

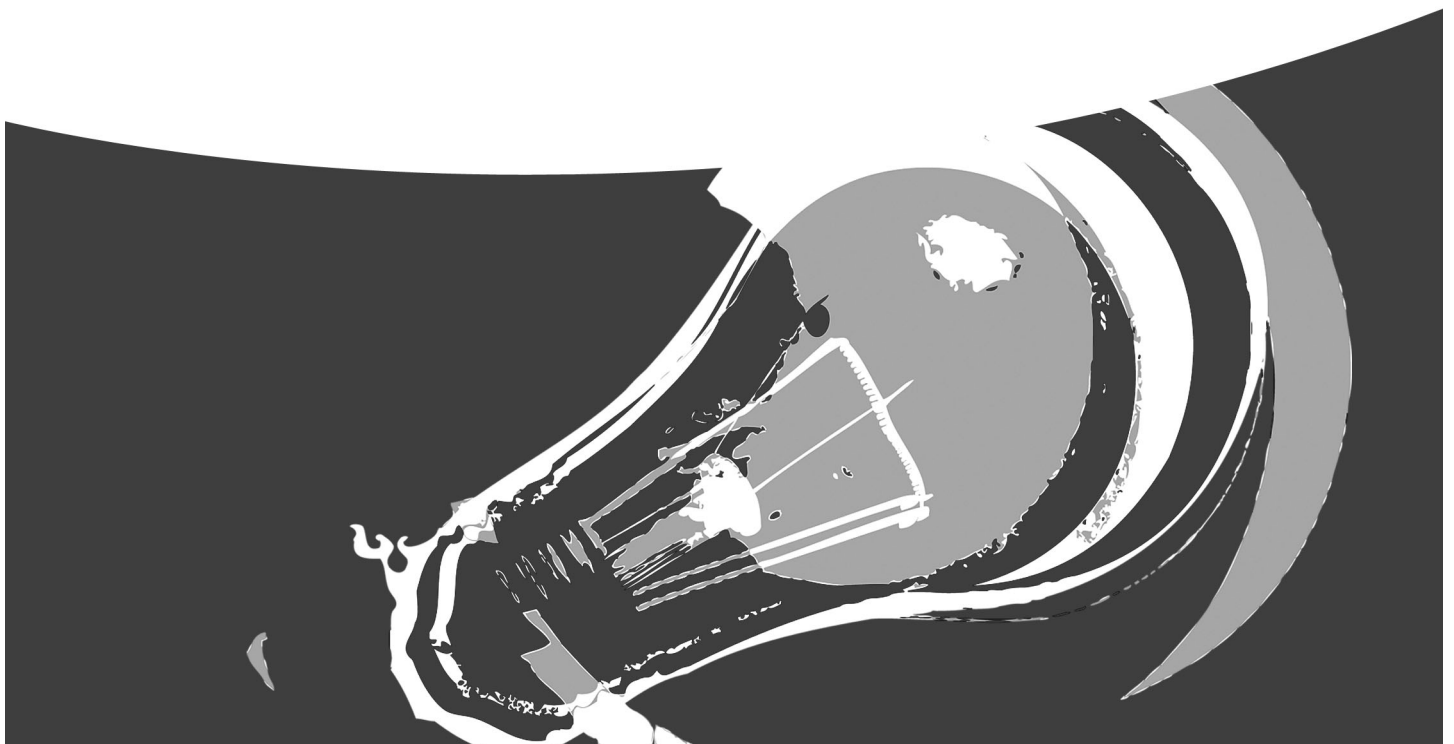
Teacher Resource Bank

Higher Project Qualification

Level 2

Candidate Exemplar Work: Sample B

‘Aspirin’





Level 2 Project Qualification(7302)
 STANDARDISATION
 EXEMPLAR
 December 2007

CANDIDATE B1

(Group B: Candidates B1, B2, B3, B4)

Aspirin

Criteria for the award of marks	Max mark	Mark awarded	Notes
(A01) Manage	10		
(A02) Use Resources/ Research	10		
(A03) Develop and Realise	20		
(A04) Review	10		
Total	50		

Form of submission: Group report of chemical preparation, Group prepared sample, Group presentation materials (contribution of Candidate B1) plus individual report over 1000 words

Logs completed and included: Yes

Presentation completed at appropriate standard: Yes



Centre-assessed work
Project Proposal Form
 2007

Level 2 Project Qualification

Centre Name: Centre No:

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Candidate Name: Candidate No:

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Part A: to be completed by the candidate

Title of the Level 2 Project:

ASPIRIN

[You may present the topic to be researched in the form of a statement/question/hypothesis with clear focus.]

Please give a brief outline of:

- the topic to be researched or activity/task to be carried out and sources to be consulted To create a presentation for adults on use, production and tableting of Aspirin.
- the course(s) of study or area(s) of personal interest to which the topic relates. We are interested in this topic and want to work as a group on this.
- your proposed action. To create a Presentation showing the results of our investigation.

