Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE EXAMINATION 2009

TECHNOLOGY

ORDINARY LEVEL CHIEF EXAMINER'S REPORT

HIGHER LEVEL CHIEF EXAMINER'S REPORT

CONTENTS

General Introduction

The Leaving Certificate Technology syllabus was introduced in September 2007, and examined for the first time in 2009.

In 2009 candidates from 44 schools were entered for assessment. This will increase to 59 schools in 2010 with further increases anticipated in subsequent years.

It is intended that this report be read in conjunction with the relevant examination papers and marking schemes, which are available on www.examinations.ie

1.1 The Syllabus

The structure of the syllabus is the same at both levels comprising a mandatory core and five optional elements from which the candidate may choose any two.

1.2 The Examination

The examination, at both Ordinary Level and Higher Level, comprises two components:

(i) Written examination;

(ii) Student coursework.

All candidates, at both Ordinary Level and Higher Level, are required to attempt both components.

1.2.1 The Written Examination

The written examination which is offered at two levels, Ordinary and Higher, takes place in June and is marked by examiners appointed and trained by the State Examinations Commission (SEC).

Ordinary Level

The written examination at Ordinary Level is of 2 hours duration and comprises 3 sections:

(i) Section A – 12 short answer questions (core);

(ii) Section B – 2 long answer questions (core);

(iii) Section C – 5 long answer questions (options).

Candidates are required to attempt any 9 of the 12 questions in Section A.

Candidates are required to attempt both questions in Section B.

Candidates are required to attempt any 2 of the 5 questions in Section C.

Higher Level

The written examination at Higher Level is of 2.5 hours duration and comprises three sections:

(i) Section A – 15 short answer questions (core);

(ii) Section B – 2 long answer questions (core);

(iii) Section C – 5 long answer questions (options).

Candidates are required to attempt any 12 of the 15 questions in Section A.

Candidates are required to attempt both questions in Section B.

Candidates are required to attempt any 2 of the 5 questions in Section C.

1.2.2 The Student Coursework

The Student Coursework is intended to assess intellectual activities such as analysis, research, planning, design and evaluation as well as practical activities such as materials processing, circuit design and production, mechanism production and integration, CAM and ICT use.

The Student Coursework consists of an artefact and a design folio. Each candidate, at both Ordinary and Higher Level, is required to submit an individual artefact and design folio in response to a coursework brief issued by the State Examinations Commission (SEC). The coursework briefs (one at Ordinary Level and one at Higher Level) are issued by the SEC in October of year two of the Leaving Certificate programme with a completion date at the end of the following April. The Student Coursework must be completed in school under the supervision of the class teacher. Each year, the SEC issues instructions to teachers and candidates regarding the requirements for the submission of valid coursework. On completion, the coursework is securely stored by the relevant school authority until June when it is laid out in the school and marked by a team of visiting examiners appointed and trained by the SEC.

1.2.3 Weightings and Mark Allocations

The examination format and mark allocation for each component is outlined in Table 1.

TECHNOLOGY	
EXAMINATION	**MARKS**
Ordinary Level	
Written examination	200
Student coursework	200
Total	**400**
Higher Level	
Written examination	200
Student coursework	200
Total	**400**

Table 1. Examination format and mark allocation

The internal mark allocations and weightings for each component are outlined in the following tables:

LEVEL	COMPONENT	MARKS
Ordinary Level	**Written examination** Section A Section B Section C	**200** 72 (9 questions at 8 marks) 48 (2 questions at 24 marks) 80 (2 questions at 40 marks)
	Student Coursework Artefact Design Folio	**200** 120 80
	Total	**400**

Table 2: Allocation of marks – Ordinary Level

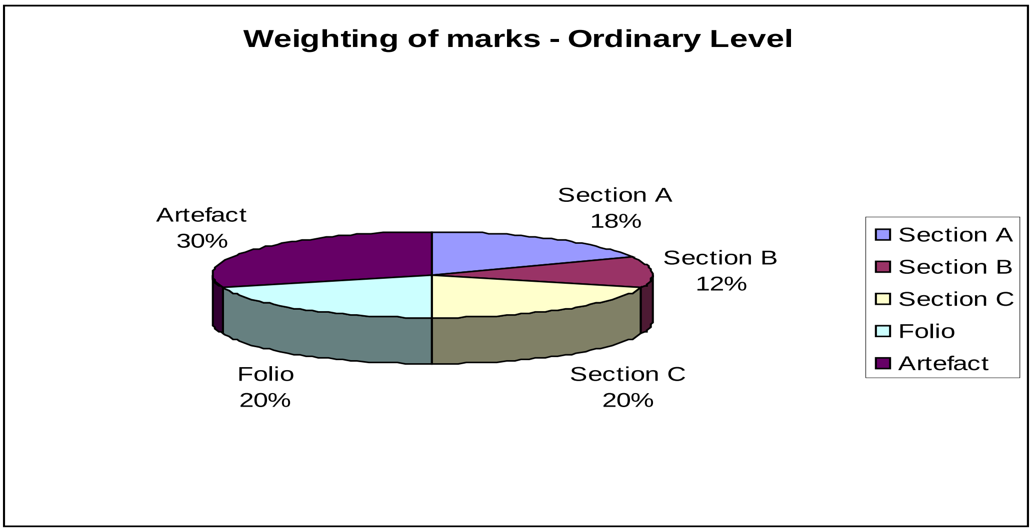


Table 3: Weightings – Ordinary Level

LEVEL	COMPONENT	MARKS
Higher Level	**Written examination** Section A Section B Section C	**200** 72 (12 questions at 6 marks) 48 (2 questions at 24 marks) 80 (2 questions at 40 marks)
	Student Coursework Artefact Design Folio	**200** 100 100
	Total	**400**

Table 4: Allocation of marks – Higher Level

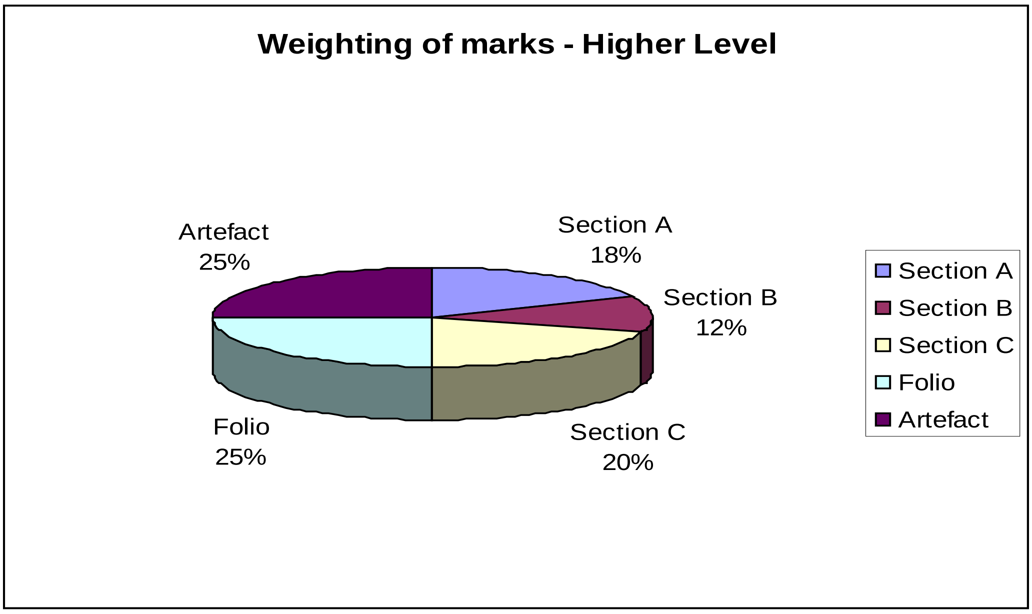


Table 5: Weightings – Higher Level

1.3 Candidature

The number and percentage of candidates taking Technology from the full Leaving Certificate candidature is shown in Table 6 below. As 2009 represents the first Leaving Certificate cohort no data exists for previous years. In 2009 Technology was offered in 44 schools, this will grow to 59 schools in 2010 with further increases in subsequent years.

Year	Full Leaving Certificate cohort	Technology	% of cohort
2009	57,455	648	1.13%

Table 6: Number and percentage of candidates taking Technology from the full Leaving Certificate cohort 2009.

Table 7 shows the number of candidates taking Technology at Ordinary Level and Higher Level in 2009. As can be seen from the table more than four out of every five candidates opted to take the subject at Higher Level.

Year	Total	Ordinary Level		Higher Level	
		Candidature	%	Candidature	%
2009	648	121	18.7	527	81.3

Table 7: Number and percentage of candidates taking Technology at Ordinary and Higher Levels 2009.

2. Performance of Candidates

2.1 Performance of Candidates at Ordinary Level

A total of 121 candidates sat the Technology examination at Ordinary Level in 2009, representing 18.7% of the cohort. A total of 25 (20.7%) of these were female.

The overall performance of candidates at Ordinary Level is shown in the accompanying table and graph below.

Table 8 shows the percentage of candidates achieving each grade when the results of both assessment components are combined.

Year	A	B	C	ABC	D	E	F	NG	EFNG
2009	4.2	19.8	33.8	57.8	23.2	13.2	4.1	1.7	19

Table 8: Percentage of candidates achieving each grade at Ordinary Level 2009

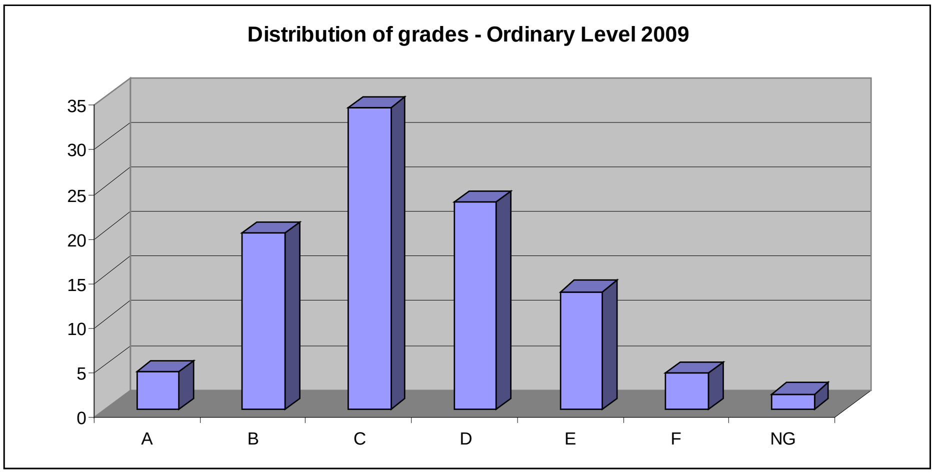


Table 9: Distribution of grades at Ordinary Level 2009

As can be seen from the table and graph, over half the candidates (57.8%) obtained a C grade or higher in this examination in 2009. However, a total of 19% of candidates did not succeed in achieving a D grade.

It will be seen in Table 16 that 12.6% of candidates did not achieve a D grade in the written examination, and in Table 28 that 14.9% did not achieve a D grade in the student coursework. These outcomes are similar to those of examinations in cognate subjects. However, what is untypical in this case is that on combining the results of the two examination components to reach the final grades awarded a surprisingly high EFNG rate (19%) is noted. Usually, combining the results of coursework and written components has the effect of reducing the final EFNG rate. An analysis of the 2009 responses confirmed that many candidates who did not achieve a D grade, did not attempt all the required components of the assessment. Consequently these candidates could not obtain sufficient marks from the answers provided to achieve a D grade when both components were combined.

Examiners noted that the elements most frequently absent were the entire student coursework or the design folio, which is an integral part of the student coursework. Of the 19% of candidates who did not achieve a pass grade 68% submitted one component only. This underlines the central importance of attempting and submitting all assessment components.

Notwithstanding the above specific concerns, candidates generally performed better in the student coursework component than in the written examination and this assisted them in achieving a better overall result.

It is noteworthy that 20.7% of the cohort was female, which is the highest proportion in any of the technological suite of subjects. The following table and graph show the percentage and distribution of grades achieved by male and female candidates as a proportion of their respective cohorts.

