GCE A LEVEL – NEW

A602U10-1

S19-A602U10-1

FRIDAY, 7 JUNE 2019 – MORNING

DESIGN AND TECHNOLOGY – A level component 1
Product Design

3 hours

A602U101
01

ADDITIONAL MATERIALS

In addition to this paper you will need:
a WJEC pink 16-page answer booklet, a calculator, ruler, pencil and coloured pencils.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.
Answer **all** questions.
Write your answers in the separate answer booklet provided.

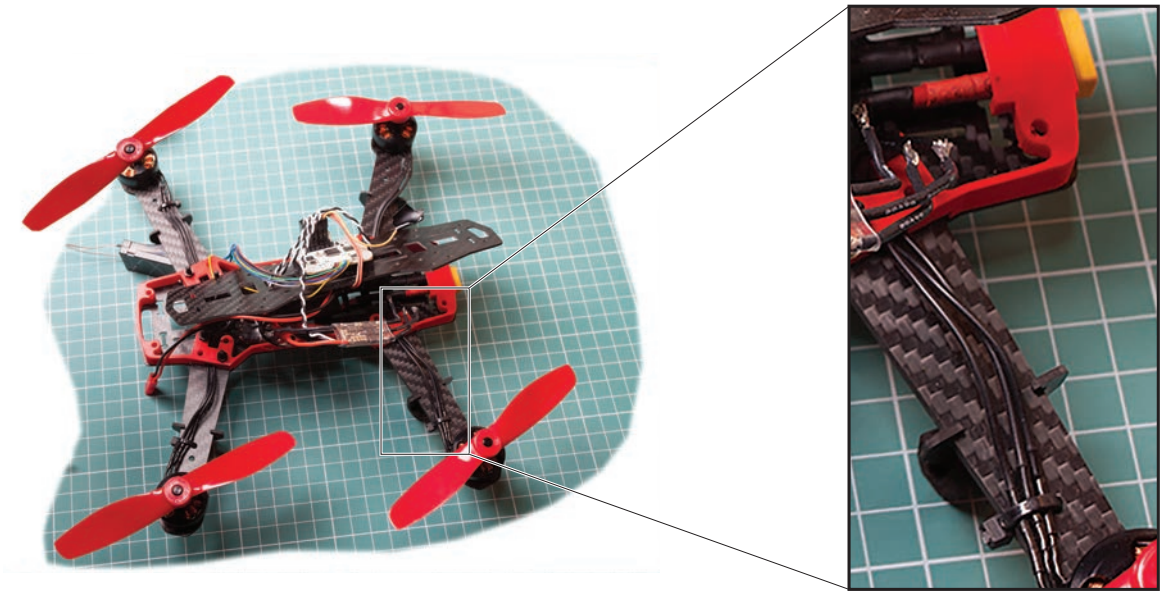
INFORMATION FOR CANDIDATES

When and where appropriate, answers should be amplified and illustrated with sketches and/or diagrams.
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 number of marks available is 100.
You are reminded of the need for good English and orderly, clear presentation in your answers.
You may use a calculator in this examination.

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Answer **all** *questions.*

1. Below is a picture of a racing drone. It has been made from a composite material.



(a) Name a composite material that could have been used. [1]

(b) Explain why this composite is a suitable choice of material for use in this application. [3]

(c) State the name of the quality assurance mark that would be displayed on the product to show that it has passed stringent standard safety tests for use within the UK. [1]

(d) Products that are certified by the British Standards Institute (BSI) have passed specific tests before being available to the consumer.

Describe a test that the drone would need to pass before being made available to the consumer. [3]

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2. The 3D component shown below **(fig. 1)** is to be printed on a standard desktop 3D printer using a reel of filament **(fig. 2)**. All dimensions are in mm.

