OCR
RECOGNISING ACHIEVEMENT

SPECIMEN

General Certificate of Secondary Education

A622

Engineering

Unit A622: Engineering Processes

Specimen Paper

Time: 1 hour

Candidates answer on the question paper.
Additional materials:

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

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			
		TOTAL	

Answer **all** questions.

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

Sectors:

- Aerospace
- Automotive
- Chemical & Process
- Computers, Communication and IT
- Medical and Pharmaceutical

Product:

Passenger aircraft door .....

Webcam .....

Windscreen .....

Shampoo ..... **[4]**

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

Sectors:

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

Product:

Passenger information system .....

Electric toothbrush .....

Blister pack .....

Eco-dome ..... **[4]**

3 Tick **two** items of personal protective equipment you should use when operating a lathe.

- goggles
- safety helmet
- gloves
- apron **[2]**

4 Describe **two** different safety precautions you should take when operating a pillar drill.

(marks will not be awarded for personal protective equipment)

1 .....

.....

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

2 .....

.....

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

5 Tick the correct meaning for the two safety signs shown.

- full face masks must be worn
- safety helmets must be worn
- controlled area
- danger area

- controlled area
- full face masks must be worn
- eye protection must be worn
- ear protection must be worn **[2]**

6 You work for a company that machines steel blocks. The finished blocks should be 52 mm long with a tolerance of ±0.1mm. Name one tool or item of equipment you could use to check they are the correct size.

.....**[1]**

Describe how you would use the tool or item of equipment you have named above.

.....

.....

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

7 Tick **one** product from the list.

Product:

- Electric toothbrush
- Passenger aircraft door
- Windscreen
- Eco-dome
- Shampoo
- Blister pack
- Webcam

Name the main **material** from which the selected product is made:

Material .....**[1]**

Name the **form** in which the material is supplied (sheet, granules, powder or liquid):

Form.....**[1]**

8 For each of the statements a-e below select an item from the box to complete the statement correctly.

low carbon steel brass nylon aluminium GRP (glass-reinforced plastic) ABS (Acrylonitrile Butadiene Styrene) silicon carbide cast iron

a .....is a polymer

b. ..... is also a polymer

c. .....is a ferrous metal

d. ..... is a ceramic

e. ..... is a composite

[5]

9 Describe **two** ways ICT is used for communication when **designing** an engineered product.

1 .....

.....

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

2 .....

.....

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

10 Describe **one** way ICT is used to ensure quality when **making** an engineered product.

.....

.....

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

11 Describe **one** quality check you have carried out when making an engineered product.

Product you have made .....

Quality Check:

.....

.....

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

12 Complete the table by giving **one** example of each engineering process

Process	Example
Shaping	.....
Chemical treatment	.....

[2]

13 Tick **one** fully automated process from the list and describe it in detail, including:

- Preparing the equipment;
- Programming; and
- Processing

Automated process:

- Surface mounting electronic components
- Robot welding
- CNC machining

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.....

.....**[6]**

14 Describe the function of any **three** of the engineering components shown below**.**

Resistor
Diode
Fuse
Rack and pinion gears
Double acting cylinder
Non-return valve

Component:.....

Function: .....

.....

Component:.....

Function: .....

.....

Component:.....

Function: .....

.....

[6]

15 The table shows a comparison of six components that could be used in an engineered product.

Component	Ease of storage	Easy to use	Safe to use	Value for money	Readily available
A	8	1	9	9	9
B	5	6	5	5	4
C	8	2	1	2	3
D	2	9	1	2	2
E	3	8	6	3	5
F	9	5	3	9	2

10 = excellent 1 = very poor

State which component is the most readily available.

..... **[1]**

Explain why component E would be the best choice for the workforce.

.....

.....

.....

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

16 Explain how the information in the table could be used to identify the best of the six components to use in the product.

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..... **[3]**

17* Discuss the impact of modern technology on the local environment.

