

General Certificate of Secondary Education

A624

Engineering

Unit A624: Impact of modern technologies on engineering

Specimen Paper

Time: 1 hour

Candidates answer on the question paper.

Additional materials:

Candidate
Forename

Candidate
Surname

Centre
Number

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Candidate
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do not write in the bar codes.
- Do not write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [] at the end of each question or part question.
- Your Quality of Written Communication is assessed in questions marked with an asterisk (*).
- The total number of marks for this paper is 60.

For Examiner's Use Only			
1		10	
2		11	
3		12	
4		13	
5		14	
6		15	
7		16	
8		17	
9		18	
TOTAL			

This document consists of **10** printed pages and **2** blank pages.

Answer **all** questions.

1 For each product listed below select the sector in which it is made.

Sectors:

- Automotive
- Chemical & Process
- Computers, Communication and IT
- Aerospace
- Structural and Civil

Product:

Road bridge

Washing up liquid

Personal Digital Assistant (PDA)

Car seat [4]

2 For each product listed below select the sector in which it is made.

Sectors:

- Aerospace
- Rail and Marine
- Medical and Pharmaceutical
- Electrical and Electronics
- Structural and Civil

Product:

Powered wheelchair

Turbine

Navigation system

Security system [4]

3 Tick **one** product from the list and state:

- **one** technology used in your chosen product; and
- **one** benefit of using that technology.

Product:

- car seat
- personal digital assistant PDA
- powered wheelchairs
- navigation system
- turbine
- security system
- washing up liquid
- road bridge

Technology [1]

Benefit [1]

4 Name **two** tools or items of equipment **you** have used to make an engineered product.

Engineered Product

Tool/equipment 1 [1]

Tool/equipment 2 [1]

5 Name **two** engineering materials **you** have used to make an engineered product.

Engineered Product

Material 1 [1]

Material 2 [1]

6 State what the letters CAD stand for.

C. **A.** **D.** [1]

7 Describe **two** benefits to a company of using CAD when **designing** engineered products.

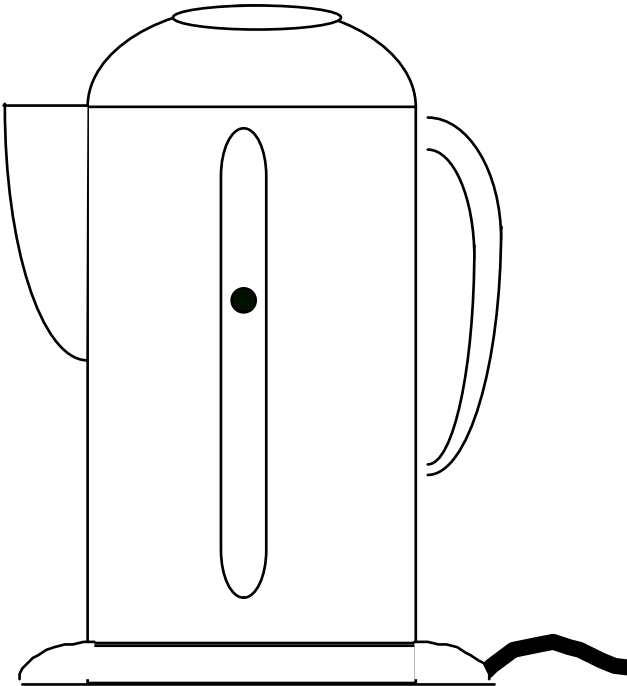
Benefit 1
.....
..... [2]

Benefit 2
.....
..... [2]

8 Describe **one** benefit to **users** of engineered products designed using CAD.

.....
.....
..... [2]

- 9 Look at the features listed and identify how they contribute to *design for the environment* by adding the features into appropriate boxes below



FEATURES

Injection moulded body

Volume indicator

Clips join body parts

Insulated outer wall

Efficient ceramic disc heat element

Use of recyclable materials

Reduce product energy consumption

1

2

3

Design for disassembly

[5]

- 10 Tick **two** recyclable materials.

