



Mark Scheme (Results)

Summer 2017

NQF BTEC Level 1/Level 2 Firsts in
Engineering

Unit 9: Interpreting and Using
Engineering Information (21174E)

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk for our BTEC qualifications. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

If you have any subject specific questions about this specification that require the help of a subject specialist, you can speak directly to the subject team at Pearson. Their contact details can be found on this link: www.edexcel.com/teachingservices.

You can also use our online Ask the Expert service at www.edexcel.com/ask. You will need an Edexcel username and password to access this service.

Pearson: helping people progress, everywhere

Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2017

Publications Code 21174E_1706_rms



All the material in this publication is copyright

© Pearson Education Ltd 2017

BTEC Next Generation Mark Scheme Engineering Unit 9 1706

Question Number	Answer	Mark
1a (i)	<ul style="list-style-type: none"> • Centre line (1) • Centreline (1) • Centre (1) 	1
1a (ii)	<ul style="list-style-type: none"> • Internal (1) <p>Accept any response containing 'Internal'</p>	1
1a (iii)	<ul style="list-style-type: none"> • CSK (1) • C/SK (1) 	1

Question Number	Answer	Mark
1b	<p>Award one mark for each of the following up to a maximum of two marks:</p> <ul style="list-style-type: none"> • A – Feeds and speeds (1) • C – Timings (1) 	2

Question Number	Answer	Mark
1c	<p>Award one mark for each correctly matched sign up to a maximum of two marks.</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Health and safety sign</p>  <p>@alohaspiritiStock (Background is green)</p>  <p>@alohaspiritiStock (Background is yellow)</p> </div> <div style="width: 45%;"> <p>Health and safety sign name</p> <div style="margin-bottom: 10px;"><input type="text" value="Danger of death"/></div> <div style="margin-bottom: 10px;"><input type="text" value="Biohazard"/></div> <div style="margin-bottom: 10px;"><input type="text" value="First aid"/></div> <div style="margin-bottom: 10px;"><input type="text" value="Poison"/></div> <div style="margin-bottom: 10px;"><input type="text" value="Emergency eye wash"/></div> </div> </div> <p>If more than one line drawn from either sign, award no mark for that sign.</p>	2

Question Number	Answer	Mark
1d	<p>Award one mark for any of the following:</p> <ul style="list-style-type: none"> • screw (1) • countersunk screw (1) • countersunk head screw (1) • countersunk slot screw (1) • countersunk slot head screw (1) • countersunk head machine screw (1) • bolt (1) <p>Do not accept 'grub screw' as an answer.</p>	1

Question Number	Answer	Mark
2a	<p>Award one mark for any of the following:</p> <ul style="list-style-type: none"> • 1st (1) • first angle (1) • first (1) <p>Do not accept answers that reference third angle orthographic projection.</p>	1

Question Number	Answer	Mark
2b	<p>Award one mark for each of the following up to a maximum of two marks.</p> <ul style="list-style-type: none"> • C – Bend allowance chart (1) • E – Data sheet for finishing materials (1) 	2

Question Number	Answer	Mark
2c	<p>Award one mark for any of the following:</p> <ul style="list-style-type: none"> • capacity (1) • milestones (1) • cycle times/timings (1) • priorities (1) • deadlines (1) • Gantt chart (1) <p>Accept any other appropriate response.</p>	1

Question Number	Answer	Mark
2d	<p>Award one mark any of the following:</p> <ul style="list-style-type: none"> • Start point (1) • Node (1) • Activity (1) • Earliest Start (ES) (1) • Latest Start (LS) (1) • Network analysis (1) <p>Accept any other appropriate response.</p>	1

Question Number	Answer	Mark
3a	<p>Award one mark for each of the following up to a maximum of two marks:</p> <ul style="list-style-type: none"> • A – Assembly sequence (1) • B – Treatments (1) 	2

Question Number	Answer	Mark
3b	<p>Award one mark for any of the following:</p> <ul style="list-style-type: none"> • operations sheet (1) • job card (1) • test schedule (1) • manufacturer's manual for assembly (1) • manufacturer's manual for testing (1) • manufacturer's manual for installation (1) • weld procedure specification (1) <p>Accept any other appropriate response.</p>	1

Question Number	Answer	Mark
4a	<p>Award one mark for any of the following, up to a maximum of two marks:</p> <ul style="list-style-type: none"> • linetypes (1) • physical dimensions/sizes/measurements (1) • surface finishes (1) • features of the component/hole details/thread sizes (1) • scale (1) • name/drawn by/checked by (1) • date (1) • material (1) • tolerances (1) • projection symbol (1) • company name/logo (1) <p>Accept any other appropriate response.</p>	2

Question Number	Answer	Mark
4b	<p>Award one mark for reason and one additional mark for appropriate expansion, up to a maximum of two marks.</p> <ul style="list-style-type: none"> • Prevents components being fitted incorrectly (1) because the data sheet will indicate polarity (1) • Reduces the risk of incorrect components being used (1) since the data sheet will state the current/voltage limitations of the component (1) • The correct components are able to be identified for the circuit (1) as datasheets contain all nominal values (1) • Check size of component (1) to make sure it fits (1) • Check number of pins (1) to make sure board is correct/matches component (1) <p>Accept any other appropriate response.</p>	2

