

OCR Report to Centres

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This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

OCR will not enter into any discussion or correspondence in connection with this report.

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Principal Learning

OCR Level 3 Principal Learning in Engineering H811

OCR REPORT TO CENTRES

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Overview

General Introduction

This is the fifth year of assessment, with this being the eighth award for the Principal Learning units in Engineering. There are nine units at level three and all have been assessed during the five years.

The opportunities for presenters to use the excellent support materials provided and make their views known on the delivery and assessment of units has helped the development of many of the units within the scheme.

Centres are to be congratulated on their efficient administration and prompt delivery of paperwork and compact discs. Centres submitted the Attendance Register and the Centre Authentication Form CCS 160 correctly filled in and on time.

Presenters and markers are reminded that progression across the bands is characterised by (i) increasing breadth and depth of understanding (ii) increasing coherence, evaluation and analysis (iii) increasing independence and originality.

When a disc is being submitted more attention needs to be paid to the labelling of files. In future each learners file must be named according to the following instructions:
Centre number_Candidate number_Unit number_Series.

F556 Engineering business and the environment

This unit was marked by centres and moderated by OCR.

The following points need to be considered:

- Some Centres made some use of contact with local industry
- Learners presented work in a neat and tidy fashion but the use of a treasury tag is to be encouraged
- The specification states that all work must be annotated
- Some use was made of photographs. This and other similar types of media are to be encouraged
- It is recommended that learners might find it useful to divide their folders into sections that follow the assessment criteria. Detailed information can then be found in the specification for each section. It also ensures that all sections are covered
- A number of folders followed the same type of presentation with a similar use of some material. In general terms, the centre should be empowering learners to take charge of their own learning and development
- In some cases, learners need to be shown how to interpret more carefully the evidence requirements for each mark band as it was difficult to find a real progression across the mark bands.

Assessment Criteria 1

The majority of learners were able to give an adequate description of the internal structure of a typical business and were able to identify different roles within the organisation. Some additional supporting evidence of possible career pathways through the business studied would have been useful.

There were some adequate responses in relation to internal and external factors affecting business operations of their chosen studies.

To gain higher marks a more detailed analysis of the risks associated with the business was needed.

Assessment Criteria 2

The majority of learners presented an adequate submission dealing with the roles of a 'Project Management' team and outlined the typical responsibilities of the individual members of the team. The concept of good time management within the team was understood but more detail would have been useful.

To gain higher marks a more detailed explanation was needed in all areas of these criteria.

Assessment Criteria 3

An adequate description and evaluation was given by learners dealing with environmental issues linked to engineering businesses.

To gain higher marks a more detailed explanation and a deeper evaluation was needed in all areas of these criteria.

Assessment Criteria 4

Learners provided an adequate explanation of the possible effects of external environmental factors and how they are managed within a typical business organisation.

To gain higher marks a more detailed explanation was needed in all areas of these criteria.

Assessment Criteria 5

All learners undertook a simple chemical analysis using local environmental samples presenting their findings in a clear and logical format. Good use was made of graphs and photographic evidence by a high proportion of learners. To gain higher marks a more detailed analysis and evaluation of results was needed.

F557 Application of computer aided designing

This unit was marked by centres and moderated by OCR.

The following points need to be considered:

- Most learners presented work in a neat and tidy fashion. In some cases the work needed to be more securely fastened
- All learners should present a contents list with page numbers and then make sure that the numbers appear on the URS888 and the work
- It is recommended that learners might find it useful to divide their folders into sections that follow the assessment criteria. Detailed information can then be found in the specification for each section. It also ensures that all sections are covered
- A number of folders followed the same type of presentation with a similar use of some material. In general terms, the centre should be empowering learners to take charge of their own learning and development
- In general terms Assessment Objectives 1.1, 2.1 and 3.1 seemed to have had sufficient time devoted to them but Assessment Objectives 4.1, 5.1 and 6.6 seemed to need more teaching/learning time
- In some cases, learners need to be shown how to interpret more carefully the evidence requirements for each mark band and it was difficult to find a real progression across the mark bands.

Assessment Criteria 1

All learners made appropriate and effective use of 2D and 3D software in designing and modelling engineering products.

