to the points given for the presentation in phase 2. This sum will define the final score and hence the ranking.

The final rating is an equal weighting combining the scores from phase 1 (experimental part) and phase 2 (final event).

6. The final event

- Schedule of final event:

| | |
|---------------|---|
| 07:40 – 09:30 | Arrivals at Roche of each class as specified (in point 3.) and 5 minutes technical check for each class Breakfast buffet |
| 10:00 – 10:30 | Welcome speech and introduction |
| 10:30 – 13:00 | Class presentations (15' for each class: 5' presentation, 5' jury questions, 5' stage change) |
| 13:00 – 14:00 | Lunch Jury Evaluation |
| 14:15 – 15:30 | Award Ceremony |
| 15:30 – 16:30 | Goodbye Apéro |

- Media:

Please be aware that media might be there. You should appoint one person to be responsible for communications if the media should want to talk to your class.

7. What we need from you now:

1. A Class list with current members (including teacher) of the class (first name, last name, mobile number of team leader and teacher, information about how you will be travelling to Basel and size of bus, if there is one) .

For this, please fill in the class list excel sheet ([see attachment](#)) and label it with your school name and class name! Send it back to scienceonthemove@simplyscience.ch **until 30.05.2011 at the latest.**

2. Please tell us if you will travel by a private bus or by public transport. If you will travel by bus, please tell us the size of the bus. We need your answer **until 30.05.2011 at the latest.** You can provide this information as well in the excel sheet mentioned above.

3. If applicable, send us your files for presentation - until the above mentioned dates, point 4. - by e-mail or Swiss post. The material **must arrive not later than on Monday 06.06.2011.**

4. If you have any questions, please do not hesitate to contact us by e-mail (scienceonthemove@simplyscience.ch) or a phone call (+41 44 368 17 46).

Have a nice day and best regards,

Your SimplyScience Team,
Sarah Schwarzenbach

Home >

▪ [\[OnTheMove // News // Top 10 Classes\]](#)



Top 10 Classes

These are the top 10 classes which are invited to the second phase of the nationwide class competition "Science on the Move":

| | | |
|----|--------------------------------------|---|
| 2 | Alte Kantonsschule Aarau | Class G1D |
| 3 | Gymnasium Bäumlhof, Basel | Class 4C |
| 7 | Gymnasium Kirchenfeld, Bern | Class M2012c |
| 8 | Gymnasium Kirschgarten, Basel | Class 4D |
| 13 | Gymnasium Münchenstein | Class "Last Minute to San Francisco" - WAMS |
| 18 | Kantonsschule Rychenberg, Winterthur | Class EF Bio |
| 25 | Lycée-Collège des Creusets, Sion | Class 3B |
| 30 | Neue Kantonsschule Aarau | Class G2B |
| 31 | Neue Kantonsschule Aarau | Class G3E |
| 33 | Seeland Gymnasium Biel | Class Sekunda d |

Link auf Homepage: <http://www.simplyscience.ch/desktopdefault.aspx/tabid-425/admin-1/>

What is science?

I. Introduction: This is simply science

Explosion of a H₂ ballon

Miss Ceylan: Welcome to the presentation of class 4C, Gymnasium Bäumlhof?

Spectator: Are you crazy? Do you want to burn down Roche?

Miss Schlienger: No, not at all, this is *simply science*.

Spectator: What do you mean by simply science?

Miss Ceylan: Would you like to have an explanation? Science is about experiments. And this was an experiment. The hydrogen in the balloon reacted with the oxygen in the air in a strong exotherm reaction leading to this tiny explosion. Wait we will demonstrate this to you.

On the right side you see pupils in white shirts being hydrogen molecules, on the left side you see pupils in red shirts being oxygen molecules. If they react together they form water.

Did you get it?

And now we would like to introduce you to our experiences during the *science on the move* competition.

Spectator: I hope it will be like the name says "on the move"...with power and young energy!

Miss Schlienger: Yes, of course...

II. Poetry Science Slam:

Science is... experimentation

We just have to keep one thing in mind,
It's the same procedure all of the time
You have a **hypothesis** which you have to prove or lose,
There's only one procedure, and you cannot choose.
You will have to perform an **experiment** now
And maybe like with our third one you think wow
That's not, - what I have expected and
This must be, a **falsification** then
And now, we have to look for the reasons for this
Even if its gonna take you seasons cause its
The only way you can get the next nice clue
And then maybe the **verification** proofs
That the hypothesis was actually true
And we jump, because of, joy right there through the roof

Science is... art

not always like us artistic

There are some things, that are characteristic

One important thing, is called **illustration**

Not only for now but for our graduation

We've learned how to design the **layout**

And as we practised this it is gonna payout

For every paper we are ever gonna write

Like the way you put pictures side by side

But layout isn't the only connection

Of science and art there are other directions

It really caught us like an infection

Just have a look at this wonderful projection

After a long time of **picture** selection

We've found this **microscopic** perfection

Science is... communication

In the beginning, we weren't a united class

We were rather, a form of undecided mass

But in the end,- we were surprised and glad

That we actually, were the ones who passed

The other teams, and we hope that it will last

Till we find ourselves in San Francisco, yes

but we realised, that we had to learn some things

we had to **split up tasks**, to really spread our wings

it was really, all about, good **communication**

a leader who could raise our own **motivation**

and now in the end it was our **imagination**

which helped us to get a nice **presentation**

and in the end we saw, what the **keyword** was

it was really, all just, the **teamwork** cause,

without **working together**, we wouldn't be here

that is a fact, undeniably clear

just like the fact that we gonna hit the disco

cause we are going to San Francisco

III. Finale: Science moves people around the globe

We are going to San Francisco

Be sure to have some science in your head

We are going to San Francisco

We're gonna meet some clever people there

We are going to San Francisco

Be sure to have some science in our head

Explosion of a H₂ ballon