- GRP (glass-reinforced plastic)
- brass
- epoxy resin
- HDPE (high-density polyethylene)
- melamine
- PET (polyethylene terephthalate)

[2]

11 Describe **one** different environmental consideration for each engineering process shown below.

Material removal
.....
..... [2]

Heat treatment
.....
..... [2]

Surface finishing
.....
..... [2]

12 Describe **one** way **information, communications and digital technology** could be of benefit to a company manufacturing engineered products.

.....
.....
..... [2]

14 Engineering materials are supplied in *standard market forms*.

Explain the benefits to the manufacturer of designing products to be manufactured using materials in their *standard market forms*.

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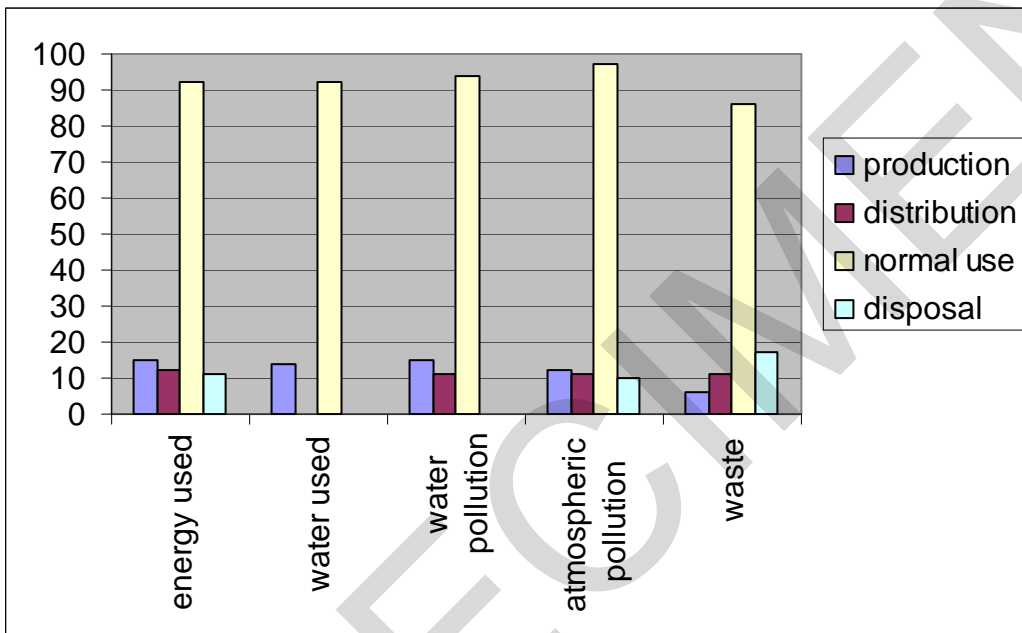
.....

[4]

SPECIMEN

15 The chart shows how much of the total environmental impact of an engineered product comes from its:

- production;
- distribution;
- normal use; and
- disposal.



(a) Tick the correct answer to show whether each of the following statements is true or false.

	True	False
More waste came from production than disposal.		
Production of the product caused more pollution than its normal use.		
Most of the environmental impact of the product came during its normal use.		
More energy was used in disposal than in production.		

[4]

16 Describe **one** example of water pollution caused by an engineered product in normal use.

.....
.....
..... [2]

17 Describe how **one** engineered product has been modified to reduce the atmospheric pollution it causes in normal use.

.....
.....
..... [2]

18* Discuss the impact upon the workforce, of the modern technologies used when manufacturing an engineered product.

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..... [6]

Total Marks: [60]

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Unit A624: Impact of modern technologies on engineering

Specimen Mark Scheme

The maximum mark for this paper is **60**.

