WJEC LEVEL 1-2 AWARDS IN ENGINEERING

SAMPLE EXTERNAL ASSESSMENT
VERSION 3

UNIT 3: SOLVING ENGINEERING PROBLEMS

For first teaching from 2013

Contents

Candidate Name	Centre Number	Candidate Number

LEVEL 1/2

AWARDS IN ENGINEERING

Unit 3: Solving Engineering Problems

AM/PM xxxday xxJune 20**

1 hour 30 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	**24**	
2	**16**	
3	**20**	
Total	**60**	

Instructions to candidates

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

Information for candidates

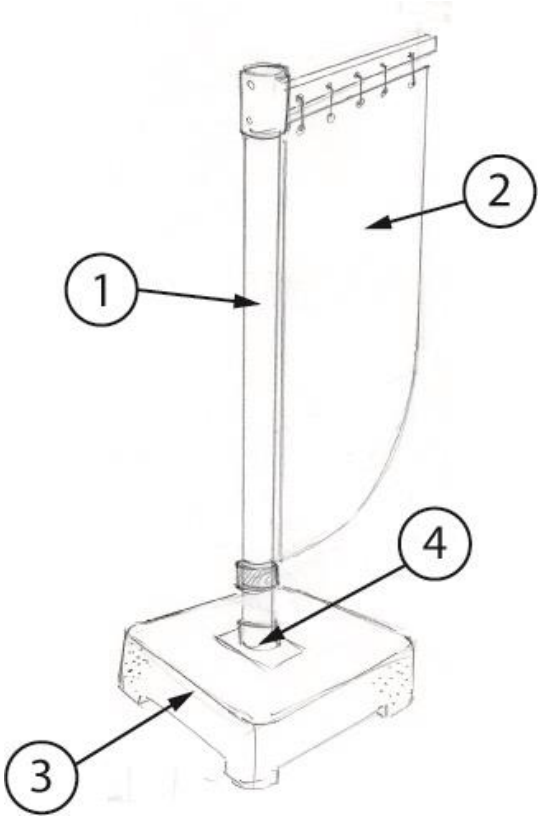
The total for the paper is 60 marks.

The number of marks is given in brackets at the end of each question or part question.

You may use the following equipment: calculator, ruler, pencil, eraser, pen.

Answer **all** *the questions in the spaces provided*

1. The following sketch shows an advertising flag used to advertise companies, events, sales and promotions. The sign is often seen outside, on pavements or garage forecourts.



Sign Details

Part 1: Upright support - Anodized aluminium

Part 2: Advertising panel – Nylon

Part 3: Base – Recycled car tyres

Part 4: Base plate – Mild steel

(a) Identify which of the following parts of the sign is likely to corrode first.
Tick (✓) **one** box only

	The Upright support (Part 1): manufactured from a non-ferrous metal
	The Base plate (Part 4): manufactured from a ferrous metal.

(b) Look at the following list of metals.

Brass
Zinc
Copper
Cast iron

(i) From the list, give **one** example of a ferrous metal.

[1]

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(ii) From the list, give **one** example of a non-ferrous metal.

[1]

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(c) The advertisement panel (Part 2 in the drawing) is manufactured from nylon. One of the properties of nylon is that it doesn't tear easily.

(i) Why is it important that the advertising panel is manufactured from a material that does not tear easily?

[2]

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(ii) Describe, using notes and sketches, how you could test the nylon to determine the point at which it would fail.

[3]

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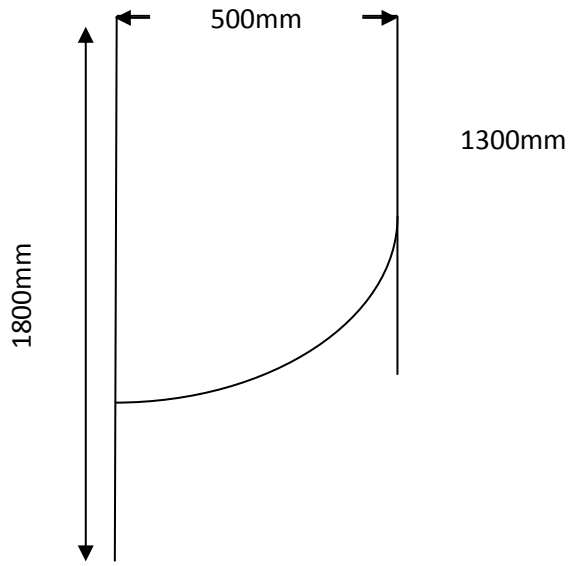
(iii) The following diagram shows the dimensions of the advertising panel.