Please give details of the courses that you are currently studying:

Qualification Type <small>(e.g. GCSE, Applied GCSE, VRQ, Modern Apprenticeship, Diplomas, BTEC, etc)</small>	Subject <small>(e.g. Mathematics, English, Leisure & Tourism, Spanish, ICT, Building & Construction, etc)</small>	Qualification Type <small>(e.g. GCSE, Applied GCSE, VRQ, Modern Apprenticeship, Diplomas, BTEC, etc)</small>	Subject <small>(e.g. Mathematics, English, Leisure & Tourism, Spanish, ICT, Building & Construction, etc)</small>
GCSE	Mathematics		
	English		
	Chemistry		
	Physics		
	Biology		

Declaration by the candidate

I certify that I have read and understood the AQA's Regulations relating to unfair practice as set out in the Notice to Candidates overleaf.

Candidate's signature: Date:

Notice to candidates

You must not take part in any unfair practice in the preparation of project work required for assessment and you must understand that to present material copied directly from books or other sources without acknowledgement will be regarded as deliberate deception. If you use or attempt to use any unfair practice you will be reported to AQA. If AQA is satisfied that you have committed an offence you may be disqualified from all subjects.

Part B: to be completed by the supervisor

Please comment below on the validity and feasibility of the proposed project, and on the suitability of the sources. The title chosen can be in the form of a statement/question or hypothesis with a clear focus. Please comment on the proposed project using the criteria given below:

Criteria	Supervisor's comments
Indicate the development/extension outside the main course(s) of study or interest or indicate how the topic complements and develops the themes/topics of the learners principal learning within the Diploma and how it supports learner progression	Not covered on GCSE specification.
Comment on the suitability of the proposed initial sources and research base	Well thought through.
Confirm that the project is feasible in the proposed timescale and/or indicate any potential difficulties	Yes. Should be achievable.
Outline the scope to produce a project that meets the assessment objectives (See specification 2.3.3)	Will meet all of the Assessment objectives.
Indicate proposed format and date of the presentation	Powerpoint and written report.

For the purposes of moderation, it is important that we know the format of the project which will be submitted by this candidate. Please tick as appropriate:

Format of Project	Please tick
Written report	Yes
Live performance (e.g. in music, drama & theatre studies)	
Electronic format (e.g. CD, video, PowerPoint presentation)	Yes
Artefact (e.g. in design & technology, art & design)	
Other (please state format)	

Is the project a contribution to a group exercise? If so, confirm that there is a defined individual contribution by the candidate (See specification 2.3.1), and list other group members below.	
Candidate No.:21	Candidate Name:
Candidate No.:22	Candidate Name:
Candidate No.:23	Candidate Name:

Supervisor's name (please print):

Supervisor's signature:

Date:



Centre-assessed work
Project Proposal Form Part C
2007

Level 2 Project Qualification

Centre Name:

Centre No:

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Candidate Name:

Candidate No:

--	--	--	--	--

Part C: to be completed by the Project Adviser

Adviser's comments:

An interesting topic. You must ensure that you clearly show what you contributed to the group activity.

Approved

Approved subject to the implementation of the adviser's recommendations

Yes

Resubmission required

Adviser's name (please print):

Adviser's signature:

Date:

The candidate should retain this form and include it in the Production Log

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Level 2 Project Production Log

Candidate name: B

Candidate number:

Level 2 Project Working Title: Aspirin: tableting and production costs (in Group B)

.....

Note: *This production log should consist of the following pages. Additional journal material, planning evidence, research evidence, records of meetings with your supervisor, etc. may be added in each section.*

	Date completed
Record of initial planning meeting	20 November
Project Proposal Form (already completed)	
Plan at start of project	4 December
Mid-project review	11 January
End-of-project review	21 February
Summary	16 April
Presentation record	16 April
Reflection	16 April

Level 2 Project Final Title: Aspirin.....

Candidate's signature Date:

Supervisor's signature Date:

Record of initial planning meeting(s)

This form records initial meetings with your supervisor to agree your project proposal.

Your first idea for your project:

What is the aim of your project? e.g. to investigate, to compare, to produce

We chose the project on Aspirin. I will be working with [Candidates B2, B3 and B4]

Your first ideas for research and development of your project:

What do you intend to do?

We have divided up the work so that we each have a contribution to the research and the practical. I am doing the tableting and the cost research.

Your supervisor's comments and advice:

This project is to create a presentation for interested adults on the use, production and tableting of Aspirin. The group must consider the complete process from raw materials to final tablet and make their own samples. They should pay particular attention to efficiency and costs. The Aspirin must be produced by the group in the school/college laboratory. The tableting must also be undertaken by the group in the same laboratory. Presentation date 29th March.

Changes you have made as a result of your discussion with your supervisor:

Group was formed in meeting and we chose to do the project of aspirin. We felt that in order to function as an efficient and successful group that we would need to set rules. We decided that any decisions would be voted upon and majority of three rules. However all ideas must be fully discussed and all parties should feel confident that the decision taken is the best option. Group members that attended: all.

Supervisor's signature: Date:

Plan at start of project

This form records your outline plan for your project before you start work.

Project title: Aspirin: tableting and production costs (in Group B)

Project aim: To create a presentation for interested adults on the use, production and tableting of Aspirin.

Outline the steps in your project:

What do you intend to do?

