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Design & Technology
AQA A-Level

Paper 1 – Technical Principles

2 hours 30 minutes

Materials required for questions

- Pencil
- Rubber
- Calculator

Instructions

- Use black ink or ball-point pen
- Try answer all questions
- Use the space provided to answer questions
- Calculators can be used if necessary
- For the multiple choice questions, circle your answer

Advice

- Marks for each question are in brackets
- Read each question fully
- Try to answer every question
- Don't spend too much time on one question

Good luck!

120 marks

Q1.1) Explain the meaning of the following terms. **(4 marks)**

Thermal conductivity:

Electrical conductivity:

Q1.2) A wall is made from a material with a thermal conductivity of 0.5 W/mK. An improved material has a thermal conductivity of 0.2 W/mK. The heat loss through the wall is directly proportional to the thermal conductivity.

Calculate the percentage reduction in heat loss when the improved material is used. **(4 marks)**

Q2) Urea formaldehyde (UF) has been used the electrical plug casing shown below. Explain two benefits of using urea formaldehyde (UF) for the plug casing. **(6 marks)**

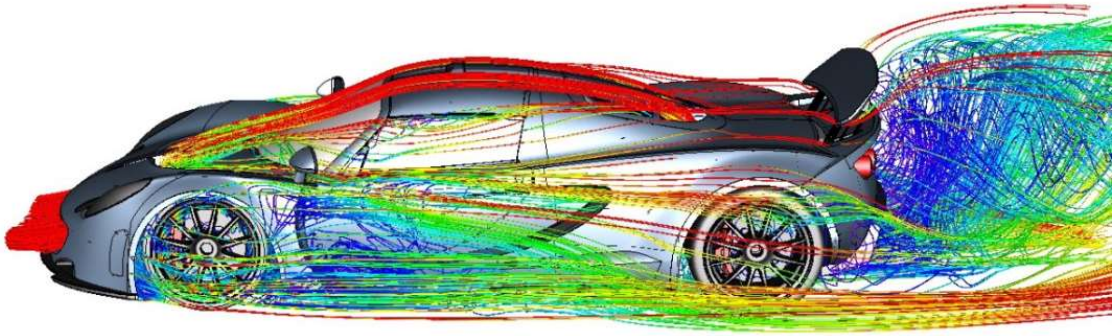
Q3) Explain why glulam is a suitable material for the manufacture of the outdoor structure shown. **(6 marks)**

Q4) Explain why shape memory alloys (SMA) are suitable for spectacle frames. **(6 marks)**

Q5) Describe the process of investment casting to produce the car part shown below. **(6 marks)**

Q6) Explain why a manufacturer may choose to use a unit production system for the manufacture of clothes. **(6 marks)**

Q7) The image below shows a CFD results for a car.



Q7.1) Justify why CFD may be used to improve efficiency during product development. **(6 marks)**

Q7.2) A CFD simulation takes 12 hours to run on a computer with a processing speed of 2.5 GHz. A new computer has a processing speed of 4.0 GHz. Assuming simulation time is inversely proportional to processing speed, calculate the new simulation time. **(4 marks)**

Q8.1) One safe working practice when operating a bandsaw would be to wear personal protective equipment (PPE). Give two other safe working practices when operating a bandsaw. **(2 marks)**

Q8.2) Manufacturing companies comply with a wide range of health and safety legislation and regulations to protect workers. Discuss the consequences for a company of non-compliance with health and safety legislation and regulations. **(6 marks)**

Q9) Despite the use of quality assurance systems consumers still occasionally receive faulty goods. Discuss how consumer rights legislation provides protection to the consumers who receive faulty goods. **(6 marks)**

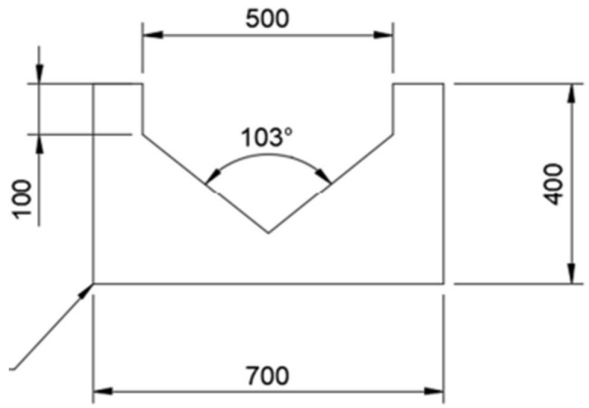
Q10.1) An airline company are considering registering some of their designs under design rights. Explain the difference between registered design rights and unregistered design rights. **(4 marks)**

Q10.2) A factory produces aircraft components. The probability that a single component fails quality control (QC) is 0.1. Three components are selected at random. Calculate the probability that at least one of the components fails QC. **(3 marks)**

Q11) Designers and manufacturers need to determine whether design solutions are commercially viable. Discuss the value of a feasibility study to determine the commercial viability of a product. **(9 marks)**

Q12) Discuss how a circular economy will reduce the impact of manufacturing activity on the environment and promote sustainability. **(9 marks)**

Q13) The image below shows the cross-section of a steel bracket. All dimensions are in mm.



The length of the bracket will 6m and 20 will be made. If the steel has a density of 7,750kg/m^3, what will the overall mass of the stell be. **(6 marks)**

Q14) The image below shows two different kettles

	
Polymer electric kettle	**Whistling kettle**

Analyse and evaluate the kettles in terms of the three features identified below:

- Ergonomics
- Functionality
- Innovation **(12 marks)**

Q15) Give two forms a trademark may take to identify the genuine product. **(2 marks)**

Q16) The table below shows tensile failure load results for a batch of steel.

Failure load in Newtons (N)	Number of failures
380	3
390	9
400	6
410	4
420	3

Calculate each of the following, using the data shown.

Q16.1) The median failure load of the steel. **(2 marks)**

Q16.2) The mean failure load of the steel. **(4 marks)**

Q17) Name a ferrous metal and give two reasons why hardening has been used to improve its function in a specific product. **(4 marks)**

Q18) Give three benefits of using stock forms of material for a manufacturer. **(3 marks)**

END OF QUESTIONS