All dimensions are in millimetres.



Calculate the area of the advertising panel.
Show all working out.

[6]

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(d) The base (Part 3 in the drawing) is made from recycled car tyres. Car tyres are made of rubber (an elastomer) and steel.

(i) What is meant by the term 'recycled'?

[1]

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(ii) How is recycling better for the environment?

[2]

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(e) The advertising flag (as shown in the diagram) would be delivered to the customer as disassembled parts. A temporary fixing is used to attach the upright support (Part 1) to the Base plate (Part 4).

Describe the process to be followed.

[6]

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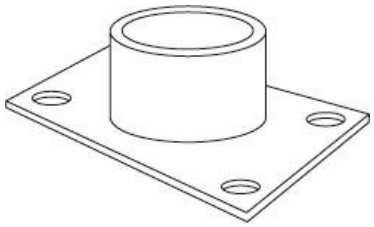
(f) A **base plate** is used to fix the base (Part 3 in the drawing) to the upright (Part 1).



Put a tick **(✓)** against the process that would be used to join the cylindrical part to the rectangular part of the base plate.

[1]

	Brazing
	Shaping
	Turning

Total marks Question 1: 24

2. Electronic devices, such as the smart phones shown in the following images, are now part of our everyday lives. Technological developments mean they are now used for more than just phones. They can be used for many different ways of communicating: texting, emails, networking, tweeting, recording digital images and video, organizing calendars and sorting data.

(a) Describe the technology of **one** electronic product, other than a mobile phone.

[4]

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(b) Explain the impact smart phone technology has had on society.

[4]

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(c) Some components found in smart phones, such as screens, are the same in newer models as previous ones. Explain how this is beneficial to the manufacturer.

[2]

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(d) Describe how advances in engineering developments have allowed smart phones to be sustainable products.

[2]

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(e) Touch screen technology used in smart phones could be applied in other products in the home. Describe **two** examples of products in the home that use or could use touch screen technology.

[4]

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2 ……

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Total marks for Question 2: 16

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3.

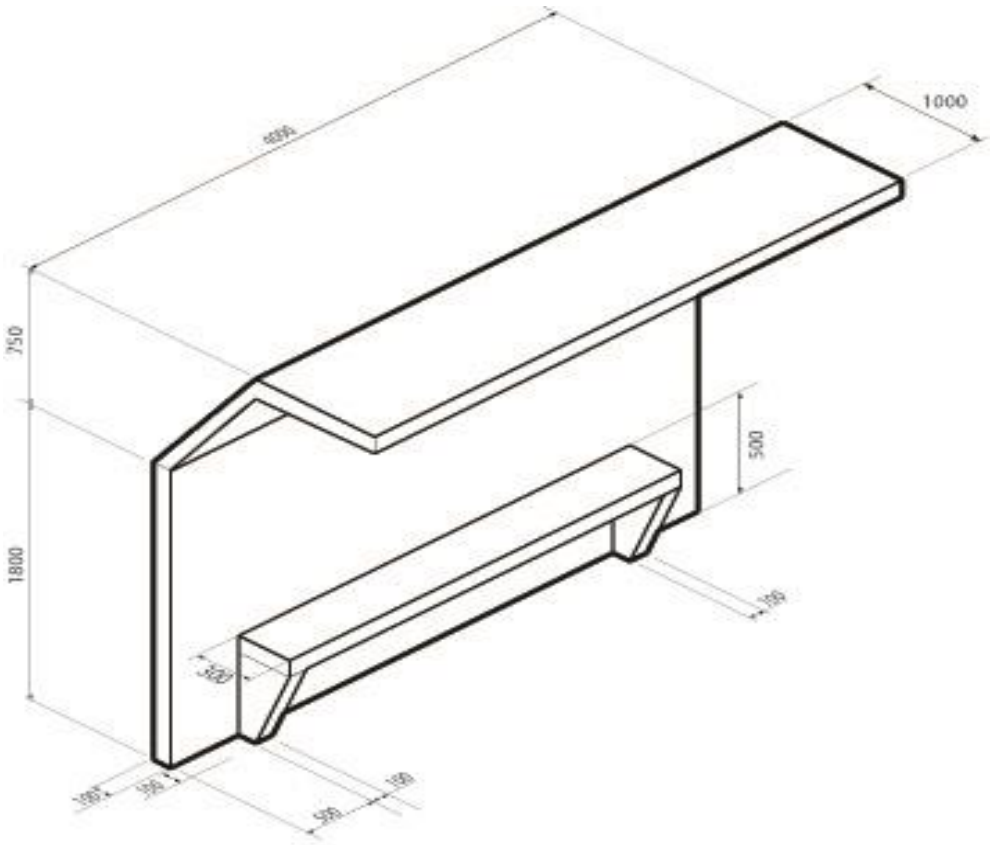
(a) A community sports group has received a grant to build a shelter for coaches and medics, etc. They have looked at many styles.