Question Number	Answer	Mark
4c	<p>Award one mark for disadvantage and one additional mark for appropriate expansion, up to a maximum of two marks.</p> <ul style="list-style-type: none"> • The location in which to place components could become confused (1) as there will be many similar looking components (1) • It is difficult to construct circuits from pictorial representations (1) as circuits symbols are normally used (1) • Exploded diagram could be hard to interpret when assembling a circuit (1) because components are all shown a distance away from the circuit board (1) • It is a non-standard method of communicating circuit designs (1) which could cause third parties to be confused when they are manufacturing the circuit (1) <p>Accept any other appropriate response.</p>	2

Question Number	Answer	Mark
4d	<p>Award one mark for reason and one additional mark for appropriate expansion, up to a maximum of two marks.</p> <ul style="list-style-type: none"> • To assist with fault finding by checking pins have been connected the correct way (1) as incorrect installation will prevent the circuit from functioning as intended (1) • To make sure components are installed in the correct orientation on a circuit board (1) as ICs/components only work when connected correctly to inputs and outputs (1) • To verify test results/multimeter readings (1) as pin configuration specifications give value for voltage/current at each pin (1) • An incorrectly installed component could cause safety issues (1) as it may overheat/burn out/cause short circuits (1) <p>Accept any other appropriate response.</p>	2







Question Number	Answer	Mark
5a	C – Schematic diagram	1

Question Number	Answer	Mark
5b	<p>Award one mark for each reason for referring to illustrations, up to a maximum of two marks.</p> <ul style="list-style-type: none">• To find details of how parts fit together (1)• To make sure the correct components are used (1)• To show internal parts that cannot be seen (1)• To show how to test that the installation works correctly (1)• To see the range of options available (1)• To see how parts are located/secured (1)• To show how the installation/components work (1) <p>Accept any other appropriate response.</p>	2

Question Number	Answer	Mark
5c	<p>Award one mark for reason and one additional mark for appropriate expansion, up to a maximum of two marks.</p> <ul style="list-style-type: none"> • Flow charts indicate the stages to be followed (1) meaning the system will be easy to operate for the end user (1) • The end user can use the flow chart for fault finding (1) because it will include questions that can help with diagnosis of faults (1) • The inclusion of a flow chart should prevent misuse of the system (1) as the chart will indicate how to set up the system correctly (1) • The flow chart will show how to control the system (1) showing how to navigate control menus on the system (1) • Flow charts are easier to understand (1) so the non-technical end user is able to gain information about the operation (1) • Flow chart allows safe operation (1) avoiding risk of injury (1) <p>Accept any other appropriate response.</p>	2

Question Number	Answer	Mark
5d	<p>Award one mark for an advantage and one additional mark for appropriate expansion, to a maximum of two marks per response, up to a maximum of four marks.</p> <ul style="list-style-type: none"> • End users can check the location of pipework/wiring/components (1) to ensure that installation was completed correctly (1) • There is less chance of accidental damage to the system (1) as the location of all parts will be known (1) • Location of components/switches/valves will be known (1) in case the system needs to be isolated in an emergency/to address faults in the system (1) • The layout diagram allows the system to be extended at a future date (1) as potential tap-off points will be indicated (1) • It shows where hot/cold air will be channelled (1) meaning the user can position other items accordingly (1) <p>Accept any other appropriate response.</p>	4

Question Number	Answer	Mark
6a	<p>Award one mark for any of the following responses:</p> <ul style="list-style-type: none"> length between 135 mm and 140 mm (1) tolerance between 135 mm and 140 mm (1) linear tolerance (1) <p>Accept any other reasonable response.</p>	1

Question Number	Answer	Mark												
6b	<p>Award one mark for each correctly matched symbol to a maximum of two marks.</p> <table border="0"> <thead> <tr> <th>Geometric tolerance symbol</th> <th>Geometric tolerance symbol name</th> </tr> </thead> <tbody> <tr> <td></td> <td><input type="text" value="Angle"/></td> </tr> <tr> <td></td> <td><input type="text" value="Maximum metal condition"/></td> </tr> <tr> <td></td> <td><input type="text" value="Profile of a surface"/></td> </tr> <tr> <td></td> <td><input type="text" value="Straightness"/></td> </tr> <tr> <td></td> <td><input type="text" value="Symmetry"/></td> </tr> </tbody> </table>	Geometric tolerance symbol	Geometric tolerance symbol name		<input type="text" value="Angle"/>		<input type="text" value="Maximum metal condition"/>		<input type="text" value="Profile of a surface"/>		<input type="text" value="Straightness"/>		<input type="text" value="Symmetry"/>	2
Geometric tolerance symbol	Geometric tolerance symbol name													
	<input type="text" value="Angle"/>													
	<input type="text" value="Maximum metal condition"/>													
	<input type="text" value="Profile of a surface"/>													
	<input type="text" value="Straightness"/>													
	<input type="text" value="Symmetry"/>													