Assessment Criteria 2

The majority of learners produced detailed and accurate drawings to specified British and International standards. In a few cases one or two dimensions appeared to be missing. A number of drawings did not have on them a name or date when they were produced.

Assessment Criteria 3

The majority of learners produced realistic and high quality presentation drawings which adequately communicated design intentions.

Assessment Criteria 4

In a number of cases more detail and attention needed to be paid to the selection of appropriate materials and processes when designing for manufacture. Many learners did not provide an in-depth response to the testing and modification of design ideas.

Assessment Criteria 5

A high proportion of learners did not carry out detailed research to identify and evaluate a wide range of applications of CAD/CAM within design and manufacturing systems.

Assessment Criteria 6

A high proportion of learners did not carry out detailed research to identify and evaluate a wide range of applications of concurrent engineering within design and manufacturing systems.

F558 Selection and application of materials

This unit was marked by centres and moderated by OCR.

The following points need to be considered:

- Some Centres made some use of contact with local industry
- Learners presented work in a neat and tidy fashion but the use of a treasury tag is to be encouraged
- The specification states that all work must be annotated.
- Some use was made of photographs. This and other similar types of media are to be encouraged
- It is recommended that learners might find it useful to divide their folders into sections that follow the assessment criteria. Detailed information can then be found in the specification for each section. It also ensures that all sections are covered
- A number of folders followed the same type of presentation with a similar use of some material. In general terms, the centre should be empowering learners to take charge of their own learning and development
- In some cases, learners need to be shown how to interpret more carefully the evidence requirements for each mark band as it was difficult to find a real progression across the mark bands.

Assessment Criteria 1

Learners carried out research into atomic structures, amount of bonding, periodicity and classification and classification of engineering materials in an adequate manner. More detail was needed regarding an in depth analysis and evaluation of materials and how a material was selected for a particular application.

Assessment Criteria 2

Learners investigated thermal equilibrium diagrams for a selection of alloys but more detail was needed when drawing conclusions from their findings. A range of materials were used for destructive and non-destructive testing. More detail was needed when carrying out an in depth analysis and evaluation of the testing procedures.

Assessment Criteria 3

Learners investigated the effects of different processing methods by testing and analysing a range of materials in a limited manner. More detail was needed when testing and analysing samples of the processing methods and the subsequent action that was taken.

Assessment Criteria 4

Learners investigated safety factors and modes of failure within a range of materials in a limited manner. Examples of failures were identified but more detail was needed in the explanation of the measures taken by a design engineer to anticipate, minimize and manage risks.

Assessment Criteria 5

More care needs to be taken in the selection of a product. The product must be made from a wide range of engineering materials. In some cases a list of materials needed to be presented in a clearer manner. More detail was needed when establishing the identity of the material, their properties and the reason why it was chosen to be used in that particular product.

Some evidence was provided about the original form in which the material was supplied and the process that was used for its manufacture but to obtain higher marks much more detail was needed.

Assessment Criteria 6

Learners seemed to have an awareness of the latest developments in the technology of new and smart materials. Learners investigated new and smart materials but more detail was needed on how such materials could be applied in engineering applications.

F559 Instrumentation and control engineering

Section A – Nine short answer questions

- 1 This was a popular question attempted by all learners with a number being awarded full marks for being familiar with block diagrams. It is important that in this type of diagram the direction of flow through the system should be clear.
- 2 The formula for gain in a positive feedback system was not particularly well known. There were some errors in the detail but some learners gained the mark for this question.
- 3 Generally well answered with a number of learners being awarded full marks. Most learners knew that feedback was the difference between open and closed loops systems. In some cases it was not made clear that the open loop system is linear.
- 4 The majority of learners gained at least one mark for naming a sensor that monitored fluid pressure.
- 5 This was not a popular question. The majority of learners had difficulty in explaining what was meant by the term 'actuator'.
- 6 Very few learners could state correctly any characteristic of an ideal operational amplifier.
- 7 The majority of learners gained at least one mark for drawing the symbol of a single acting cylinder. The position of a spring was not well known and the quality of the drawing was poor. In a number of cases the single acting cylinder was drawn with the piston out-stroked.
- 8 The majority of learners gained at least one mark for stating a practical application that uses a servo control system.
- 9
 - (a) The A-D Converter was generally well known with the majority of learners being awarded the available mark.
 - (b) The concept of multiplexing was not widely known.