Here is an isometric drawing of the chosen design.

Draw it in 3rd angle orthographic projection, showing all construction lines and hidden detail.

[12]

All dimensions are in mm



You can use the space on this page for any draft work. You will not be marked on any notes and sketches produced on this page.

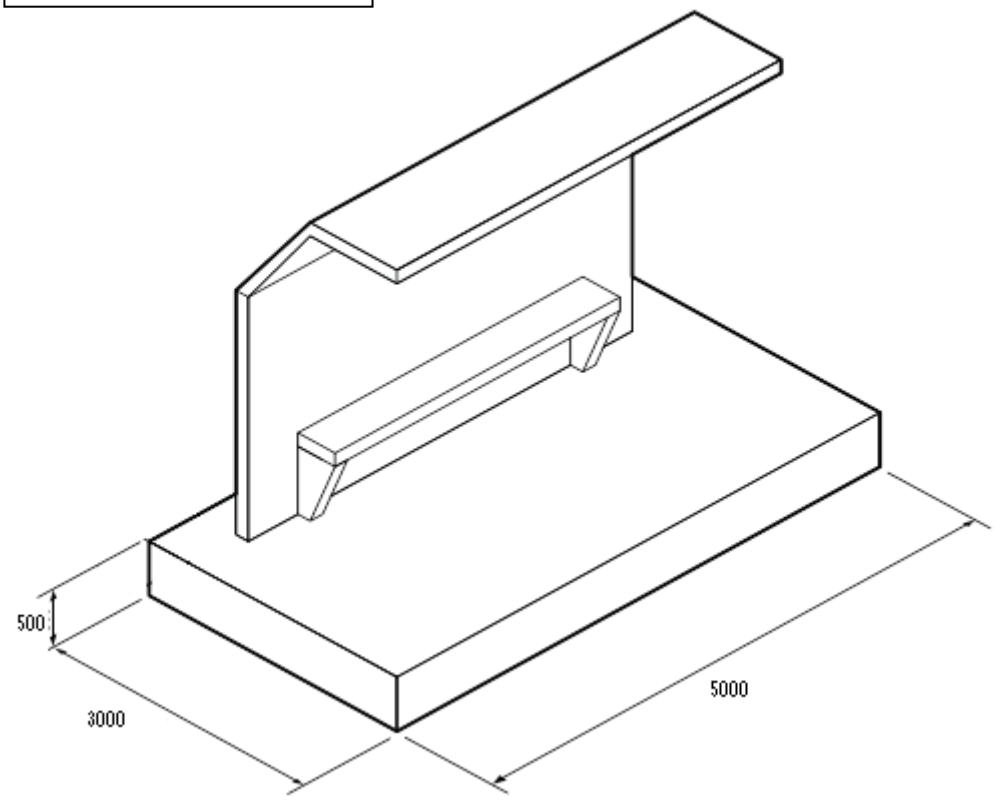
Draw your orthographic 3rd angle projection of the shelter here.

