GCSE
ENGINEERING
48503

Unit 3 Written Paper
Mark scheme

4850
June 2016

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

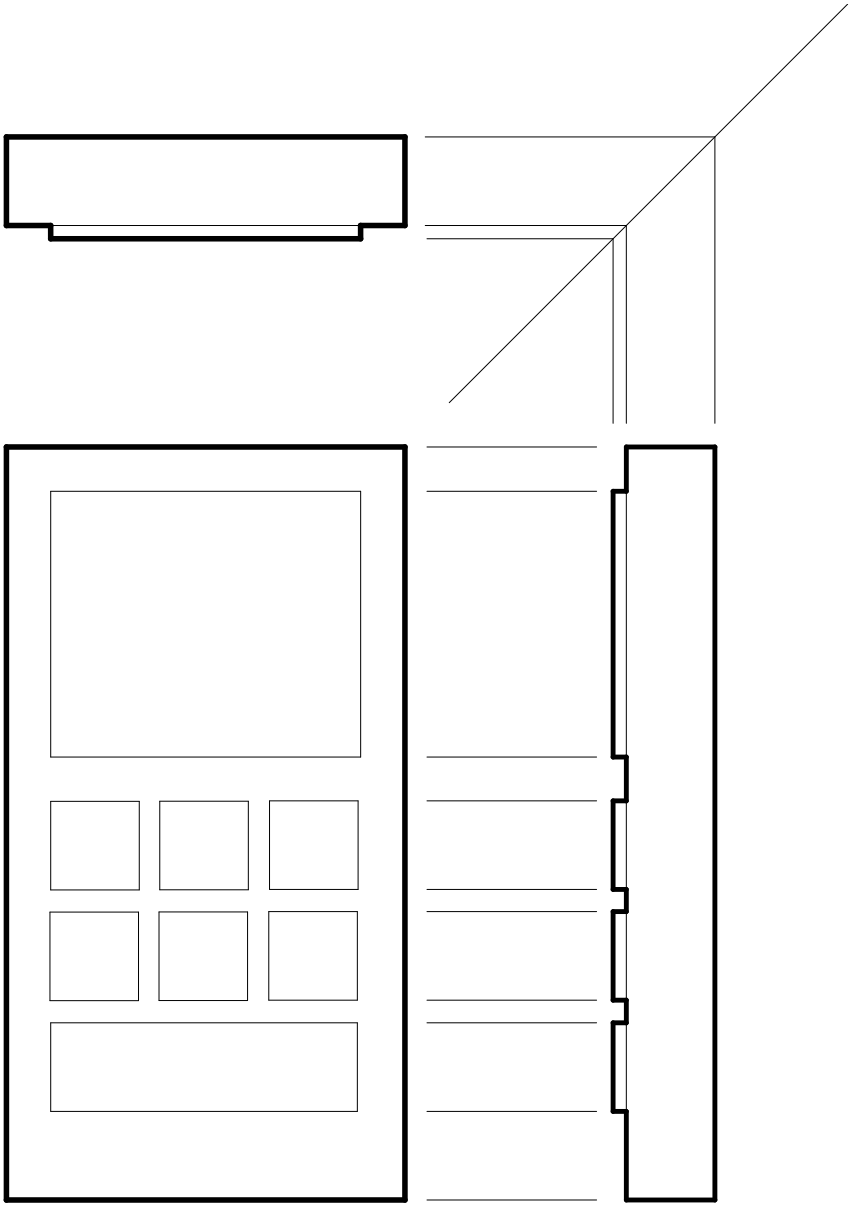
Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