Section B Four questions from eight to be answered.

- 1 The majority of learners answered this question, with most gaining some marks in all three parts.
 - (a) Most responses had good examples of the practical applications of an LDR. A few learners gave very similar responses which were based on lighting.
 - (b) The majority of learners answered this correctly.
 - (c) The use of an LDR to operate a control circuit was not well known and most responses included an inaccurate drawing of a circuit diagram with poor labelling.

- 2** This was not a very popular question.
- (a)** Generally well answered with the majority of learners naming each component correctly
 - (b)** Most learners gave correct examples of practical applications of a pneumatic system. The answers provided were wide ranging. There were a few instances of inappropriate applications which use hydraulic rather than pneumatic systems
 - (c)** The majority of learners could not correctly describe how the pneumatic circuit operated. Many learners were confused about the use of 3-port and 5-port valves. The action of a 5-port valve and use of a pilot air signal to actuate the valve was not widely understood
- 3** A fairly popular question badly answered.
- (a)** The meaning of the term 'feedback' in a control system was generally well known with the majority of learners being awarded full marks
 - (b)** The majority of learners could not draw a correct circuit diagram of an inverting operational amplifier. The symbol for the operational amplifier was generally known but the positioning of the feedback resistor was not
 - (c)** The formula for overall gain in a positive feedback amplifier was not very well known. A few learners correctly stated and used the formula to determine the overall gain. In general those who had attempted this part did gain marks for the calculations.
- 4** A fairly popular question badly answered.
- (a)** The majority of learners could not explain the purpose of a 'monitoring control system'. Very few learners made any reference to the fact that it is to make sure that no unexpected conditions or events occurred
 - (b)** In general the examples chosen for this part were close enough to gain the marks; choice of a valid practical application would have been easier if the operation of the monitoring control system had been appreciated
 - (c)** The majority of learners chose three examples from the six given. The most popular ones being the detectors, bell box and the panic button. Written explanations were in some cases very brief and did not explain how the chosen item was used in a monitoring system.
- 5** This was not a popular question.
- (a)** The term 'signal conditioning' was not fully understood by most learners.
 - (b)** The purpose of a feedback path in this context was generally well known with the majority of learners being awarded full marks.
 - (c)** Written explanations were in some cases very brief and did not explain the function of the selector, control circuit or the output transducer.

- 6** This was not a popular question.
- (a)** The term 'Proportional plus integral plus derivative mode (PID) controller' was not generally well known
 - (b)** A few learners gave correct examples of practical applications of a PID controller. The answers provided were wide ranging. There were a few instances of inappropriate applications
 - (c)** Some learners correctly described the manner in which PID's have had an impact on instrumentation and control systems.
- 7** This was not a popular question.
- (a)** The term 'data signal transmission' was not well known but those learners who did attempt it generally gained marks
 - (b)** A few learners gave correct names for types of sensing elements
 - (c)** The majority of learners could not draw a correct circuit diagram for a piezo-electric ultrasonic wave detector. In a number of cases the description that followed was incorrect.
- 8** This was a popular question.
- (a)** The term 'simulation software' was well known to the majority of learners and many of the explanations included details of software that was familiar to the learner
 - (b)** The benefits of using simulation software were well known to the majority of learners
 - (c) (i)** A majority of learners stated correctly the three changes needed to enable the multi-meter to measure current in the motor
 - (c) (ii)** The description of why the changes were necessary proved to be a little more difficult. Learners need to be reminded that an ammeter is always connected in series with a component and that to measure current the multi-meter dial must be set at A.

F562 Innovation, design and enterprise

This unit was marked by centres and moderated by OCR.

The following points may need to be considered:

- it is essential that an internal moderation system is implemented. This would ensure consistent assessment decisions and is a key to good practice
- Most learners presented work in a neat and tidy fashion but the use of a contents list with page numbers should be encouraged
- It is recommended that all learners divide their folders into sections that follow the assessment criteria. Detailed information can then be found in the specification for each section. It also ensures that all sections are covered
- In a number of cases learners needed to state at the beginning of the work which product and entrepreneur was being considered
- The specification states that all work must be annotated
- Some use was made of photographs; this and other similar types of media are to be encouraged
- Most of the folders observed followed a standard type of presentation with similar material being used. In general terms the centres should be empowering learners to take charge of their own learning and development.