(b) Before fitting the shelter, a concrete slab must be laid. The cost is £30.00/$m^{3.}$ Calculate the total cost of the concrete slab based on the given sizes.

Show all working out.

[4]

All dimensions are in mm



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(c) The design of the shelter includes a simple bench seat which the manufacturer wishes to replace with something more comfortable. The designer has now specified seats with more comfortable forms made out of the composite material Glass Reinforced Plastic (GRP).

(i) Describe what is meant by the term 'composite material'.

[2]

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(ii) Explain why GRP would be a suitable material to use for the seats.

[2]

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Total marks for Question 3: 20

WJEC

Level 1/2

AWARDS IN ENGINEERING

Unit 3: SOLVING ENGINEERING PROBLEMS

SAMPLE EXTERNAL ASSESSMENT

60 MARKS

MARK SCHEME

Question	Answer	Marks
1. (a)	1 mark for correct answer **Answer:** The Base plate (Part 4), manufactured from a ferrous metal.	1
(b)	1 mark for each correct answer **Answer:** (i) Ferrous – cast iron (ii) Non-ferrous – brass, zinc or copper	1 + 1
(c) (i)	Up to 2 marks available 1 mark awarded for a basic response. Additional mark for clear development of reasoning. **Indicative content** • can cope with movement • no fracture • flexible • tough • copes with weather **Example 2 mark answer** It is flexible so can cope with movement caused by the weather.	2
(ii)	Up to 3 marks available. 1 mark for use of sketching. Up to 2 marks for notes provided. Second mark for referring to 'point of fail'. **Indicative content** • Reference to equipment used • Reference to operation of equipment • Reference to selection of sample of nylon • Reference to point of fail **Example 2 mark answer** As each individual weight is added, the sample of nylon should be reviewed and comments recorded. As the sample becomes under greater load, the cloth should show signs of tearing before the cloth fails to hold the weight.	3

Question	Answer	Marks
1. (c) (iii)	Up to 6 marks available Up to 2 marks for area of rectangle – 1 for formula and 1 for calculation (does not have to be shown as a formula) Up to 3 marks for area of quadrant – 1 mark for formula and 2 marks for calculation (does not have to be shown as a formula) 1 mark for total **Example answer** (1800 – 500) x 500 = 650000mm^2 (πr^2)/4 = 3.142 x (500 x 500) / 4 = 196375mm^2 Total 650000 + 196375 = 846375mm^2	6
(d) (i)	1 mark for correct answer **Answer** Processing used or waste material for new uses/products	1
(ii)	Up to 2 marks available. 1 mark awarded for a basic response. Additional mark for clear development of reasoning. Answers may be generic or linked to recycling tyres. Answers must relate to benefits to the environment. **Indicative content** • Rubber/elastomers don't naturally degrade • Lots of rubber tyres so big problem • No way to get rid of rubber • Rubber can leak toxins if left around • Reduces harmful toxins/pollutants • Reduces greenhouse gas emissions • Reduces need for waste sites • Conserves natural resources • Reduces energy needs – can be less energy to recycle than manufacture • Recycling prevents habitat reduction • Or any other reasonable response **Example 2 mark answer** Because there is no way to naturally get rid of rubber so reusing them for something else stops harmful effects to environment.	2

Question	Answer	Marks
1. (e)	Up to 6 marks available. Up to 4 marks for content – 1 mark for each aspect of the process described in appropriate sequence. Up to 2 marks for presenting as description, i.e. no simple bullet point statements, using connective words and phrases. **Indicative content** • Marking out • Centre punch hole • Drill clearance hole • Deburr • Fit nut and bolt into hole and tighten **OR** • Marking out • Centre punch hole • Drill hole using tapping drill • Tap hole • Fit screw or bolt into hole and tighten	6
(f)	1 mark for correct answer. **Answer** Brazing	1
	Total marks question 1	**24**