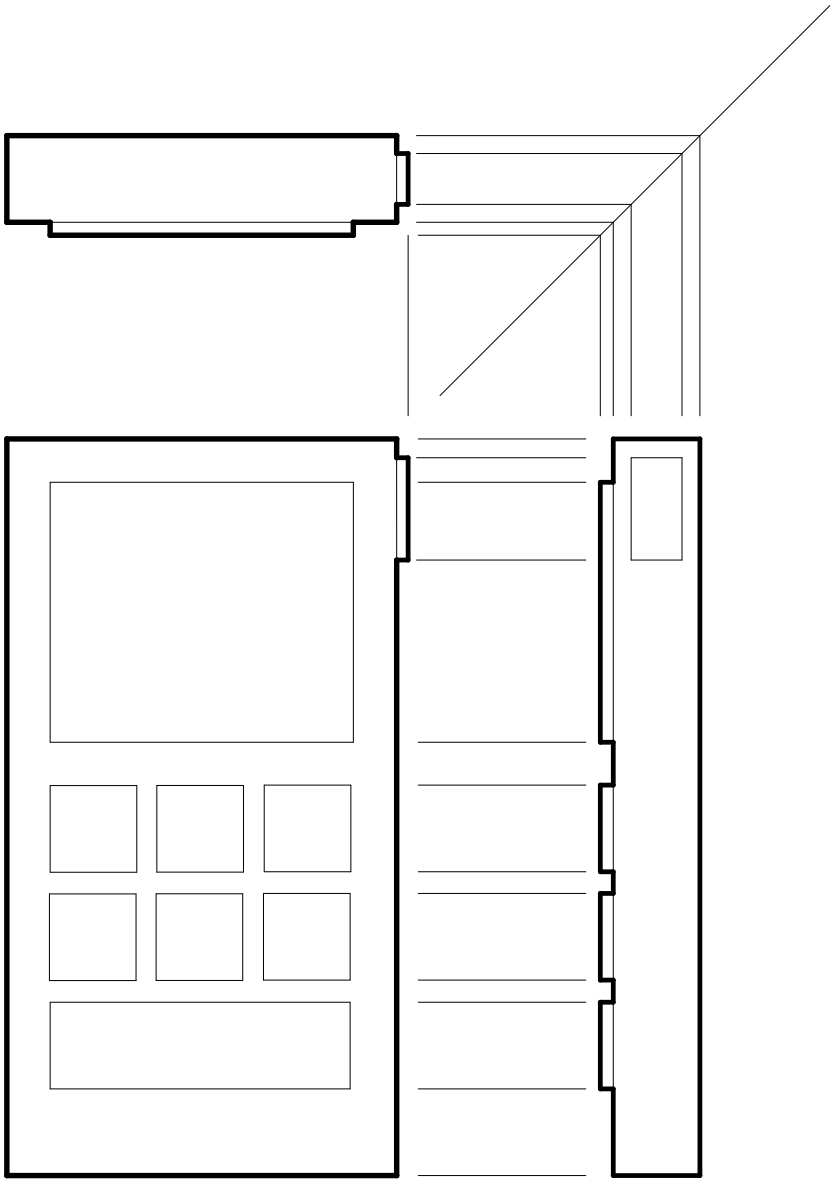
You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Qu	Part	Marking guidance	Total marks
1	(a)	1 mark for each correct response. A - Screw thread B - Square undercut or square groove C - Knurl D - Chamfer	4
1	(b)	1 mark for each correct response. E - Diameter F - Centre line	2
1	(c)	2 marks for a good explanation with two points from below. 1 mark for a limited explanation with one point from below. Symbols and abbreviations take less time to apply on a drawing than would be required to state the same with words. The symbols and abbreviations require less space on the drawing. The drawing is much easier to read as it is not overcrowded. Symbols and abbreviations can be read by people from nationalities without the need for language conversion.	2

2	(a)(i)	1 mark for correct alignment. 1 mark for correct orientation. 1 mark for correct view/drawing detail. 	3

2	(a)(ii)	1 mark for correct location on drawing. 1 mark for correct alignment and orientation. 	2

2	(b)	Very good explanation 2 - 3 marks. Colour and shading could be added to the drawing to show texture and materials to make the drawing look more realistic. The use of thin lines to show detail, and thick lines around the outside of the drawing, to make it stand out. Good explanation 1 mark. Colour and shading could be added to the drawing to show texture. The use of thick lines to make the drawing stand out. Do not award marks for single word responses with no explanation.	3

3	(a)	1 mark for each stage of the calculation. 1 mark for the correct answer. **Answer:** Single sheet = 167 x 150 **Close answer:** Try 150 into 350 = 2 167 into 650 = 3 Therefore 2 x 3 = 6 which means 6 pieces may be cut from the sheet. **Correct Answer:** Try 167 into 350 = 2 150 into 650 = 4 Therefore 2 x 4 = 8 Which means 8 pieces may be cut from the sheet. **Number of components per sheet = 8**	4

3	(b)(i)	1 mark for each of the following statements. 1 mark for explaining how it is an advantage of automated production. Higher production rates. Very quick production rates. Can run continually for mass production quantities. Better quality products. Less labour is required keeping production costs down. Quick change around (colour). Less scrap is produced.	2