By when?

Trip to [.....] to find out any available information on aspirin to give us some direction in our project. Our undefined aims were problematic because the staff of the centre were not so willing to help us. We looked in several books but found only vague reference to aspirin so thought it best to use the computer databases. We found lots of information on aspirin and sub-divisions of our topic. Unfortunately, the information was sometimes too detailed and complex for our comprehension. We were unable to get any information on the economical aspects of aspirin production. Group members that attended: B1 and B3.

What resources will you use?

Talk to staff at [.....]. Look at books and use the internet.

Who can help you?

Staff at [] and supervisor.

Your supervisor's comments and advice:

None

Changes you have made as a result of your discussion with your supervisor:

We got into the lab and We actually made the aspirin in this session. Although the methodology was new to us all, we managed to work successfully as a group upon which the practical relied. Group members that attended: all.

Supervisor's signature: Date:

Mid-project review

This form records your outline plan half-way through your work. It is an opportunity to consider what has gone well and what has been less successful. You can discuss these with your supervisor, make changes and revise your original plan.

Is your project following your original plan?
What is going well? What changes have you made? Why?

The need was felt to review our current position in the completion of this project. A discussion was held about the way forward. A rough guideline was drawn up for our presentation's structure. We decided to do a practical write up to go with our aspirin specimen. Group members that attended: B2, B3 and B4.

Outline your planned steps to complete your project:
What do you intend to do? By when?

I've written up my part of the practical and done some research visits (see next page)

What resources will you use?

We will use our knowledge gained to produce a presentation.

Who can help you?
We may need to talk to General Practitioner.

Your supervisor's comments and advice:

You are making a valuable contribution to progress but you need to get on with tableting your product

Changes you have made as a result of this discussion with your supervisor:

I need to urgently find out how to make tablets.

Supervisor's signature: Date:

End-of-project review

This form records the (near) completion of your project.

Did your project following your revised plan (from the mid-project review)?
What worked well? What changes have you made? Why?

Group tableted the aspirin using starch as the filler and capsules. Made eight tablets. We've got our aspirin in capsules in a child-proof container. On my own done an introduction for my report on aspirin including: a short history on its origins; its constituent chemicals; its role and effects in the body and general information on the drug itself. Contacted an outside expert to help on this difficult issue. The General Practitioner was very helpful in guiding me towards useful sources and the result of my conversation was to help move me along in writing this difficult chapter. We have to get all together to get our presentation organised. Mr [Supervisor] suggested we put dates and deadlines on a list of what we do to help keep on track.

Do you need to do anything else to complete your project?
What do you intend to do? By when?

Organise our presentation.

Your supervisor's comments and advice:

23-2-07 Re-visited the [... ...] Institute to fill in the gaps of our research such as how Aspirin actually works in the body and it's uses. This visit was more useful than the first because we knew what we needed and sought it out without much difficulty. Group members that attended: B1 and B4. Later we arranged the presentation and what we would all be doing. Group members that attended: B1, B2 and B4.

Changes you have made as a result of this discussion with your supervisor:

None needed.

Supervisor's signature: Date:

Summary

This form gives an overview of your project.

Project title: Aspirin: tableting and production costs (in Group B)

Project aim: To create a presentation for interested adults on the use, production and tableting of Aspirin.

Main content/what did you do?

Our assignment was to consider the methodology of aspirin production and to become aware of ways of limiting the manufacturing costs. Our main aims were:

- to produce aspirin in the laboratory, including tableting and packaging;
- to research the methods of industrial aspirin production;
- to compare the manufacturing costs to the retail costs;
- compare our method to industrial methods of production and
- compare our aspirin yield to the theoretical yields explaining the differences.

I took responsibility for researching and reporting on the tableting and the costs comparisons.

Project findings/conclusion:

The costs of medicines we buy from day to day are astronomic in comparison to the cost of producing the product.

Presentation record

Type of presentation of project:

How will you present your project? eg written report, power-point presentation, play, product, etc. You may choose more than one type of presentation.

Our presentation was to 12 adults who were the parents association committee and two of our teachers and the headteacher. It took about half an hour to do our bits. I had the bits on costs and tableting which had a bit on how pure the aspirin was as it is a medicine.

We used Powerpoint and had copies of our project to hand round and our aspirin and the aspirin we bought.

We had lots of questions.

My Powerpoints are on the next page.

The main time in the end that I spoke was trying to answer questions that they kept on asking to explain why we had to mix up the aspirin and the starch to make our capsules and why our capsules are better than tablets not just easier.

How will you structure your presentation?

eg timing, use of visual aids, use of notes, etc.

We will each present our part of the research. We will use Powerpoint and we will hand round copies of our project. We will not need notes, as we will have the Powerpoint to look at.

Supervisor's signature: Date:

How we made the aspirin capsules

Problem

How to get an accurate amount of aspirin (100mg) into a capsule

Solution

Mix it with starch, therefore minimising degree of inaccuracy

Pure Aspirin?