Question	Answer	Marks
2. (a)	Up to 4 marks available. 1 mark for identifying the product. Up to 3 marks for description of the technology. 1 mark for each aspect described. Maximum marks can only be awarded if the response is descriptive. **Indicative content** Any development that is technology related is acceptable. **Example answer** The kindle (1) uses **electronic ink** technology (1). There are millions of electrically charged white and black particles (1). Working together, they make the words and images you see on the screen (1).	4
(b)	Up to 2 marks available for each impact explained. 1 mark for identifying impact with additional mark for explanation **Indicative content** • More likely to keep in contact • Immediate access to emergency services • Easier to keep in touch long distance • Have more virtual friends • Not just used as phone, language changing through text language • Keep up to date with social issues through feeds • Social networking • Problems with people using when driving so dangerous • Potentially long term health effects • Eyesight issues through constant use **Example 4 mark answer** People find it easier to keep in touch, (1) especially those in remote areas where it is difficult to put in telephone lines. (1) People get killed crossing roads (1) because they are too busy sending messages and not watching out for traffic.(1)	4

Question	Answer	Marks
2. (c)	Up to 2 marks available. 1 mark awarded for basic response. Additional mark for clear development of reasoning. **Indicative content** • Cost of components • Lowers development costs • Cost of redesign • Screen not glass but invisible circuits so expensive • Already tested • Ergonomically designed **Example 2 mark answer** A manufacturer will have a lot of expensive components spare from other versions so it will save them money to design a new product that can use existing components.	2
(d)	Up to 2 marks available. 1 mark for each development that contributes to sustainability 2 marks for a detailed description. **Indicative content** • Solar powered potential • Using recycled plastics • Apps to show power usage • Apps to power save • Using components that rely on less energy • Photos don't need chemicals to process **Example 2 mark answer** You can now get apps to show power usage so people are aware of how much they are using and try to reduce it.	2
(e)	Up to 4 marks available. Up to 2 marks for each application described. 1 mark for identifying appropriate application and a further mark for description. **Indicative content** Could relate to any aspect of the home. **Example 2 mark answer** Touch screen technology could be used on a cooker, where the buttons/dials would be touch screen and more hygienic.	4
	Total marks question 2	16

Question	Answer	Marks
3. (a)	Up to 12 marks available. 1 mark for producing in 3rd angle orthographic projection. Up to 2 marks for each of the three completed views – (6) maximum marks where all features are included. Up to 2 marks for inclusion of construction lines. Up to 2 marks for hidden detail – 1 mark if indicated, 2 marks if correctly applied. 1 mark for neatness.	12
(b)	Up to 4 marks in total. Up to 2 marks for calculating volume to be concreted. 1 mark for formula (does not have to be shown as a formula). 1 mark for calculation. Up to 2 marks for calculating the cost. 1 mark for formula (does not have to be shown as a formula). 1 mark for calculation. **Answer** 5 x 3 x 0.5 = 7.5m^3 Total cost: 7.5 x 30 = £225	4
(c) (i)	Up to 2 marks available. 1 mark for simple answer. 1 additional mark for detail. **Indicative answer** • mixture • layers of materials • gives strength **Example 2 mark answer** Composite means a mixture of different materials in layers.	2
(ii)	Up to 2 marks available. 1 mark awarded for basic response. Additional mark for clear development of reasoning. **Indicative content** • doesn't corrode • not affected by weather • some elasticity • lightweight which would make it easy to hold in position for fixing • available in a range of colours **Example 2 mark answer** The bench will be outside so will get rained on but doesn't corrode so not likely to be affected.	2
	Total marks question 3	20

Allocation of Assessment Criteria to Questions

Question Number	LO1			LO2			LO3		LO4				Total
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	4.4	
1. (a)						1							**1**
(b) (i)				1									**1**
(ii)				1									**1**
(c) (i)						2							**2**
(ii)					3								**3**
(iii)									6				**6**
(d) (i)			1										**1**
(ii)			2										**2**
(e)							6						**6**
(f)							1						**1**
2 (a)	4												**4**
(b)		4											**4**
(c)			2										**2**
(d)			2										**2**
(e)			4										**4**
3 (a)										12			**12**
(b)									4				**4**
(c) (i)						2							**2**
(ii)						2							**2**
Total	**4**	**4**	**11**	**2**	**3**	**7**	**7**		**10**	**12**			**60**