3	(b)(ii)	1 mark for each of the following statements. Expensive to install. Not all companies can afford it. Computers might fail. Difficult to maintain.	2

4	(a)	**Component 1 = Resistor** Component positioned in correct place - 1 mark. **Component 2 = LED** Component positioned in correct place - 1 mark. Component the correct way around - 1 mark. **Component 3 = Transistor** Component positioned in correct place - 1 mark. Component the correct way around - 1 mark.	5

4	(b)	1 mark for each correct component in the correct place.  	2

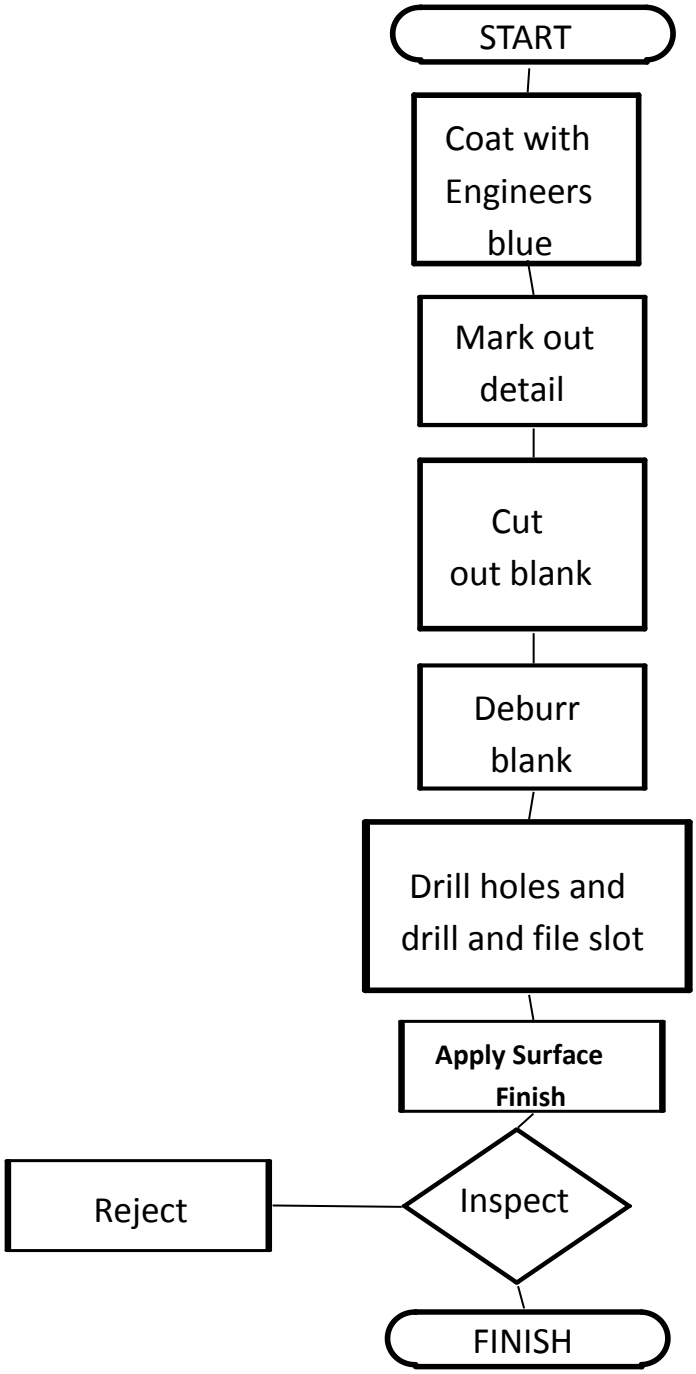
4	(c)	Very good explanation - 2 marks. The light sensor circuit works by a drop in light from daytime to night-time. As an example, the circuit trips the LED on when the sensor is put into darkness. This would save energy as the LED is on only at night-time and is off during normal daylight. Good explanation - 1 mark. The circuit operates by a drop in light. It is on during the night and off during the day, this will save energy as the LED is not on all the time. 1 mark for suitable application. Warehouse lighting. Shop floor lighting. Entrance to the building lighting. Car park lighting.	3