2009	A	B	C	ABC	D	E	F	NG	EFNG
Male	**1.04**	**17.71**	**38.54**	**57.29**	**27.08**	**10.42**	**3.13**	**2.08**	**15.63**
Female	**16.00**	**28.00**	**16.00**	**60.00**	**8.00**	**24.00**	**8.00**	**0.00**	**32.00**

Table 10: Candidates achieving each grade as a percentage of their respective cohorts

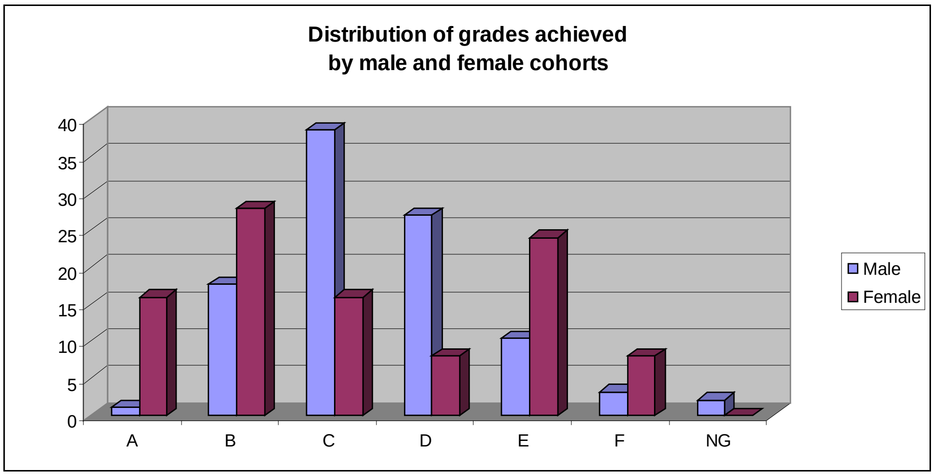


Table 11: Distribution of grades achieved by male and female candidates at Ordinary Level as a percentage of their respective cohorts.

Females are particularly well represented at the A and B grades. However, a substantial E rate is also noted, largely accounted for by non submission of student coursework as previously outlined.

2.2 Performance of Candidates at Higher Level

A total of 527 candidates sat the Technology examination at Higher Level in 2009, representing 81.3% of the cohort. A total of 104 (19.7%) of these were female.

The overall performance of candidates at Higher Level is shown in the accompanying table and graph below.

Table 12 shows the percentage of candidates achieving each grade when the results of both assessment components are combined

Year	A	B	C	ABC	D	E	F	NG	EFNG
2009	12.1	31.1	34.9	78.1	16.5	3.6	1.7	0	5.3

Table 12: Percentage of candidates achieving each grade at Higher Level 2009

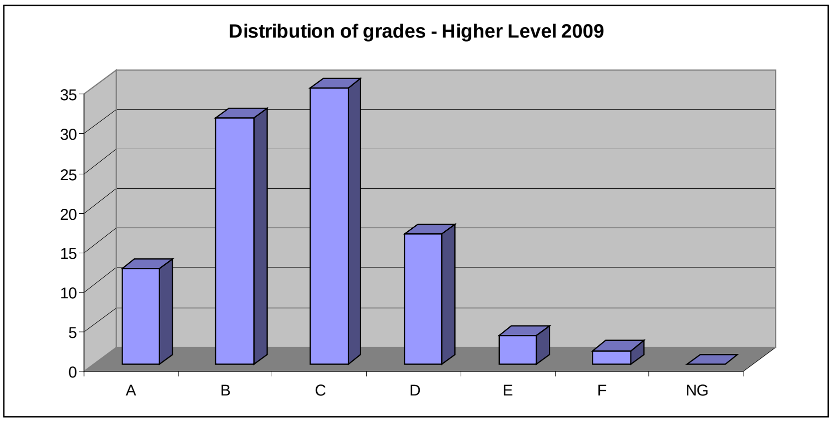


Table 13: Distribution of grades at Higher Level 2009

It is noteworthy that 19.7% of the cohort was female, which is the highest proportion in any of the technological suite of subjects. The following table and graph show the percentage and distribution of grades achieved by male and female candidates as a proportion of their respective cohorts.

2009	A	B	C	ABC	D	E	F	NG	EFNG
Male	11.8	29.1	35.7	76.6	17.3	4.3	1.9	0.0	6.2
Female	13.4	39.5	31.7	84.6	13.4	1.0	1.0	0.0	2.0

Table 14: Candidates achieving each grade as a percentage of their respective cohorts

Table 14: Candidates achieving each grade as a percentage of their respective cohorts

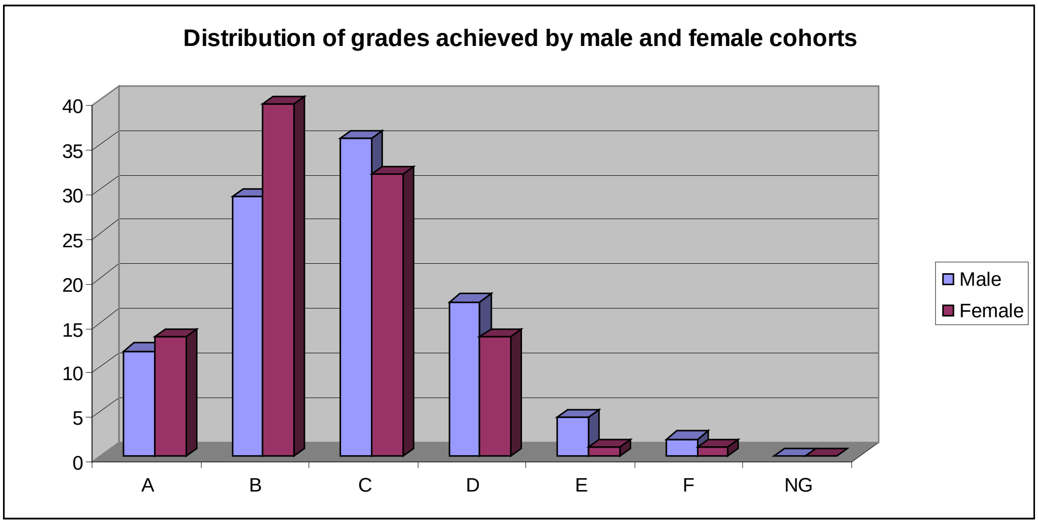


Table 15: Distribution of grades achieved by male and female candidates at Higher Level as a percentage of their respective cohorts.

3. Written Examination – Ordinary Level

3.1 Introduction

At Ordinary Level, the written paper is allocated 200 marks and represents 50% of the Technology examination at this level.

The written examination is of two hours duration and the examination paper comprises three sections:

(i) Section A (72 marks) – 12 short answer questions;

(ii) Section B (48 marks) – 2 long answer questions;

(iii) Section C (80 marks) – 5 long answer questions.

Section A and Section B assess the mandatory Core elements of the syllabus.

Section C assesses the five Optional elements of the Syllabus which comprise: Applied Control Systems; Electronics and Control; Information and Communications Technology; Manufacturing Systems and Materials Technology

Candidates are required to attempt any 9 of the 12 questions in Section A. All questions carry 8 marks.

Candidates are required to attempt both questions in Section B. Each question carries 24 marks.

Candidates are required to attempt any 2 of the 5 questions in Section C. All questions carry 40 marks.

In 2009, a total of 119 candidates sat the written examination in Technology at Ordinary Level, representing 18.3% of the total cohort. Of the 119 candidates who sat the Ordinary Level paper, 12.6% had presented coursework at Higher Level. These candidates were awarded a grade at Ordinary Level by combining the marks achieved in each component

There was broad agreement among the team of examiners that the presentation and content of the examination paper was well suited for this level and that the paper offered candidates opportunities to demonstrate their knowledge of the syllabus.

3.2 Performance of Candidates

The following table and graph show the overall distribution of grades for the Ordinary Level written examination in 2009. As this is the first year of the examination a comparative analysis from year to year is not possible.

Year	A	B	C	ABC	D	E	F	NG	EFNG
2009	9.2	21.8	33.6	64.7	22.7	10.1	1.7	0.8	12.6

Table 16: Percentage of candidates achieving each grade in the Ordinary Level written examination 2009

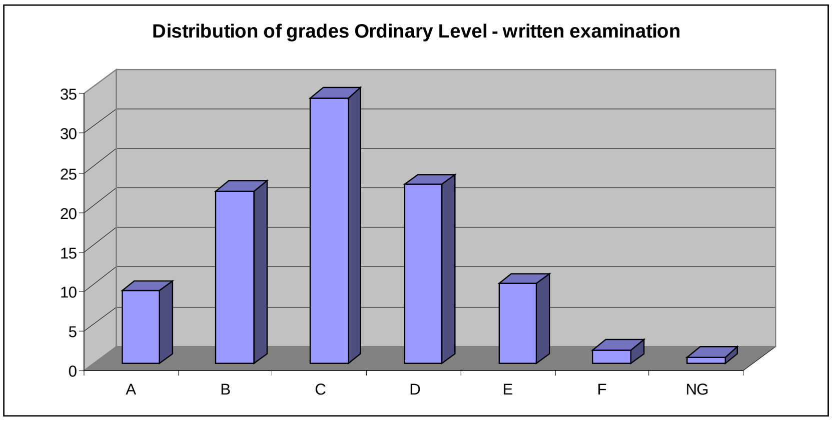


Table 17: Distribution of grades at Ordinary Level written examination 2009

As can be seen from the table and graph, 64.7% of candidates at this level obtained a C grade or higher in the written paper in 2009. However, a total of 12.6% of candidates did not succeed in achieving a D grade.

An analysis of the 2009 responses confirmed that many candidates who did not achieve a D grade did not attempt the required number of questions and consequently could not obtain sufficient marks from the answers provided to achieve a D grade.

3.3 Analysis of Candidate Performance

The statistical analysis in this section is based on an analysis of all 119 scripts.

The commentary on candidate performance is based on the reports of the examiners who were involved in the marking of this component and should be read in conjunction with the relevant examination paper and marking scheme, which are available on www.examinations.ie

Section A – Core

Overall Average mark for Section A: 50.3 out of 72 (69.8%)
Section A was attempted by 100% of the cohort.

The following table shows the frequency of attempts for each question in Section A.

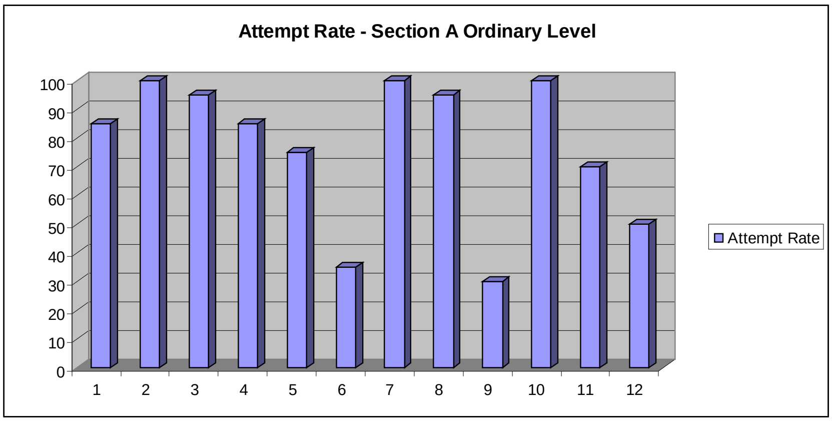


Table 18: Attempt rate – Section A, Ordinary Level

The table below shows the average mark achieved for each question in Section A.

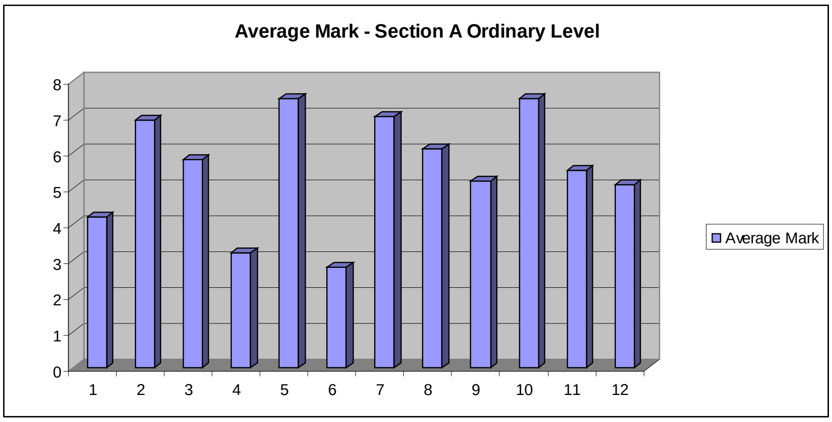


Table 19: Average mark – Section A, Ordinary Level

The following commentary is based on the observations of the team of examiners**.**

Q.1 *Attempted by 85% of candidates. Average mark 4.2*
This question was well answered. Most candidates attempted to describe a function of an operating system However, candidates found it difficult to give examples of operating systems. Common incorrect answers for part (ii) of this question included MS Office, Word etc.

Q.2 *Attempted by 100% of candidates***.** *Average mark 6.9*
This question was very well answered with most candidates giving appropriate properties of brass (does not rust and is decorative) which make it a suitable material for hinges.

Q.3 *Attempted by 95% of candidates***.** *Average mark 5.8*
This question was well answered though some candidates had difficulty in naming an energy conversion. However, most candidates were able to give examples of renewable and non-renewable energy sources.

Q.4 *Attempted by 85% of candidates. Average mark 3.2*
This question was generally poorly answered. Some candidates understood the function of a resistor. However, very few performed the calculation correctly. Only one candidate answered the calculation correctly. 720 ohms was the most common incorrect answer.