Assessment Criteria 1

Virtually all learners scored well in this area. Learners generally planned and carried out thorough research into a successful engineered product, referencing it to an associated entrepreneur.

Sources of research were, in the main, well documented, acknowledged and included as part of their evidence.

Assessment Criteria 2

Learners generally showed a good awareness of how early entrepreneurship gives rise to a range of new and innovative products. Many had carried out an analysis of their chosen product and provided good evidence of how it can be developed using new and emerging technologies.

Higher marks could have been obtained by giving a deeper analysis of the product as an example of an innovative engineering design.

Assessment Criteria 3

Some learners needed to give more detail concerning the issues of marketing and selling the new product. Other learners did not give sufficient detail when critically evaluating the commercial aspects of the product.

The principles of developing, marketing and selling a new product should have included: market research, protecting ideas, business planning, start-up costs, finance and grants, taxes, health and safety, IT and e-commerce, sales and marketing.

Assessment Criteria 4

A reasonable awareness was shown by some learners regarding the environmental and social impacts of engineering activities. Other learners needed to be more aware of the local and global impact of engineering in terms of: resources, noise, ecology, biodiversity and climate. In some cases the learner needed to produce a detailed evaluation of the environment and social impact of the product studied. A number of learners needed to give more detail of the social impact of engineering, locally and globally in terms of: economic wellbeing, physical safety, health and security.

Assessment Criteria 5

Some learners presented a reasonable description of sustainable engineering and drew valid conclusions as to whether their chosen engineered product could be construed as being an example of sustainable engineering. More detail could have been provided describing sustainability in terms of energy, materials, chemicals and water. The use of materials that are renewable within the lifetime of the product they are part of and that are capable of return to ecological systems to perform useful function was not fully covered by many learners.

F563 Mathematical techniques and applications

Section A Fifteen short answer questions

- 1 Generally well answered but in a few cases learners did not correctly state + 20.
- 2 Generally well answered.
- 3 A mixed response. A number of learners could not correctly deal with the denominators of 4 and 8.
- 4 Generally well answered. In a few cases after finding $6x - 9 = 4x - 4$ learners could not correctly arrive at $x = 2.5$
- 5 A badly answered question. Most learners could not quote the correct formula for the area of a sector.
- 6 A mixed response. A number of learners could not state that $\sin 30^\circ = BC/1.5$
- 7 Generally well answered.
- 8 A mixed response. A proportion of learners stated the incorrect formula for the area of a triangle.
- 9 Generally well answered. In a few cases the rules of differentiation were not known.
- 10 A mixed response. Most learners differentiated $\cos x$ but a multitude of incorrect answers were given for $\ln(5x)$
- 11 A mixed response. Most learners could not correctly carry out the integration.
- 12 A mixed response. Most learners could not correctly calculate the value of the given definite integral.
- 13 Generally well answered.
- 14 A badly answered question. Most learners could not correctly draw a distribution curve with a positive skew.
- 15 Generally well answered.

Section B The learner had a choice of answering three questions from eight.

- 1 A very popular question.
 - (a) Generally well answered with a majority of learners giving the correct response of 16.
 - (b) (i) The majority of learners could not transpose the given formula correctly.
 - (b) (ii) The majority of learners could not correctly calculate a value for t .
 - (c) Generally well answered.