Salicylic acid + acetic anhydride

↓ sulphuric acid

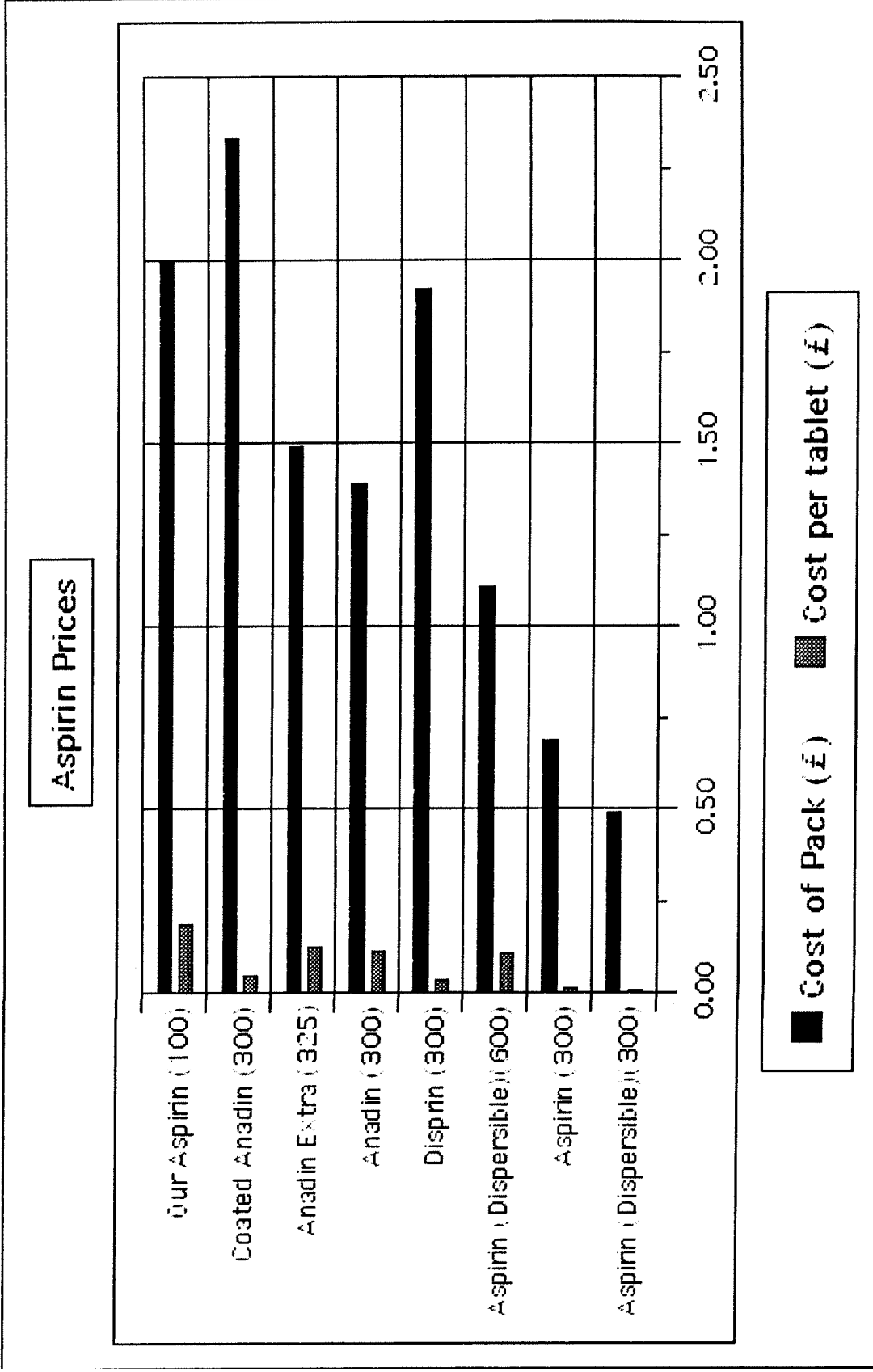
ASPIRIN + acetic acid

- Vacuum filtration – leaves crude aspirin on filter paper

Possible sources of impurities

- catalyst
- ethanoic acid
- unreacted salicylic acid

- Aspirin recrystallised to reduce degree of contamination
- Aspirin crystals only form if aspirin is pure



Reflection

This form is to record your own evaluation when you have completed your project and your presentation.

What are the strengths and weaknesses of your project?

Consider the planning, carrying out the activity and the outcomes.

As a group, we have not always functioned very well. We didn't meet all the demands until the very end at which point the realisation of the deadline sunk in. We were all waiting for another group member to do the initiating instead of taking responsibility for it ourselves. After a lot of pushing and shoving, we did finally pull together as a group although our unity had much to be desired. In the end, we realised that we were dependant on each other. We all took individual responsibility for sections of the report and worked together to meet the group deadline so that the report could be compiled for the presentation. To improve on the work that we have done, it would have been better if we had worked more together from the beginning of the project as this would have improved the overall quality of the piece.

To extend the work, we could compare different methods of producing aspirin in the lab by looking at the yield and the product's purity. The product's purity could be tested by using a range of techniques that are new to us.

What have you learnt from completing this project?

This is not just the result of the project but other skills you have acquired. You may be able to comment on how you learn.