Q.5 *Attempted by 75% of candidates***.** *Average mark 7.5*
This question was generally very well answered. The experience of doing coursework benefited the candidates significantly in this question.

Q.6 *Attempted by 35% of candidates***.** *Average mark 2.8*
This was not a popular choice and candidate answers demonstrated a low level of knowledge in this area. Frame and shell structures were not identified by the majority; compression and tension were given in the majority of cases though sometimes in the incorrect order.

Q.7 *Attempted by 100% of candidates. Average mark 7.0*
This question was universally popular and very well answered. Most candidates visualised the correct view of the alarm clock. However, some candidates gave an oblique view of the clock instead.

Q.8 *Attempted by 95% of candidates. Average mark 6.1*
This question was very well answered though approximately 50% of candidates could not explain the term 'biodegradable'. However, most candidates were able to give appropriate advantages in using such materials.

Q.9 *Attempted by 30% of candidates. Average mark 5.2*
This question was not a popular choice. However, marks were awarded for references made to conforming to safety and environmental standards.

Q.10 *Attempted by 100% of candidates. Average mark 7.5*
This question was extremely popular and very well answered. Candidates gained significantly by drawing upon their own workshop experiences in answering this question.

Q.11 *Attempted by 70% of candidates. Average mark 5.5*
This question was well answered with most candidates correctly identifying the gear arrangement to be a worm and worm wheel. Few candidates achieved full marks in this question as a consequence of giving poor advantages for this gear arrangement. Examples given included "nice and smooth" and "easy to use".

Q.12 *Attempted by 50% of candidates. Average mark 5.1*
This question was reasonably well answered when attempted with the use of appropriate techniques such as shading or colour rendering. Examiners expressed some surprise that the attempt rate was not higher than 50%.

Section B – Core

Overall Average mark for Section B: 33.6 out of 48 (70%)

The graph below shows the frequency of attempts and average % mark for each question in Section B**.**

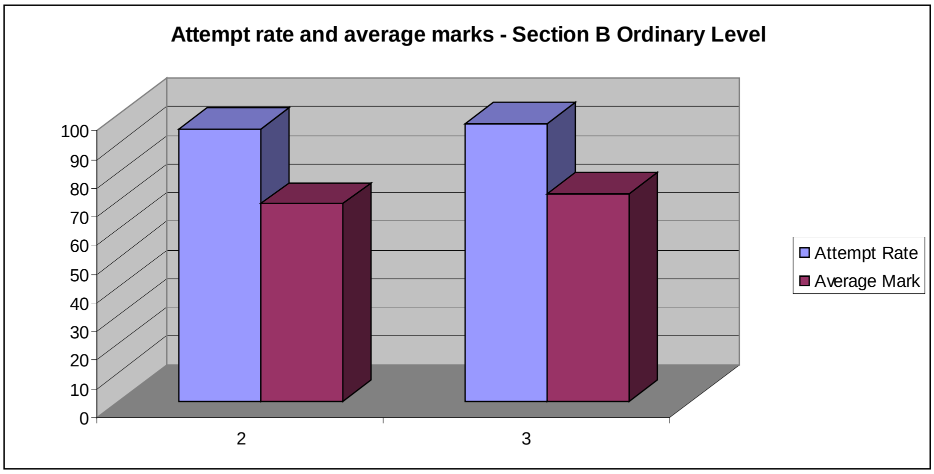


Table 20: Attempt rate and average mark (%) – Section B, Ordinary Level

Q.2 *Attempted by 95% of candidates. Average mark 16.6/24 (69.1%)*

In part (a), most candidates were able to give appropriate reasons for using LED's instead of tungsten filament bulbs. However, many candidates had difficulty in describing the function of the compound gear train. Very few candidates made reference to the concept of an increase in the RPM of the motor.

In part (b), most candidates were able to select suitable materials for the body of the self-powered torch. However, appropriate manufacturing processes were rarely suggested by candidates. Some candidates had difficulty in naming two energy conversions taking place in the torch.

In the last section of (b), the quality of sketching was quite good by most candidates. However, some candidates produced sketches which were small and minimalist. Some candidates incorrectly suggested that gluing grip A onto the handle B was the most appropriate method of attachment.

In part (c), candidates were again able to draw upon their project work experiences in outlining two functions of a Gantt chart. Most candidates were able to provide at least one benefit of purchasing a more expensive product. Typical reasons given included the quality of the material and the length of guarantee.

In part (d), most candidates were able to give examples of responsible and sustainable uses of energy. Some examples given included road safety signs incorporating solar panels and wind up radios. Candidates also described very well the different ways that self powered products can reduce the demand for non renewable energy. Part (c) was more popular than part (d).

Q.3 *Attempted by 97% of candidates. Average mark 17.4/24 (72.5%)*

In part (a), most candidates selected a suitable material for the base of the mobile phone holder. Examples of materials given included acrylic and red deal. Candidates also used sketching to describe the most appropriate method of attachment - the most common method being the use of screws.

In part (b) most candidates made a reasonable attempt at drawing the development of the holder. However, isometric views were given occasionally. The circuit diagram was not answered very well - some candidates producing a sketch of separate electronic components rather than a complete circuit diagram. Some candidates had difficulty in describing the function of flux. However, most had no difficulty in giving safety precautions when soldering.

Part (c) of this question was slightly less popular than part (d). Candidates gave appropriate advantages and disadvantages associated with mobile phone masts. A common advantage given by candidates was "better coverage", while the appearance and health concerns were common disadvantages given. Triangulation was described reasonably well. However, very few sketches were drawn to expand and reinforce the candidates' explanations.

In part (d), most candidates were able to give both positive and negative impacts of mobile phone technology on today's society. Examples given included the ability to stay in touch, emergencies, etc. Health concerns were frequently cited on the negative side. The final section of (d) was also well answered. Some of the advantages given for using freehand sketching at the design stage included – “the design is drawn very quickly” and “it is very easy to change if necessary”.

Section C – Options

Overall Average mark for Section C: 38.5 out of 80 (48.1%)

The graph below shows the frequency of attempts and average % mark for each question in Section B**.**

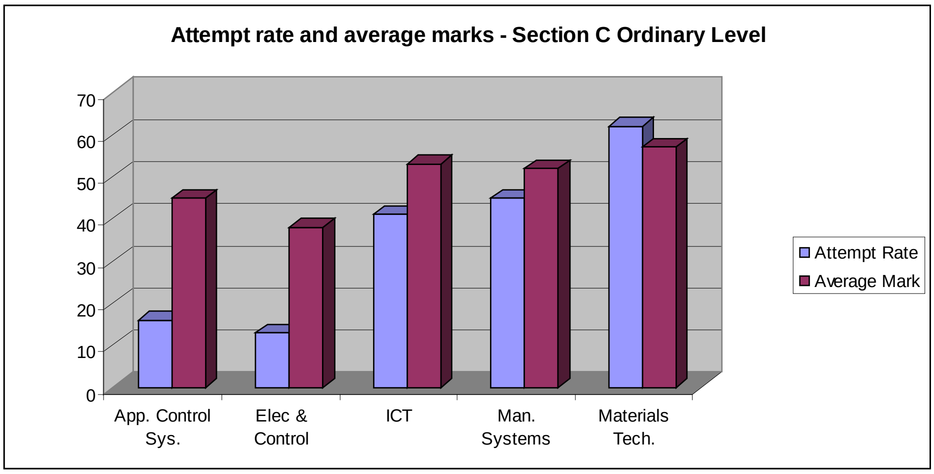


Table 21: Attempt rate and average mark (%) – Section C, Ordinary Level

Option 1 – Applied Control Systems

Attempted by 16% of candidates
Average mark 18.1/40 (45%)

Part **A** (i) was less successfully answered by many candidates. The concept of a PIC as a reprogrammable controller was not commonly given in responses. However, most candidates were able to give appropriate examples of where PIC’s are used e.g., microwaves and washing machines. In part **B** (i), candidates had difficulty in giving reasons for using flowcharts when writing PIC programs. Difficulties also arose in outlining the functions of the two commands given and very few candidates successfully completed the flowchart in the correct sequence.

Very few candidates attempted part **C** of this question. However, candidates answered part **D** (i) very well. References were made to the ease of manufacture and accuracy, as positive contributions and loss of jobs as a negative contribution in the use of robotic systems in society. In the final section of part **D,** few candidates were successful in given complete responses. However, a good knowledge of *Degrees of Freedom* was shown though *End Effectors* were rarely fully explained.

Option 2 – Electronics and Control

Attempted by 13% of candidates
Average mark 15.1/40 (38%)

In part **A,** many candidates were successful in giving an explanation of how a capacitor works. Some candidates made reference to the "filling" of the capacitor but not always with electric charge. However, very few candidates were able to give the correct unit of measurement for capacitance.

In part **B,** some candidates were able to give the function of the resistor but few showed an understanding that the two components were included to indicate that the circuit has been activated or switched on. Most candidates correctly identified the variable resistor. However, not all candidates were able to fully explain its function. In the last section of part **B** few candidates managed to correctly redraw the circuit with the positions of the thermistor and variable resistor switched.

Part **C** was not as popular as part **D**. Few candidates correctly identified the given arrangement as a Darlington Pair and, as a consequence, very few were able to describe its function. In the latter part of **C** candidates made good attempts to describe the effect of the inclusion of the Darlington Pair on the circuit. Common answers included that the buzzer would be "stronger", "quicker" and have "more power".

Part **D** (i) was answered very well with most candidates suggesting that in using PCB's it was easier to assemble components and they were more reliable overall. Reference was made to using a CNC router to produce PCB's although not all candidates were aware of the correct name of this machine.

Option 3 – Information and Communications Technology

Attempted by 41% of candidates
Average mark 21.1/40 (53%)

In part **A**, candidates had no difficulty in listing three factors for consideration when purchasing a home computer. Most candidates were able to define ROM and RAM, however, descriptions of each varied in their accuracy and completeness.

In part **B**, few candidates successfully identified the connector to be an RJ-45. References were made to the internet and networks. Most candidates outlined factors affecting the choice of cable very well. Candidates also described the differences between Infrared (IR) and Radio Frequency (RF) reasonably well. In the last section of **B**, candidates successfully gave various examples of security risks when transferring files over a network.

Part **C** was as popular as part **D**. Part **C** (i) was answered very well by most candidates. In the latter part of **C** not all candidates were able to suggest a suitable file format for the manipulated image, but, when they did, they were successful in justifying their selection.

In part **D**, most candidates showed a good understanding of the term *compression* in relation to MP3 files. The last section of **D** was also answered well with candidates being able to suggest arguments in support of, and against the statement given.

Option 4 – Manufacturing Systems

Attempted by 45% of candidates
Average mark 20.8/40 (52%)

Part **A** (i) was answered very well with cheap labour being cited in most cases as a reason for choosing developing countries for the manufacture of running shoes. In the latter part of **A** some candidates had difficulty in giving two negative effects on the environment caused by transporting goods long distances.

In part **B,** most candidates correctly identified mass production to be the most suitable manufacturing process. However, the reasons given for their choice proved to be a greater challenge. Part **B** (ii) was reasonably answered. However, some obscure departments were also cited. Part **B** (iii) was poorly answered with very few candidates being able to suggest any key feature of a system that would ensure high quality manufacture.

Part **C** was not as popular as part **D** with few candidates attempting it. Candidates were generally unsuccessful in identifying UCL and LCL and, as a consequence, were not able to use the information given in the chart about the process in question.

In part **D,** most candidates correctly identified the two areas most contributing to the quality problems. In the latter section of **D** many candidates did not specifically refer to particular problem solving methods. Instead this part of the question tended to be answered in very general terms.

Option 5 – Materials Technology

Attempted by 62% of candidates
Average mark 22.9/40 (57%)

In part **A**, most candidates identified suitable materials and suggested appropriate properties for both the tyre and the bottle.

Most candidates did well in the first section of part **B**. Hardwoods was a common answer given as a suitable wood for the rail. Some candidates had difficulty in distinguishing between permanent and semi-permanent joints for the seat. Strength was one of the main reasons given for using tubular steel for the support A.

Part **C** was not as popular as part **D**. In Part **C** (i) many of the sketches showing the edge profile of the rail were of poor quality. However, most candidates were able to identify appropriate safety precautions. In the latter section of **C** some candidates correctly identified galvanised steel as a suitable material for support A.

In part **D,** most candidates were able to identify a suitable surface treatment however in many instances detail was lacking on how these surface treatments might be applied. In part **D** (ii) most candidates answered this question very well offering recycling and the scaling down of projects as ways to reduce the adverse environmental impact of a project.

3.4 Conclusions

- this examination effectively discriminated between candidates across the attainment range
- the vast majority of candidates demonstrated a clear understanding of the structure of the examination paper. Most candidates presented their work in an organised fashion
- the majority of candidates scored very well in Section A and Section B
- many candidates who did not do well in this examination had not attempted the required number of questions
- 20.2% of candidates did not attempt the required two option questions and 5.9% did not attempt any option question. Some candidates did not attempt the required number of parts within specific questions
- candidates selected a wide range of option questions. Materials Technology was the most frequently attempted optional question and was very well answered
- candidates did very well in questions which had a strong emphasis on the properties & applications of materials, and also on questions relating to health and safety
- the quality of sketching was reasonable at this level. However, some candidates tended to produce small sketches which lacked detail and labeling.

