



The Scottish Baccalaureate in Science

Interdisciplinary Project- Exemplar 5

“The Evolution of Automobile Engines to Become More Environmentally Friendly”

Grade: C

Science: Interdisciplinary Project

Proposal

Candidate name									
SCN									
Centre name									
Assessor name									
Project title	The Evolution of Automobile Engines to Become More Environmentally Friendly								
Project outline (<i>what it is you want to do and how will you go about it</i>)	<p>I will investigate the ways in which automobile engines have changed to reduce the quantity of carbon dioxide produced while also becoming more powerful. I will look at how this has affected the pollution caused by automotive transport. I am also interested in the motivation for investment in environmental improvements in the automobile industry and how developments and innovations have been affected by the sport of formula one racing, legislation and public opinion.</p> <p>I will initially conduct internet research looking at recent legislation regarding engine emissions and the development of cleaner running engines. I will also look at alternative fuels and their viability. I will use YouTube videos to gauge change in public opinion by comparing advertising by car manufacturers over the last 30 years looking for the inclusion of environmental messages. I will contact a number of car manufacturers directly requesting information about their research and development to reduce engine emissions and their plans for the use of alternative fuels.</p>								
Reasons for choosing this project (<i>eg personal interest, future plans, links to other subjects you are studying/ have studied</i>)	<p>I will be interested to discover the ways in which the automotive industry is helping to reduce Carbon Dioxide emissions as it is a concern of mine. I have an interest in the different methods of transport and so the project appeals to me on a personal level as well as educational. I am studying Higher Chemistry and Advanced Higher Physics and this project relates to them both. I am also hopeful that this project will benefit me in the future through my career as I am looking to study aero-mechanical engineering at university. After I have completed research into the topic, I will then deliver a presentation to a Standard Grade class, teaching them about the impact cars have on the environment, and ways in which this can be changed by advancement in engine technology. This will mean the project will also be of benefit to the Standard Grade pupils and hopefully inspire them in an area I find fascinating. I also intend to upload my presentation to YouTube in order to reach a wider audience.</p>								

The broad contexts this project will cover are

- Citizenship Enterprise Employability
 Economic development Sustainable development

Learning environments I will access are

I will use the internet to research through websites and YouTube to access advertising and promotional videos. I will contact the research and design departments of automobile engine manufactures via email.

How I will use my knowledge of science/technology

From studying Chemistry, I have an understanding of what gasses produced by an engine are poisonous and the ways in which they have a negative effect on the human body and the ozone layer. I will also use my knowledge of Physics and transport to gain an understanding of how each of the engines work.

The skills I will develop and/or improve in the course of this project are:

(carry out a short analysis of your current strengths and weaknesses in the skills areas below and how you think your project will allow you to develop and/or improve these skills)

This project will encourage me to be entirely independent in my research. This is something with which I am unfamiliar and so the project will help me develop a sense of responsibility in my work. The fact that I have chosen the subject area rather than it being assigned will be motivating as it is an area of great interest to me and I know will be useful at school, at university and possibly in a future career. I have often been criticised for lacking independence at school and I feel the project will do a great deal to help me improve this. The project will also allow me to exercise presentation skills. Presentations are something which I have struggled with in the past due to nerves and lack of confidence in front of an audience. Working towards being able to deliver a presentation to other pupils will allow me to gain skills and greater confidence in this area. Another way in which the project will help me is by giving me the opportunity to apply my knowledge of chemistry and physics in a real life context. I expect this to give me a deeper understanding of knowledge I have learned in class.

Assessor feedback to candidate

An excellent choice of topic area. It is suitable as it gives an opportunity to use your subject knowledge in a context you don't explore within the Physics and Chemistry curricula. I can also see that you have a passionate interest in the subject area which will help you to remain focussed and see the project through to completion when other responsibilities impact on your limited time.

When constructing your plan be clear about your aims and exactly which aspect of environmental innovations you want to concentrate on.

