2003 HSC Notes from the Marking Centre Engineering Studies

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GPO Box 5300
Sydney 2001
Australia

Tel: (02) 9367 8111
Fax: (02) 9367 8484
Internet: www.boardofstudies.nsw.edu.au

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2003 HSC NOTES FROM THE MARKING CENTRE ENGINEERING STUDIES

Introduction

This document has been produced for the teachers and candidates of the Stage 6 course in Engineering Studies. It provides comments with regard to responses to the 2003 Higher School Certificate Examination, indicating the quality of candidate responses and highlighting the relative strengths and weaknesses of the candidature in each section and each question. Comments have often been made that are intended to indicate how candidates could have improved their responses.

It is essential for this document to be read in conjunction with the relevant syllabus, the 2003 Higher School Certificate Examination, the Marking Guidelines and other support documents that have been developed by the Board of Studies to assist in the teaching and learning of Engineering Studies.

General Comments

In 2003, approximately 1280 candidates attempted the Engineering Studies examination.

Teachers and candidates should be aware that each examination includes a number of different question styles. These range from questions that require the simple recall of knowledge through to those that expect candidates to respond by integrating the knowledge and skills they have developed through a comprehensive understanding of the entire course.

In this examination paper, all questions were compulsory and candidates were expected to complete eighteen questions that followed the format outlined below.

	Question/s	**Mark Value**	**Syllabus Area**
Section I	1-10	1 mark/question	All (multiple-choice)
Section II	11	10 marks	Historical and Societal Influences, and the Scope of the Profession
	12	10 marks	Civil Structures
	13	10 marks	Personal and Public Transport
	14	10 marks	Lifting Devices
	15	15 marks	Aeronautical Engineering
	16	15 marks	Telecommunications Engineering
Section III	17	10 marks	Engineering and the Engineering Report
	18	10 marks	Engineering and the Engineering Report

Section I – Multiple Choice

General comments

This section contains ten multiple-choice questions that covered all areas of the syllabus. In several of these questions candidates were expected to complete calculations in order to select the most appropriate response from the four choices given.

Question	Correct Response
1	A
2	D
3	C
4	C
5	B
6	B
7	D
8	D
9	D
10	A

Section II – Extended Response Questions

General Comments

Overall, the candidates' responses indicated that the majority had a good grasp of engineering concepts, appropriate for HSC candidates. Candidates need to be aware that the answer space allocated is a guide to the length of the required response.

Question 11 – Historical and Societal Influences, and the Scope of the Profession

This question allowed candidates the opportunity to demonstrate an understanding of four areas of aeronautical engineering knowledge provided in training and to discuss how each of the listed knowledge areas is applied to the design or construction of an aircraft or its components.
In order to demonstrate a thorough understanding of historical and societal engineering influences over the past 200 years, candidates were asked to outline the improvements to materials used in civil structures and link these to changes in design features. Candidates were also asked to discuss how these changes have affected society.

(a) This question was answered reasonably well with the majority of candidates able to provide some information about the four knowledge areas, related to aeronautical engineering. While candidates provided good discussions relating to the design of aircraft, there was an apparent lack of knowledge about the area of aircraft construction. Candidates displayed good knowledge of engineering materials and fluid mechanics. The application of lightweight and strong materials such as duralumin was predominantly used as an example for engineering materials. Many candidates were able to provide answers such as the fluid pressures applied to flight controls and instrumentation as well as the hydraulic systems controlling flight controls and landing gear.
Candidates found difficulty in providing accurate information related to aerodynamics and failed to display knowledge of aerodynamic concepts such as Bernoulli's principle, airflow over

the aerofoil, angle of attack, flight control surfaces and stalling. Many candidates were unable to demonstrate how the legal and ethical implications that are faced by an engineer such as adhering to safety guidelines, patents and copyright issues, noise and pollution guidelines are applied to the design and/or construction of an aircraft.