3.5 Recommendations for Teachers and Students

It is recommended that teachers:

- choose the two Optional areas of study as early as possible in the course and focus attention on these in parallel with the Core areas
- highlight the importance of attempting the required number of questions, in particular in Section C. Equally highlight the importance of attempting the required number of parts within each question
- encourage students to read the full examination paper at the start of the examination, before attempting any questions
- familiarise students with all requirements of the written examination
- encourage students to familiarise themselves with Marking Schemes and Sample Solutions to previous examination papers available on the SEC website (www.examinations.ie)
- practise freehand sketching and line diagrams with their students and advise students to use diagrams / sketches to support their answers as appropriate
- advise students to use the full allocation of time allowed to sit the examination.

It is recommended that students:

- focus attention on the chosen Optional areas of study from as early as possible in the course in parallel with the Core areas of study
- attempt the required number of questions and thus maximise their chances of doing well in this component
- read all the examination questions carefully at the beginning of the examination
- be familiar with Marking Schemes and Sample Solutions to previous examination papers available on the SEC website (www.examinations.ie)
- use past papers and marking schemes to practise and become familiar with required techniques and terminology and to practise descriptions of equipment and processes
- practise freehand sketching and drawing line diagrams, use this skill in the examination to convey information and thus gain the marks from questions which require supporting sketches
- use the full allocation of time allowed to sit the examination**.**

4. Written Examination – Higher Level

4.1 Introduction

At Higher Level, the written paper is allocated 200 marks and represents 50% of the Technology examination at this level.

The written examination is of two and a half hours duration and the examination paper comprises three sections:

(i) Section A (72 marks) – 15 short answer questions (core);

(ii) Section B (48 marks) – 2 long answer questions (core);

(iii) Section C (80 marks) – 5 long answer questions (options).

As the Core is mandatory, students are assessed on all main elements of the core in Section A and Section B of the examination paper.

Section C assesses the five Optional elements of the Syllabus which comprise: Applied Control Systems; Electronics and Control; Information and Communications Technology; Manufacturing Systems and Materials Technology.

Candidates are required to attempt any 12 of the 15 questions in Section A.
All questions in Section A carry 6 marks.

Candidates are required to attempt both questions in Section B. Each question carries 24 marks.

Candidates are required to attempt any 2 of the 5 questions in Section C. All questions carry 40 marks.

A total of 527 candidates sat the written examination in Technology at Higher Level in 2009, representing 81.3% of the total cohort. A total of 104 (19.7%) of these were female.

Examiners noted that the examination paper allowed all candidates an opportunity to demonstrate their knowledge of the syllabus, and was generally perceived as challenging but fair.

4.2 Performance of Candidates

The following table and graph show the overall distribution of grades for the Higher Level written examination in 2009. As this is the first year of the examination a comparative analysis from year to year is not possible.

Year	A	B	C	ABC	D	E	F	NG	EFNG
2009	**9.5**	**28.2**	**28.3**	**66.0**	**24.5**	**7.6**	**1.7**	**0.2**	**9.5**

Table 22: Percentage of candidates achieving each grade in the Higher Level written examination 2009

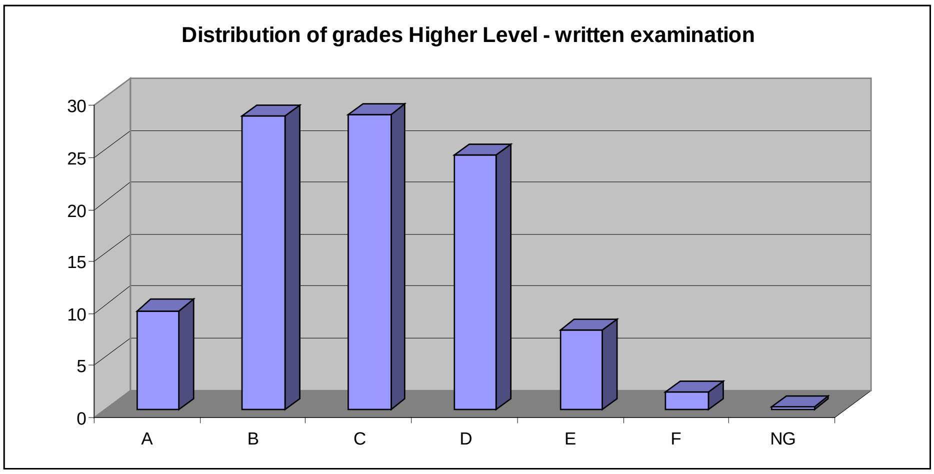


Table 23: Distribution of grades at Higher Level written examination 2009

As can be seen from the table and graph, 66% of candidates at this level obtained a C grade or higher in the written paper in 2009, while a total of 9.5% of candidates did not succeed in achieving a D grade. However, the percentage of candidates failing to achieve a D grade overall (both components combined) drops to 5.3% clearly illustrating that candidates at this level performed well on the student coursework component.

4.3 Analysis of Candidate Performance

The statistical analysis in this section is based on an analysis of all 527 scripts.

The commentary on candidate performance is based on the reports of the examiners who were involved in the marking of this component and should be read in conjunction with the relevant examination paper and marking scheme, which are available on www.examinations.ie

Section A – Core

Overall Average mark for Section A: 50.4 out of 72 (70%)
Section A was attempted by 100% of the cohort.

The following table shows the frequency of attempts for each question in Section A.

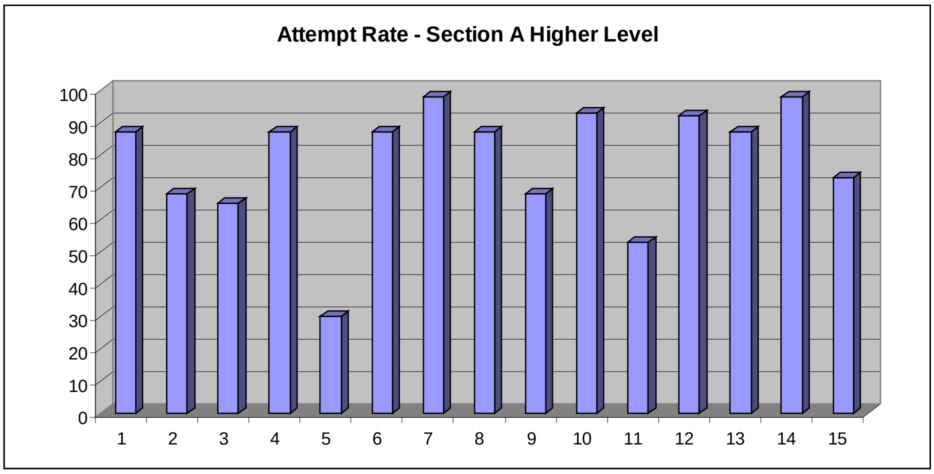


Table 24: Attempt rate – Section A, Higher Level

The table below shows the average mark achieved for each question in Section A.

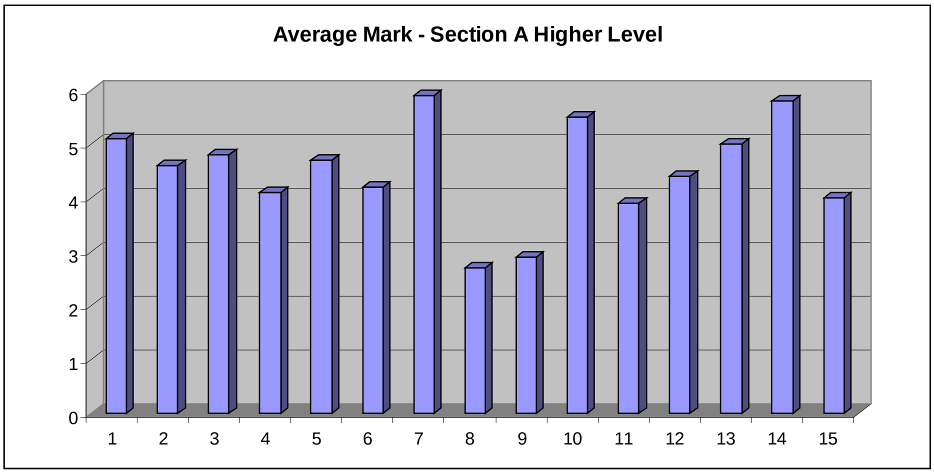


Table 25: Average mark – Section A, Higher Level

Q.1 *Attempted by 87% of candidates. Average mark 5.1*
Possible solutions given included using high grade insulation, renewable energies, A-rated appliances and solar panels.

Q.2 *Attempted by 68% of candidates. Average mark 4.6*
Some candidates were not familiar with the specific WEEE directive. However, this question was well answered with candidates generally demonstrating a good knowledge of recycling.

Q.3 *Attempted by 65% of candidates. Average mark 4.8*
This was well answered with most candidates demonstrating a good understanding of the concepts involved in using logic gates.

Q.4 *Attempted by 87% of candidates. Average mark 4.1*
This was well answered though some candidates had difficulty in establishing the correct gear ratio and as a consequence the output speed of gear C.

Q.5 *Attempted by 30% of candidates. Average mark 4.7*
This was not a popular choice though it was reasonably well answered. Less successful responses interpreted ‘open loop’ as meaning ‘on’ and ‘closed loop’ as meaning ‘off’.

Q.6 *Attempted by 87% of candidates. Average mark 4.2*
This was popular and well answered with candidates showing a good understanding of media types and relative advantages.

Q.7 *Attempted by 98% of candidates. Average mark 5.9*
This was very popular and well answered with clear evidence that candidates related well to this question through their own classroom experiences.

Q.8 *Attempted by 87% of candidates. Average mark 2.7*
This question was quite popular. However, the average mark was low at 2.7. An explanation of plasticity proved difficult for most candidates.

Q.9 *Attempted by 68% of candidates. Average mark 2.9*
While the majority of candidates answered the resistor values correctly, many candidates had difficulty in calculating the 'voltage out' in the given circuit.

Q.10 *Attempted by 93% of candidates. Average mark 5.5*
This was popular and well answered with candidates showing a good understanding of product lifecycle. The most common stages discussed were development, introduction and decline.

Q.11 *Attempted by 53% of candidates. Average mark 3.9*
Most candidates successfully described the operation of a relay but had difficulty in giving a suitable application.

Q.12 *Attempted by 92% of candidates. Average mark 4.4*
Most candidates were successful in identifying the mechanism but had difficulty in giving a full explanation for its suitability in this application.

Q.13 *Attempted by 87% of candidates. Average mark 5.0*
A good understanding of the three orthographic views was evident. However, some candidates mixed up the alignment of views relative to each other.

Q.14 *Attempted by 98% of candidates. Average mark 5.8*
This was popular and well answered with candidates demonstrating an excellent understanding of the properties of materials.

Q.15 *Attempted by 73% of candidates. Average mark 4.0*
Correct identification of the pictorial representation was evident with most candidates applying graphic techniques to enhance the specified components.

Section B – Core

Overall Average mark for Section B: 29.8 out of 48 (62%)

The graph below shows the frequency of attempts and average % mark for each question in Section B.

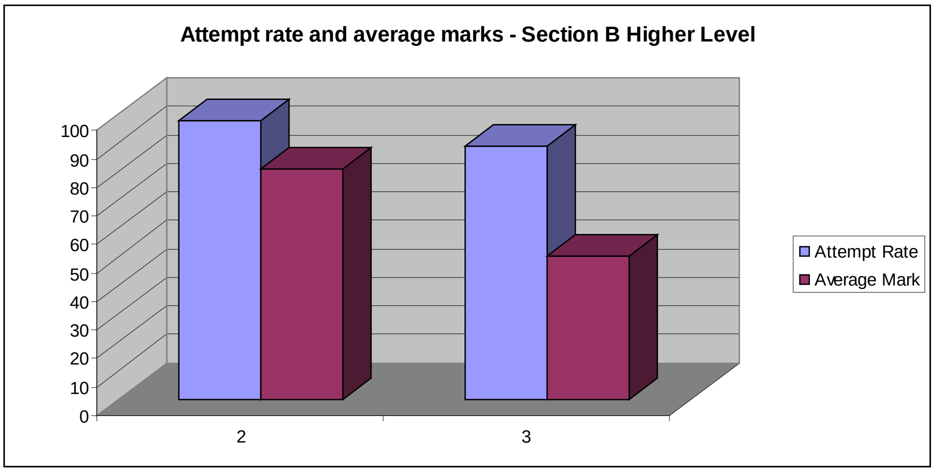


Table 26: Attempt rate and average mark (%) – Section B, Higher Level

Q.2 *Attempted by 98% of candidates. Average mark 19.5/24 (81%)*

In part **A**, candidates related very well to the theme of personal safety in the home and were able to cite various appropriate situations where the elderly might be vulnerable.