Proposal approved	✓	Further work required	
Candidate signature		Date	
Assessor signature		Date	

Science: Interdisciplinary Project

Plan

Candidate name	
SCN	
Centre name	
Assessor name	
Project title	The Evolution of Automobile Engines to Become More Environmentally Friendly
Is this a group project? yes <input type="checkbox"/> no <input checked="" type="checkbox"/>	
If a group project my individual role or responsibilities will be:	
Timescales (<i>this should be a detailed timeline and any separate spreadsheets or charts should be included as evidence</i>) A separate Gantt chart is attached recording my deadlines and planning.	
Planning (<i>how you are going to meet the agreed objectives of your project</i>) I am also taking part in the 'Cansat' project and I therefore will require to plan my time carefully to be able to meet deadlines for both projects. I will make sure I meet all final deadlines through structuring the project into segments. I will give each segment an interim deadline. Structuring the project in this way will make it much easier for deadlines to be reached on time and efficiently.	
Resources (<i>e.g. people, materials, places</i>) Companies at the forefront of engine evolution such as Honda, Renault, Toyota etc. I aim to contact a representative of these companies to help provide me with information. I will also look at the way the advertising industry has changed with the introduction of hydrogen powered and electric engines. I will look at the qualities manufacturers advertise compared to that of 20/30 years ago. I have already acquired a lot of information through internet sources.	

Research methods (<i>e.g. contacting companies, surveys, focus groups, experimentation</i>) I will use the company websites to attain information and then contact a representative from the company itself to gather more information. I will also conduct research into what makes an engine uneconomical and the emissions each type of engine generally

produces. This will help give me an indication as to what engine is the most economical and the pros and cons of each. I will use car magazines to research statistics of current models of cars and to look at environmental messages in advertising. I will also use YouTube to look at advertising over the last 20/30 years.

Presentation

- **Who do I think will benefit from listening/reading/looking at my presentation of my project findings/product?**

I plan to give a PowerPoint presentation to 3rd year pupils studying Physics. The presentation will tie in with the both the Transport and Energy Matters topics in the Standard Grade course. It will make the younger pupils aware of the environmental issues surrounding transport and also the ways in which this can be tackled in the future. I also feel the general public would benefit from seeing my presentation and hope to reach a wider audience through the internet.

- **What methods are appropriate to my audience(s)** (e.g. demonstration, presentation software, websites, oral, report, piece of theatre, DVD, wiki/blog or any combination)

Presentation software such as Microsoft PowerPoint combined with an oral report. I also plan to upload the presentation to YouTube and display it on the school plasma screen system.

Dependencies (what is required for your project to go ahead ie reliance on other people or resources, steps in plan that must be completed before starting the next step)

The project relies quite heavily on the cooperation of the companies I contact on information about their engines. I must also first research the different types of engine on the commercial market and the advantages and disadvantages of each and so it depends on the availability of the specific detailed technical information I need. It also depends on being able to find information on the legal requirements placed upon the motor industry. All aspects of the project depend upon me having reliable access to the internet and a phone.

Contingencies

Any anticipated problems

- Lack of feedback from the companies.

My plans for overcoming the anticipated problems.

- Contact a large number of engine manufacturers to ensure I get sufficient response.

