RECOGNISING ACHIEVEMENT

# Principal Learning

## Engineering

OCR Level 3 Principal Learning **H811**

# Examiners' Reports

# January 2011

**H811/R/11J**

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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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**EXAMINERS' REPORTS**

# Chief Examiner's Report

Centres are systematic in their approach to the engineering diploma. 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.

Opportunities for centre staff to attend INSET and take advantage of the excellent support materials provided and make their views known on the delivery and assessment of units will help 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.

When a CD 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

# Unit F556 Engineering business and the environment

This unit was marked by centres and moderated by OCR.

- Centres made good use of contact with local industry.
- Learners presented work in a neat and tidy fashion.
- Some use was made of photographs. This and other similar types of media are to be encouraged.
- 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. Centres should encourage learners to take charge of their own learning and development.
- We recommend learners are shown how to interpret the evidence requirements for each mark band. It was sometimes difficult to identify progression across the bands. Progression is characterised by; increasing breadth and depth of understanding, increasing coherence, evaluation and analysis, increasing independence and originality.

**Assessment Criteria 1**
Most learners were able to give an adequate description of the internal structure of a typical business and to identify different roles within an 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**
Most 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. To gain higher marks a more detailed explanation was needed in all areas of the 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 the 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 the 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 bar charts but graphs of results would have been useful. The use of photographs for these criteria would help obtain higher marks.

# Unit F558 Selection and application of materials

This unit was marked by centres and moderated by OCR.

The following points need to be considered:

- It is envisaged that learners will work on the production of a range of 2D and 3D CAD models of design ideas.
- It is possible that work undertaken at Level 2 could be further enhanced using the learner's own brief and specification from previous units. Otherwise they will need to produce a design brief and specification.
- Some models could be produced using reverse engineering techniques from existing products incorporating standard components. This approach could enhance the presentation of the technical work required for the product study in Unit F558: Selection and application of engineering materials.
- The results of testing could be recorded in short reports with screen shot animation or video sequences,
- Evidence could also include the use of digital photography taken in real time as activities occur.

**Assessment Criteria 1**
Learners should use 2D and 3D software packages to design and model simple engineered products e.g. TechSoft 2D Design, AutoCAD, ProDesktop, SolidWorks, AutoDesk Inventor Parts may include solid objects, castings, engineering components, folded sheet components, moulds and formers. Learners should be encouraged to use components of existing products as a basis for CAD modelling, scanning and reverse engineering – consumer products, engineering components, jewellery, historical artefacts.

Learners should incorporate standard components in assemblies of parts – fastenings, nuts, bolts, screws, gears, pulleys, electrical and pneumatic components.

**Assessment Criteria 2**
Learners must be aware of current British Standards appropriate for working drawings and cross-reference standards available on software packages. They should also be able to create orthographic and pictorial views of parts and assemblies to the appropriate standard; add part lists, dimension and tolerances. Appropriate cross-sectional views should be used to enhance information of interior or hidden detail.

Assessment Criteria 3 Learners should use appropriate software to present and communicate designs through drawings, which may be: coloured, textured, rendered, rotated, exploded, sectioned and annotated. Learners could create temporary cross sections or translucency to view interior details.

There should be views of parts enhanced by photorealistic material rendering with the addition of background images and additional graphics relevant to the designed product – additional graphics could be logos, user interface instructions or photographic images.

**Assessment Criteria 4**
Testing can be physical tests or computer generated such as Finite Element Analysis, e.g. applying loads – thermal transfer characteristics to designed components and observing and evaluating outcomes. e.g. compare load bearing characteristics of a part with a number of different modifications – sharp/radiused edges, square/round holes, with/without stiffening ribs. SolidWorks, Inventor, ProEngineer.

Learners could manufacture a prototype in foam or wax to evaluate ergonomics. Learners could simulate motion in parts and assemblies and use animation to explain how mechanisms work.

**Assessment Criteria 5**
Learners could research and investigate the integration of CAD/CAM into combined design/ manufacturing systems through industrial visits, videos and visiting speakers.

**Assessment Criteria 6**
Centres should encourage learners to investigate concurrent engineering systems by arranging industrial visits and by providing videos and visiting speakers.

# F559 Instrumentation and control engineering

Section A - Most learners attempted all 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 for which they will get no reward.

**Section A**

**1** This was a popular question attempted by all learners with a number of learners being awarded the full five marks. The input and feedback blocks were correctly completed in most cases with the remaining blocks providing discrimination.