In part **B**, some candidates lacked the required level of detail in the Work Breakdown Structure (WBS). The standard of design and sketching demonstrated in many cases was excellent. However, some candidates specified inappropriate gauge materials for vacuum forming. Most candidates selected CNC routering as a suitable production method for PCB's.

Part **C** proved more popular than part **D**. Again excellent sketching of solutions was evident in part **C**. Typical solutions included belt clips or wrist band attachments. The inclusion of LED's was a popular design modification as part of the design solution.

In Part **D,** understanding the difference between characteristics and attributes proved to be difficult for many candidates. As a consequence, part (ii) of this question was poorly answered.

Q.3 *Attempted by 89% of candidates. Average mark 12.1/24 (50.4%)*

This question proved challenging for many candidates, with particular difficulties evident in the application of formulae and in working through calculations.

In part **A**, most candidates were successful in naming, sketching and giving appropriate applications for the different classes of levers, however many struggled with the calculations, in particular, calculating the efficiency of the device.

In part **B** (i), only the most successful responses correctly calculated the load. Difficulty in applying the correct units was frequently evident. In part **B** (ii) most candidates were successful in demonstrating a good understanding of rigidity and design principles. Many used triangulation as their solution to the design fault here.

In Part **C** (i), good quality sketching was evident in drawing a suitable mechanism for the gripper, with a wide variety of suitable solutions shown. Many candidates opted for a 'bicycle brake caliper' type arrangement though some also opted for geared systems. In Part **C** (ii), many candidates had difficulty in calculating the required distance to the position of the counterbalance. Again, difficulty in applying the correct units and formula was evident.

In part **D** (i), candidates demonstrated a good understanding of appropriate circuits to control the motor giving forward and reverse motion – a DPDT switch and variable resistor being the most common solution. In part **D** (ii), candidates demonstrated a good understanding of a wide variety of sensors which could be used to detect the presence of an object in the jaws of the gripper, LDR's and proximity sensors being frequently cited and their application explained.

Section C – Options

Overall Average mark for Section C: 44.2 out of 80 (55.2%)

The graph below shows the frequency of attempts and average % mark for each question in Section B**.**

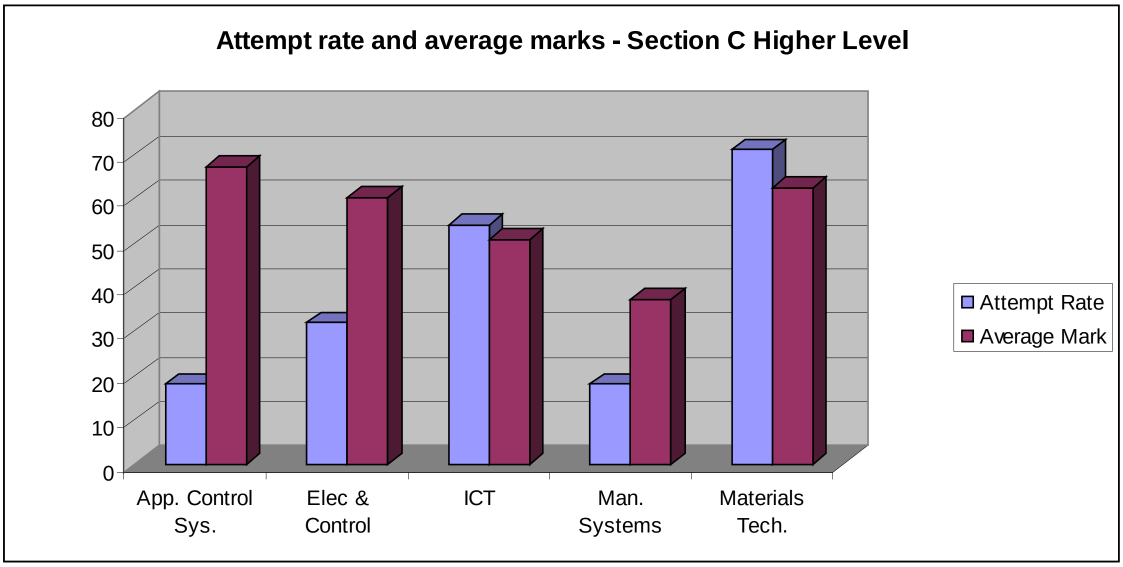


Table 27: Attempt rate and average mark (%) – Section C, Higher Level

Option 1 – Applied Control Systems

Attempted by 18% of candidates.
Average mark 26.9/40 (67.25%)

In part **A**, candidates clearly demonstrated an understanding of microcontrollers and their applications**.** Part **B** (i) was also well answered with the majority of candidates getting full marks for the decision box, and for moving the output box.

In part **B** (ii), candidates were less successful with few achieving full marks. In part **B** (iii), candidates again demonstrated a clear understanding of why a transistor circuit was required.

Part **C** was more popular than part **D**. Part **C** (i) was successfully answered, though some candidates failed to give appropriate examples of robotic control. Few candidates were fully successful in their responses to Part **C** (ii), but did suggest using programmes to control stepper motors, instead of the "Walk through method of Programming". The majority of candidates were able to list problems associated with not aligning the car correctly.

Part **D** was very well answered with most candidates achieving top marks, but some did get the direction of the flow regulator valve incorrect.

Option 2 – Electronics and Control

Attempted by 32% of candidates.
Average mark 24.1/40 (60.25%)

Part **A** was very well answered with candidates successfully identifying parts to be recycled and giving reasons for the EU ban on the disposal of electrical/electronic goods.

In part **B**, the majority of candidates identified the 555 timer. The capacitor and resistor were identified reasonably well but methods of increasing time delay caused some difficulty. In the final section of **B,** some candidates gave the correct formula but only a minority performed the calculation correctly.

Part **C** was less successfully answered - most candidates gave only one configuration for the OP AMP (comparator) with very few managing to give the second configuration (current amplifier).

Part **D** was more popular than **C** and here most candidates successfully identified the 3 logic gates required. However, fewer candidates drew the truth table correctly while some candidates misread the question and gave a truth table for an AND gate. The last section of part **D** caused no difficulty with candidates giving many examples of electronic safety features.

Option 3 – Information and Communications Technology

Attempted by 54% of the candidates
Average mark 26.9/40 (50.75%)

Part **A** was successfully answered with many students applying their experience of social networking sites and demonstrating a good awareness of the methods used to combat cyber bullying. Candidates explained the meaning of URL, often in their own words rather than exclusively in technical terms, but successfully nonetheless. The explanation of parts of the web address was generally good.

In part **B**, candidates outlined clearly the benefits of LAN's. Some found it difficult to explain what a Network Switch was, but defined the Server, Network Card and IP address very well. The block diagram was reasonably well answered but some candidates connected the printer incorrectly. Only the most successful responses gave all steps required to connect a network printer.

Part **C** was more popular than part **D**. In part **C**, few candidates were successful in explaining clearly the differences between vector and bitmap graphics. The explanation of vector representation caused most problems, whereas the bitmap explanation was more successfully answered. Most candidates gave the required three different file formats for the company logo, but were not able to justify their selection in some instances.

In part **D** (i), candidates did well, giving clear descriptions of the various types of software mentioned. However, the latter part of this question was less successfully answered with many candidates failing to demonstrate a full knowledge of *amplitude, sampling rate* and *sample format*.

Option 4 – Manufacturing Systems

Attempted by 18% of candidates
Average mark 14.9/40 (37.25%)

In part **A**, valid answers were given for the reasons for accelerated testing. However, few candidates managed to successfully identify two accelerated tests. The calculation was answered very well with most candidates who attempted it getting full marks.

In part **B**, quality control was explained well. However, quality assurance was less successfully so. Bar charts were used to graphically show the difference between the costs of conformance and costs of non-conformance and in a few cases line graphs were drawn. Most candidates succeeded in calculating the cost of quality from the data given though less were successful in citing appropriate improvements to quality procedures.

In part **C**, few candidates were successful in demonstrating a full understanding of process capability. Because of this, very few candidates were successful in calculating the process capability correctly.

Part **D** was more popular than **C** with most candidates demonstrating a good understanding of *Break Even Quantity* (BEQ). Calculation rather than use of a graph was the preferred method in determining which production process was the most economical.

Option 5 – Materials Technology

Attempted by 71% of candidates
Average mark 25/40 (62.5%)

In part **A**, candidates successfully demonstrated their knowledge of the various material categories. However, the definition of toughness caused problems for some candidates. In part **B**, silicon and titanium were popular choices of material identified as being commonly used in implant technology. Candidates also suggested and justified a wide variety of materials for the various components used in the arm prosthesis. In the last section of part **B**, some candidates confused composites with alloys.

Part **C** was more popular than part **D**. Most candidates showed good understanding of the three types of stress mentioned. This was supported with diagrams to demonstrate directions of acting forces etc. Candidates also drew upon their classroom experience in executing well annotated sketches of the band saw and vacuum former.

Part **D** (i) was less successfully answered with a minority of candidates giving a suitable hardness test. The last part of this question was well answered with most candidates successfully demonstrating their knowledge of CAM technologies and their applications.

4.3 Conclusions

- this examination effectively discriminated between candidates across the attainment range
- many candidates demonstrated a good knowledge of the syllabus and excellent levels of preparedness for the examination
- the vast majority of candidates demonstrated a clear understanding of the structure of the examination paper. Most candidates presented their work in an organised fashion
- the more successful candidates gave structure to their answering by tabulating their answers, using bullet points to highlight and give emphasis, presenting neat and accurate graphs and using sketches and diagrams to illustrate their answers where appropriate
- the majority of students attempted the required number of questions
- candidates selected a wide range of option questions. Materials Technology was the most frequently attempted optional question and was well answered
- the majority of candidates scored very well in Section A
- candidates scored highly in questions which had a strong emphasis on design and which required sketching in relation to design modifications
- candidates did very well in questions which had a strong emphasis on the properties & applications of materials, and also on questions relating to health and safety
- candidates did not score as highly in questions which required calculations, application and use of formulae and, particularly, in questions which were related to calculations on mechanisms
- time management seemed to be a problem in some cases, with candidates spending too long on Questions 2 and 3 (core), and as a result did not have sufficient time to complete the option questions.

4.4 Recommendations for Teachers and Students

It is recommended that teachers:

- choose the two Optional areas of study as early as possible in the course and focus attention on these in parallel with the Core areas
- encourage students to read the full examination paper at the start of the examination, before attempting any questions
- familiarise students with all requirements of the written examination
- encourage students to familiarise themselves with Marking Schemes and Sample Solutions to previous examination papers available on the SEC website (www.examinations.ie)

- practise freehand sketching and line diagrams with their students and advise students to use diagrams / sketches, tables and bullet points to clarify and support their answers as appropriate
- ensure that students are familiar with the application and use of formulae and with common calculations as relevant to the Higher Level syllabus
- advise students to use the full allocation of time allowed to sit the examination.

It is recommended that students:

- focus attention on the chosen Optional areas of study from as early as possible in the course in parallel with the Core areas of study
- read all the examination questions carefully at the beginning of the examination
- be familiar with Marking Schemes and Sample Solutions to previous examination papers available on the SEC website (www.examinations.ie)
- use past papers and marking schemes to practise and become familiar with required techniques and terminology and to practise descriptions of equipment and processes
- practise freehand sketching, drawing line diagrams and using tables and bullet points to clarify and support their answers, as appropriate, and use this skill in the examination to convey information clearly and succinctly and thus gain maximum marks
- practise the application and use of formulae and common calculations as relevant to the Higher Level syllabus
- use the full allocation of time allowed to sit the examination**.**

5. Student Coursework

5.1 Introduction

The Student Coursework is intended to assess intellectual activities such as analysis, research, planning, design and evaluation, as well as practical activities such as materials processing, circuit design and production, mechanism production and integration, CAM and ICT use.

The Student Coursework consists of an artefact and a design folio and accounts for 50% of the overall assessment at both Ordinary Level and Higher Level. Each candidate, at both Ordinary Level and Higher Level, is required to submit an individual artefact and design folio in response to a coursework brief issued by the State Examinations Commission (SEC). The coursework briefs (one at Ordinary Level and one at Higher Level) are issued by the SEC in October of year two of the Leaving Certificate programme with a completion date at the end of the following April. The Student Coursework must be completed in school under the supervision of the class teacher. Each year, the SEC issues instructions to teachers and candidates regarding the requirements for the submission of valid coursework. The SEC policy and practice for the acceptance of practical coursework for assessment are outlined in circulars S68/08 and S69/04. Copies of these circulars are available on the SEC website **(www.examinations.ie).**

On completion, the coursework is securely stored by the relevant school authority until June when it is laid out in the school and marked by a team of visiting examiners appointed and trained by the SEC.