SPECIMEN

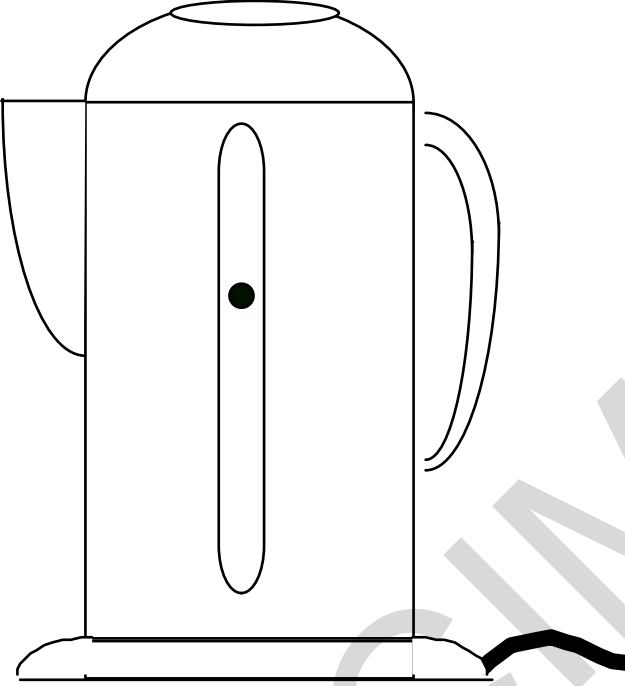
Question Number	Answer	Max Mark																																			
1	<p>For each product listed below select the sector in which it is made.</p> <p>Sectors:</p> <ul style="list-style-type: none"> • Automotive • Chemical & Process • Computers, Communication and IT • Aerospace • Structural and Civil <p>Road bridge</p> <p>Washing up liquid</p> <p>Personal Digital Assistant (PDA)</p> <p>Car seat</p> <p>One mark for each correct answer.</p> <table border="1"> <thead> <tr> <th>Product</th> <th>Road bridge</th> <th>Washing up liquid</th> <th>PDA</th> <th>car seat</th> </tr> </thead> <tbody> <tr> <td>Sector</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Automotive</td> <td></td> <td></td> <td></td> <td>X</td> </tr> <tr> <td>Chemical & Process</td> <td></td> <td>X</td> <td></td> <td></td> </tr> <tr> <td>Computers Communication and IT</td> <td></td> <td></td> <td>X</td> <td></td> </tr> <tr> <td>Aerospace</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Structural and Civil</td> <td>X</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Product	Road bridge	Washing up liquid	PDA	car seat	Sector					Automotive				X	Chemical & Process		X			Computers Communication and IT			X		Aerospace					Structural and Civil	X				[4]
Product	Road bridge	Washing up liquid	PDA	car seat																																	
Sector																																					
Automotive				X																																	
Chemical & Process		X																																			
Computers Communication and IT			X																																		
Aerospace																																					
Structural and Civil	X																																				

Question Number	Answer	Max Mark																																			
2	<p>For each product listed below select the sector in which it is made.</p> <p>Sectors:</p> <ul style="list-style-type: none"> • Aerospace • Rail and Marine • Medical and Pharmaceutical • Electrical and Electronics • Structural and Civil <p>Powered wheelchair.....</p> <p>Turbine.....</p> <p>Navigation system.....</p> <p>Security system.....</p> <p>1 mark for each correct answer.</p> <table border="1"> <thead> <tr> <th>PRODUCT</th> <th>Powered wheelchair</th> <th>Turbine</th> <th>Navigation system</th> <th>Security system</th> </tr> </thead> <tbody> <tr> <td>SECTOR</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Aerospace</td> <td></td> <td>X</td> <td></td> <td></td> </tr> <tr> <td>Rail and Marine</td> <td></td> <td></td> <td>X</td> <td></td> </tr> <tr> <td>Medical and Pharmaceutical</td> <td>X</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Electrical and Electronics</td> <td></td> <td></td> <td></td> <td>X</td> </tr> <tr> <td>Structural and Civil</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	PRODUCT	Powered wheelchair	Turbine	Navigation system	Security system	SECTOR					Aerospace		X			Rail and Marine			X		Medical and Pharmaceutical	X				Electrical and Electronics				X	Structural and Civil					[4]
PRODUCT	Powered wheelchair	Turbine	Navigation system	Security system																																	
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Structural and Civil																																					

