OCR
RECOGNISING ACHIEVEMENT

Principal Learning

Engineering

OCR Level 3 Principal Learning in Engineering **H811**

Reports on the Units

June 2010

H811/R/10

Oxford Cambridge and RSA Examinations

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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

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REPORTS ON THE UNITS

Chief Examiner's Report

General Introduction

This is the second year of assessment, for the Principal Learning units within the Diploma in Engineering.

The opportunities for presenters to attend INSET, 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. All presenters are encouraged to attend one of a number of opportunities that are available for training.

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

There is evidence that some centres are becoming systematic in their approach to this diploma. With this systematic approach in mind centres should consider the learners' complete learning experience when designing learning programmes. This is particularly important in relation to learners studying part time alongside real work commitments where they may bring with them a wealth of experience that should be utilised to maximum effect by presenters.

When there are a number of centres in the consortium it is essential that an internal standardisation system is implemented. This would ensure consistent assessment decisions and is a key to good practice.

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

Unit F556 Engineering business and the environment

This unit was marked by centres and moderated by OCR.

Most learners presented work in a neat and tidy fashion but the use of a contents list with page numbers is to be encouraged.

A high proportion of learners used a local engineering business as their model for covering this unit. This practice is to be encouraged.

Assessment Criteria 1
The majority of learners were able to give an adequate description of the internal structure of a typical business, and did identify different roles within the organisation. Some additional supporting evidence on possible career pathways through the business studied would have been advantageous.

There were some good responses in relation to internal and external factors affecting business operations of their chosen studies along with a brief analysis of risks associated with running both small and large businesses.

Assessment Criteria 2
The majority of learners presented a good overall 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 well understood with viable examples being given.

Assessment Criteria 3
These sections were particularly well covered, with learners giving valid reasons and explanations regarding the environmental issues related to business in respect of controlling contamination of air and water, and controls to reduce solid and liquid waste materials.

Assessment Criteria 4
Learners provided sound judgements on the possible effects regarding external environmental factors and how they are managed within a typical business organisation.

Assessment Criteria 5
All learners undertook a simple chemical analysis using local environmental samples and presented their findings in a clear and logical format.

Unit F558 Selection and application of materials

This unit was marked by centres and moderated by OCR.

The following points need to be considered:

- Centre staff must make more comments on the Unit Recording Sheet in the teacher comments panel provided. The column headed 'Page' also needs to be completed.
- Most learners presented work in a neat and tidy fashion but the use of a contents list with page numbers is to be encouraged.
- Some use was made of photographs. This and other similar types of media are to be encouraged together with much more use of ICT.
- It is recommended that for some learners they 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 and it was difficult to find a real progression across the mark bands.
- 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.

Assessment Criteria 1
Learners carried out research into atomic structures, amount of bonding, periodicity and classification and classification of engineering materials in a limited 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 – Most learners attempted eight questions.

Section B – All learners attempted four or more questions. Centres are reminded to encourage learners to attempt four questions only and spend their time on providing accurate and correct answers rather than wasting time on other questions.

Section A – Eight short answer questions

1 The pressure switch function was not well understood. The on/off aspect of the switch was mentioned but not the actual function of measuring water level in the context of a washing machine.

The heating element was clearly recognised as being an output. The function of the temperature sensor was understood by all learners. The purpose of the solenoid valve was widely understood though learners should remember that responses should refer to the given context. The programmer was recognised as being the process part of the system.

2 The majority of learners could draw an accurate system diagram with the feedback path in the correct position. In all cases the arrows to indicate direction of feedback were omitted, with the loss of a mark.

3 Passive transducers were correctly chosen in the majority of cases; the most common error was to list the solar cell as a passive transducer.

4 Completion of the digital multi-meter diagram was in most cases accurately carried out but learners should note that the switch will not select between two values, it should be positioned next to a value.

5 This question was well answered with clear advantages of a simulation video over a factory visit being noted.

6 No learner gained marks on this question.

7 Very few marks were awarded for this question. Learners appeared to be unfamiliar with the logic probe as a test instrument, the majority not attempting a response.

8 No correct responses were recorded for the gain formula in a system using negative feedback.

Section B Four questions from eight to be answered.

1

(a) The majority of learners answered this question, with most of these gaining marks in all three parts. Learners should be aware that if a practical application is called for a response which is generic will not gain marks; in this case responses such as crash test rigs, robotic weighing and strain measurement in engineering applications gained marks.

(b) All learners answering the question gained marks for their explanation of why it is necessary to measure strain.

(c) This part of the question was not well interpreted by learners. The requirement was for a labelled diagram of how a strain gauge can be used in a control system. In most cases the responses were too general to be awarded marks. Knowledge of factors such as temperature compensation was not demonstrated and the principle of connection in the form of a Wheatstone bridge was not used in any of the responses.

2

(a) This question was attempted by a minority of learners. One practical application was correctly given.

(b) The graph of the proportional controller output was not well answered; marks were available for the correct vertical and horizontal positions as well as the shape of the graph.