- 2** Not a very popular question. Presenters and learners are urged to re-read the specification that deals with quadratic equations. In particular Assessment Criteria 1.13, 1.14 and 1.15.
- 3** Not a very popular question.
Presenters and learners are urged to re-read the specification that deals with Learning Outcome 2. In particular the examples (a) and (b) quoted in the exemplification column.
(b) A number of learners needed to remember to set their calculators to radians mode rather than degrees.
- 4** A popular question.
- (a)** Generally well answered with a majority of learners giving the correct response that the length of the path BA is 377.42 m.
- (b)** Generally well answered.
- (c)** Generally well answered with a majority of learners giving the correct response that the angle BAC is 103° .
- 5** Not a very popular question.
The majority of learners did not attempt this question. Presenters and learners are urged to re-read the specification that deals with Learning Outcome 3 and Assessment Criteria 3.4.
- 6** Not a very popular question.
The majority of learners did not attempt this question. Presenters and learners are urged to re-read the specification that deals with Learning Outcome 3 and Assessment Criteria 3.11 and 3.12.
In particular the examples (a), (b) and (c) quoted in the exemplification column.
- 7** Not a very popular question.
- (a) (b)** The majority of learners had little understanding of the addition and multiplication laws for probability.
- (b)** The method for calculating the probability that there are two screws and either a washer or a nut when three items are drawn at random, without replacement, was not well known.
- 8** A very popular question.
- (a)** Generally well answered with a multitude of correct words being used.
- (b)** Generally well answered with a well drawn labelled bar chart.
- (c)** A mixed response. Learners calculated correctly the mean value for the data but the majority could not calculate correctly the standard deviation.

F564 Scientific principles and applications

This unit was marked by centres and moderated by OCR.

It was a pleasure to see so many well presented solutions to the tasks/experiments from learners who had clearly developed a very sound understanding of the principles and techniques required for this unit.

The following points need to be considered:

- Learners presented work in a neat and tidy fashion but the use of a contents list with page numbers is to be encouraged
- The annotation found on the Unit Recording Sheet for each learner work was found to be useful
- Some use was made of photographs. This and other similar types of media are to be encouraged
- In some cases more care needs to be taken when using units and symbol abbreviations
- Centres are reminded that the OCR Web page is always being updated and should be regularly looked at. For the next submission the latest model assignment is available with some details as follows:

For assessment you will undertake ten tasks which will cover the Learning Outcomes.

Task	Learning Outcomes
1	1 Forces and Motion and 2 Kinematics
2	3 Dynamics and 4 Force, Work and Power
3	5 Deformation of solids and 17 Properties of Materials
4	6 Electricity
5	10 Gravitational Fields, 11 Electric Fields and 12 Capacitors
6	13 Electromagnetism and 14 Electromagnetic Induction
7	15 Thermal physics and 16 Nuclear Atom and Radioactivity
8	18 Electronics
9	7 Quantum Physics, 8 Electromagnetic Waves and 9 Waves
10	19 Chemical Reactions and 20 Organic Compounds and functional groups

Each task will be marked out of 30 marks giving a total of 300 marks for this unit.

Learners submitted a folder of ten tasks/experiments to satisfy the assessment requirements for this unit. Each experiment consisted of eleven points. The learning outcome 'Health and Safety' did not appear as a separate point but was inherent throughout the conduct of all of the experiments.

Title, description and theory

Learners stated a title, gave a thorough explanation of the theory behind the experiment with fairly detailed knowledge being presented and adequately described the stages involved in the experiments. In some cases there were omissions and inaccuracies.

Equipment, diagrams and photographs

Learners listed the equipment used with a reasonable degree of accuracy but a few learners needed to make clear that they could find and use the same equipment again if the experiment needed to be repeated. Other learners made use of identification codes. Most learners produced clearly drawn diagrams, fully and accurately labelled. The use of annotated photographs was found to be very useful in the moderation process.

Methodology

Learners described in reasonable detail the method of carrying out the experiments and gave details of any health and safety issues that needed to be considered. In some cases more detail was needed about how the experiment had been carried out and much more emphasis needed to be placed on health and safety matters.

Results, format and errors

Learners generally produced results in the form of a table. Tabulated data, as seen, is much easier to interpret and use than a disconnected collection of numbers. The labelling of the table, in some cases was not completely accurate. Most learners stated the correct quantity but did not correctly state the unit.

Where appropriate, graphs were drawn to a sensible size with accurate labelling of axes. It was obvious from the graph where data had been taken from to work out subsequent values. A number of learners could have made a more detailed statement of how accurately the results had been taken and how many errors had been found and how these errors had been dealt with. It is often a useful practice to leave the equipment intact so that if errors or omissions become obvious it is possible to check previous observations since the equipment is still available for use.

Conclusion

In some cases learners needed to give a more detailed explanation of their conclusions giving in particular a more in-depth evaluation of all aspects of the experiment.

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