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[6]

Total Marks: [60]

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OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

General Certificate of Secondary Education

ENGINEERING A622

Unit A622: Engineering Processes

Specimen Mark Scheme

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

Question Number	Answer	Max Mark
1	**For each product select from the sector shown in which it is made.** **Sectors:** • **Aerospace** • **Automotive** • **Chemical & Process** • **Computers, Communication and IT** • **Medical and Pharmaceutical** One mark for each correct answer.	**[4]**

PRODUCT	Passenger aircraft door	Webcam	Windscreen	Shampoo
SECTOR				
Aerospace	x			
Automotive			x	
Chemical & Process				x
Computers Communication and IT		x		
Medical and Pharmaceutical				

Question Number	Answer	Max Mark
2	**For each product select from the sector shown in which it is made.** **Sectors:** • **Automotive** • **Electrical and Electronics** • **Medical and Pharmaceutical** • **Rail and Marine** • **Structural and Civil** One mark for each correct answer.	**[4]**

Product	Passenger Information System	Electric toothbrush	Blister pack	Eco-dome	
Sector					
Automotive					
Electrical and Electronics		x			
Medical and Pharmaceutical			x		
Rail and Marine	x				
Structural and Civil				x	

Question Number	Answer	Max Mark
3	**Tick two items of personal protective equipment you should use when operating a lathe.** • goggles • safety helmet • gloves • apron one mark each for goggles and apron.	**[2]**
4	**Describe two different safety precautions you should take when operating a pillar drill.** **(marks will not be awarded for personal protective equipment)** two marks for each of two safety precautions when using a pillar drill, including how or why for example: Make sure you know where the safety cut off switch is before you start work. Tie back hair and tuck in all loose clothing. Clamp work to machine table or hold in machine vice to avoid it spinning. Avoid contact with swarf which may cut.	**[4]**

Question Number	Answer	Max Mark
5	**Tick the correct meaning for the two safety signs shown.**  • full face masks must be worn • safety helmets must be worn • controlled area • danger area  • controlled area • full face masks must be worn • eye protection must be worn • ear protection must be worn one mark for each correct response: Safety helmet must be worn and Eye protection must be worn	**[2]**
6	**You work for a company that machines steel blocks. The finished blocks should be 52 mm long with a tolerance of ±0.1mm. Name one tool or item of equipment you could use to check they are the correct size.** ..... One mark for Vernier callipers, go-nogo gauge, ruler, or jig. **Describe how you would use the tool or item of equipment you have named above.** two marks for describing correct use: callipers or ruler – must state how to read correctly. One mark for incomplete answer (eg see if it fits, measure it).	**[1]** **[2]**

Question Number	Answer	Max Mark
7	**Tick one product from the list.** **Product** • Electric toothbrush • Passenger aircraft door • Windscreen • Eco-dome • Shampoo • Blister pack • Webcam **Name the main material from which the selected product is made:** **Material** ..... **Name the form in which the material is supplied (sheet, granules, powder or liquid):** **Form** ..... No marks for product selection. One mark for appropriate prime material and one mark for the form in which it is supplied. Passenger aircraft door: aluminium alloy -sheet Windscreen: glass -sheet Shampoo: water -liquid Webcam: toothbrush Webcam/toothbrush: **ABS** (Acrylonitrile Butadiene Styrene) -granules Blister pack PVC or aluminium laminate film sheet eco-dome: ETFE (Ethylene Tetrafluoroethylene) -sheet	**[2]**

Question Number	Answer	Max Mark
8	For each of the statements a-e below select an item from the box to complete the statement correctly. low carbon steel brass nylon aluminium GRP (glass-reinforced plastic) ABS (Acrylonitrile Butadiene Styrene) silicon carbide cast iron **a.** .....**is a polymer** **b.** .....**is also a polymer** **c.** .....**is a ferrous metal** **d.** .....**is a ceramic** **e.** .....**is a composite** Nylon ABS (Acrylonitrile Butadiene Styrene) Low carbon steel or cast iron Silicon carbide GRP (glass-reinforced plastic)	**[5]**
9	**Describe two ways ICT is used for communication when designing an engineered product.** two marks for each of two descriptions giving the ICT used and how or for what, for example: Presentation package to show design ideas to client Spreadsheet to calculate loadings/costs/total weight Word processor to write for details of….. Email to write for…/ to attach CAD files /etc to send to…. Mobile phone to check with site surveyors.	**[4]**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Max Mark</th></tr>
<tr><td>10</td><td>Describe one way ICT is used to ensure quality when making an engineered product.

