

Write your name here

Surname

Other names

Pearson
Edexcel GCE

Centre Number

--	--	--	--	--	--

Candidate Number

--	--	--	--	--	--

Engineering

Unit 1: Engineering Materials, Processes and Techniques

Monday 15 May 2017 – Morning
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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

P48752RA

©2017 Pearson Education Ltd.

1/1/1/1/1/1/1/1/1/1



P 4 8 7 5 2 R A 0 1 2 0



Pearson

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

Some of the questions in this paper relate to a dumper truck, as shown in **Figure 1**.

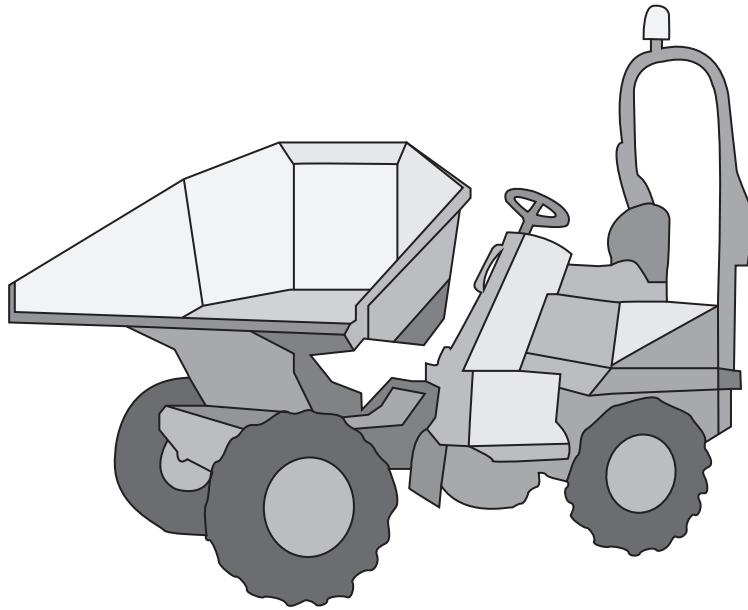


Figure 1

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

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

From the materials listed, complete the following table by naming:

- the class of each material
- **one** significant property of each material.

Each answer must be different.

Specific material	Class of material	Significant property of material
High carbon steel		
Polyamide (nylon)		
Urea formaldehyde (UF)		

(Total for Question 1 = 6 marks)



2 The table below lists four processes used in manufacturing the dumper truck.

Complete the table by giving:

- **one** risk involved in each process
- **one** different precaution/control measure to prevent injury.

Each answer must be different.

Process	Risk	Precaution/Control measure
Metal drilling		
MIG welding		
Spray painting		
Handling hot metal		

(Total for Question 2 = 8 marks)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE



P 4 8 7 5 2 R A 0 5 2 0

- 3 The table below shows the properties of some materials used in the manufacture of the dumper truck.

Material	Density kg m^{-3}	Electrical resistivity ohm-m	Tensile strength MN m^{-2}
Rubber	1200	$>10^{11}$	30
Copper	8960	1.68×10^{-8}	215
Low carbon steel	7860	10.6×10^{-8}	690
Aluminium	2700	27.0×10^{-8}	82
Brass	8360	9.0×10^{-8}	500
Cast iron	7000	10×10^{-8}	200

Using the information in the table and your knowledge of materials, select the most appropriate material to use for the following parts of the dumper truck and explain your choice.

- (a) The electric cables that supply power to the instruments

(i) Material

(1)

(ii) Explanation

(2)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(b) The tyres that move the dumper truck

(i) Material (1)

(ii) Explanation (2)

(c) The engine block that supports the pistons to provide the power to move the dumper truck

(i) Material (1)

(ii) Explanation (2)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(d) The axle that provides power to rotate the wheels

(i) Material

(1)

(ii) Explanation

(2)

(Total for Question 3 = 12 marks)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

4 **Figure 2** shows an illustration of a crankshaft.



Figure 2

(a) Explain why hardness and toughness are important properties in the smooth running of the crankshaft.

(4)

.....

.....

.....

.....

.....

.....

.....

.....



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(b) Describe, with the aid of diagrams, a hardness test for low carbon steel. Name the hardness test and state the units of measurement.

Name of hardness test

Units of measurement

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



(c) Describe, with the aid of diagrams, the difference between compressive strength and tensile strength.

(6)



.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 4 = 16 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



5 Figure 3 shows a frying pan.

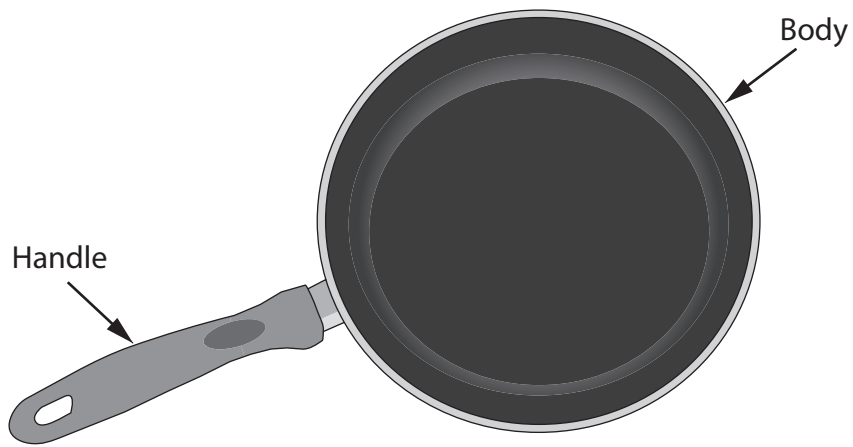


Figure 3

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(a) The frying pan body is made from aluminium alloy using the press forming process.