Generally, the student coursework was displayed by schools in an acceptable manner with individual artefacts and reports identified with the candidates' examination number and presented in numerical order at both Higher Level and Ordinary Level. Such an effort is to be commended as it values the effort of the candidates and offers a showcase within the school for the creativity and skills of the candidates. A small number of centres had some inconsistencies with Higher Level and Ordinary level artefacts presented together or design folios absent without any clarification. It has been reported by examiners that school authorities acted promptly and with courtesy to resolve any such issues which arose.

Teachers, students and the school management are to be commended on the success of this first cohort of student coursework as much work was undertaken in setting up rooms, sourcing and ordering equipment, training for new curricular areas and presenting the coursework for assessment.

Coursework briefs for the Technology Student Coursework are designed to support the primary aims of the Leaving Certificate Technology Syllabus, two of which are –

"to contribute to a balanced education, giving students a broad and challenging experience that will enable them to acquire a body of knowledge, understanding, cognitive and manipulative skills and competencies and so prepare them to be creative participants in a technological world"

"to enable students to integrate such knowledge and skills, together with qualities of co-operative enquiry and reflective thought, in developing solutions to technological problems, with due regard for issues of health and safety"

In this context, and in general, examiners reported favourably on the nature and the level of the candidates' solutions to the given briefs. Examiners noted the diversity of design skills in many centres, including creativity, innovation and problem solving. They also commented on the high quality of practical skills exhibited by candidates in coursework artefacts which were manufactured using a wide variety of processes. However, it was also reported that in a small number of centres, the skill level and quality of work varied greatly. The standard of presentation of the design folio was reported as excellent in many centres with excellent use of freehand sketching and ICT based presentation skills. In a minority of centres, there was cause for concern in relation to the standard of finish and presentation of both the artefact and folio.

5.2 Ordinary Level

5.2.1 Coursework brief

The Student Coursework brief, Ordinary Level, 2009 is given below:

Thematic Brief:

Toys for young children are often colourful, exciting and attractive. Many toy shops carry an exciting range of toys. Such toys often incorporate structures, mechanisms and electronics.
Safety is a very important consideration when designing for children.

Design and make an activity-based toy that will be attractive and appealing to a child. The toy should be safe when in use and incorporate a mechanical and/or electronic system.

Note: The maximum dimension of the artefact you present for assessment must not exceed 400 mm.

At Ordinary Level, the Student Coursework is allocated 200 marks and represents 50% of the Technology examination at this level.

Each candidate is required to produce an individual artefact (120 marks) and a design folio (80 marks) in response to a coursework brief issued by the SEC. The candidates are given 15 broad headings under which they are required to respond to the brief. These headings are the assessment criteria against which the coursework is marked and are outlined in the marking scheme which is issued with the brief.

5.2.2 Performance of Candidates at Ordinary Level

A total of 101 candidates presented Technology student coursework at Ordinary Level in 2009. This represents 15.9% of candidates taking the subject at Leaving Certificate level this year.

The following table and graph show the overall distribution of grades for Ordinary Level student coursework in 2009. As this is the first year of the examination a comparative analysis from year to year is not possible.

Year	A	B	C	ABC	D	E	F	NG	EFNG
2009	12.9	30.7	20.8	64.4	20.7	7.9	5.0	2.0	14.9

Table 28: Percentage of candidates achieving each grade in Ordinary Level student coursework 2009

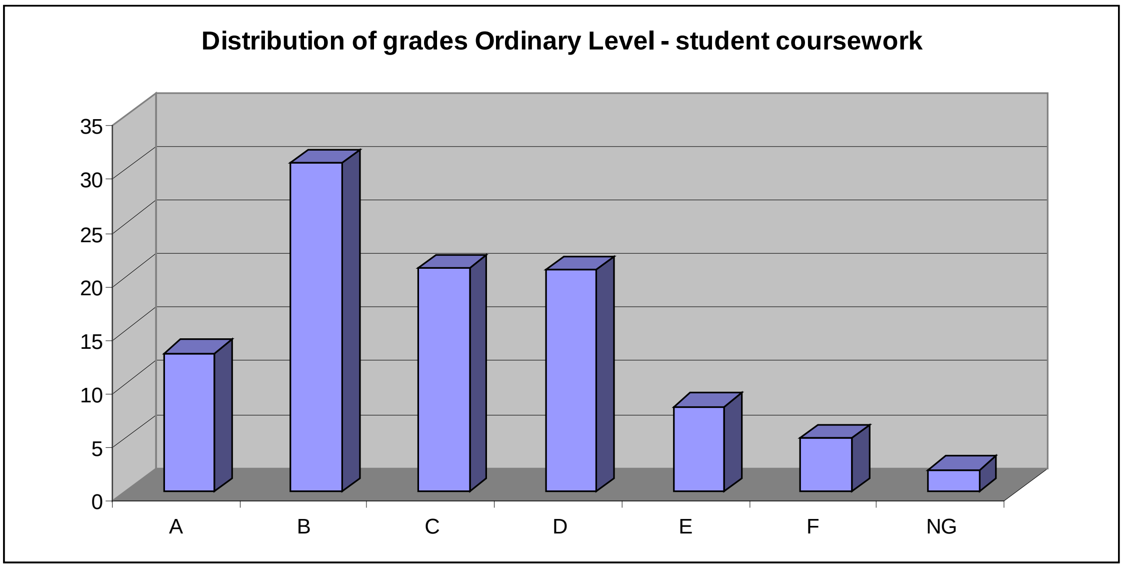
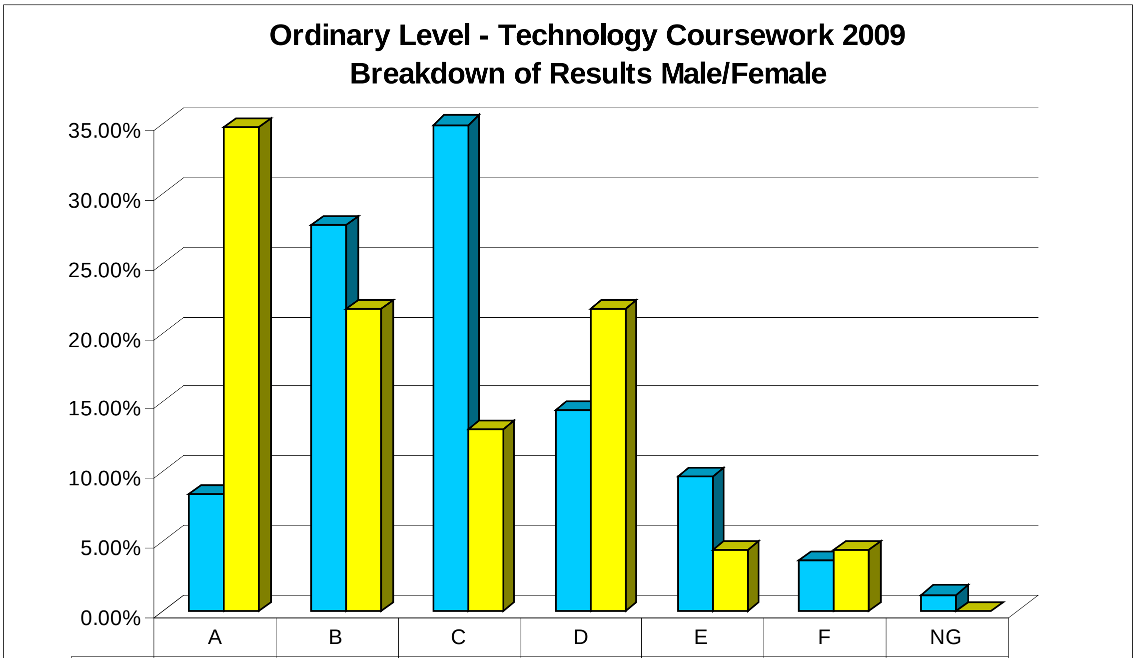


Table 29: Distribution of grades for Ordinary Level student coursework 2009

The grade profile shows that a very satisfactory 12.9% of candidates achieved an A grade, while 64.4% successfully achieved an ABC grade. The proportion of candidates who did not succeed in achieving a D grade was just under 15%. However, 22% of candidates at this level did not submit a design folio which led to a higher EFNG rate than would otherwise have been evident.

It is noteworthy that 21.9% of the cohort was female, which is the highest proportion in any of the technological suite of subjects. The following graph shows the percentage and distribution of grades achieved by male and female candidates as a proportion of their respective cohorts.



	A	B	C	D	E	F	NG
Boys	8.43%	27.71%	34.94%	14.46%	9.64%	3.61%	1.20%
Girls	34.78%	21.74%	13.04%	21.74%	4.35%	4.35%	0.00%

Table 30: Distribution of grades achieved by male and female candidates at Ordinary Level as a percentage of their respective cohorts.

The success of female candidates is clearly evident with more than one in three achieving an A grade at this level. Somewhat surprisingly it was noted that co-educational schools rarely had a significant proportion of female candidates entered for the subject, with most female candidates coming from all-girl schools.

5.2.3 Analysis of Candidate Performance at Ordinary Level

Candidate responses to the Ordinary Level brief produced solutions which ranged from excellent to quite weak. Successful candidates availed of the opportunity to demonstrate research, design, presentation and processing skills to great effect, producing well thought-out, perfectly assembled and functioning artefacts, with high levels of accuracy and finish inherent.

Examiners also reported some poor work, in both the artefact and the folio. This work was often confined to specific centres. 22% of candidates at this level did not present a design folio and thereby lost 40% of the available marks.

An analysis of candidate performance under the main sections of the marking scheme is presented in Table 31

No.	Heading	Mark	Section Total	Average Mark
Design Folder – 80 marks				
1	Analysis, research and investigation	10	**30**	**22.1**
2	Overall management of the project	5		
3	Environmental impact	5		
4	Design ideas and selection of solution	10		
5	Sketches and drawings for manufacture	15	**40**	**24.4**
6	Production planning	10		
7	Product realisation	15		
8	Evaluation and testing	5	**10**	**4.1**
9	Presentation and ICT	5		
Artefact - 120 marks				
1	Artefact meets theme and specification	15	**30**	**23.1**
2	Creativity	15		
3	Production skills	30	**60**	**43.0**
4	Functionality	30		
5	Quality and finish	20	**30**	**21.5**
6	Presentation	10		

Table 31: Average marks awarded for each section, Student Coursework Ordinary Level.

Note: While the general headings and section marks will largely remain the same, the breakdown of marks may vary depending on the actual brief for any given year.

The following commentary is based on the reports of the examiners who marked this component. This commentary examines candidate performance under each of the headings on the marking scheme.

The Design Folio

The most significant contributory factor to poor scores in the Student Coursework component at Ordinary Level was failure to compile a complete design folio which addressed all assessment headings. Furthermore, 22% of candidates did not submit any design folio.

Analysis, research and investigation: *Attempted by 74% of candidates*
The use of the internet as a research tool was much in evidence with many candidates using this as their primary form of research. More successful responses offered an opinion and analysis of the solutions that had been researched, though points offered as an analysis of the thematic brief were often too general and did little to frame the investigation. Candidates in some centres included superfluous material in their folios, often printed directly from the internet. The internet can be a very useful resource, but candidates must show evidence of analysis or reflective thought.

Overall management of the project: *Attempted by 57% of candidates*
This section tended to be either omitted completely or, when included, was well answered. Candidates scored highly when making reference to available resources, time constraints and proposed timeframe.

Environmental impact: *Attempted by 42% of candidates*
More successful responses made reference to types of materials chosen but could have expanded to include reference to energy use in tools and equipment. Some candidates detailed the suitability of materials chosen for recycling and the most successful responses considered the reuse or 'end of life use' of the artefact. This is a new and welcome aspect to coursework.

Design ideas and selection of solution: *Attempted by 72% of candidates*
This section was well attempted with most candidates providing sketches of three possible solutions and giving some justification for their choice of preferred solution. The extent, quality and labeling of sketches could be improved; the use of freehand sketches with effective labels and the inclusion of appropriate colour and shading would contribute much to the quality of work in this section. Some candidates could consider the use of grid or isometric paper as an aid to improving the quality of sketches.

Sketches and drawings for manufacture**:** *Attempted by 58% of candidates*
Less than 10% of candidates scored full marks in this section. A simple rule of thumb appropriate to this section might be "could an external person/company produce the artefact from the information given?" In many instances critical design information was absent and production of the artefact from the information presented would not be feasible. In the less successful responses, drawings were characterised as incomplete, lacking dimensions and presented with a poor level of draughtsmanship. In more successful responses, excellent detail and dimensional information was present together with circuit diagrams and component specifications as appropriate.

Production planning: *Attempted by 44% of candidates*
A materials list was presented by less than half of the total number of candidates. The most successful responses presented their materials list as a table with quantity, material, size and cost included. The process of scheduling or work breakdown structure should be integrated into the design folio but was absent in many instances.

Product realisation: *Attempted by 49% of candidates*
One third of candidates attained full marks in this section. The most successful responses recorded the sequence of preparation, processing and assembly at all stages using a photographic record with appropriate commentary and explanatory notes. Less successful responses provided insufficient detail or omitted processes /stages of the realisation.

