Write your name here

Surname	Other names

Edexcel GCE

Centre Number	Candidate Number

Engineering

Unit 1: Engineering Materials, Processes and Techniques

Monday 16 May 2011 – Afternoon **Time: 1 hour 30 minutes**	Paper Reference **6931/01**

You do not need any other materials.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Answer ALL questions. Write your answers in the space provided.

The questions in this paper relate to a seatbox for anglers shown in Figure 1.

This is a multi function device for transporting and storing fishing tackle. It is also used as a seat when fishing.

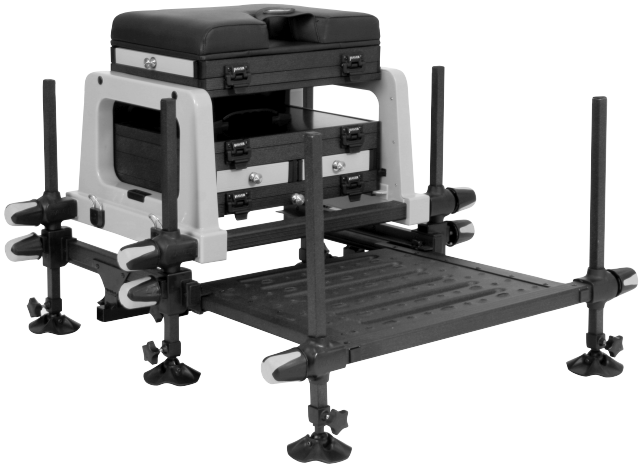

Figure 1

1 The materials used to manufacture the seatbox can be grouped into classes.

For each class of material listed, complete the following table by naming:

- one specific material
- one significant property.

Class of material	Material	Significant property
Thermosetting polymers		
Composites		
New materials		
Elastomers		
Non-ferrous metals		

(Total for Question 1 = 10 marks)

2 A number of processes are used to manufacture the seatbox.

Complete the following table by giving:

- one hazard involved in each process
- one risk resulting from each hazard.

Each answer must be different.

Process	Hazard	Risk
Arc welding		
Sawing metal tube		
Injection moulding		
Metal turning		

(Total for Question 2 = 8 marks)

3 Three methods of finishing the metal frame are galvanising, painting and plastic coating.

(a) Outline the advantages and disadvantages of each finishing method.

(i) Galvanising

(3)

(ii) Painting

(3)

(iii) Plastic coating

(3)

(b) One of the finishing processes mentioned is galvanising.

Explain the preparation and process of galvanising the metal frame, including health and safety precautions.

(5)

(Total for Question 3 = 14 marks)

4 The metal frame of the seatbox can be made from low carbon steel. This material is tested to determine its ultimate tensile strength (UTS).

(a) Sketch a graph to show the relationship between Load and Extension when testing low carbon steel.

(6)

(b) Show on the graph the:

(i) range over which specimens extend elastically

(1)

(ii) ultimate tensile strength

(1)

(iii) yield point

(1)

(c) A specimen tested has a uniform cylindrical cross section. The dimensions of the specimen are:

length 100mm

cross sectional area $30mm^2$

A load of 6000N increases the length of the specimen by 0.3mm

(i) State the formula to calculate the strain

(1)

.....

(ii) Calculate the strain

(4)

Space for working

(iii) State the formula to calculate the stress

(1)

.....

(iv) Calculate the stress

(4)

Space for working

(Total for Question 4 = 19 marks)

5 The drawers and trays which store various items of equipment can be made from polymers.

(a) Explain the difference in properties between thermosetting polymers and thermoplastic polymers.

(6)

(b) Using a labelled diagram, show the basic molecular structure of:

(i) a thermosetting polymer

(2)

(ii) a thermoplastic polymer

(2)

(Total for Question 5 = 10 marks)

6 Anglers often have to use the seatbox in bad light especially when starting or finishing a day's fishing. The manufacturer wishes to offer an optional extra of a lamp to attach to the seatbox at such times.

(a) Using notes and sketches, design a portable lamp which can be attached to the seatbox.

Your design must include the following:

- a method of attaching the lamp to the seatbox
- a method of controlling the light source
- a method of adjusting the position of the lamp
- a method of storing the lamp when not in use.

(8)

(b) (i) Name **two** materials used in the design of your lamp.

(2)

1 .....

.....

2 .....

.....

(ii) Describe **one** property of each material.

(4)

Material 1

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.....

.....

.....

Material 2

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.....

(iii) State why **one** of the properties in (ii) is required for the lamp.

(1)

.....

.....

(Total for Question 6 = 15 marks)

7 One property of the metal used for the seatbox frame is hardness.

(a) Describe, using notes and sketches, how a hardness test is carried out.

(4)

(b) When two materials are tested using the method in (a), explain how one is shown to be harder than the other.

(2)

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(c) The support feet of the frame are manufactured from acrylonitrile-butadiene-styrene (ABS) using the injection moulding process.

Explain why this process is suitable for the manufacture of the feet.

(2)

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*(d) Two materials that can be used for the frame of the seatbox are aluminium alloy and low carbon steel.

Discuss the advantages and disadvantages of using aluminium alloy and low carbon steel for the frame of the seatbox.

(6)

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(Total for Question 7 = 14 marks)

TOTAL FOR PAPER = 90 MARKS

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