(b) (i) Over the past 200 years, improvements to the materials used in civil structures have changed the design features of these structures. The majority of candidates were able to outline basically how improvements to materials have affected two of the listed features. Many candidates discussed material improvements such as timber replaced by reinforced concrete, and others discussed improvements of irons to high tensile alloy steels or the improvement of corrosion resistance using zinc or polymer protective coatings. The responses to this question indicated that candidates were well aware of the historical developments of materials in civil structures but were often unable to outline how those improvements have affected the features of the civil structures listed within the question.

(ii) This question asked candidates to discuss how society has been affected by the changes to any two design features. Very few candidates were able to develop a good discussion of societal effects that could be directly attributed to engineering design and development over the past few centuries. Issues such as increases in population, possible overcrowding, lower costs of transportation being passed onto consumers, reduced travelling time bringing communities closer together or reduced manufacturing and maintenance costs providing savings for society were often implied but candidates were often unable to discuss these societal effects. The lack of a detailed response appears to indicate a trend over the past few years that candidates are not preparing well in this field of engineering study.

The responses this year indicate that the majority of candidates were well briefed on some of the knowledge areas of aeronautical and civil structures engineering but were unaware of others. Future candidates would be well advised to further research the legal, ethical and societal considerations the engineer faces when designing and constructing and to more thoroughly examine the interrelationships between engineering and the society that it serves.

Question 12 – Civil Structures

This question looked at the analysis of common construction materials through the identification of beneficial features and through a comparison of properties. The question also involved the calculation of the extension of a tendon and the sketching of a pictorial view.

(a) (i) This part of the question required candidates to calculate the extension of a length of steel through the use of the Young's modulus formula. The majority of candidates made a reasonable attempt at the question but a number appeared to have difficulty in determining the correct area. Common errors included using an incorrect radius or diameter or using incompatible units in terms of the use of metres and millimetres. Failure to convert other data to compatible units was another common error and subsequently solutions had the correct numbers but incorrect order of magnitude. Some candidates became confused when manipulating the formula to make 'e' the subject.

(ii) This part of the question required an explanation of the benefits of using pre-stressed concrete beams over beams made from reinforced concrete. The majority of candidates could nominate two benefits of pre-stressed concrete but could only give a reasonable explanation for one benefit. A number of candidates did not fully understand the advantage of pre-stressing the tendons to obtain greater bending strength in the composite material.

(iii) This question asked candidates to discuss two factors to consider when choosing to use either a laminated timber or pre-stressed concrete beam in a structure. This was answered reasonably well as most candidates could state two factors and discuss one or two of them well, either as a disadvantage or advantage. Some candidates still used strength and cost as factors despite being specifically advised in the question not to discuss them. Some candidates had difficulty discussing their second factor, frequently because their two factors were similar.

(b) In this question candidates interpreted an orthogonal drawing then sketched a pictorial view of a steel piped bracket attached to a frame by a bolt. The majority of candidates correctly interpreted the orthogonal views and made a good attempt at sketching either an isometric or oblique view. Some candidates had trouble with the drawing of the bracket in pictorial and were often unable to show the pipe support extending out from the base of the bracket. There were still some candidates who did not understand the meaning of a pictorial view and simply redrew the orthogonal version from the examination paper, without sectioning.

Question 13 – Personal and Public Transport

This question required a description of the structure of high carbon steel after surface hardening and then the calculation of the power required to move a train up an incline. This question also tested the candidates' knowledge of electrical motors and their application in transport systems.

(a) This question was poorly answered by the majority of candidates. It was evident that a number of candidates did not have an understanding of the changes that would occur in the surface due to hardening. However, a significant number of candidates did understand that 0.8% carbon steel will be mainly pearlitic and a large number of candidates also understood that the quenching process would result in some form of hardening. Some candidates thought that this occurred because of work-hardening rather than because of the formation of martensite. Most candidates did not compare the final structure of the surface with that of the core.