Question Number	Answer	Mark
6c	<p>Award one mark for an implication and one additional mark for the appropriate expansion to a maximum of two marks.</p> <ul style="list-style-type: none"> • Errors could occur when using the drawings on site as drawings become hard to interpret (1) due to damage/tearing/rips (1) • Drawings can become harder to select from other drawings available on site (1) as incorrect folding will mean the drawing details are not visible without being opened out fully (1) • Drawings will need to be replaced more frequently, which increases costs/delays (1) as incorrect folding or failure to fold reduces the life span of the drawing (1) • Incorrect folding of drawings results in drawings needing to be opened out fully to be used (1) requiring more space to be used (1) <p>Accept any other reasonable response.</p>	2

Question Number	Answer	Mark
6d	<p>Award one mark for an implication and one additional mark for the appropriate expansion to a maximum of two marks, up to a maximum of four marks</p> <ul style="list-style-type: none"> • Customers would not be able to get duplicate drawings (1) as the files are no longer available (1) • The customer would need to have a new drawing produced (1) leading to delays in manufacture (1) • The customer's existing designs could no longer be adapted for changes (1) leading to longer development times for new drawings (1) • The customers could lose trade (1) leading to damage to their reputation (1) • Investment may be required (1) as further CAD resources may be necessary (1) • Customer needs to keep secure any copies of the original file/drawing (1) as these are now the only files available (1) <p>Accept any other reasonable response. Do not accept cost without justification.</p>	4

Question Number	Indicative content	Mark
7	<p>Positive effects of using SPC charts</p> <ul style="list-style-type: none"> • Does not slow down the rates of production • Identifies when products are out of tolerance • Charts identify how to improve the manufacturing process • Allows machinery/equipment to be monitored to ensure it conform to the norm • SPC should be able to identify trends that will stop the machine producing out of tolerance parts • Trends should be identified before any need to identify parts that are out of tolerance <p>Negative effects of using SPC charts</p> <ul style="list-style-type: none"> • Relies on accurate record keeping • Does not identify faulty products as they are produced • Faults can be unnoticed as SPC charts rely on random sampling • Relies on staff to monitor both production and complete documentation • SPC charts do not indicate which specific components are out of tolerance • SPC charts do not show whether a component is over or under tolerance • Need to have a statistically sound batch of components produced before the SPC can be set up, which poses a risk of early faulty parts being produced <p>Positive effects of using Pareto charts</p> <ul style="list-style-type: none"> • Identifies the aspects of production where the most faults occur • Identifies those stages of production that contribute the most to faulty outcomes • Allows the company to identify the aspects of production where most investment is needed to achieve improvements • Allows for a visual comparison of results before and after interventions • Can identify the root causes of manufacturing problems <p>Negative effects of using Pareto charts</p> <ul style="list-style-type: none"> • Does not show the variations in quality that occur • Does not distinguish between frequent and infrequent faults • Requires other documentation to be able to diagnose faults fully • Data used is from the previous manufacturing and may not be up to date • Only shows qualitative data, with no numerical values such as mean data 	8

The use of SPC and Pareto charts focus on mass production of components, reducing errors and predicting performance rather than 100% inspection. They do not guarantee faulty products will not be produced.

Model answer

Both methods of using quality control data have their advantages, with Pareto charts being able to identify the stages of production where errors happen most often, and SPC charts will show when components are out of tolerance. Combined they will show the stages where faults occur and the quantity of components that do not meet standards. However, neither method gives details of the types of fault with components, such as how out of tolerance a component is, or what the actual fault is with components. A Pareto chart has the advantage of showing where there are errors in production, but it does not show what these are, whereas a SPC chart will show what the error is in general terms, but not where it occurs. Both rely on sampling, which could result in false values for the quantity of faulty components, with an above average number of faulty components being sampled, or alternatively faulty components being missed and therefore machinery issues being overlooked. To conclude, the two types of control chart can improve the output and reduce the quantity of faulty components, however they both rely on accurate data and require further inspections or documentation to be effective.

Level	Descriptor	Marks
0	No rewardable material.	0 marks
1	Basic arguments on both sides identified, or only one side considered. The answer is likely to be in the form of a list. Points made will be superficial/generic and not applied/directly linked to reducing the quantity of faulty parts using quality control information. No conclusion produced or the conclusion a consequence of only one side of the argument being considered. Limited knowledge of the use of quality control information.	1-3 marks
2	Arguments for and against are described, but there will be more emphasis on one side than the other. The answer will be unbalanced. A conclusion is present, but this is either implicit or as a result of unbalanced consideration of the arguments. There is little or unfocused justification of the conclusion. Most points made will be relevant to reducing the quantity of faulty parts using quality control information, but the link will not always be clear. A good understanding of the use of quality control information.	4-6 marks
3	Balanced explanation of both sides for and against. A conclusion is produced which is justified and clearly linked to the consideration of arguments for and against, and their relative importance to the situation. The majority of points made will be relevant and there will be a clear link to reducing the quantity of faulty parts using quality control information. A developed understanding of the use of quality control information.	7-8 marks