Describe, using notes and sketches, how the body of the frying pan is manufactured.

(4)



(b) Explain **two** reasons why aluminium is a suitable material for the body of the frying pan.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(c) The frying pan handle is made from a thermosetting polymer. Using notes and diagrams, explain why a thermosetting polymer has been used in preference to a thermoplastic.

Your answer should refer to the molecular structure of each type of polymer.

(8)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 5 = 16 marks)



6 **Figure 4** shows a plan and front elevation of a hammer head.

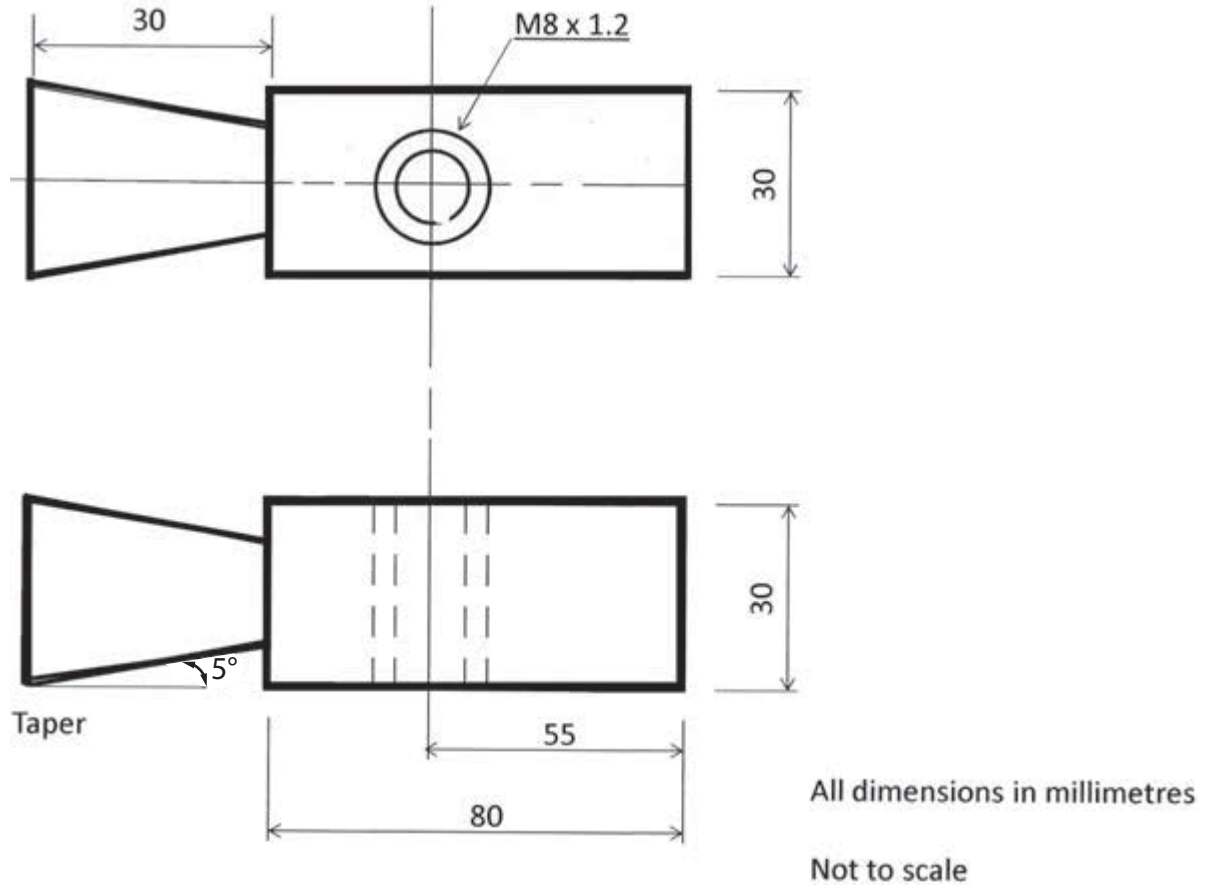


Figure 4

Describe, using notes and sketches, how the hammer head could be manufactured in a school workshop using a manual centre lathe.

Your description should include:

- a sequence of making tasks
- how the work is held centrally in the chuck
- how the taper is achieved
- how the screw thread is produced on the lathe using a tap
- how a drunken thread (a thread that wobbles in use) is avoided.



Answer page for Question 6

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Large empty rectangular box for writing the answer.

Series of horizontal dotted lines for writing the answer.

(Total for Question 6 = 12 marks)



7 A removable weatherproof canopy is required for the dumper truck.

Design a canopy that can be temporarily attached to the dumper truck.

Your design must include:

- a canopy that protects the driver from the weather
- a canopy that enables the driver to have an all-round view
- a temporary method of fastening the canopy to the dumper truck
- a safe working design that completely functions
- a justified choice of two materials used in the design of the canopy.

You should explain how each of the specification points have been achieved in your answer.

(10)



Answer page for Question 7

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 7 = 10 marks)