(b) Concepts of energy and power appeared to be poorly understood by a number of candidates unable to analyse the data adequately and therefore making little or no attempt to solve this problem. Very few candidates were able to calculate the work done and therefore the power required to move the train up the incline. Candidates needed to realise that to determine the total power, the power required for the climb had to be added to the power required in overcoming the rolling resistance. Those candidates who had some understanding of power often failed to convert the data to compatible units, confused work with weight or could not calculate the forces acting parallel to the incline.

(c) (i) Most candidates demonstrated a good understanding of the operation of an electric motor as they were able to explain the attraction/repulsion of the magnetic fields and how this was converted to rotary motion. Many candidates were able to gain some marks because they demonstrated an understanding of the formation of induced magnetic fields when current is passed through copper coils. Some candidates misunderstood the question and discussed the use or the application of electric motors while others showed very little understanding as they confused electric motors with combustion engines.

(ii) This section was well answered and most candidates were able to describe two applications of electric motors as used in transport systems. Some candidates simply named the type of electric motors without describing the application. A few others gave an excellent description of only one application. This prevented them from accessing the full range of marks.

Question 14 – Lifting Devices

This question looked at the analysis of mechanical structures and materials.

(a) A number of candidates had difficulty analysing the problem and identifying the forces acting on the beam RQP. To successfully answer this, candidates needed to apply a moments equation about R though many candidates incorrectly took moments about point Q. Some candidates, who identified point R for their moments equation, successfully found the vertical force at Q but incorrectly applied trigonometry and were unable to find the force in QS. This problem could also be resolved graphically by applying the three-force rule. However, very few candidates chose this method.

(b) (i) This question referred to the diagram in part (a), with a new force of 21.35kN in member QS, and required candidates to produce a labelled shear force diagram. For candidates to correctly answer this problem, they were required to find the vertical component at Q then calculate the forces at R and P. Only a small number of candidates recognised that they needed to use the vertical component (21.35sin40°) to correctly solve this problem. Shear force diagrams reflected a poor understanding of this concept. When teaching this area it may be helpful to students that a force, which is inclined to a beam, also be used as a sample problem.

(ii) This part of the question required candidates to have an understanding of pressure and Pascal's principle. The question stated a cross-sectional area for the slave cylinder and a mechanical advantage for the system. Candidates were required to find the diameter of the master cylinder. For candidates to successfully achieve the solution, they needed to divide the stated area of the slave cylinder by the mechanical advantage so as to find the cross-sectional area of the master cylinder then resolve this area into a diameter. Some common errors indicated a limited understanding of this question. Most commonly, candidates simply found the diameter from the area given, or used the formula for mechanical advantage, but were unable to progress further. Some candidates used loads or forces from part (a) or (b)(i) with the area in a pressure equation; however they did not use the MA. Two other misconceptions were to find a diameter then apply the MA, or to multiply the given area by the MA.

(c) Candidates were required to identify an alternative process for the manufacture of gears used in lifting devices, then to contrast properties resulting from this process with those of powder-formed gears. Overall this question was well attempted with most candidates identifying a suitable forming process then making a contrast of at least one property. The most common error occurred when candidates contradicted themselves by stating the same properties for both processes. Many candidates described the two forming processes. It is suggested that candidates read the question carefully, identify the key words and also read their response to check that it is sensible. Candidates need to work on the clarity and structure of their responses.

Question 15 – Aeronautical Engineering

This question involved an explanation of an airspeed indicator, an analysis of materials and corrosion of metals, a comparison of stresses on a wing strut, a calculation of a bending stress, and an outline of conditions that may result in stalling.

(a) Most candidates displayed a reasonable understanding of the airspeed indicator. Better responses included an explanation of the difference between total and static pressure that resulted in expansion or contraction of the diaphragm. Reasonable responses stated how increased airspeed led to an increase in total pressure causing expansion of the diaphragm but failed to mention the role of static pressure. Poor responses simply restated the diagram and tracked the flow of air into the chamber and mentioned movement of the diaphragm.

(b) (i) This question was generally well answered with candidates displaying a reasonable understanding of how the protective oxide layer makes aluminium, and its alloys, more corrosion resistant than steel. Many candidates however, recognised the formation of the oxide layer on the surface of the aluminium without explaining how it provides further protection from corrosion.