**2** Generally well answered with a wide range of suitable systems using feedback control being named by learners.

**3** The majority of learners gained at least one mark for naming the thermistor as a passive transducer. There were a few errors found in the choice of the second transducer, a minority of learners correctly naming the strain gauge.

**4** Generally well answered with learners naming one input and one output device used in a control. Incorrect answers were limited to careless completion of the question where responses were transposed.

**5** Generally well answered. There were two marks for this and the majority of learners gained both. The requirement was to identify the 'instrument display' as an output unit and to explain that it gives a visual representation of the data. In a few cases there was no reference to it being an output unit.

**6** This question caused some problems and it was clear that learners were not fully aware of the transmission problems occurring at frequencies greater than 2500MHz. Responses were in some cases very general and did not show evidence of the knowledge required to gain the two marks available at this level.

**7** Generally well answered. Virtual test equipment was well known to learners and they were in most cases able to access both marks available. Clear explanations of uses and benefits were given.

**8** The formula for overall gain in a system with positive feedback was not accurately recalled by many learners. The most common fault was to give the formula for negative feedback.

**9** This was a popular question attempted by all learners with a number of learners being awarded the full two marks. Clear understanding was shown in relation to the benefits of a video camera in a monitoring surveillance system. Storage of data and use in a subsequent prosecution was given by higher grade learners.

**Section B**

**1** The majority of learners answered this question, with most gaining marks in all three parts.

**(a)** This was a popular question with the majority of learners attempting it and gaining marks on this part. The function of a strain gauge was generally known along with the reason for measuring strain.

**(b)** Examples of practical applications for a strain gauge in some cases showed imagination in the choice of application while still gaining the marks.

**(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. Presenters are encouraged to urge learners to draw neat and accurate labelled diagrams.

**2** The majority of learners answered this question, with most gaining marks in all three parts.

**(a) (i)** This was a popular question with the majority of learners attempting it and gaining marks on this part. The closed loop control system to maintain a room at constant temperature was clearly stated.

**(a) (ii)** Most learners stated correctly that a thermistor was needed to sense temperature in a control system. Those who failed to gain the mark had named a 'temperature sensor' which was not precise enough and was a rearrangement of the term used in the question.

**(b)** Generally well answered. Clear understanding was shown here with good examples being used of specific rooms or areas which require precise temperature control. Surprisingly few learners gave energy conservation and fuel cost reduction as a reason.

**(c)** Most learners did not achieve high marks. Much more in-depth detail was needed in the description of how the system shown can be used to control the temperature of a room. For full marks all parts of the system had to be described and an understanding shown of the part played by the operational amplifier. When an explanation is required about a system shown in a block diagram it is often useful if the learner deals with each block in turn.

**3** The majority of learners answered this question, with most gaining marks in all three parts.

**(a)** The meaning of the term 'closed loop' control was generally well known.

**(b)** Learners explained the advantages of a closed loop control system over an open loop control system laying emphasis that feedback is an important element of a closed loop system. The non-linear nature of the system was rarely commented on, thus losing a mark.

**(c)** In some cases there was evidence that the question had not been read carefully as the mechanical nature of the required closed loop system was either generalised or substituted by an electronic system. The standard of drawing was low. A good response would have referred to a ball float being used to operate a sliding valve to keep the water level in a cistern at the desired level.

4 Not a very popular question.

**(a) (i)** The symbol for a single acting spring return cylinder was not well known. Confusion between an operating 3/2 valve and a single acting cylinder was a cause of lost marks.

**(ii)** The symbol for a double acting cylinder was well known.

**(b)** The powered outstroke of the single acting cylinder along with the spring return was known to a minority of learners.

**(c)** The description should have included use of pilot air or a control lever to switch the main air supply to out-stroke or in-stroke the piston. Mention should have been made of the exhaust ports and main air switching when the pilot air or control lever is activated.

**5** Although not the most popular question this one was attempted by over half of the learners.

**(a)** Practical applications of a pressure gauge were well known and marks were generally obtained for this part.

**(b)** The difference between absolute press and gauge pressure was not well known.

**(c)** Learners could not describe, with the aid of a diagram, the construction and action of a bellows pressure gauge. In some cases the bellows part was accurately drawn but a greater problem was encountered in converting a pressure change to an analogue electrical signal.