Eventually we learned that we had to work as a group. We should have been better organised at the start.

What have you learnt from comments made by your supervisor and your peers?

That we need to get on with our research quicker.

What would you do differently if you had a similar project to complete?

I would organise who did which bits at the start of the project, and we would work quicker.

In order to find out how to measure out such minute quantities of aspirin in each tablet, we went to the local pharmacy to speak with the pharmacist. He was very helpful in explaining how the tablets are made in industry in such vast numbers. We will have to use large amounts of ingredients and make sure that they are properly mixed. This will ensure that the aspirin is evenly distributed throughout the mixture. We will then be able to weigh out the tablets and even be able to work out the error involved in our measurements. We also found out that starch would be the best filler to use in our tablets as it breaks up very quickly in the stomach which means that the aspirin will relieve any symptoms very quickly. Group members that attended: B1 and B4.

Trip to local pharmacist [] to find out about aspirin. Questions asked included: how aspirin is tableted in a lab; the concentration of aspirin in each tablet; type of tablet coating used and price of aspirin from different pharmaceutical companies. The pharmacist was very helpful, and answered as many questions as he could in the 10 minutes that he had to spare. Group members that attended: B1.

While I was doing this our aspirin needed to be refined and re crystallised.
Group members that attended: B2, B3 and B4.

Visited another local pharmacy to look at the range and cost of all the aspirin products of the market. There were many aspirin products with a range of dosages and additional substances such as vitamin C for cold and flu relief. Made a list of the costs and later broke the costs down in a table to compare costs per tablet and milligram. Group members that attended: B1.

2-3-07: Meeting with Mr [Supervisor]. Due to the lack of progress of the group, we decided to split the sections of the report and presentation and assign their completion to a particular group member. The tasks were assigned as follows:

- B1- Comparison of production costs
- B2- Biological functioning of aspirin in the body
- B3- Writing leftover sections of the presentation
- B4- How we made aspirin and practical write-up

4-3-07: Numerous telephone conversations on the final progress of the project. Important ideas and suggestions were discussed about the content of the "How we made Aspirin" report. Resulted in good discussions, which solved some problems that we were facing in writing the final report. Group members that attended: B1, B2 and B4.

6-3-07 The deadline set for task completion was for Tuesday 20th March by which time B1 would be given the work to compile.
Group members that attended: B1 and B4.

23-3-07 Meeting with Mr [Supervisor]. Project was not complete due to group members not meeting their deadlines. Luckily there was another meeting we could do our presentation at. It was agreed that the work must be done in the holidays and sent to B1 by Saturday 7th April. Group members that attended: All.

10-4-07 Finished presentation write-up by making adjustments where needed.
Group members that attended: B1 and B4.

16-4-07 Presentation day.

Childproof container containing 8 Aspirin capsules submitted by Group B

(Picture removed for copyright reasons)

Chemical Synthesis of Aspirin

By: B1
B2
B3
B4

From: [... ..] School
Date of Completion: 10th April 2007

Acknowledgements:

We would like to thank the following persons, companies and institutions for their invaluable support in this project:

- Mr. [... ..] (Tesco PLC)
Pharmacist at the [... ..] Branch
Spoke with B2. Discussed the problems of accurate tableting
- Mr. and Mrs. [... ..]
Pharmacists at [... ..] Ltd.
[... ..] Road
Helped B1 by giving information on the cost of aspirin products.
- Mr. [... ..]
Pharmacist at [... ..] Street Pharmacy
Discussed many aspects of aspirin production at great length with B1 and B2 including fillers, how to tablet and the benefits of using capsules.
- The staff at the [... ..] Information Centre
They directed B3 and B4 to useful texts and databases in the library.
- Mr. [... ..] (Supervisor)

How we produced “pure” aspirin

In order to produce 2-ethanoylhydroxybenzoic acid (aspirin), we need to esterify 2-hydroxybenzoic acid (salicylic acid) using acetic anhydride. Concentrated sulphuric acid was used as the catalyst. Although this has the desired effect of speeding up the reaction, it also adds impurities to the aspirin.

It is very difficult to measure out accurate masses of solids and liquids using the equipment that we had. As we found to our expense, there was no way that we could transfer exactly 10g of dry salicylic acid and 14ml of acetic anhydride to a conical flask. The salicylic acid (a white solid), was partly lost when it was weighed and transferred to the flask. However, we tried to be as accurate as possible in adding these measurements. Adding 5 drops of the concentrated sulphuric acid to the solution in the flask was not as difficult. Adding the acid was done with great care, because of its dangerous nature. On later purification of the product, any excess of either ingredient is removed. It was important that throughout the practical safety glasses are worn.

Salicylic acid has a solubility of 0.18g/100cm³, and would therefore take some time before fully dissolving (in the acetic anhydride). To speed up the rate of dissolving the conical flask was warmed in a pre-heated waterbath at 60°. We made sure the temperature remained within this range by placing a thermometer in the conical flask. In order to dissolve most of the salicylic acid, the conical flask had to be stirred continuously during its warming. It was decided that one person could not handle this task alone, as our hands became too tired. Instead we each took shifts in swirling the solution in the water bath warming the solution for about 4 minutes each. We then allowed the mixture to cool for about 2-3 minutes, stirring it occasionally.