Evaluation and testing: *Attempted by 57% of candidates*
The process of evaluation was generally limited to a description of how well the product worked. More successful responses included the identification of modifications and an analysis of their effectiveness. Consideration should be given to a more systematic evaluation through comparison with schedules and stated objectives.

Presentation and ICT:
This was very satisfactory in most instances; folders were generally presented bound having being printed from computer. The most successful responses reflected a flow in the design process, followed a logical sequence in its presentation and included all headings as outlined on the marking scheme. The use of superfluous 'clip art' should be avoided as it does not add materially to the information presented and is wasteful of resources.

The Artefact

Artefact meets theme and specification
Most candidates presented a toy as required. The solutions included shape sorting devices, pull-along vehicles, jig saw games and moveable toys with a mechanism. There was a wide diversity of quality of toys to be assessed. Some less successful responses did not relate to specifications identified by the candidate in the design folio, and lost some marks accordingly.

Creativity
Many of the toys presented were very creative in their design, particularly in the case of candidates who had undertaken significant research into existing solutions. Drawing on this research, these responses tended to demonstrate creativity in their choice of materials, production processes and assembly methods. In general, responses tended to be highly individual with no evidence of group or whole class replication.

Examiners reported a significant use of MDF for the production of toys. Safety concerns would suggest that alternatives be considered especially if the materials are to be machine cut and machine sanded.

Production skills
A significant range of materials was evident in the responses presented. However, many of the processing techniques used were dependent on hand tools, drilling, bandsaw and sander work. Excellent results can be achieved by working in this way, and manual skill levels are developed. However, consideration should be given to the inclusion of processes such as vacuum forming, CNC routing etc., where appropriate.

Functionality
The most successful responses were designed and produced with simple mechanisms and electronics but with a high quality of manufacture and assembly. Less successful responses were overly ambitious in their choice of design and ran into difficulties with production and completion. It could have been expected that a greater degree of electronics control would be integrated in the responses. However, there was very limited use of commercial components in evidence.

Quality and finish
Only the most successful and complete responses scored well under this heading. In the case of the less successful responses, edges of work pieces were unfinished, wooden toys were unvarnished or painted etc. To score well here these issues should be addressed and materials such as acrylics and metals should be filed and polished.

It is essential that the finished artefacts do not pose a health and safety risk for the end user of the product.

Presentation
In the most successful responses, operating features were clearly labeled and visible without dismantling, and careful consideration had been given to the choice of material, colour and texture.

5.4 Conclusions

- in many instances candidates and teachers are to be commended for the display and diversity of design skills, creativity, innovation and problem solving presented
- many candidates also demonstrated excellent practical skills in producing coursework artefacts which were manufactured to very high standards
- some candidates managed their time poorly and thus spent an excessive amount of time on some areas, leaving others incomplete
- some candidates failed to pay adequate attention to safe and neat wiring in the construction of electronic circuits. This resulted in poor placement or housing of the electronic circuit/components/battery, loose wiring and poor soldering
- at Ordinary Level, the folio was frequently the weakest part of the coursework presented. Some folios showed little evidence of research or planning and working drawings were often without dimensions and details
- at Ordinary Level a significant proportion of candidates failed to submit a folio. This is a serious concern as it impinges on the candidate's ability to achieve a high grade both on this component and in the examination as a whole

- ICT was widely and effectively used
- new areas such as the production of Gantt charts, work breakdown structures (WBS), critical path diagrams, analysis of environmental impact and the need for critical reflection on the entire process were generally embraced and worked well for most candidates. These areas will further improve as the cohort of students and teachers become more familiar with them
- there were few areas of concern regarding the authenticity of coursework presented, with all centres having the required signoff sheet completed and coursework presented correctly. Issues of outside assistance, plagiarism and inappropriate collaboration need constant vigilance and a continued awareness of the consequences of such actions
- the SEC acknowledges the assistance of the Technology teachers and the school authorities in the preparation and layout of centres for marking the projects.

5.5 Recommendations for Teachers and Students

It is recommended that teachers:

- display in the Technology room the posters and Directions to Candidates relevant to project work, which are issued by the SEC
- ensure that all examination candidates have a copy of the issued Coursework Briefs and that they fully understand the General Directions to Candidates, criteria for assessment and the outline Marking Scheme
- provide candidates with frequent opportunities to engage with the design process over the two years of study leading to the examination
- guide candidates in planning their work in advance and in devising a project management log or Gantt chart to help them set targets and thus help optimise the use of time spend on coursework
- advise candidates to develop the folio in tandem with the development of the artefact
- encourage candidates to compile the folio by following the relevant headings in the design brief pertaining to the level at which they are submitting coursework
- encourage candidates to develop their range of investigative and research skills
- guide candidates in developing the higher order skills of analysis and evaluation
- practise freehand sketching and line diagrams with their students and advise students to use diagrams / sketches, tables and bullet points to clarify and support their design folio as appropriate
- guide students in the process of finishing of the artefact to the highest standard they can achieve
- ensure that all candidates complete and sign the necessary documentation prior to leaving the school

- securely store all coursework on completion and arrange layout in ascending numerical order for the visiting examiner
- complete and sign the relevant documentation

It is recommended that students:

- read the General Directions to Candidates issued by SEC with the Coursework Briefs, and follow these in the development and execution of their project work
- ensure that they are familiar with the outline Marking Scheme and the criteria for assessment
- manage their time carefully so that an excessive amount of time is not spent on project work, at the expense of the theory component
- keep a project management log, or Gantt chart, detailing target dates set for coursework and recording the work completed by each target date
- develop their folio in tandem with the artefact and ensure that the folio contains a complete contemporaneous record of the work-in-progress. Keep a photographic record of the manufacture of the coursework and all important processes
- compile a folio following the relevant headings in the coursework brief relevant to the level at which they are submitting coursework
- avoid the inclusion of superfluous material in the folio
- show evidence of analysis or reflective thought if including material downloaded from the internet, and credit the source of such material in the folio
- integrate the use of ICT in the development of the folio to enhance its content and presentation
- practise freehand sketching and line diagrams and use these skills to clarify and support their design folio as appropriate.
- ensure that all parts are accessible, especially electronic circuits and mechanisms, as the examiner will need to see them
- pay particular attention to the finishing and the overall presentation of the artefact
- display the completed coursework – artefact and folio – in a neat and attractive manner clearly identified with the relevant examination number.

5.6 Higher Level

5.6.1 Coursework brief

The Student Coursework brief, Higher Level, 2009 is given below:

> **Thematic Brief:**
>
> In the context of the current debate regarding peak oil and gas production, our current modes of transport place huge demand on fossil fuel reserves. Such modes of transport are ultimately unsustainable.
> In exploring the future of transportation, there is increased focus on the importance of sustainable local transport.
>
> *Within the context of contemporary design, with a focus on carbon footprint and environmental impact, design and make a working model of a mode of transport that will help reduce dependency on fossil fuels.*
> *The model should incorporate electronic and/or mechanical systems.*
>
> Note: The maximum dimension of the artefact you present for assessment should not exceed 500 mm.

The Student Coursework at Higher Level consists of an artefact (100 marks) and a design folio (100 marks). Each candidate is required to produce an individual artefact and design folio in response to a coursework brief issued by the State Examinations Commission (SEC). The candidates are given 16 broad headings under which they are required to respond to the brief. These headings are the assessment criteria against which the coursework is marked and are outlined in the marking scheme which is issued with the brief.

The coursework brief for Higher Level was well received by candidates and teachers and was deemed to be a fair but challenging test. The scope of the brief was highlighted by the diversity of the projects presented.

5.6.2 Performance of Candidates at Higher Level

A total of 533 candidates presented Technology student coursework at Higher Level in 2009. This represents 84.1% of candidates taking the subject at Leaving Certificate level this year.

The following table and graph show the overall distribution of grades for Higher Level student coursework in 2009. As this is the first year of the examination a comparative analysis from year to year is not possible.

Year	A	B	C	ABC	D	E	F	NG	EFNG
2009	24.4	30.6	25.0	80.0	14.8	4.7	0.5	0.0	5.2

Table 32: Percentage of candidates achieving each grade in Higher Level student coursework 2009

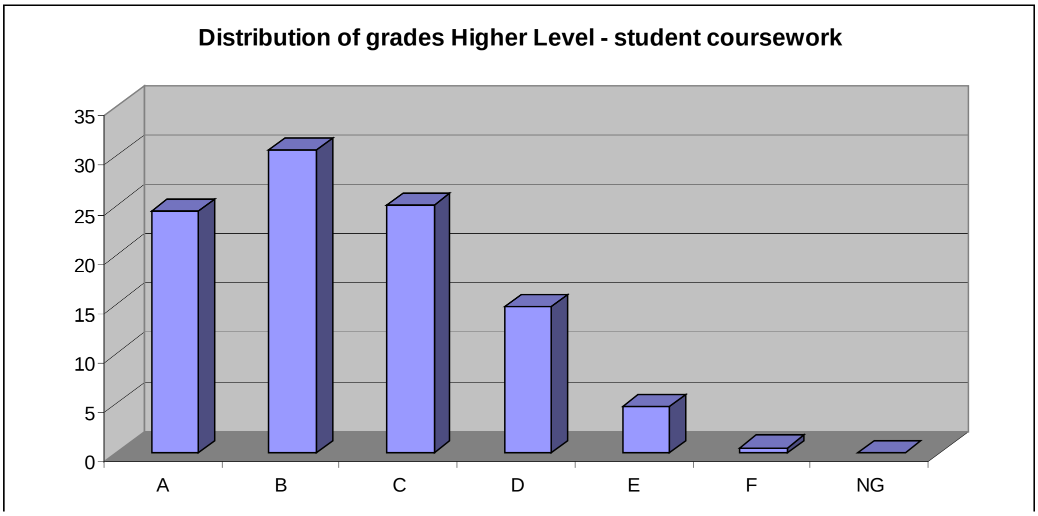
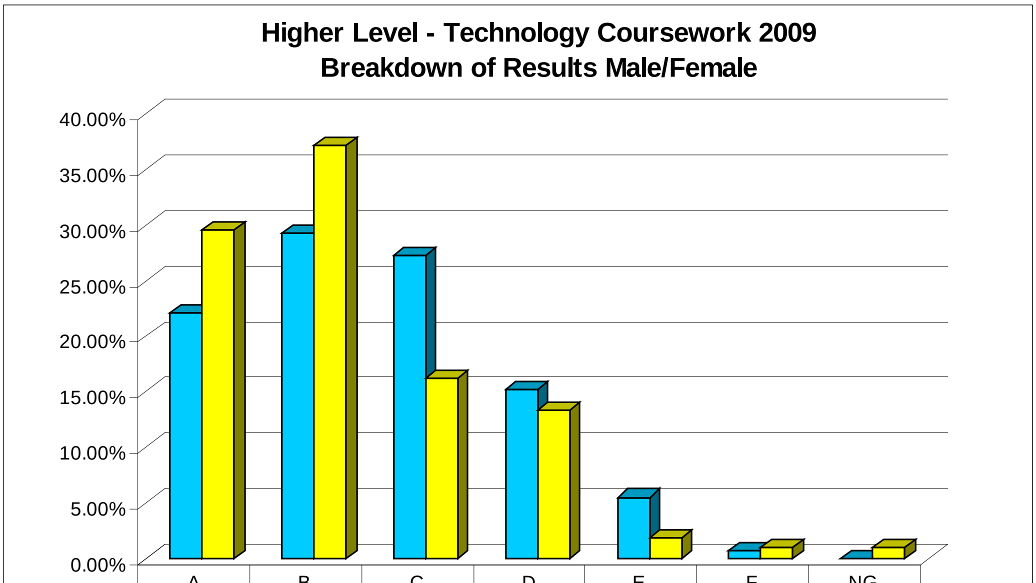


Table 33: Distribution of grades for Higher Level student coursework 2009

The grade profile shows that 24.4% of candidates achieved an A grade, while 80% or four out of every five candidates successfully achieved a C grade or higher in this component, at this level. The proportion of candidates who did not succeed in achieving a D grade was low at just over 5%, though this was largely as a result of the 3.8% of candidates who did not submit a design folio for assessment.

It is also noteworthy that 19.6% of the cohort at this level was female, which is the highest proportion in any of the technological suite of subjects. The following graph shows the percentage and distribution of grades achieved by male and female candidates as a proportion of their respective cohorts.



	A	B	C	D	E	F	NG
Boys	22.12%	29.26%	27.19%	15.21%	5.53%	0.69%	0.00%
Girls	29.52%	37.14%	16.19%	13.33%	1.90%	0.95%	0.95%

Table 34: Distribution of grades achieved by male and female candidates at Higher Level as a percentage of their respective cohorts

The success of female candidates is clearly evident with almost 30% achieving an A grade and over 82% attaining a C grade or higher.