two marks for a description of ICT used to check quality giving the ICT used and how or for what, for example:
Sensors are used to check dimensions and the computer controls which are passed, sent for rework or rejected.
Computer selects a random sample and runs electrical tests on them,</td><td>[2]</td></tr>
<tr><td>11</td><td>Describe one quality check you have carried out when making an engineered product.

Product you have made ……

two marks for a description of a quality check carried out by an individual. For example visual check that finish is glossy, manual for smoothness.</td><td>[2]</td></tr>
<tr><td>12</td><td>Complete the table by giving one example of each engineering process

<table>
<tr><th>Process</th><th>Example</th></tr>
<tr><td>Shaping</td><td>.....</td></tr>
<tr><td>Chemical treatment</td><td>.....</td></tr>
</table>
one mark for a correct example of each process:
Shaping - press moulding, bending, forming
Chemical treatment - galvanising, pickling, dipping, anodising</td><td>[2]</td></tr>
</table>

Question Number	Answer	Max Mark
13	**Tick one fully automated process from the list and describe it in detail, including:** • **Preparing the equipment;** • **Programming; and** • **Processing** • Surface mounting electronic components • Robot welding • CNC machining Six marks for a full description (Won't be as detailed as below, example shows type of information to be credited. 1 mark for each of 6 relevant points shown) **Surface mount technology** Where components are to be placed, the printed circuit board has flat, solder pads without holes (1). Solder paste is applied to all the solder pads with a stainless steel stencil (1). If components are to be mounted on the second side(1), a numerically controlled (NC) machine(1) places small liquid adhesive dots at the locations of all second-side components(1). The boards then proceed to the pick-and-place machines (1), where they are placed on a conveyor belt (1). Small surface mount devices are usually delivered to the production line on paper or plastic tapes wound on reels (1). Integrated circuits are typically delivered stacked in static-free plastic tubes or trays (1). NC pick-and-place machines remove the parts from the reels or tubes and place them on the PCB. Second-side components are placed first (1), and the adhesive dots are quickly cured with application of low heat or ultraviolet radiation. The boards are flipped over and first-side components are placed by additional NC machines. (1) The boards are then conveyed into the reflow soldering oven. (1) Following reflow soldering, certain irregular or heat-sensitive components may be installed and soldered by hand, (1) or in large scale automation, by focused infrared beam (FIB) equipment. (1) After soldering, the boards are washed (1) to remove flux residue (1) and any stray solder balls that could short out closely spaced component leads. (1) Finally, the boards are visually inspected (1) for missing or misaligned components (1) and solder bridging (1). If needed, they are sent to a rework station where a human operator corrects any errors (1). They are then sent to the testing stations to verify that they work correctly (1). **CNC machining** A series of CNC machines may be combined into one station, commonly called a "cell"(1), to progressively machine a part requiring several operations(1). Components for machining are delivered to the cell(1) and manually loaded in batches(1). CNC machines today are controlled directly from files created by CAM software packages (1), so that a part or assembly can go directly from design to manufacturing (1) (accept older tech eg punched tape/floppy disks used to transfer G-codes into the controller) The files containing the G-codes to be interpreted by the controller are usually saved under the .NC extension. (1)	