<ul style="list-style-type: none"> • Difficulties in accessing the internet and phone during the school day. • Lack of availability of detailed technical information on engine design and emissions. 	<ul style="list-style-type: none"> • Seek permission to use the computer in Lab 10 to access the internet and use my mobile phone in my study periods. Also work out with school hours. • Use advanced features in the search engine to return technical documents and persevere when information is not easily obtained.
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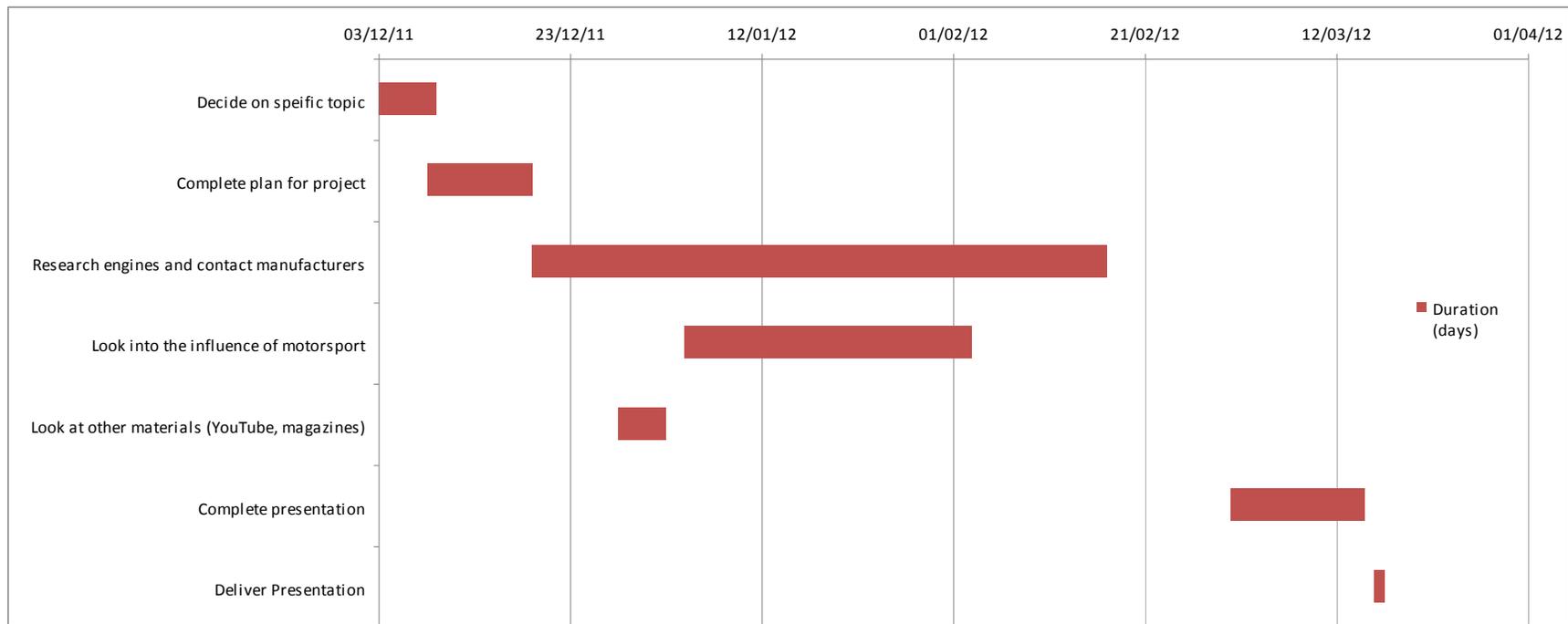
Method for recording my skills development and future areas for improvement

I plan to include a slide in my presentation of my 'PDP', personal development planning. This slide will reflect on what I have learned and achieved throughout the project and how this will benefit me in the future. I also plan to make use of an electronic diary.

Assessor feedback to candidate

Your plan shows you have carefully considered the specialist information you will need to gather and how you will attain it. I am satisfied that you realise the issues that might slow your progress with the project and have considered what you will do should you have difficulty getting first hand information from companies regarding their developments. Your use of the Gantt chart shows me you have planned well to meet the deadline.

Plan approved	✓	Further work required	
Candidate signature			Date
Assessor signature			Date



Science: Interdisciplinary Project

Presentation of Project Findings/Product

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How I presented my project findings

The presentation was done by delivering a PowerPoint presentation to a class of 3rd year Standard Grade pupils. This was relevant as the 3rd year class were in the process of studying the transport unit. The presentation provided another angle of transport which is not covered by the course. It will also relate to the energy matters topic which they will study next year. I tried to involve the class in the project by asking them questions on their thoughts towards the environmental impact of engines and if they think there is a change needed. The aim of the presentation was to inform the class of the options available and that in the future something will need to be done about the carbon emissions produced by cars. By doing this I hoped to raise awareness among the pupils and hopefully they will react in an enthusiastic way towards the concept of alternative engines. The pupils asked questions regarding the subject so hopefully I have sparked an interest within them.