(ii) A number of candidates had difficulty giving both an advantage and disadvantage of the use of composite materials in aircraft components. Most candidates were able to identify increased strength to weight ratio or increased stiffness as an advantage. Disadvantages of composites, such as sudden failure, were not identified by many candidates.

(c) (i) This question challenged a number of candidates, with only a small number able to correctly compare the stresses on the surfaces of the wing strut under different conditions. The best responses identified that while the plane is on the ground, the top surface of the strut is in tension and the bottom surface in compression, but in flight the bending up of the wing, due to lift, induced tension in the bottom and compression in the top. Better responses included the dynamic nature of flight, with turbulence and drag also affecting the nature of stresses.

(ii) Candidates had some difficulty in correctly answering this question. Most errors centred on the conversion of data to compatible units, particularly for 'I' (second moment of area given in mm^4). Subsequently the solutions had the correct numbers but incorrect order of magnitude. Many candidates did not calculate the bending moment and simply substituted the 15kN force into the equation.

(d) This question was generally well answered with most candidates outlining at least one condition that causes an aircraft to stall. Some candidates however, incorrectly related stalling to the failure of the engine and not to the angle of attack or low airspeed.

Question 16 – Telecommunication

This question required candidates to explain applications for copper and fibre optics, to describe the problems associated with the cold drawing of copper wire, to discuss technological changes within the telecommunications industry and the societal effects of these changes, to describe the transmission of data between mobile phones and explain the possible life-endangering effects of mobile phone communications through their interference on other electronic systems.

(a) (i) Many candidates interpreted 'State a different application' as a different application outside the telecommunication industry. Some candidates correctly identified optical fibre as a composite material and then selected one of its component materials, usually glass, and suggested an alternate application. Better responses noted that the electrical conductivity of copper made it suitable for data transmission in telephone wire, and the use of glass in fibre optics provides the capacity to transmit large amounts of data via light energy for such applications as the transfer of internet data.

(ii) Many candidates named two problems, however did not describe them or a subsequent process to reduce them. Better responses included problems associated with cold drawing such as increased brittleness, possible failure during drawing or a reduction of conductivity. These better responses then described annealing which involves heating the copper to its recrystallisation temperature to allow recrystallisation of the structure and modification of the properties.

(b) This part was answered well with the majority receiving full marks. Those candidates who set out their answer logically, into 'change and related effect', scored well. Poorer responses were generally too vague and not clearly related to a societal effect.

(c) (i) Better responses included a flow chart-type response in the mobile phone cellular transmission network. Many candidates wisely used diagrams to convey their knowledge and understanding. Terms such as analogue, digital, conversion, transmission, microwave and multiplexing were used by a number of candidates and indicated a sound understanding of the workings of a cellular network. Poorer responses were typically vague, often omitting whole links in the transmission cycle. The role of satellites was often overstated or misunderstood in the context of cellular networks.

(ii) Many candidates were unable to explain the effects of mobile phone communications on other electronic systems. Better responses often linked mobile phone transmissions to the interference or malfunction of sensitive medical equipment or aircraft navigation systems. A number of candidates incorrectly described how the mobile phone 'microwaves' or 'EMF' caused the explosion of petrol pump computers that then ignited the petrol vapour. Some candidates linked using a mobile phone while driving to car crashes due to distraction, or discussed brain cancers, further showing they had misunderstood the question. These answers did not adequately illustrate an effect on an electronic system.

Section III

This section of the examination paper includes questions 17 and 18 and relates to engineering and the engineering report.

Question 17

This question looked at the design of a public shade area. It involved an outline of some design-related issues, the completion of an orthogonal sketch and an analysis/synthesis of various components of the shade area.

(a) This part of the question was well answered by the majority of candidates. They were able to offer a large variety of technical and social issues to be considered in an engineering report. A small, but significant, number of candidates incorrectly offered valid areas for consideration which were either economic or environmental issues. Other candidates responded with issues that would be part of a feasibility study for the shade area, such as 'Do the people really want it?' or 'Could council really afford it?'

