

Surname	Centre Number	Candidate Number
Other Names		2



**GCE AS/A LEVEL – NEW**

2601U10-1



**DESIGN AND TECHNOLOGY – AS unit 1**  
**Engineering Design**

MONDAY, 14 MAY 2018 – AFTERNOON

2 hours

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	8	
2.	8	
3.	8	
4.	8	
5.	8	
6.	40	
<b>Total</b>	<b>80</b>	

**ADDITIONAL MATERIALS**

A calculator, ruler, pencil and coloured pencils.

**INSTRUCTIONS TO CANDIDATES**

Use black ink or black ball-point pen.

Answer **ALL** questions.

Write your name, centre number and candidate number in the spaces at the top of this page.

Write your answers in the spaces provided in this booklet. If you run out of space, use the continuation page at the back of the booklet, taking care to number the question(s) correctly.

**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets at the end of each question or part-question. You are advised to divide your time accordingly.

The total number of marks available is 80.

You are reminded of the need for good English and orderly, clear presentation in your answers. The quality of your written communication, including appropriate use of punctuation and grammar, will be assessed in your answer to question 5.

Answer **all** questions.

1. Computers are increasingly being used when both developing and manufacturing products.

(a) Explain in detail **one** benefit of using solid modelling to the designer. [2]

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(b) Explain why computer aided manufacture (CAM) is increasingly used in preference to traditional manufacturing methods. [2]

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(c) When making incremental developments to existing products engineers often use digital 3D scanning to capture data for analysis. Give **two** reasons why this is considered to be beneficial in the development of products. [4]

Reason 1

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Reason 2

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2. (a) Explain the purpose of a five step risk assessment when producing either a mechanical or an electronic product. [2]

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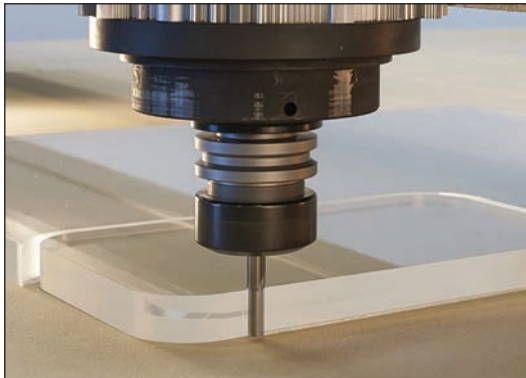
- (b) State any **three** steps in a five step risk assessment. [3]

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- (c) The images below show a CNC router. Suggest **three** features that would need to be added to the machine in order to ensure that it complies with health and safety legislation. [3]



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3. In order to make products such as mobile phones more sustainable they are increasingly being designed for disassembly.

(a) Explain why products that are easily disassembled are considered to be more sustainable. [2]

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(b) Discuss how products can be designed in order that they can be easily disassembled. [6]

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4. The image below shows the structure of a railway bridge based on a simple Warren Truss. As a train moves across it, the bridge is subject to forces of tension, compression, torsion and shear.



Evaluate and explain how the bridge structure reacts to and withstands the applied forces. [8]

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- 5. In developing a wide range of consumer products Dyson UK uses an iterative design process, with emphasis on free hand sketching and cardboard modelling.

Describe the way in which this process has enabled Design Engineers at Dyson to make both radical and incremental developments. [8]

*Marks will be awarded for the content of the answer and the quality of written communication.*

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6. A theme park has a new roller coaster attraction. The roller coaster car from the new attraction is shown below and holds up to four people.



- (a) Analyse the information given and in the space below write **four** justified specification points that would need to be included when designing the roller coaster car. [8]

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Justification:

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Point 2:

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Justification:

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Point 3:

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Justification:

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Point 4:

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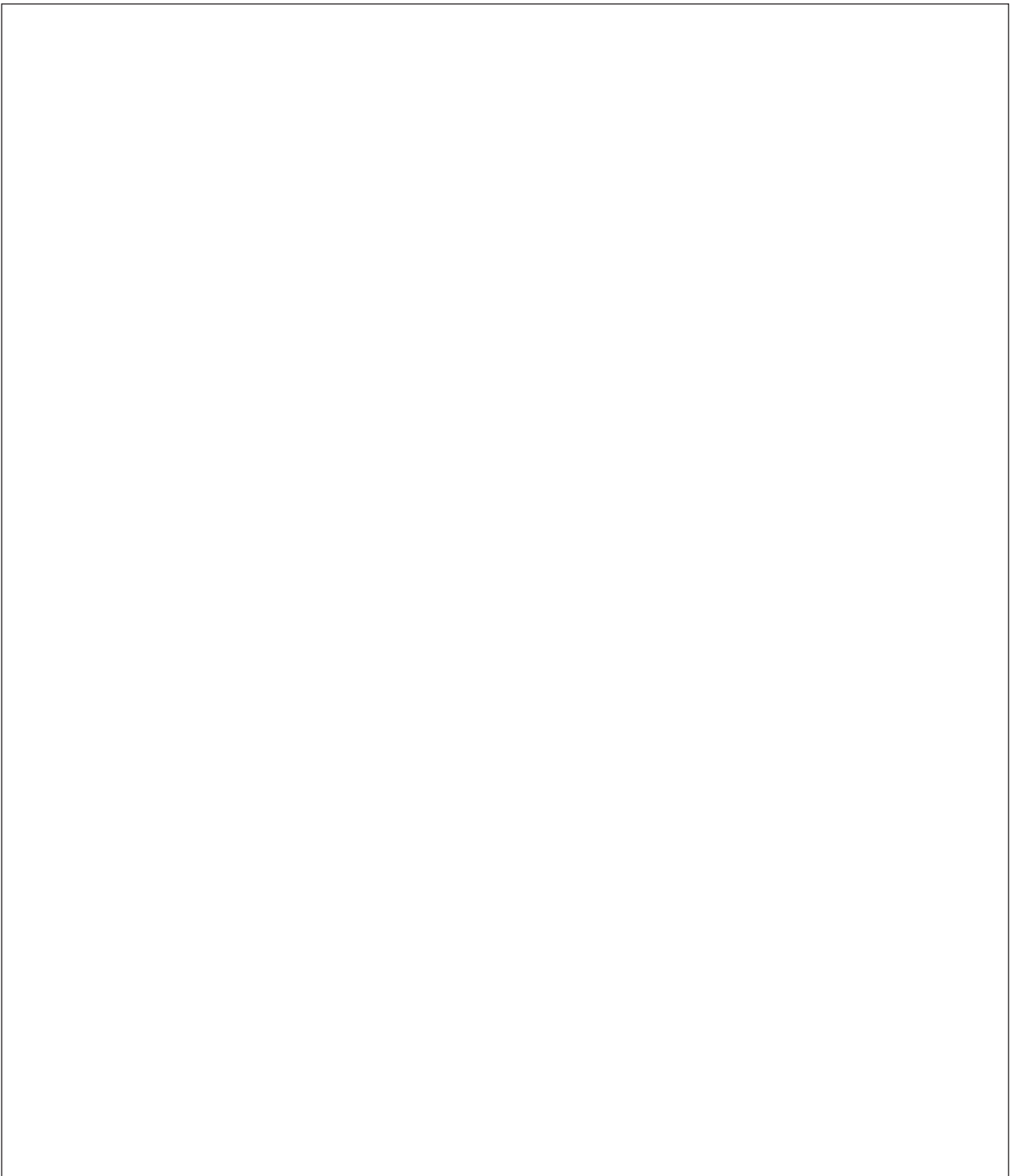
Justification:

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(b) (i) The roller coaster uses an electronic system to ensure that the car will not move until it is safe to do so. This includes sensors to check:

- that the safety harness for each seat has been fully closed;
- that the operator has activated the start switch that releases the vehicle.

In the box below, draw a detailed block diagram explaining the requirements for a suitable system that includes both **sensors**, process components and an output device. [8]



- (ii) The safety harness for each seat consists of a padded tubular steel bar which can be closed around each rider. The bar should lock in position until it is automatically released when the car stops at the end of the ride.

In the box below, draw a detailed annotated diagram of a suitable mechanical system that can be used to lock and unlock the safety harness. [8]

*Marks will be awarded for a suitable mechanical locking system, a method by which the harness can be quickly released and the use of appropriate communication techniques.*



- (c) To ensure that the roller coaster car does not leave the rails it requires wheels that are located above, below and to the side of the track. Potential wheel arrangements are shown in the illustrations below.



In the box below, produce a suitable design for one of the wheels and a method of attaching it to a stub axle. Your design must include constructional details and named materials from which the components will be manufactured. [8]

Blank area for drawing the wheel design and its attachment to a stub axle.

(d) Discuss the way in which ergonomic and anthropometric factors play critical roles in the design of a new roller coaster. [8]

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