(c) The float lever proportional controller was accurately described though more detail would have been beneficial in the diagram.

3

(a) This part of the question required a block diagram as the response; however credit was given to responses demonstrating knowledge of the principle of DA and AD conversion.

(b) The general features of multiplexing were well explained. The fact that measurements can come from more than one location was not reflected in the responses.

(c) The method of parallel AD conversion at component / circuit level were not known; a diagram showing three op amps set up as comparators was expected in the response; the inverting inputs coming from a potential divider chain. Following on from this the application of a reference voltage at the non inverting input and a description of how the comparator output is decided was required.

4

(a) Practical applications for a thermister were generally well known among those learners answering the question, with clear examples being given.

(b) (i) Reading resistance values from the graph was completed accurately and all responses gained the two marks available.

(i) As with the previous part the graph was accurately interpreted as showing a temperature of 0°C.

(c) Generally the block diagram was completed better than the circuit diagram. The circuit diagram should have shown the thermister used as one half of a potential divider with the resulting changing voltage being used to switch a transistor or Darlington pair arrangement connected to an output transducer. A number of possible circuit arrangements would have gained marks in this part.

5
This was a popular question attempted by all learners.

(a) A variety of features found on alarms protecting factory units were correctly identified. A few of these were features which could have been found in any electronic system. Where possible with this type of question learners should be advised to choose features which are peculiar to the system in question rather than those which are generic.

(b) Benefits and uses of security cameras in alarm systems were well known in most cases. Marks were lost through stating a fact and then failing to expand upon it. The question asked learners to 'explain', any assertions made in this type of question should always be justified.

(c) The circuit diagram was a good differentiator between learners. Where a block diagram was used this was taken into account though it did not answer the question. Learners should be aware that annotation of circuit diagrams is very important, in this case in explaining the operation of the circuit. A variety of circuits could have been used but all should have had a power supply, a sensor and an output device.

6
This again was a popular question tackled by most learners.

(a) The term 'open loop control' was clearly understood and all responses gained marks for this part of the question.

(b) This part of the question was well answered. Marks were lost through learners failing to read the question fully; the closed loop system was accurately described but a full comparison was not made with an open loop system.

(c) A number of different circuits could have been used to describe the operation of a water level alarm. Once again full reading of the question was important in order to gain access to all marks. A block diagram and a labelled circuit diagram were required. Only block diagrams appeared in the responses.

7
This question was not attempted by any learner.

8
(a) Attempted by a minority of learners, this first part was answered with realistic examples of industrial applications of a pressure gauge being used.

(b) There were no correct responses to this part. The explanation should have identified absolute pressure as being measured against zero pressure; with gauge pressure including the addition of atmospheric pressure.

(c) With the exception of well drawn diagrams form one learner the question was not well answered.

F560 Maintaining engineering systems

This unit was marked by centres and moderated by OCR.

The following points need to be considered:

- More care needs to be taken when the Unit Recording Sheet is filled in. Incorrect candidate numbers are being quoted and in some cases the candidate number is missing altogether. Centres could provide more teacher comments in the panel provided along with page numbers indicating where evidence can be found.
- Most learners presented work in a neat and tidy fashion but the use of a contents list with page numbers should be encouraged.
- Some limited use was made of photographs. This and other similar types of media are to be encouraged together with much more use of ICT.
- Most of the folders observed followed a standard type of presentation with similar use of some material. In general terms, the centre should be empowering learners to take charge of their own learning and development.

Assessment Criteria 1
Learners, in general, showed an ability to select and construct only a limited range of data and to apply basic statistical methods to it. All learners satisfactorily undertook some form of basic maintenance activity.

Assessment Criteria 2
Learners only showed a basic ability to evaluate the correlation between maintenance plans and operational strategy.

Assessment Criteria 3
Learners need to show a better awareness of the correlation between maintenance plans and operational effects.

Assessment Criteria 4
Learners were generally unaware of the need to carry out a cost benefit analysis in regards to their maintenance plans.

F561 Production and manufacturing

This unit was marked by centres and moderated by OCR.

The following points need to be considered:

- More care needs to be taken when the Unit Recording Sheet is filled in.
- The unit outcome should take the form of a case study based upon an appropriate context.

Assessment Criteria 1
Learners need to give more detail in their descriptions of different types of manufacturing processes and systems. Presenters must make more reference to the list of manufacturing systems given in the exemplification section of the specification for this unit. Learners needed to provide more detail when explaining the advantages and disadvantages of each type of system.

Assessment Criteria 2
Learners needed to give more detail when explaining what was meant by Computer Aided Engineering (CAE), Computer Aided Manufacture (CAM) and Computer Numerically Controlled (CNC) machines. To gain marks in the higher band learners needed to identify in detail the applications of CAE, CAM and CNC within an engineering manufacturing system. The understanding and advantages of rapid prototyping was not well known

Assessment Criteria 3
In some cases it was difficult to understand which manufacturing system had been chosen for study by the learner. The recording of the investigations and research into assembly systems, quality control, quality assurance and statistical process control was not well known by learners.