(b) This question was well answered with a significant percentage of candidates achieving maximum marks. Interpretation of the exploded pictorial drawing and the completion of the orthogonal sketch were generally well done; however a number of candidates needed to take more care with sizes and scales on the sketches. Candidates generally displayed a better understanding of AS1100 drawing standards, but there were still candidates who presented pictorial representations of threads in their orthogonal drawing even though they were not required to sketch any threads in the solution.

A pleasing trend this year was the number of candidates presenting sketch, rather than instrument-drawn, solutions. The question required a sketch and candidates who presented instrument-drawn solutions possibly spent too much time on an answer even though they are not gaining any extra marks for the extra time involved. The quality of sketch answers has shown improvement. However, many candidates need more experience and practice in sketching techniques.

One of the dimensions in the exploded pictorial drawing was incorrect, with the diameter labelled as the radius. The inconvenience to candidates appeared minimal, with most either ignoring the mistake or realising what the correct dimension should have been. Those candidates who did try to draw the orthogonal sketch using the incorrect dimension were awarded marks accordingly and every effort was made to ensure that these candidates were not disadvantaged in any way.

(c) This question challenged a number of candidates, requiring them to analyse an engineering situation, synthesise knowledge from a number of sources and then provide conclusions.

(i) This question required candidates initially to realise that the two supports, A and B, did have different structures and that member A was in tension and member B was in compression. They were then required to realise that member B, because it was in compression, was likely to undergo some form of bending under certain load conditions, where member A would not. The structure of member B could then be explained because it has a higher second moment of area than the round bar and would resist the forces causing the bending.

The vast majority of candidates were able to identify that member A was in tension and member B was in compression, but then failed to relate this knowledge to the different structure of the members. Some candidates responded that one member was in tension and the other was in compression, but failed to identify which one was which.

(ii) A small percentage of candidates correctly answered the question by describing the design changes to a shade structure as a result of developments in engineering textiles. These candidates were able to identify issues such as increased span lengths, the need for fewer and lighter support structures and the ability to coordinate colour schemes with the surrounding environments. A number of candidates attempted to discuss advancements in polymers and polymer technology, but generally found this difficult.

Question 18

This question focused on the candidates' knowledge of CAD systems, polymers and mechanics.

(a) This part was generally well answered with over half of the candidates gaining maximum marks. Common errors included the failure to clearly make a comparison between the two systems, and the repetition of features that were essentially the same.

(b) (i) In general, responses were only fair with many candidates describing non-suitable processes. When a suitable process was described, the candidate often gave a poor description and/or failed to name the process, demonstrating a limited understanding of either the process or the requirements of the question.

(ii) About half of the candidates were able to identify at least two factors related to service. The most common error included the listing of non service-related factors such as those related to the manufacture of the lid or the chemical structure of the polymer.

(c) Many candidates were challenged by this question. A number of candidates did not draw a free-body diagram and also failed to determine the reactions at the ends of the ramp. Some candidates were able to substitute values into the friction formula, but then didn't know how to use the resulting information. Poorer responses were guesses without any justification by calculation. This question could have been solved easily through the application of a graphical solution and candidates must be familiar with the range of solutions available to engineering mechanics problems.