Assessor feedback to candidate

I was very impressed by your presentation as were the class. You showed a depth of understanding and spoke from a confident knowledge of your topic without the need to refer to notes or read from your PowerPoint presentation. This allowed you to make eye contact with individual pupils and include them by asking questions. You engaged your audience by pitching at their level without patronising them and managed to include plenty of relevant information. You also had the confidence in your knowledge to invite questions from the group and deal with this interaction well. The PowerPoint presentation itself was well prepared and expertly put together clearly showing the learning from your research.

Candidate signature		Date	23/3/12
Assessor signature		Date	23/3/12

Science: Interdisciplinary Project

Evaluation of project

Candidate name									
SCN									
Centre name									
Assessor name									
Project title	The Evolution of Automobile Engines to Become More Environmentally Friendly								
How successful has my project been overall?									
<p>As a whole I would conclude that the project has been very successful. The project was based on two levels. One level was the way in which I could learn about the alternatives to petrol and diesel engines and the way in which they functioned. The aim was also to discover the advantages and disadvantages of each. On the second level the aim was to make the SG pupils aware that there were alternatives to petrol and diesel engines and deliver the knowledge I had gained. I feel I managed to successfully achieve this as the pupils appeared to take a genuine interest in the subject. I can deem it successful on a personal level as I have really furthered my skills in many different areas concerning the project as well as learning much about hydrogen engines and electrical engines through my research. I do feel it has been useful and the skills and knowledge I have gained will be helpful at university and in my future career.</p>									
How effective were my communication methods throughout the project?									
<p>The communication methods were fairly successful. Through repeated emailing of various representatives from motor companies, I was eventually able to get statements from a number of companies including a very helpful and detailed description from a representative at Renault. This was very useful research in my project and provided depth to it. However, I did not get a response from Toyota. I did try and phone Toyota but again received no reply. I believe my communication methods were as effective as possible and it was more reluctance on Toyota's part to help me. However this risk had been calculated for in risk analysis, so this did not pose a major problem in my project, particularly with the excellent reply from Renault. My communication in the presentation went better than I expected and once I got over my initial nerves I actually enjoyed it. The pupils asked thoughtful questions which showed they had been listening and were interested in the topic.</p>									

Is there any aspect of my project that could be taken further? What might my next steps be?

The project could be used as an unofficial part of the Standard Grade Physics in the school. This of course could only be done if the class is ahead of schedule but nonetheless would provide the pupils with another angle of transport at which to look at.

Had I had more time I would have liked to look further at innovations in formula one racing cars. I could look at the changes in safety in the sport as well as emissions and the possibility of using alternative fuels.

Candidate signature		Date	26/3/12
Assessor signature		Date	26/3/12

Science: Interdisciplinary Project

Self evaluation of generic and cognitive skills development

Candidate name									
SCN									
Centre name									
Assessor name									
Project title	The Evolution of Automobile Engines to Become More Environmentally Friendly								

In evaluating your skills consider the skills analysis which you carried out at the Proposal stage and how you said you would develop and improve these skills. Now refer to your reflective diary/log/blog and feedback you have received and evaluate how you have developed and/or improved these skills through the work on your Interdisciplinary Project.

Application of subject knowledge and understanding

My knowledge in science, in particular physics and chemistry, were fundamental in allowing me to understand the concept of hydrogen and electric engines. This was perhaps the most challenging part of the project but it allowed me to expand my knowledge in the field. Atomic physics was particularly helpful when understanding how a hydrogen engine works.

Research skills – analysis and evaluation

The majority of my research was conducted over the internet. Other methods of research included phoning organisations for more information on their policies regarding environmentally friendly engines. I also borrowed a number of engineering magazines which contained articles about various hydrogen and electric engines. This was as a result of Renault's recent launching of their line of electric powered cars. I began research very early so as to keep time-management very strict. This allowed plenty of time for replies from those I had contacted and allowed me to compile that research for my presentation.

Interpersonal skills – negotiate and collaborate

My interpersonal skills were developed through contacting various representatives. I took their replies on board and this helped tremendously as evidence for my presentation. I believe my interpersonal skills have been greatly developed as a result of the project and the people I have contacted. I also improved my interpersonal skills in delivering a presentation to a class of younger pupils.