Assessment Criteria 4
Most learners did not produce a detailed production plan. Much more detail was needed on assembly systems and techniques, quality control and quality assurance requirements and statistical process control.
More information was needed about industrial visits, videos and visiting speakers.

Assessment Criteria 5
Learners needed to give much more detail when producing a coherent detailed project plan and schedule for the production of an engineering product. Presenters need to spend more time with learners when Gantt charts are being produced.

F562 Innovation, design and enterprise

This unit was marked by centres and moderated by OCR.

The following points need to be considered:

- More care needs to be taken when the Unit Recording Sheet is filled in. Incorrect candidate numbers are being quoted and in some cases the candidate number is missing altogether. Centres could provide more teacher comments in the panel provided along with page numbers indicating where evidence can be found.
- Most learners presented work in a neat and tidy fashion but the use of a contents list with page numbers should be encouraged.
- Centres must ensure that learners choose an entrepreneur and not an inventor.

Assessment Criteria 1
A majority of learners scored well in this area. Learners planned and carried out a quite thorough research into a successful engineered product and referenced it to an associated entrepreneur. Sources of research were, in the main, well documented and 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.

Assessment Criteria 3
Good descriptions were provided relating to the commercial issues of developing and marketing new and innovative products especially in relation to their own chosen items.

Assessment Criteria 4
A reasonable awareness was shown by most learners regarding the environmental and social impacts of engineering activities.

Assessment Criteria 5
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.

F563 Mathematical techniques and applications

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

Section A – Most learners attempted fifteen questions.
Section B – All learners attempted three or more questions. Centres are reminded to encourage learners to attempt three questions only and spend their time on providing accurate and correct answers rather than wasting time on other questions.

When attempting a question a few learners gave a final answer without showing any working. It is always in the best interest of the learner to show as much detail as possible because if the answer is incorrect nothing can be awarded but if information is provided of how the final answer was arrived at, marks can often be awarded for the methods employed.

Section A Fifteen short answer questions

1 Generally well answered.

2 Candidates were given credit for any reasonable answer.

3 Generally well answered. In a few cases after finding (4x + 8 - x – 5)/6 it was disappointing to find learners could not correctly deal with + 8 and – 5.

4 Generally well answered. In a few cases after finding 6x - 8 = 5x + 6 learners could not correctly arrive at x = 14.

5 A badly answered question. Learners could not recall the formula for the length of an arc of a circle which is clearly stated in assessment criteria 2.3 together with an example in the exemplification column.

6 Generally well answered.

7 Generally well answered.

8 Generally well answered. In a few cases the unit of area was given as mm and not mm^2. However, full marks were awarded for a numerical response of 1500.

9 Generally well answered. In a few cases the rules of differentiation were not known.

10 In some cases the learners could not differentiate sine and cosine correctly.

11 In some cases the rules of integration were not known and a number of learners omitted the constant C.

12 Generally well answered.

13 A high proportion of learners answered this question correctly. A few did not know what to do with the 11 and 12.

14 A high proportion of learners answered this question correctly. Full marks were awarded for a numerical response of 15.5.

15 A high proportion of learners answered this question correctly.

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

1
No responses.

2
(a) The equation of the curve was determined correctly by a number of learners but a few omitted the constant C.

(b) The integration of sin 4x, 2cos 3x, and √x was not well known

(c) A proportion of learners integrated the equation v = 16t - 6t^2 correctly but could not calculate correctly the constant C when time t = 0. This then led to an incorrect solution for the distance for a time t = 3 s.

3
No responses.

4
No responses.

5
(a) Generally well answered. The quality of drawing was to a high standard showing clearly the position of the mean value.

(b)(i)(ii) Generally well answered.

(c) A proportion of learners answered this question correctly with a well drawn histogram and frequency polygon.

(d) The explanation of how a frequency distribution can be changed to a cumulative frequency distribution was not well known.

6
(a)(i)(ii) The standard of transposition of formula was very low and as a consequence calculations were incorrect.

(b) A few learners calculated correctly the value for x.

7
The second most popular question.

(a)(i)(ii) A generally well answered question with learners applying the cosine rule correctly.

(b)(i)(ii)(iii) A proportion of learners calculated correctly the value for angle B, the length of side a and the length of side c.

8
The most popular question.

All parts answered with a high level of correct responses.

F564 Scientific principles and applications

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.

This unit was marked by centres and moderated by OCR.
Centres submitted the Attendance Register and the Centre Authentication Form correctly filled in and on time.

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 individual learners work was found to be useful but Centre staff need to make more comments on the Unit Recording Sheet in the teacher comments panel provided. The column headed 'Page' also needs to be completed.
- When a disk is being submitted, it should be labelled with Centre number_Candidate number_Unit number_Series.
- Some use was made of photographs. This and other similar types of media are to be encouraged.

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. 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. For example, m/s was used instead of ms^-1.

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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