Engineering Studies

2003 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
1	1	Polymer	H1.2
2	1	Electronics	H3.1
3	1	Load/factor of safety	H3.1
4	1	Force – methods of sections	H3.1
5	1	Electronics – semi conductors	H1.2
6	1	Forming processes	H1.2, H2.1
7	1	Corrosion	H1.2, H2.1
8	1	Age hardening	H1.2, H2.1
9	1	Graphics, developments	H3.1, H3.3
10	1	Graphics developments	H3.1, H3.3
11 (a)	4	Aeronautics training	H1.1, H2.2, H4.3
11 (b) (i)	3	Engineering design	H1.1, H2.1
11 (b) (ii)	3	Engineering effect on society	H1.1, H2.2, H4.2
12 (a) (i)	2	Stress/strain	H3.1, H6.1, H6.2
12 (a) (ii)	2	Beam	H1.2, H2.1
12 (a) (iii)	3	Beams laminates and concrete	H1.2, H2.1, H6.2
12 (b)	3	Graphic	H3.1, H3.3
13 (a)	3	Induction heat treatment	H1.2, H2.1
13 (b)	3	Power	H3.1, H6.1, H6.2
13 (c) (i)	2	Electric motor	H4.1, H6.1, H6.2
13 (c) (ii)	2	Electric motor applications	H6.1, H6.2
14 (a)	2	Force/movement	H3.1
14 (b) (i)	2	Shear force diagram	H3.1
14 (b) (ii)	3	Hydraulics/pressure	H3.1

Question	Marks	Content	Syllabus outcomes
14 (c)	3	Powder processing	H1.2, H2.1
15 (a)	3	Aeronautical instrumentation	H3.2, H6.2
15 (b) (i)	2	Aluminium corrosion	H1.2, H2.1
15 (b) (ii)	2	Aeronautical polymers	H1.2, H2.1
15 (c) (i)	3	Aeronautical mechanics	H3.2, H6.2
15 (c) (ii)	3	Bending stress	H3.1, H6.2
15 (d)	2	Aeronautical principles	H3.2, H6.2
16 (a) (i)	4	Telecommunication materials	H1.2, H2.1
16 (a) (ii)	3	Cold working and heat treatment	H1.2, H2.1
16 (b)	4	Technological change and society	H2.2, H4.1, H4.2, H4.3
16 (c) (i)	2	Telecommunication data transmission	H4.1
16 (c) (ii)	2	Telecommunication social implications	H2.2, H4.3
17 (a)	2	Engineering report social	H3.2, H4.1, H4.3
17 (b)	4	Graphics – bracket	H3.1, H3.3
17 (c) (i)	2	Shade truss analysis	H2.1, H3.1
17 (c) (ii)	2	Shade polymer	H1.2, H2.1, H2.2, H4.1, H4.3
18 (a)	3	CAD – graphics	H3.3, H4.1, H5.2
18 (b) (i)	2	Polymer forming process	H1.2, H2.1, H2.2
18 (b) (ii)	2	Polymer – engineering products	H1.2, H2.1, H2.2
18 (c)	3	Friction	H3.1, H3.3

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2003 HSC Engineering Studies Marking Guidelines

Question 11 (a)

Outcomes assessed: H1.1, H2.2, H4.3

MARKING GUIDELINES

Criteria	Marks
• Applies all four knowledge areas appropriately to aircraft design or construction	4
• Applies three knowledge areas appropriately to aircraft design or construction OR • Loosely associates all four knowledge areas	3
• Applies two knowledge areas appropriately to aircraft design or construction OR • Loosely associates three knowledge areas	2
• Applies only one knowledge area appropriately to aircraft design or construction OR • Loosely associates two knowledge areas	1

Question 11 (b) (i)

Outcomes assessed: H1.1, H2.1

MARKING GUIDELINES

Criteria	Marks
• Outlines well how improvements to materials have affected two features	3
• Outlines well how improvements to materials have affected one feature OR • Outlines basically how improvements to materials have affected two features	2
• Outlines basically how improvements to materials have affected one feature	1

Question 11 (b) (ii)

Outcomes assessed: H1.1, H2.2, H4.2

MARKING GUIDELINES

Criteria	Marks
• Discuss well the societal effects of changes to two features	3
• Discusses well the societal effects of changes to one feature OR • Outlines two societal effects	2
• Outlines one societal effect	1

Question 12 (a) (i)

Outcomes assessed: H3.1, H6.1, H6.2

MARKING GUIDELINES

Criteria	Marks
• Correct equations, working and/or answer	2
• Some understanding but incorrect answer	1