The solution in the flask should ideally have contained aspirin and acetic acid only, while the catalyst (sulphuric acid) remained unchanged. At this point the smell of vinegar became quite apparent. This was a sign that the reaction had occurred, because ethanoic acid (acetic acid) is a product of the esterification. Acetic acid is vinegar, therefore the smell was expected. In large scale aspirin production, the acetic acid required to make acetic anhydride was usually obtained from sour wine or sour fruits (e.g. sour cider). This was the most economical method of obtaining it. However it is now obtained quite cheaply from industrial fermentation processes.

To separate the aspirin from the solution, 150ml of water was added to it. The solution was then stirred and filtered at the pump. This process is better known as vacuum filtration, and is a fast way of separating the required solid from the solution. The equipment involved included a Buchner funnel, filter paper, the pump and the conical flask itself. The crude aspirin left above the filter paper is impure, still containing some ethanoic acid and acid catalyst. Also, if the reaction is incomplete or if the reagents were added in the wrong proportions, the aspirin would be contaminated with unreacted salicylic acid. Re-crystallising the crude aspirin is a good method of reducing the degree of contamination.

This was done by dissolving the solid in 30ml of hot alcohol, and pouring the solution into 75ml of warm water. Some of the solid separated at this point, therefore the

mixture was warmed until all the solid had dissolved. The clear solution was allowed to cool slowly and was left over night. When the solution was checked very attractive, needle-like crystals formed. The formation of the crystals is a very good sign, signifying the presence of fairly pure aspirin.

The crystals were then dissolved in alcohol and re-crystallised in order to remove further any leftover impurities. "Pure" aspirin was left above the Buchner funnel on the filter paper. It is likely that the aspirin will contain some impurities, but they have been kept to a minimum.

The purity of aspirin tablets can be checked in many ways. Four of these methods are thin-layer chromatography, a titration, a back titration and a colorimetric technique. If the group had more time, the aspirin tablets that we made could have been tested with commercial tablets to compare the differences in purity and the accuracy of our method.

The simplified molecular formulae of the reaction which should have occurred is:



If we used 10g of $C_7H_6O_3$, this meant that we used (moles = mass/ RMM), moles = 10 divided by 138 = 0.07. Hence, because the ratio of aspirin to salicylic acid is 1:1, our theoretical yield of pure aspirin should have been (mass = moles x RMM), mass = 0.07 multiply by 180 = 13 grams. The mass of pure aspirin that we had was 2g. Therefore our actual percentage yield of aspirin was (2g divided by 13g) multiply by 100 = 15.4% yield.

This difference in yield can be accounted for by the limitations of our technique in producing the aspirin. We must consider that the reaction may not have been complete, therefore not producing the ideal mass of aspirin. Also, much of the aspirin was lost in the re-crystallising process, i.e. it dissolved in the filtrate. Some of the aspirin was also left on the filter paper, being too difficult to scrape off. This is a problem because the greater the purity of the product, the lower the yield will be. This is because purification methods are used more times. This increases the amount of product lost at each stage. These losses were kept to a minimum by our group, but the yield difference is too large for this exact process to be used in large scale production of aspirin.

When the product was made and purified, it was ready to be tabletted. We decided that it would be easier for us to use capsules instead of actually tableting. This is because when a product is tabletted, it will need to be wet and contain binding agents as well as the filler. This will be more difficult for us to handle and will increase the inaccuracies in our method. Also, it will be difficult to remove the tablets in the mould. Capsules are easier to handle.

We decided that we would use starch as the filler in the capsules. Once starch gets in the body, it breaks down very quickly so this would enable the aspirin contained in the starch to take effect faster.

We mixed one gram of 'pure' aspirin with two grams of starch. We put both ingredients in a conical flask and sealed it with a bung. The flask was then shaken for fifteen minutes so that the ingredients were evenly mixed together. If the mixture is mixed evenly, this decreases the range of error in the mass of aspirin in each tablet because the error is shared out over three grams (total mass) rather than the 0.2 grams that will go into each capsule. The required mass was then weighed out and put slowly, using a small piece of filter paper, into the capsule. The capsules must be held with dry, cold hands so it is easier to wear plastic gloves. The capsules were then sealed and put into an airtight container.

(Picture of Aspirin capsules removed for copyright reasons)

Bibliography:

- 'Vogel A1: A Textbook of Practical Organic Chemistry'
Third Edition 1956

Aspirin

Report by Candidate B1

Introduction:

Aspirin is a commonly used drug which is easily available over the counter. It is a salicylate medication used for a wide range of purposes including pain relief, blood thinning, reducing fever and as an anti-inflammatory agent.

Its history dates back to the early 5th century BC. The Greek physician, Hippocrates extracted an aspirin-like substance from the common white willow tree and used it to relieve pain. However, it was the German chemist, Dresser whom first prepared and identified acetylsalicylic acid.