As with Ordinary Level it was noted that co-educational schools rarely had a significant proportion of female candidates entered for the subject, with most female candidates coming from all-girl schools.

5.6.3 Analysis of Candidate Performance at Higher Level

Successful candidates displayed an excellent understanding of energy and sustainability issues while their artefacts and folios reflected a thorough understanding of the design process with creativity, inventiveness and excellent manufacturing skills in evidence. The most successful candidates availed of the opportunity to demonstrate research, design, presentation and processing skills to great effect, producing well thought-out, perfectly assembled and functioning artefacts, with high levels of accuracy and finish inherent.

Examiners also reported some less successful work, often confined to specific centres, in both the artefact and the folio. Incomplete or unfinished work was a difficulty for some candidates as a result of poor initial planning and time management. 3.8% of candidates did not present a folio at this level.

An analysis of candidate performance under the main sections of the marking scheme is presented in Table 35

Note: *While the general headings and section marks will largely remain the same, the breakdown of marks may vary depending on the actual brief for any given year.*

<table>
<tr><th colspan="5">Design Folder – 100 marks</th></tr>
<tr><th>No.</th><th>Heading</th><th>Mark</th><th>Section Total</th><th>Average Mark</th></tr>
<tr><td>1</td><td>Analysis of thematic brief</td><td>10</td><td rowspan="5">50</td><td rowspan="5">36.4</td></tr>
<tr><td>2</td><td>Overall management of the project</td><td>5</td></tr>
<tr><td>3</td><td>Environmental impact</td><td>10</td></tr>
<tr><td>4</td><td>Research, investigation and specifications of brief</td><td>10</td></tr>
<tr><td>5</td><td>Design ideas and selection of solution</td><td>15</td></tr>
<tr><td>6</td><td>Sketches and drawings for manufacture</td><td>15</td><td rowspan="3">35</td><td rowspan="3">24.5</td></tr>
<tr><td>7</td><td>Production planning</td><td>10</td></tr>
<tr><td>8</td><td>Product realisation</td><td>10</td></tr>
<tr><td>9</td><td>Testing, evaluation and critical reflection</td><td>10</td><td rowspan="2">15</td><td rowspan="2">12.3</td></tr>
<tr><td>10</td><td>Presentation and ICT</td><td>5</td></tr>
</table>

Artefact - 100 marks				
1	Artefact meets theme and specification	15	**30**	**23.7**
2	Originality and creativity	15		
3	Production skills	25	**45**	**32.6**
4	Functionality	20		
5	Quality and finish	15	**25**	**18.3**
6	Presentation	10		

Table 35: Average marks awarded for each section, student coursework Higher Level

The Design Folio

A significant factor in the impressive scoring by candidates at Higher Level was, without doubt, the performance in the design folio section of the coursework. Traditionally this has been a weaker link at junior cycle Technology. The release of a sample folder in the training of teachers for the introduction of the subject has been of great benefit.

Project management is crucial towards a successful outcome in this examination component, given the constraints imposed by time and by elements of the brief. It was evident from the folios of many candidates that a structured process had been implemented. This involved analysing the brief, conducting primary research, brainstorming, investigating a number of possible solutions, selecting a final solution, planning their production from Gannt charts and working drawings, and testing and evaluating continuously throughout the process.

At this level only 3.8% of candidates presented coursework without a design folio.

The following commentary is based on the reports of the examiners who marked this component. This commentary examines candidate performance under each of the headings on the marking scheme.

Analysis of thematic brief: *Attempted by 100% of candidates*
The use of the internet in researching the broader context of the theme was impressive, and candidates provided excellent information on fossil fuels, current models of renewable energy, carbon footprint and transportation issues. Candidates scoring highly tended to integrate research, taken from the internet and other sources, in their investigation. Less successful responses tended to copy and paste whole sections of material into their report without any analysis or obvious relevance. The requirement to acknowledge sources of research information, as specified in the instructions to candidates, needs to be borne in mind at all times.

In the most successful responses the key outcomes of this primary research and analysis were used to derive and inform the chosen parameters for the coursework. Less successful responses failed to do this.

Overall management of the project: *Attempted by 82% of candidates*
The most successful responses here made reference to available resources, time constraints and proposed timeframe and used Gantt charts to good effect. The full timeframe available for the student coursework was planned for and all main stages considered and included. Less successful responses tended to use a more generic and less personalized Gannt chart which did not fully and accurately reflect the production of their coursework. Some candidates also used spreadsheets and other software applications to good effect and this is to be commended.

Environmental impact: *Attempted by 86% of candidates*
This section is a new consideration for many candidates undertaking coursework. However, most candidates successfully referred to the impact of the main materials selected in their coursework. The most successful responses considered the embodied energy required in the materials production as well as energy requirements for its processing and finishing. These also made reference to 'end of life' use for their artefact and reflected this in the assembly methods chosen with consideration given to the suitability for recycling of constituent parts.
Less successful responses tended to consider the environmental impact of the finished artefact only and did nor consider this issue at the planning stage.

Research, investigation and specifications of brief: *Attempted by 99% of candidates*
Less successful responses did not focus initial research sufficiently broadly on the theme of transportation but moved instead to a specific area or solution. An analysis of the research data is expected at Higher Level leading to a statement of a final brief for each candidate. A schedule of specifications should then be compiled. The most successful responses followed this process clearly while less successful responses did not identify fully what the outcome of the coursework was to be.

Design ideas and selection of solution: *Attempted by 95% of candidates*
Under this heading candidates are required to present a justification for the final solution selected. This is a higher-order skill and the teacher's role is pivotal in developing this prior to candidates commencing the coursework. The candidates who were most successful presented reasons why their individual solution satisfied the given brief. Some included a discussion on the merits of the selected final solution as compared to the other possible solutions, in terms of satisfying all criteria and specifications of the design brief.

The quality of sketching varied greatly from centre to centre with some excellent examples in evidence, though this was not universal. The candidates who were most successful used clear sketches, diagrams and, occasionally, models or prototypes to arrive at a final solution. It is expected that the optimum solution be clearly identified and justified with strong reference to the specifications and criteria already developed.

Sketches and drawings for manufacture**:** *Attempted by 90% of candidates*
Most candidates provided working drawings. However, the quality of the drawings varied significantly. Some candidate used 'SolidWorks' or other CAD packages to great effect in this section, including both 2D and 3D presentations. This was evident in many centres and was very welcome and appropriate. A simple rule of thumb appropriate to this section might be "could an external person/company produce the

artefact from the information given?". The most successful responses met this criterion. Less successful responses delivered incomplete and poorly detailed drawings which lacked dimensions and with circuit diagrams frequently omitted.

Production planning: *Attempted by 80% of candidates*
The most successful responses presented their materials list as a table with quantity, material, size and cost included. The process of scheduling through work breakdown structure, Gantt charts or critical path diagrams were also integrated into the design folio. Less successful responses frequently omitted this section.

Product realisation: *Attempted by 88% of candidates*
The most successful responses recorded the sequence of preparation, processing and assembly at all stages using a photographic record with appropriate commentary and explanatory notes. Less successful responses provided insufficient detail or omitted processes /stages of the realisation.

This section, in itself provides an excellent verification of the steps taken to complete the coursework. The need to have an on-going record, as work proceeds from the outset, is vital. Some candidates neglected to record the early stages fully or at all and so did not capture a complete picture of the process.

Testing, evaluation and critical reflection: *Attempted by 91% of candidates*
Under this section candidates should ask themselves the question 'does the manufactured final solution satisfy the brief'? Testing of the artefact tends to be an affirmation of the product and process, and the final artefact should be evaluated through comparison with the stated brief and objectives, schedules of manufacture and the identification of modifications to develop the product. The most successful candidates carried out appropriate testing at each stage of their design development and manufacture They often included prototypes of individual components or mechanisms and modified their solution, if appropriate, as a result of this ongoing testing. Less successful responses tended to carry out some testing at the completion of the manufacture only, thereby missing the opportunity for design development and improvement which evaluation and testing throughout the process offers.

Presentation and ICT:
The folio provides an ideal opportunity for the integration of ICT and many candidates integrated ICT very successfully into the folio. This is to be commended. Many candidates included digital images as an ongoing record of work in progress, some candidates included excellent 3D CAD models and almost all candidates provided typed folios. Teachers are to be commended for leading these developments. The folios further displayed a high degree of ICT skills through the use of internet research, tables, graphs, Gantt charts and graphics for work breakdown structures.

The Artefact

The most common solutions presented were based on cars powered directly by solar panels or batteries charged by solar power. Some recognised the limitations of solar power and set up a system to charge large capacitors to drive motors more effectively. Many other modes of transport were recognised including mass transport using buses, trains, trams, boats, and human powered vehicles.

Artefact meets theme and specification

The majority of the artefacts presented met the thematic brief and the specifications identified by the candidate. Less successful responses did not fully outline their specifications at the initial stages and lost some marks as a result.

Originality and creativity

An excellent range of solutions was presented with very effective and innovative designs attempted and generally well executed. There was a reliance on the more common workshop materials, especially wood and acrylic. However, in some centres there was experimentation with modeling foams and polymorph plastics to expand the range of shapes and form that may be generated.

Production skills

The quality of skills displayed varied greatly. Some products were excellently crafted using traditional skills and equipment. Vacuum forming was widely used to produce hollow vehicle bodies but many candidates had difficulty in assembling these thin plastic parts to the rest of the model. The main work in the use of this technique is the production of the mould; this should be displayed with the finished artifact as it highlights a significant volume of work.

Many candidates used basic electronics in the form of a solar panel connected directly to a motor and switch. Others employed PIC circuits to control and drive various modes of transport.

In a large proportion of centres, there was evidence of equipment such as CNC routers etc, but the use of this equipment in producing coursework is not yet as widespread as is desirable.

Functionality

Most candidates were successful in producing an artefact which functioned as required. However, the solar charging units chosen by some candidates were not integrated successfully into their products. As expected with solar powered vehicles, it proved difficult to drive motors directly on solar power but many excellent variations were offered including charging capacitors, very lightweight vehicles, solar charging for batteries, boats not requiring wheels to move, etc.

Quality and finish

It was evident that while some candidates had excellent ideas, they did not have the necessary practical skills or project management skills to realise their solutions. It is noteworthy that some candidates referred to their difficulties in the Evaluation section of their folios. This is good practice as it is evidence of a level of awareness and understanding on the part of the candidate.

An improvement in the quality and finish of presented artefacts is desirable. Issues such as edge finishing of parts, use of adhesives, polishing, loose wiring and inadequate assembly need particular attention and improvement. Most products were finished but attention to quality and detail is expected at this level.

Examiners reported a significant use of MDF. Safety concerns would suggest that alternatives be considered especially, if the materials are to be machine cut and machine sanded.

Presentation

Presentation, finish and completeness are vital components in a successful artefact. Marks were awarded where the candidate paid particular attention to the finishing of individual components and the overall finish and presentation of the artefact. High quality finishes significantly improve the potential for accurate assembly as well as contributing to the overall presentation of the complete artefact. Examiners reported standards of finish and presentation ranging from very high quality to very poor. Examiners also reported that marks were lost by candidates who paid insufficient attention to finish or fine detail and, for example, left sharp edges prominent.

There were few instances of multimedia presentations used to provide a context for coursework presented. This area affords an alternative for candidates to highlight details, such as a testing process, that may not be obvious from the artefact or design folio.

Coursework was generally well presented and labeled. There is an opportunity for candidates to create a special impression with some creativity in presenting their model.

5.7 Conclusions

- in many instances candidates and teachers are to be commended for the display and diversity of design skills, creativity, innovation and problem solving presented
- many candidates also demonstrated excellent practical skills in producing coursework artefacts which were manufactured to very high standards
- some candidates managed their time poorly and thus spent an excessive amount of time on some areas, leaving others incomplete
- some candidates failed to pay adequate attention to safe and neat wiring in the construction of electronic circuits. This resulted in poor placement or housing of the electronic circuit/components/battery, loose wiring and poor soldering
- the quality of the folios submitted was very high in many instances and it was evident that many candidates devoted much time and energy to the development of the folio. However, some candidates who presented very good practical work, paid less attention to the folio and thus lost a significant amount of marks
- at Higher Level, candidates achieved very high grades in their coursework with almost a quarter attaining an A grade

- at Higher Level the folio sections, *'Analysis of thematic brief'* and *'Testing, evaluation and critical reflection'* proved the most problematic, and resulted in valuable marks being lost
- ICT was widely and effectively used
- new areas such as the production of Gantt charts, work breakdown structures (WBS), critical path diagrams, analysis of environmental impact and the need for critical reflection on the entire process were generally embraced and worked well for most candidates. These areas will further improve as the cohort of students and teachers become more familiar with them
- there were few areas of concern regarding the authenticity of coursework presented with all centres having the required signoff sheet completed and coursework presented correctly. Issues of outside assistance, plagiarism and inappropriate collaboration need constant vigilance and a continued awareness of the consequences of such actions
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6. List of Tables included