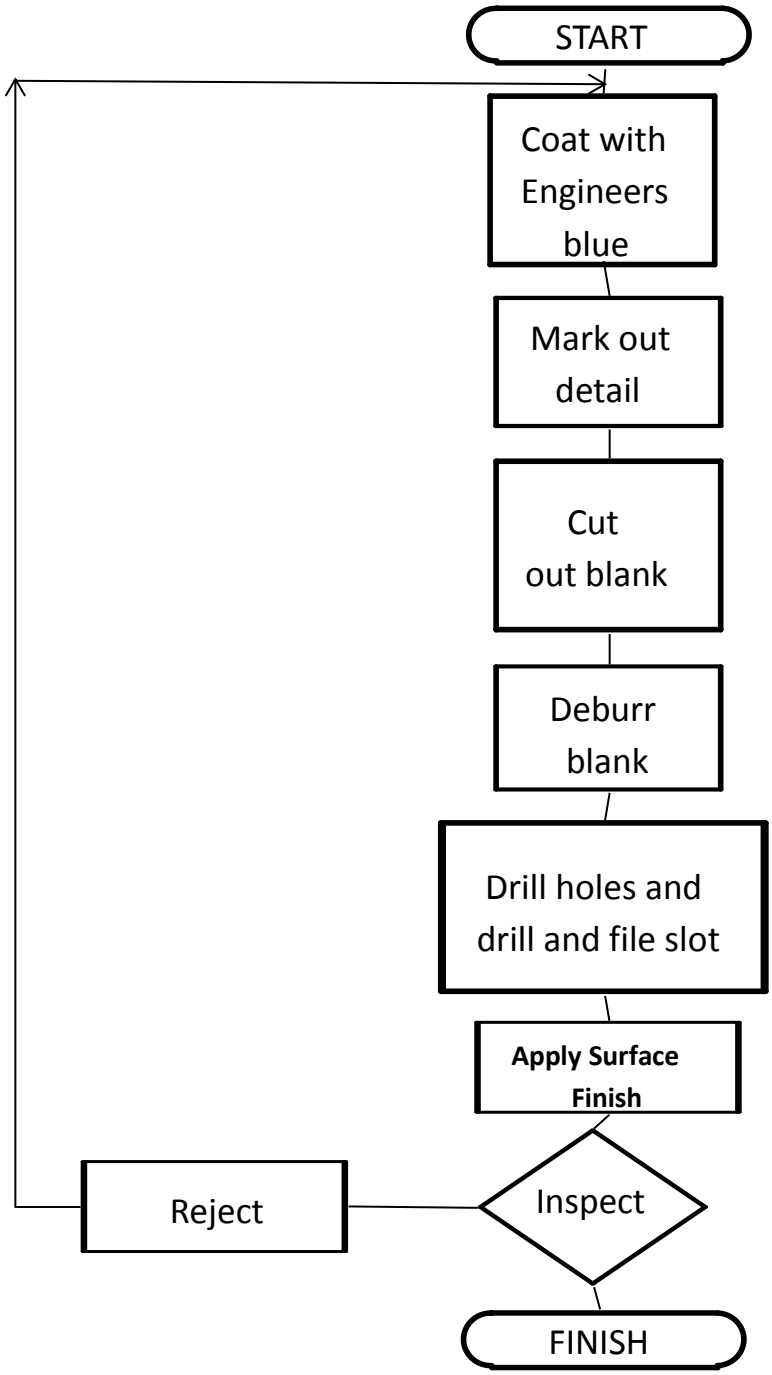
5	(a)	2 marks for a good explanation of choice including one point from below. 1 mark for a limited explanation of choice including one point from below. Availability - low carbon mild steel is widely available in a range of different stock sizes. Ease Of Manufacture - easy to machine with tungsten carbide and high speed steel. Workability - easy to cut, fabricate and weld. Finishes - can easily take a range of different finishes to protect it from corrosion. Cost - Relatively cheap to by compared to other steels. Strength - far less brittle than harder steels and can therefore give and flex in its application where a harder, more brittle, material would crack and break. Hardness - surface hardness can be increased through carburizing to protect against wear.	4

5	(b)	1 mark for a suitable process. Zinc galvanising. Electrophoretic lacquering. Polymer Powder coating.	1

5	(c)	1 mark for each hazard identified. Fumes - from the process. Heat- generated from the process. Skin contact - with the product. Airborne particles - from the process. Strains and injuries - by lifting heavy objects.	2