Question 12 (a) (ii)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• Two benefits, with explanation	2
• One benefit, with explanation OR • Lists two benefits with little or no explanation	1

Question 12 (a) (iii)

Outcomes assessed: H1.2, H2.1, H6.2

MARKING GUIDELINES

Criteria	Marks
• Answer discussing two factors	3
• An answer discussing one factor OR • States two factors	2
• States one factor	1

Question 12 (b)

Outcomes assessed: H3.1, H3.3

MARKING GUIDELINES

Criteria	Marks
• Good overall shape with some minor errors using a pictorial method	3
• Reasonable overall shape with some minor errors of a pictorial method	2
• Some aspects of major components in relative position	1

Question 13 (a)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• A description of the structure and resultant properties through the rail	3
• Description of structure and one property OR • Description of two properties	2
• Outline of structure OR • Description of one property OR • Identification of two properties	1

Question 13 (b)

Outcomes assessed: H3.1, H6.1, H6.2

MARKING GUIDELINES

Criteria	Marks
• Correct equations, working and/or answer	3
• Demonstrates a general understanding with some minor errors	2
• Demonstrates a limited understanding of the question	1

Question 13 (c) (i)

Outcomes assessed: H4.1, H6.1, H6.2

MARKING GUIDELINES

Criteria	Marks
• Describes how the magnetic field of the coil causes the coil to rotate due to attraction and repulsion of components	2
• Displays a limited understanding of the operation of an electric motor	1

Question 13 (c) (ii)

Outcomes assessed: H6.1, H6.2

MARKING GUIDELINES

Criteria	Marks
• Describes two applications for electric motors in transport systems	2
• Describes only one application of electric motors in transport systems OR • Describes two types of electric motors used in transport systems without describing an application	1

Question 14 (a)

Outcomes assessed: H3.1

MARKING GUIDELINES

Criteria	Marks
• Using acceptable method and/or correct solution	2
• Acceptable method – minor errors	1

Question 14 (b) (i)

Outcomes assessed: H3.1

MARKING GUIDELINES

Criteria	Marks
• Correct diagram shape and appropriate label of values	2
• Correct diagram shape and incorrect label of values OR • Incorrect diagram shape and correct label of values (calculations) OR • Appropriate calculations not applied to a diagram	1

Question 14 (b) (ii)

Outcomes assessed: H3.1

MARKING GUIDELINES

Criteria	Marks
• Correct equations, working and/or answer	3
• Correct method – but minor errors in calculations	2
• Limited understanding of the question demonstrated	1

Question 14 (c)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• Names another manufacturing process and contrasts two properties with those of powder formed gears	3
• Names another manufacturing process and contrasts one property with those of powder formed gears	2
• Outlines the properties of powder formed gears OR • Names an alternative forming process	1

Question 15 (a)

Outcomes assessed: H3.2, H6.2

MARKING GUIDELINES

Criteria	Marks
• Good explanation of airspeed indicator operation	3
• Reasonable explanation of airspeed indicator operation	2
• Poor explanation of airspeed indicator operation	1

Question 15 (b) (i)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a reasonable understanding that aluminium forms a protective oxide layer which prevents further corrosion	2
• Basically explains that aluminium forms a protective or oxide layer	1

Question 15 (b) (ii)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• Identifies both an advantage and a disadvantage	2
• Identifies either one advantage or one disadvantage	1

Question 15 (c) (i)

Outcomes assessed: H6.2, H3.2

MARKING GUIDELINES

Criteria	Marks
• A good comparison of the nature of stress both on the ground and in flight	3
• A reasonable comparison of the nature of stress both on the ground and in flight	2
• A basic comparison of the nature of stress both on the ground and in flight	1

Question 15 (c) (ii)

Outcomes assessed: H6.2, H3.1

MARKING GUIDELINES

Criteria	Marks
• Correct equations, working and/or answer	3
• Demonstrates a general understanding with some minor errors	2
• Demonstrates a limited understanding of the question	1

Question 15 (d)