**6**

**(a)** well answered with a reasonable diagram of an ideal operational amplifier being presented. Most learners did not label the inverting and non-inverting terminals or the power supply polarities.

**(b)** Not many learners could name three characteristics of an ideal operational amplifier. Good responses should have included: infinite voltage gain, infinite input impedance, infinite bandwidth, zero output impedance. The most popular response was infinite voltage gain.

**(c) (i)** The calculation was correctly carried out by a number of learners with most correcting their result to two decimal places.

**(c) (ii)** Very few learners attempted this question. Those that did could not transpose the overall gain formula to find the feedback fraction.

**7** Not a very popular question.

**(a)** Some clear diagrams representing an analogue to digital converter were seen. To gain both marks a clear visual indication of the analogue input and digital output were required.

**(b)** Comparison of a ladder DA converter to a binary-weighted DA converter was not widely understood with few marks being gained for his part.

**(c)** As with the previous part the principle of operation of an R-2R ladder converter was not well known, resulting in very few marks being awarded.

**8** A fairly popular question.

**(a)** Examples of practical applications for a liquid crystal display were well known and most learners who had attempted the question gained marks.

**(b)** The advantages of liquid crystal displays over other types of display were well known in most cases and explanations given resulted in at least two of the three marks being awarded.

**(c)** This part of the question was not attempted by many learners. It was fairly clear that learners did not understand the difference between a transmissive mode LCD and a reflective mode LCD.

# 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 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 for which they will get no reward.

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** Generally well answered.

**3** Generally well answered. In a few cases after finding (2x +10 - x -2)/6 it was disappointing to find learners could not correctly state the final answer as (x + 8)/6.

**4** Generally well answered. In a few cases after finding 4x - 12 = 5x + 6 learners could not correctly arrive at x = -18.

**5** Generally well answered. In a few cases the answer was not corrected to one decimal place.

**6** Generally well answered. In a few cases the answer was not corrected to the nearest degree.

**7** Generally well answered. In a few cases a cosine was sketched on the axis instead of a sine wave.

**8** Generally well answered.

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

**10** A badly answered question. Most learners had little idea of how to differentiate this equation.

**11** A badly answered question. In some cases the rules of integration were not known.

**12** A badly answered question. In some cases the rules of integration were not known.

**13** Generally well answered. A high proportion of learners answered this question correctly.

**14** Generally well answered. A high proportion of learners answered this question correctly.

**15** Generally well answered. A high proportion of learners answered this question correctly.

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

**1**
A very popular question. In most cases, for all parts, learners achieved high marks.

**2**
Not a very popular question.
**(a)** Very few learners could show that d^2 + 520d -2800 = 0.
**(b)** At least one learner solved the equation correctly.

**3**
Not a very popular question. However, the strong learners answered all parts correctly.

**4**
A fairly popular question.
**(a)** Generally well answered with good labelled diagrams being drawn.
**(b)** Generally well answered.
**(c) (i)** A few learners solved the equation to give the correct answer as 52 degrees correct to the nearest degree.
**(c) (ii)** A high proportion of learners did not give a correct answer for finding the other solutions for angles between 90 and 360 degrees

**5**
Not a very popular question.
**(a)** Generally well answered with maximum marks being awarded.
**(b)** Generally well answered. The learners calculated correctly the maximum turning point y = +80 but had some difficulty in calculating y = -28 for the minimum turning point.
**(c)** Generally well answered with maximum marks being awarded.

**6**
Not a very popular question.
**(a) (i)** Many learners did not use the correct limits as 0 and 4 seconds thus giving an incorrect answer for the distance the vehicle had moved.
**(a) (ii)** Many learners did not use the correct limits as 4 and 5 seconds thus giving an incorrect answer for the distance travelled in the fith second.
**(b)** Learners had little idea of how to calculate the area enclosed between the curve and the straight line.

**7**
A very popular question.
**(a)** Most learners completed the table correctly for class width and frequency density.
**(b)** The drawing of the histogram to represent the information gained in part (a) was completed correctly to a high standard. Most learners gained a maximum of marks.
**(c)** Very few learners stated correctly that the histogram was a positive skew.
**(d)** Very few learners stated correctly the modal group.
**(e)** Very few learners gave a correct estimate of the mode.

**8**
A very 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.

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.
- Some use was made of photographs. This and other similar types of media are to be encouraged.
- When a disc is being submitted, it must be labelled with Centre number_Candidate number_Unit number_Series.

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 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 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 experiments.

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