5	(d)	A concise and detailed response, showing a good understanding of why painting is not a viable option to preventing the casing against corrosion. (3 marks) The paint would scratch very easily if the plug was to come in contact with the socket bearing the naked mild steel which would rust easily and make the socket look unappealing. The use of Zinc to galvanise the casing is ideal as it gives a good surface finish and is much more scratch resistant to painting so the casing would last for many years rust free. Powder coating is much more resistant to wear than paint and this could be used as an alternative protection method. Sound response showing some understanding of why paint is not used to prevent corrosion of the casing. (1 -2 marks) Paint would scratch much more easily than zinc galvanising. The scratched material would rust and would constantly needed to replaced or repainted to keep its aesthetic appeal. Zinc galvanising would keep the casing rust free for many years of use.	3

5	(e)	1 mark for each descriptor in the correct sequence. If integrity of scheme is correct but boxes are misplaced deduct only for misplaced boxes. If integrity of scheme is not correct only award marks for correct place in flowchart.  	7

5	(f)	1 mark for correct location of feedback loop. 1 mark for correct direction of arrows.  	2

6		1 mark for each missing value.	7

Operation	X co-ordinate	Y co-ordinate	Z co-ordinate
Move to start of slot	20	20	10
Plunge to depth	20	20	-7
Move to end of slot	**100**	**20**	-7
Exit slot	100	20	**10**
Move to start of hole 1	20	**90**	10
Drill hole 1	20	90	**-7**
Exit hole 1	20	90	10
Move to start of hole 2	**60**	90	**10**

7	(a)	A number of advantages and disadvantages covered in some detail and good comparisons drawn. (3 marks) Several advantages and/or disadvantages referred to but with minimal detail provided. (2 marks) Very few comparisons made and only one or two advantages and/or disadvantages given. (1 mark) Advantages similar to: • Composite materials are less dense than metals. • It has better corrosion resistance. • It is as tough, if not tougher, than most metals. • Better quality of surface finish. • Much lighter than most metals. • Has better aesthetic qualities – looks better. • Looks modern and is highly desirable. • Disadvantages similar to: • Cost much more than metal equivalents. • There are problems joining the components that make up the frame. • Attaching different parts to the frame. • If damages there are less options available to repair composites at present. • A large capital cost to set up manufacturing facilities. • More time consuming to manufacture with composites. • Not as hard as most metals so easily scratched. • Any similar point. **QWC** A concise and detailed response showing a good understanding of factors relating to the above statement. The answer is well-structured, with good use of appropriate engineering terminology and showing a good grasp of grammar, punctuation and spelling. (3 marks) A fairly detailed response which refers to some of the factors relating to the above statement. The answer is fairly well structured, with some use of engineering terminology and with a small number of errors in grammar, punctuation and spelling. (2 marks) A response which contains very limited reference to any of the factors above. The answer is vague or poorly structured, with little use of engineering terminology and with a considerable number of errors in grammar, punctuation and spelling. (1 mark)	6

7	(b)	1 mark for the correct response. Phosphorus paint.	1

7	(c)	A concise and detailed response, showing a good understanding of the working properties of the material. (3 marks) The bike frame could be coated with Phosphorus paint. The painted frame looks the same as any other painted bike frame. However, in normal daylight, the Phosphorus paint absorbs the energy from natural sunlight during day time hours. At night, the energy absorbed by the paint during day time hours is emitted as light, which illuminates the bike frame in the dark so it can be seen by other road users in the dark. Sound response showing some understanding of the working properties of the material. (2 marks) The bike frame is coated with a special paint which absorbs energy from sunlight during the day. At night time, the energy absorbed by the paint during the day is emitted as light so the frame glows in the dark. Basic answer showing some understanding of the working properties of the material. (1 mark) The bike frame is coated with a special paint which allows it to glow in the dark.	3

8		**Repair** - make sure the product can easily be repaired by producing replacement parts for the product so that its life will be extended. **Recycle** - could recycled materials be used, or is the product made from materials that are easy to recycle? **Refuse** - do not accept things that are not essential, which could cause damage to the environment. **Reuse** - Could the product have more than one use? Could the parts be used to repair or manufacture another product? **Rethink** - is there a better way to design and manufacture the product which will cause less damage to the environment? **Reduce** - is it possible to reduce the amount of energy and materials used to manufacture the product? This will help the environment and use less valuable resources. 1 mark for each relevant point which has been explained as to how it can reduce the environmental impact of a product. Do not award marks for single word responses with no explanation.	5