Outcomes assessed: H3.2, H6.2

MARKING GUIDELINES

Criteria	Marks
• Outlines two conditions which cause stalling	2
• Outlines one condition which causes stalling	1

Question 16 (a) (i)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• States an application for each material and explains why each is used	4
• States two applications but gives poor reasons OR • States one application with two reasons OR • Provides two good explanations of properties OR • States two applications and gives one reason	3
• States one application and explains why it is used OR • Provides a limited explanation of two properties OR • States two applications	2
• States one application plus a limited explanation of properties OR • Provides a good explanation on one material property	1

Question 16 (a) (ii)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• Describes two problems associated with cold drawing for this use and describes a heat treatment process at the various stages	3
• Describes two problems but does not describe the heat treatment process OR • Describes one problem and describes the heat treatment process	2
• Describes one problem OR • Describes the treatment process	1

Question 16 (b)

Outcomes assessed:H2.2, H4.1, H4.2, H4.3

MARKING GUIDELINES

Criteria	Marks
• Two changes identified and related societal effect for each discussed	4
• Two changes identified and one related societal effect discussed OR • Discussion of two societal effects with implied technological changes OR • One change identified and two related societal effects discussed	3
• One change identified with one related societal effect discussed OR • Two changes identified with unrelated effect(s)	2
• One change identified and one unrelated effect OR • Two changes with no discussion given OR • Two effects of technological change listed	1

Question 16 (c) (i)

Outcomes assessed: H4.1

MARKING GUIDELINES

Criteria	Marks
• Description of transmission from mobile phone to mobile phone	2
• Description of transmission from mobile phone to tower	1

Question 16 (c) (ii)

Outcomes assessed: H4.3, H2.2

MARKING GUIDELINES

Criteria	Marks
• Explains one effect and states two situations	2
• States two situations OR • Explains one effect OR • States one effect and one situation	1

Question 17 (a)

Outcomes assessed: H3.2, H4.1, H4.3

MARKING GUIDELINES

Criteria	Marks
• Good outline of both issues	2
• Good outline of one appropriate issue OR • Identification of two issues	1

Question 17 (b)

Outcomes assessed: H3.1, H3.3

MARKING GUIDELINES

Criteria	Marks
• Correct assembly and proportion of components in two views (some latitude with accuracy)	4
• Reasonable assembly and proportion of components	3
• Basic assembly and proportion of components	2
• Poor assembly and proportion of components	1

Question 17 (c) (i)

Outcomes assessed: H2.1, H3.1

MARKING GUIDELINES

Criteria	Marks
• Makes clear the relationship between the size and shape of members and the nature of the forces (tension/compression) acting on them	2
• Poor explanation of relationship of shape and size of member to nature of forces acting	1

Question 17 (c) (ii)

Outcomes assessed: H1.2, H2.1, H2.2, H4.1, H4.3

MARKING GUIDELINES

Criteria	Marks
• Discussion of at least one development related to textiles in shade areas	2
• Discussion of one development	1

Question 18 (a)

Outcomes assessed: H3.3, H4.1, H5.2

MARKING GUIDELINES

Criteria	Marks
• Discusses at least two points about CAD vs traditional methods	3
• Identifies two points, without discussion OR • Discusses one point	2
• Identifies one point	1

Question 18 (b) (i)

Outcomes assessed: H1.2, H2.1, H2.2

MARKING GUIDELINES

Criteria	Marks
• Description of a suitable forming process	2
• Identification of a suitable process	1

Question 18 (b) (ii)

Outcomes assessed: H1.2, H2.1, H2.2

MARKING GUIDELINES

Criteria	Marks
• Outline of 2 or more appropriate reasons related to service	2
• Outline of 1 appropriate reason related to service OR • Outline of 2 or more reasons not related to service	1

Question 18 (c)

Outcomes assessed: H3.3, H3.1

MARKING GUIDELINES

Criteria	Marks
• Correctly answer the question	3
• Demonstrates a general understanding with some minor errors	2
• Demonstrates a limited understanding of the question	1