Question Number	Answer	Max Mark
13 Cont'd	Things like tool breakage detection have given the CNC the ability to call the operators mobile phone if a tool breaks so she can come replace it (1). While the machine is awaiting replacement on the tool, it would run other parts it is already loaded with up to that tool (1) and wait for the operator. Some machines might even make 1000 parts on a weekend with no operator, checking each part with lasers and sensors. (1) **Robotic welding** The setup or programming of motions and sequences for an industrial robot is typically taught by linking the robot controller via communication cable(1) to the Ethernet, FireWire, USB or serial port of a laptop computer(1). The computer is installed with corresponding interface software. Robots can also be taught via a teach pendant, (1) (1) a handheld control and programming unit. The teach pendant or PC is usually disconnected after programming and the robot then runs on the program that has been installed in its controller. The body panels are taken to the robot on a conveyor belt(1) and lifted into position with a mechanical grip (1). Alignment is checked by sensors (1) and the position adjusted until both parts are perfectly aligned (1). The arc weld arm is positioned for the first weld(1) then moved to each position in turn. (1)	**[6]**
14	**Describe the function of any three of the engineering components shown below.** **Resistor** **Diode** **Fuse** **Rack and pinion gears** **Double acting cylinder** **Non-return valve** Two marks for each correct response: Controls (1) the current flow (1) in a circuit Allows current (1) to pass in one direction (1) Protects (1) circuit (1) Change speed (1) of rotation (1) Allows air to move piston (1) in or out (1). Only allows air (1) through one way (1)	**[6]**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Max Mark</th></tr>
<tr><td>15</td><td>
The table shows a comparison of six components that could be used in an engineered product.
<table>
<tr><th>Component</th><th>Ease of storage</th><th>Easy to use</th><th>Safe to use</th><th>Value for money</th><th>Readily available</th></tr>
<tr><td>A</td><td>8</td><td>1</td><td>9</td><td>9</td><td>9</td></tr>
<tr><td>B</td><td>5</td><td>6</td><td>5</td><td>5</td><td>4</td></tr>
<tr><td>C</td><td>8</td><td>2</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>D</td><td>2</td><td>9</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>E</td><td>3</td><td>8</td><td>6</td><td>3</td><td>5</td></tr>
<tr><td>F</td><td>9</td><td>5</td><td>3</td><td>9</td><td>2</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">10 = excellent 1 = very poor</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
State which component is the most readily available.

A

Explain why component E would be the best choice for the workforce.

1 mark for identifying both ease of use and safe to use as key features to consider.
1 for relevant comparison from: best total for 2, not worst for either, or better than average both.
</td><td>[1]

[2]</td></tr>
<tr><td>16</td><td>
Explain how the information in the table could be used to identify the best of the six components to use in the product.

3 marks for clear explanation, giving points such as: reject any that is poor in any category; add up all the scores; consider other (stated, relevant) features; weight features according to (stated, relevant); considerations of other company priorities (current use, experience, equipment etc).
</td><td>[3]</td></tr>
</table>

Question Number	Answer	Max Mark
17*	**Discuss the impact of modern technology on the local environment.** Examples of points • Improved transport links and traffic controls • internet purchases means less travel effect on local roads • less emissions • less noise or more noise – needs explanation • better / more improved domestic products • improved social facilities • more people working from home • improved domestic and commercial communications • better local lighting. • reduce crime (CCTV), speed cameras, traffic lights • landfill sites Identification and expansion on any of the above. List is not exhaustive. Level 1 (0-2 marks) Basic discussion showing some understanding of the impact of modern technology on the local environment. 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. Level 2 (3-4 marks) Adequate discussion showing an understanding of the impact of modern technology on the local environment. 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. Level 3 (5-6 marks) Thorough analysis, showing a clear understanding of the impact of modern technology on the local environment. 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.	**[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	4	0	0	**4**
5	2	0	0	**2**
6	0	3	0	**3**
7	0	2	0	**2**
8	0	5	0	**5**
9	4	0	0	**4**
10	2	0	0	**2**
11	2	0	0	**2**
12	0	2	0	**2**
13	0	6	0	**6**
14	0	6	0	**6**
15	0	0	3	**3**
16	0	0	3	**3**
17*	0	0	6	**6**
Totals	**24**	**24**	**12**	**60**