Question Number	Answer	Max Mark
3	<p>Tick one product from the list and state: one technology used in your chosen product; and one benefit of using that technology.</p> <p>Product:</p> <ul style="list-style-type: none"> • car seat • personal digital assistant PDA • powered wheelchairs • navigation system • turbine • security system • washing up liquid • road Bridge <p>Technology [1] Benefit [1]</p> <p>No marks for selecting a product. For the selected product, one mark for stating a technology used in the product, and one for a benefit. For example technology:</p> <p><u>Car seat</u> memory foam, electronic adjustment, driver setting memory, <u>Personal digital assistant</u> microchip/microelectronics, surface mounting <u>Powered wheelchairs</u> as car seat, mouth/eye/control <u>Navigation system</u> satellite/ <u>Turbine</u> digital control <u>Security system</u> LEDs, wireless comms, <u>Washing up liquid</u> thickeners, antibacterial <u>Road bridge</u> CAD design/test, Benefit examples: Increased user comfort/security Increased strength/ smaller item, less weight.\accept product features.</p>	[2]

Question Number	Answer	Max Mark
4	<p>Name two tools or items of equipment you have used to make an engineered product.</p> <p>Engineered Product</p> <p>Tool/equipment 1 [1] Tool/equipment 2 [1]</p> <p>No marks for product, one mark for each of two specifically named engineering tools or items of engineering equipment. E.g. (vernier/outside/inside.) callipers, hacksaw, engineer's square, feeler gauge, centre punch, cold chisel, engineer's vice, named file, named hammer.</p>	[2]
5	<p>Name two engineering materials you have used to make an engineered product.</p> <p>Engineered Product</p> <p>Material 1 [1] Material 2 [1]</p> <p>(b) No marks for product, one mark for each of two specifically named materials used in the product. For example: Aluminium alloy, low carbon steel,</p>	[2]
6	<p>State what the letters CAD stand for.</p> <p>C A D</p> <p>One mark for Computer Aided Design</p>	[1]

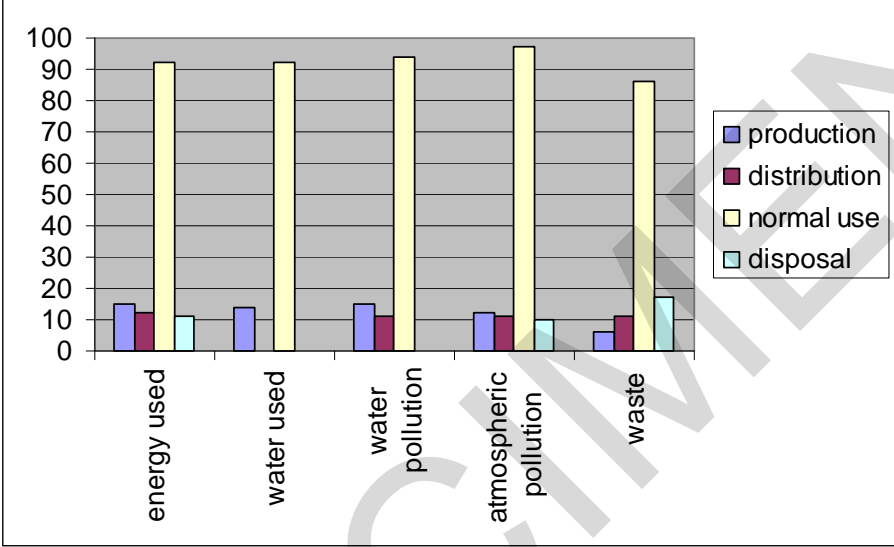
Question Number	Answer	Max Mark
7	<p>Describe two benefits to a company of using CAD when designing engineered products.</p> <p>Benefit 1</p> <p>.....</p> <p>..... [2]</p> <p>Benefit 2</p> <p>.....</p> <p>..... [2]</p> <p>Two marks for each of two benefits described, for example a feature and why or how it is beneficial to a company: Designs can be sent electronically saving time and postage. Designs can be amended without redrawing, saving time. 2D drawings can be viewed as 3D objects; stress/load calculations can be carried out automatically.</p>	[4]
8	<p>Describe one benefit to users of engineered products designed using CAD.</p> <p>Two marks for a benefit to the user, with why or how, as above, for example: Customised products more available/can be made by amending CAD files and sending to CAM. Designs are tested as models so finished product more reliable. Calculations can be carried out on design so can optimise designs to use less material – lighter products, lower transport costs – cheaper product. New/improved products available quicker. One mark for single point e.g. faster</p>	[2]