Our assignment was to consider the methodology of aspirin production and to become aware of ways of limiting the manufacturing costs. Our main aims were:

- to produce aspirin in the laboratory, including tableting and packaging;
- to research the methods of industrial aspirin production;
- to compare the manufacturing costs to the retail costs;
- compare our method to industrial methods of production and
- compare our aspirin yield to the theoretical yields explaining the differences.

I took responsibility for researching and reporting on the tableting and the costs comparisons.

We then had to give a half hour presentation to a parents association meeting where we put our work together.

In this report I start off by looking at how Aspirin actually works on the body once it is there. I then look at the benefits of using this medication and what other advantages it can offer. Then I tell the story of our research and give you the details especially the bits that I undertook, a comparison of the prices of Aspirin products on the market and also with the cost of our Aspirin is made. I look at why the prices vary from one brand to the other when ultimately, we get the same thing. Finally I make some conclusions on the whole project itself.

How does Aspirin Work?

When cells in the body become damaged, a group of hormones called prostaglandins are produced by a number of chemical reactions. Their effect on the body is the onset of pain, fever and inflammation. Aspirin functions by stopping the production of these hormones, hence relieving the symptoms. As prostaglandins controls other chemical reactions in the body, aspirin can work wherever they are being produced.

Prostaglandins are synthesised from a fatty acid called arachidonic acid which is produced from the fatty acids in the phospholipids that make up cell membranes.

The arachidonic acid combines with the oxygen on the active site of the enzyme, cyclo-oxygenase. This produces prostaglandin intermediates. This is dangerous because, for example, these intermediates can be used by platelets in the blood to make thromboxane which can cause clots. Thromboxane causes platelets which are essential for blood clotting, to stick together and cause narrowing of arteries. If this narrowing is excessive and not in equilibrium with the opposite reaction which prevents the clotting in a healthy body, a clot can form. Aspirin acts as a permanent inhibitor so that the enzyme, cyclo-oxygenase cannot form prostaglandin intermediates (Taken from 'A New Role for Aspirin' by the Medical Research Council 1995).

Benefits of Aspirin Use:

In recent decades, medical research has shown a number of new uses for aspirin. The most important of these uses is aspirin's ability to decrease cardiovascular disease which is the most common cause of death in the United States.

The British scientist, Sir John Vane, explained the biochemical properties of aspirin, in the 1960s and 70s, and how suggested they could help to reduce risk of cardiovascular disease. Vane's ideas were put into practice in the 80s. Results came through indicating that aspirin was indeed reducing cardiovascular disease. The statistics showed that patients with previous cardiovascular disease who have received regular aspirin medication had: a 32% lower rate of non-fatal attacks; a 27% lower rate of stroke and a 15% reduction in general deaths from cardiovascular disease.

This 'wonder drug' has many other benefits such as cataract prevention, migraine relief and reducing blood pressure during pregnancy.

One of the recent applications is the prevention of miscarriage. An article published in the 'Daily Mail' (November 1996) reported on a women who had suffered twelve miscarriages from the age of seventeen. She had been prescribed a regular aspirin dosage in the hope of preventing further miscarriages. Doctors were happy with her progress and she was ready to give birth at the time of the article's publication.

However, as with other medicines, aspirin also has side effects. These include; nausea, vomiting, gastrointestinal bleeding, ulcers, hives and hepatitis. It can also worsen asthma.

Research methods:

Because of our initial lack of knowledge and understanding of the task before us, our first visit to the [...] Institute to gather as much information about aspirin and the surrounding topics as possible. Although this was not an approach that would directly fulfil our aims, it helped to increase our background understanding of the project. The [...] Institute were unable to help us with any information about the economical aspects and also warned us of the reluctance of pharmaceutical companies to part with such confidential information (i.e. comparing production costs with retail costs). The only information that we would have access to in terms of the costs would be medicines sold in the chemists. This was very limiting because of the additional costs that are added to the medicines that we buy over the counter.

In one chemist alone, seven different products was sold containing aspirin as the main ingredient.

Product Number:	Product Name:	Amount Of Aspirin In Each Tablet:	No. Of Tablets In Pack:	Cost Per Pack:	Cost Per Tablet:	Cost Per Milligram:
1	Aspirin Dispersible	300mg	50	£0.49	0.98p	0.0033p
2	Aspirin	300mg	50	£0.69	1.38p	0.0046p
3	Aspirin Dispersible	600mg	10	£1.11	11.1p	0.0185p
4	Dispirin	300mg	50	£1.92	3.84p	0.0128p
5	Anadin	300mg	12	£1.39	11.58p	0.0386p
6	Anadin Extra	325mg	12	£1.49	12.42p	0.0382p
7	Coated Anadin	300mg	48	£2.33	4.85p	0.0162p

To compare the costs of our tableting with the brand names, we can estimate the cost that we incurred:

Ingredient:	Cost:	Amount per cost:	Mass Used:	Cost of Mass Used
Salicylic Acid	£9.60	250g	10g	£0.384
Acetic Anhydride	£4.90	100g	14g	£0.686
Capsule	£0.10	1 capsule	8	£0.80

So the estimated cost of our product was £1.07 (cost of mass used of salicylic acid and acetic anhydride added together) for two grams of aspirin. We used only one gram to make eight capsules. Therefore £1.07 divided by two gives a cost of £0.535 per gram of aspirin. Eight capsules cost £0.80. This in addition to the cost of the aspirin used means that the final bottle of capsules that we had cost approximately £1.34 to make. This makes the cost per tablet approximately £0.17. This is very expensive. Even when compared with the most expensive tablet on the market, it costs five pence in addition for our tablet.