Planning – time, resource and information management

Time management was kept to a strict limit. This was with the help of my Gantt chart, which was used to give me an indication of how behind or ahead I was with a certain aspect of the project. I used the Gantt chart to both set targets and record the progress of these targets, this was a great help in my project. I found it took longer than expected to get any response from representatives from the car industry but with persistence I did manage to get a useful response.

Independent learning – autonomy and challenge in own learning

I used my skills in a variety of areas of the project. The first was with research. Right from the start of the project I knew exactly what to research and where to find information regarding it. My knowledge in science was also a great catalyst in my research. I was able to collect ideas quickly and efficiently and discuss the pros and cons of each. This was also a help with time management. I managed to access unfamiliar learning environments particularly through the link I formed with the Renault representative. This was perhaps the most successful use of critical thinking on my part.

Problem solving – creative approaches; critical thinking; logical approaches

Source material which I analysed was based off my detailed response from Renault. This was used in my presentation. A problem which I managed to overcome was the lack of response from Toyota. To overcome this, rather than get a direct response, I had to look at PR material regarding Toyota engines. After this, I conducted my own research into the engines which Toyota produced and how these were different from other manufacturers.

Presentation skills

The choice of audience was very relevant as the class I presented it to was studying the transport topic in Standard Grade physics. Therefore the layout of the presentation was structured in a way that was informative but also easy to understand. There was a high degree of formality associated with the presentation as this was a way in which the topic could be effectively conducted. However, I gave the opportunity for involvement of the pupils by asking them questions and allowing them to ask questions of me. This was a less formal interaction which they responded well to.

Self evaluation – recognition of own skills development and future areas for development

The main area in which I have improved is through my responsibility. I was forced to work entirely independent and this was very beneficial for my level of responsibility. I had to think about things in a logical manner whilst also keeping track of time management. This is something which I have had no previous experience of in this working environment. An area which could be improved was being able to establish more links with more people. Although I did make an attempt to establish links, I feel more could have been done on my part to gain more points of view on the subject.

Science: Interdisciplinary Project

Assessor Report

Candidate name _____

Candidate number _____

Centre _____

Project proposal	Tick as appropriate
Grade C criteria	
The title and aims of the project.	✓
Clear aims and reasoned arguments to support the relevance and practicability of the project.	✓
Identification of opportunities for:	
• own skills development	✓
• collaborative working	✓
• accessing less familiar learning environments	✓
• application of science subject knowledge in a broad context	✓
• use of knowledge and skills across different disciplines	✓
• making connections between subject knowledge and the wider world	✓
Evidence of the ability to communicate clearly and concisely in advocating the proposal.	✓
Grade A criteria, includes all of above plus	
Well conceived proposal which sets creative and challenging goals which are at the same time realistic, achievable and practicable.	
Robust and carefully argued justification of the proposal.	
Substantial links and understanding of possible connections across disciplines contributing to the project.	
Comments	
<p>The candidate's choice of project was appropriate as it is a topic of great interest to him and links in well with his university course and future career aspirations. It allowed plenty of opportunity to overcome all requirements of the project. It covered an area of application of both chemistry and physics which was ideal for the involvement of this subject knowledge.</p>	

Project plan	Tick as appropriate
Grade C criteria	
Development of clear project objectives in line with the project proposal.	✓
Relevant and detailed planning strands to enable the project to be implemented, monitored, presented and evaluated.	✓
Realistic timescales and achievable milestones for each stage of the project.	✓
Clear identification of resources needed, research methodologies to be used, opportunities for support and feedback.	✓
Grade A criteria, includes all of above plus	
Careful selection and effective use of research/investigation techniques.	
Anticipation of probable and possible factors which may impact on the project.	
Clear identification of dependencies or reliance on the success of other strands of work and of necessary adjustments to the plan.	
Outline the process for achieving own identified development needs.	
Comments	
<p>The candidate's plan gave sufficient detail to pass the Grade C criteria. His planning took account of the other project he was involved in and relied on him making a great deal of use of his Christmas holiday. In discussion he convinced me that he had also taken into account preparation for prelim exams. He was also aware that contacting manufacturers would need to be done after the Christmas break although this is not clear from his Gantt chart. He was able to use time during the study leave to contact representatives from the car manufacturers from home. He was very self-motivated and persevered with his research despite numerous set backs.</p>	