Question Number	Answer	Max Mark
9	<p>Look at the features listed and identify how they contribute to <i>design for the environment</i> by adding the features into appropriate boxes below</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  </div> <div style="text-align: left;"> <p>FEATURES</p> <ul style="list-style-type: none"> Injection moulded body Volume indicator Clips join body parts Insulated outer wall Efficient ceramic disc heat element </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 20px;"> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <p>Use of recyclable materials</p> </div> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <p>Reduce product energy consumption</p> <p>1</p> <p>2</p> <p>3</p> </div> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 20px; width: 45%;"> <p>Design for disassembly</p> </div> <p style="margin-top: 20px;">One mark for each of 5 correctly placed features: Injection moulded body (urm) Volume indicator(rpec) Clips join body parts(dfid) Insulated outer wall(rpec) Efficient ceramic disc heat element(rpec)</p>	<p>[5]</p>

Question Number	Answer	Max Mark
10	<p>Tick two recyclable materials.</p> <ul style="list-style-type: none"> • GRP (glass-reinforced plastic) • brass • epoxy resin • HDPE (high-density polyethylene) • melamine • PET (polyethylene terephthalate) <p>One mark each for brass and HDPE (high-density polyethylene)</p>	[2]
11	<p>Describe one different environmental consideration for each engineering process shown below.</p> <p>Material removal</p> <p>Heat treatment</p> <p>Surface finishing</p> <p>In each of 3 parts, two marks for a clear description of what needs to be considered with how or why. Different in each case. For example:</p> <p><u>Material removal</u> : e.g. Energy used by different processes or can material removed be re-used/sold or how disposed or will hazardous dust/fumes be formed from the process.</p> <p><u>Heat treatment</u> Energy used by different process Health and Safety issues for workforce or will hazardous fumes/waste be formed.</p> <p><u>Surface finishing</u> Energy used by process will hazardous dust/fumes be formed.</p>	<p>[2]</p> <p>[2]</p> <p>[2]</p>

Question Number	Answer	Max Mark
12	<p>Describe one way information, communications and digital technology could be of benefit to a company manufacturing engineered products.</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>Two marks for a description of a benefit to a company, for example: aiding research and development (1) or increasing efficiency (1) reduces the company's costs (1) digital communication.</p> <p>The use of digital communication (1) allows companies to transfer information instantly (1) between employees and customers (1) reducing company cost (1) and increasing efficiency(1) or similar.</p>	[2]
13	<p>One issue considered when <i>designing for the environment is manufacture without producing hazardous waste.</i> Explain in detail how a designer can address this issue.</p> <p>Six marks for a detailed explanation, including, for example:</p> <p>At each stage of the design process (1) consider materials (1) and manufacturing methods (1) checking whether any of the options considered could potentially cause hazardous waste (1) select materials(1) that do not give rise to HW when they were produced)(1) or when worked. Consider disposal methods (1)/potential for recycling.</p>	[6]

Question Number	Answer	Max Mark
14	<p>Engineering materials are supplied in <i>standard market forms</i>.</p> <p>Explain the benefits to the manufacturer of designing products to be manufactured using materials in their <i>standard market forms</i>.</p> <p>One mark for identification of benefit and one for explanation of benefit to the manufacturer.</p> <ul style="list-style-type: none"> • ease of handling – material taken directly from stock; • cost implications – reduced machining time, reduced manufacturing cost, ability to negotiate with material supplier, reduced cost to customer, increases manufacturers competitiveness; • availability – materials widely available, ease of supply, not limited to a single specialist supplier leads to production flexibility; • environmental benefit – minimises waste, reduces landfill/disposal charges. 	[4]