Within the over-the-counter market, the prices per tablet show great variation in price. Despite the product being the same, the costs vary due to marketing costs such as advertisements which is extremely expensive. In addition, the costs included transportation, wages of the employees, packaging and other factory costs. On top of all that, there is an addition of profit at each of the numerous stages which also accounts for the high costs of a relatively cheap tablet.

Conclusions:

The main thing that I found during this project is that the costs of the medicines that we buy from day to day are astronomic in comparison to the cost of producing the product. It actually costs “mere pennies” to produce hundreds of aspirin tablets commercially but we get charged pennies for each tablet. The difference in the prices contribute to the whole process from the wages of the factory worker to the packaging of the aspirin. However, as consumers, we are ill-informed about what we are actually paying for. The main limitation for my part of our our project was the lack of access that I had to the actual production costs of aspirin so that a more direct comparison could be made.

References:

- Home Medical Advisor (database)
Accessed from the [... ..] Institute
- ‘A New Role for Aspirin’
Medical Research Council 1995
- ‘Medicine for Man’
Published by The Medicine for Man Organised Committee
- American Council for Science and Health (database)
Accessed from the [... ..] Institute
- Encarta
Accessed from the school library
- ‘Want a baby? Just take an aspirin’ by Stephen Oldfield
Daily Mail (library archive), 9th November 1996

Candidate B

Aspirin; tableting and production costs

AO1 MANAGE

It is clear that a suitable topic has been chosen, although the title chosen is perhaps a little too succinct. However, a fuller, and clearer, statement is offered on page 164 ('Our assignment was to consider ...'), and on the same page there is a list of the project aims – five in total. Given that this is a group project, the candidate also states what their own contribution to the project was. In this respect the project has a clear plan.

The candidate provides a relatively detailed assessment of the progress of their project in the Production Log. The candidate says, for example, 'The need was felt to review our current position in the completion of this project. A discussion was held about the way forward...' (page 147), and again (on page 150), 'Due to lack of progress of the group, we decided to split the sections of the report and presentation and assign their completion to a particular group member'.

A mark in the top mark band of 7/10 could be awarded.

AO2 USE RESOURCES/RESEARCH

There is evidence throughout the project report of research having been carried out, but it is not altogether clear how the resources cited in the bibliography (page 167) have actually been used.

The candidate, and the group in which they were working showed some initiative in the range of 'resources' chosen, making use of 'experts' and arranging a visit to Glaxo Smithkline, and the Production Log contains numerous references to the reasons why these were chosen and the use made of them. For example, the candidate says, on page 149, 'Contacted an outside expert to help on this difficult issue. The General Practitioner was very helpful in guiding me towards sources and the results of my conversation was to help move me along in writing this difficult chapter.'

The approach adopted demonstrates some ability on the part of the candidate to offer some critical analysis of the research carried out. For example, the candidate discusses the methods they employed in 'tableting' aspirin and the costs involved, and uses this knowledge to make pertinent comments on the retail price of aspirin tablets.

The project can be credited in the top band with mark of 7/10.

AO3 DEVELOP AND REALISE

A wide range of research skills has been employed, and there is some analyses of the effectiveness of these. For example, the candidate says, on page 149, 'Re-visited the xxx Institute to fill gaps of our research such as how Aspirin actually works in the body and it's uses. This visit was more useful than the first because we knew what we needed and sought it out without much difficulty..'

The candidate also reflects upon changes made to the original plan. On page 150 the candidate says, for example, 'Due to the lack of progress of the group, we decided to split the sections of the report and presentation and assign their completion to a particular group member' and '.. resulted in good discussions, which solved some problems that we were facing in writing the final report.' Both of these demonstrate some awareness of why changes may be required in the research undertaken.

The overall report is clearly communicated and structured, and the candidate has gone to great pains to make clear what was their contribution to the group activity. There is a competent synthesis of material from the sources referred to, and the fact that the candidate was able to 'field' questions from members of the audience for the Presentation may also suggest that they had been able to achieve this synthesis.

The candidate's work may be credited in the middle mark band with a mark of 13/20

AO4 REVIEW

In the Reflection section (page 157) the candidate offers a mature assessment of some of the strengths and weaknesses of their project, commenting in particular about the pitfalls of working on a group activity. Also, as already commented upon, the candidate offers observations on what they discovered about the retail pricing of aspirins.

The candidate's report (pages 164-167) is well structured and clearly communicated, and, read in conjunction with the Production Log, suggests that the candidate should be rewarded at the top of the middle band with a mark of 6/10. A greater focus on the strengths and weaknesses of the completed project in the candidate's own report might easily have resulted in the award in the higher band of marks.

AO1 Manage	7/10
AO2 Use Resources/Research	7/10
AO3 Develop and Realise	13/20
AO4 Review	6/10
Total	33 /50