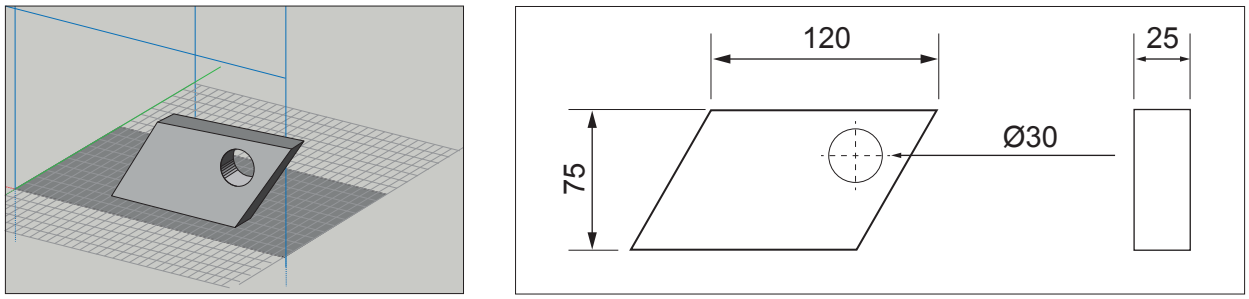


fig. 1 (3D component to be printed)



fig. 2 (filament reel for a 3D printer)

(a) (i) Calculate the overall volume of the component in **fig. 1** using the sizes provided. *Show all calculations*. [3]

(ii) The component is to be printed at 10 % density (including surface area). Calculate the volume based on this 10 % density. [1]

(iii) If 1 cm of filament prints 125 mm³, calculate how many centimetres of filament will be needed to complete 4 of these prints. *Show all calculations*. [2]

(b) The manufacturer requires a logo to be spray-painted onto the component for modelling purposes. Explain how the use of a template would be beneficial. [2]

(c) Describe **one** advantage of producing the component shown in **fig. 1** on a 3D printer, rather than producing it by hand. [2]

(d) Discuss the environmental impact of using plastic material for pre-production models. [4]

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3. The outer casing of the bluetooth headphones shown below is made from a thermoplastic and has been injection moulded.



(a) Describe the sequence of steps used in the injection moulding process. [4]

(b) Explain in detail why moulds for injection moulding are often made from steel. [4]

4. Cell production systems are typically used when manufacturing consumer electronics such as e-readers.

(a) Describe **two** benefits of cell production to the manufacturer. [4]

(b) A manufacturer pays production staff £15.32 per hour, and the cell production manager £17.32 per hour. There are 6 people in the production team (which includes the manager) and they each work an 8 hour shift. It takes 3 shifts for the production cell to complete their specified job. Work out how much it costs to pay the whole workforce for this specific job.
Show all calculations. [4]

(c) (i) The workforce completed the job and are eligible for a 3.7% pay bonus. Work out how much extra money each member of the team would be paid, including the cell production manager.
Show all calculations. [4]

(ii) Calculate how much more the cell production manager will be paid after the bonus in comparison to the cell production staff. Show your answer as a percentage. [1]

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5. The trampoline shown below has been made from several different materials, each of which was chosen for their respective working properties.



(a) Explain the difference between 'physical properties' and 'mechanical properties'. [2]

(b) The trampoline frame is made from galvanised mild steel tubing. Describe the mechanical properties of galvanised mild steel tubing that make it suitable for use in this product. [4]

(c) The protective sleeves on the upper frame have been made from high density foam. Describe the properties of high density foam that make it suitable for use in this product. [4]

6. Explain how the use of composite boards has impacted on the design and manufacture of modern flat-pack furniture items. [5]

7. Study the image of the hand drill below.



(a) Analyse the ways in which the designer has considered consumers' safety in the design and manufacture of this product. [6]

(b) Many manufacturing plants that make consumer goods are investing in renewable energy to help power their factories. Evaluate the use of solar energy as the main power source to the manufacturing plant used to make products such as the hand drill. [6]

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8. Many companies are now reconsidering their environmental and sustainable credentials. When they design products they often 'design for maintenance' by the consumer in order to extend the product's life.

Using named examples, explain how designers are making products 'maintainable' by the consumer in order to extend the product's life and analyse how this impacts on the environment. [9]

9. Explain how CAD/CAM technologies have facilitated a truly global workforce in terms of the design and manufacture of products. [9]

10. Evaluate the advantages and disadvantages to the designer and manufacturer of using concurrent engineering for either high volume consumer products such as mobile phones or large complex one-off projects such as a modern ocean liner. [12]

END OF PAPER

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