Question Number	Answer	Max Mark																														
15	<p>The chart shows how much of the total environmental impact of an engineered product comes from its:</p> <ul style="list-style-type: none"> • production; • distribution; • normal use; and • disposal.  <p>The bar chart displays the percentage contribution of four stages to the total environmental impact across five categories. The Y-axis represents the percentage from 0 to 100. The X-axis lists the categories: energy used, water used, water pollution, atmospheric pollution, and waste. The legend indicates: production (blue), distribution (maroon), normal use (yellow), and disposal (cyan).</p> <table border="1"> <thead> <tr> <th>Category</th> <th>production</th> <th>distribution</th> <th>normal use</th> <th>disposal</th> </tr> </thead> <tbody> <tr> <td>energy used</td> <td>15</td> <td>15</td> <td>90</td> <td>10</td> </tr> <tr> <td>water used</td> <td>15</td> <td>0</td> <td>90</td> <td>0</td> </tr> <tr> <td>water pollution</td> <td>15</td> <td>10</td> <td>90</td> <td>0</td> </tr> <tr> <td>atmospheric pollution</td> <td>15</td> <td>10</td> <td>90</td> <td>10</td> </tr> <tr> <td>waste</td> <td>5</td> <td>10</td> <td>85</td> <td>15</td> </tr> </tbody> </table> <p>Tick the correct answer to show whether each of the following statements is true or false.</p> <p>One mark for each correct response:</p> <p>False False True False</p>	Category	production	distribution	normal use	disposal	energy used	15	15	90	10	water used	15	0	90	0	water pollution	15	10	90	0	atmospheric pollution	15	10	90	10	waste	5	10	85	15	[4]
Category	production	distribution	normal use	disposal																												
energy used	15	15	90	10																												
water used	15	0	90	0																												
water pollution	15	10	90	0																												
atmospheric pollution	15	10	90	10																												
waste	5	10	85	15																												

Question Number	Answer	Max Mark
16	<p>Describe one example of water pollution caused by an engineered product in normal use.</p> <p>two marks for description including a named product that gives rise to polluted water in normal use (1) and the type of contamination(1): E.g. washing machines produce water contaminated with detergent. Cars when washed – water polluted with particulates, grime oils etc. NOT at the end of the products useful life, or unintended use (e.g. oil slicks from stricken tankers etc)</p>	[2]
17	<p>Describe how one engineered product has been modified to reduce the atmospheric pollution it causes in normal use.</p> <p>..... </p> <p>two marks for a description of how a named product has had its atmospheric pollution in normal use reduced. One only for stating a technology (e.g. engine management systems, catalytic converter) or an advanced product (Dual fuel car).</p>	[2]

Question Number	Answer	Max Mark
18*	<p>Discuss the impact upon the workforce of modern technologies used when manufacturing an engineered product.</p> <p>Six marks for a discussion giving 3 relevant points, stating why 2 are relevant and giving an example. Or</p> <p>For critical evaluation of the impact (showing understanding of the effects on the workforce)</p> <ul style="list-style-type: none"> • redundancy; • working conditions; • training; • lifestyle; • availability of products; • health and safety. <p>Level 1 (0-2 marks)</p> <p>Basic discussion showing some understanding of the impact of modern technologies upon the workforce. There will be little, or no, use of specialist terms. Answers may be ambiguous or disorganised. Errors of spelling, punctuation and grammar may be intrusive.</p> <p>Level 2 (3-4 marks)</p> <p>Adequate discussion showing an understanding of the impact of modern technologies upon the workforce. There will be some use of specialist terms, although these may not always be used appropriately. The information will be presented for the most part in a structured format. There may be occasional errors in spelling, punctuation and grammar.</p> <p>Level 3 (5-6 marks)</p> <p>Thorough analysis, showing a clear understanding of the impact of modern technologies upon the workforce. Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate can demonstrate the accurate use of spelling, punctuation and grammar.</p>	[6]
Paper Total		[60]

Assessment Objectives Grid (includes QWC)

Question	AO1	AO2	AO3	Total
1	4	0	0	4
2	4	0	0	4
3	2	0	0	2
4	0	2	0	2
5	0	2	0	2
6	1	0	0	1
7	4	0	0	4
8	2	0	0	2
9	5	0	0	5
10	0	2	0	2
11	0	6	0	6
12	0	0	2	2
13	0	6	0	6
14	0	4	0	4
15	0	0	4	4
16	1	0	1	2
17	1	0	1	2
18*	0	0	6	6
Totals	24	22	14	60