Presentation of project findings/product	Tick as appropriate
Grade C criteria	
Evidence of effective and critical use of — resources, research methodologies, information and time management, prioritisation, problem solving approach to reach objectives, feedback, collaborative approaches, self monitoring.	✓
Application of specialist and interdisciplinary subject knowledge to establish meaningful connections within the broad context.	✓
Clear presentation of main findings/outcomes.	✓
Grade A criteria, includes all of above plus	
Critical thinking, analysis and reflection used at key stages in the project to construct rigorous arguments, draw convincing, well supported conclusions, identify and resolve issues.	
Skilful and creative use of resources, including people, information and learning context to progress the project.	
Accurate and deepening of understanding through application of	

subject knowledge in the chosen context, with meaningful connections well established.	
Comments	
<p>The candidate was initially very unsure about presenting to a full class of younger pupils. He has offered assistance in the department in raising attainment of an individual S4 pupil through tutoring and expresses himself well in a one to one situation. However, this was a new challenge for him and he was nervous about how the class would respond to him. His presentation was engaging, instructive and pitched at the correct level for his audience. He showed skill in incorporating animations and video clips into the presentation. It was clear that he had a confident knowledge of the subject and had prepared well. He quickly got over his initial nerves and was able to involve the pupils actively through questioning. It was very well received by the class.</p> <p>The content of the presentation showed he had been successful in meeting the objectives described in his proposal and plan.</p>	

Evaluation of project	Tick as appropriate
Grade C criteria	
A critical and justified evaluation of all stages of the project process — planning, implementation and findings/outcomes in terms of strengths, weaknesses and learning points.	✓
Effective use of chosen communication method(s).	✓
Grade A criteria, includes all of above plus	
Incisive, well balanced evaluation of the project outcome against project aims, supported convincingly by well selected evidence.	
Careful choice and skilful use of communication and presentation methods(s).	✓
Comments	
<p>Throughout the project the candidate remained enthusiastic and resolute. I was very aware of the pressure he was under to deliver on this project, the Cansat project and the Physics Advanced Higher Investigation all with similar deadlines. I was not convinced he would be able to meet these deadlines due to lack of time. However, the candidate showed impressive strength of character and was determined to succeed.</p>	

Self evaluation of generic/cognitive skills development	Tick as appropriate
Grade C criteria	
A critical evaluation of own skills development against the list of specified generic/cognitive skills.	✓
A reasoned evaluation of own strengths and key goals for development in the specified list of generic/cognitive skills, which takes account of feedback sought and evidenced from others throughout the project.	✓
Grade A criteria, includes all of above plus	
Insightful, balanced and well structured self evaluation of own development.	
Assertive and justified use of feedback from others in evaluation and identification of development areas.	
Comments	
<p>The candidate demonstrated improvement in all the specified skills, particularly in time management, interpersonal skills, research, independence and presentation. Although he has been brief in his discussion of the development of some of the required skills in his evaluation, I have been impressed by his attitude throughout the project and seen a growth in his confidence and application of all skills.</p>	

The overall grade will be:

- A indicative of a highly competent performance which meets the additional Grade A criteria and consistently demonstrated a high degree of autonomy, initiative and effective information management across the five pieces
- B indicative of a competent Grade C performance across the five pieces, but with some aspects of work meeting the criteria for highly competent performance (as outlined by the Grade A criteria)
- C indicative of a competent performance across the five pieces, with all aspects of the work meeting the criteria identified for Grade C performance

Overall Grade Awarded	A	B	C	Unsuccessful
Additional Comments/Overview The candidate has gained a great deal by his involvement in this project. He is aware of this and appreciates the opportunity. It involved a lot of work over an extended time period. As none of this time was timetabled it involved a great deal of commitment on the candidate's part and he made the effort to meet with me at lunch times and after school to discuss his progress. Had more time been available to him I am sure he would have achieved a Grade A. His work was done entirely independently and he should be commended for this. I feel it has been excellent preparation for university.				

Assessor signature _____

Date 26/3/12

Internal verifier signature _____

Date 26/3/12