GCE

Design and Technology: Systems and Control Technology

Mark scheme

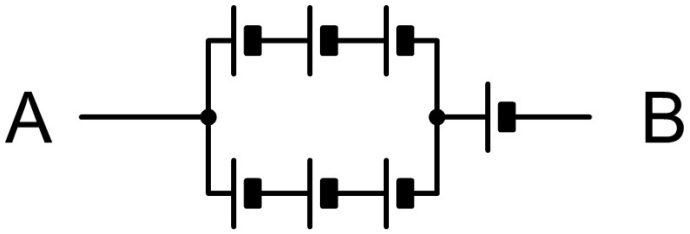
SYST1
June 2015

Version V1: Final Mark Scheme

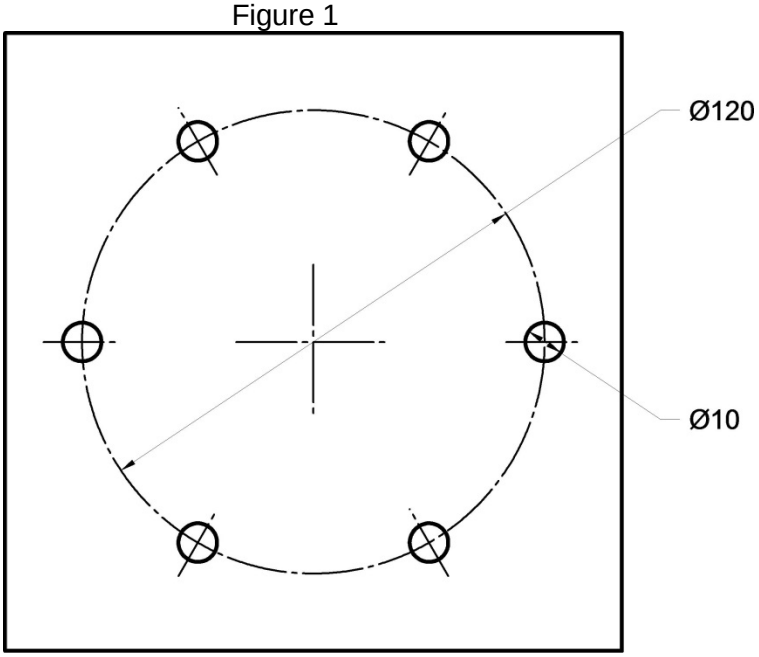
Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this 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.

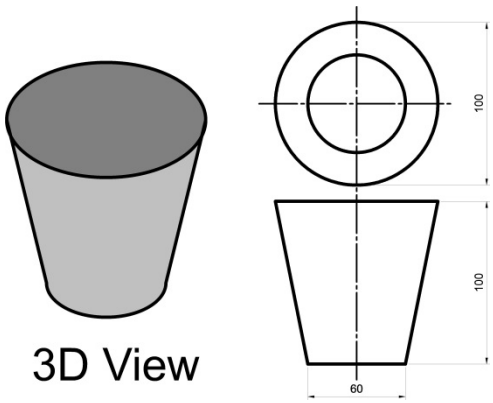
It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment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

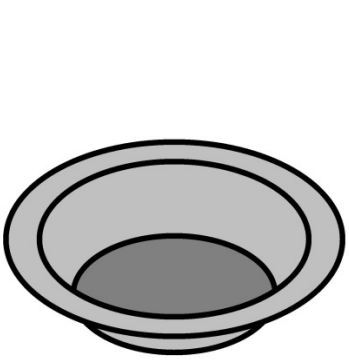
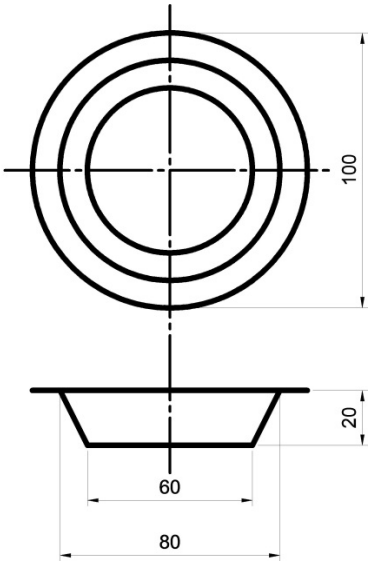
Further copies of this Mark Scheme are available from aqa.org.uk

1	**a**	**i**	Name a suitable lubricant for reducing the friction between a shaft and a bearing. Oil or Grease or Graphite or Air or Teflon or any other lubricant	**1 mark**
1	**a**	**ii**	Name a suitable component for reducing the amount of current flowing in an electrical circuit. Resistor or Variable resistor or Potentiometer or Rheostat	**1 mark**
1	**b**		Calculate the total Potential Difference between points A and B.  All Cells 2 Volts Working showing 6v for those in parallel + 2v in series 1 mark Total Potential difference between A and B = 8v 1 mark	**2 marks**
2	**a**		Explain the following terms: Mark/space ratio. On time 1 mark compared to Off time 1 mark	**2 marks**
2	**b**		A negative going pulse. Changing from Positive 1 mark to Negative 1 mark	**2 marks**
3			With the aid of an annotated sketch explain how a 25:1 reduction in speed of rotation between parallel shafts can be achieved using only gears with no more than 50 teeth. Compound Gear system 1 mark Selection of suitable pinions – not less than 3 teeth 1 mark Correctly configured so that the gears engage 1 mark Correct ratio 1 mark	**4 marks**

4	**a**		Draw a circuit that will operate in the following sequence: A SPDT switch is momentarily operated A 12volt light bulb comes on and remains on A second SPDT switch is momentarily operated The system resets and the light bulb goes off SPDT's, Bulb and Power supply 1 mark Bulb switches on 1 mark Latching facility 1 mark Reset 1 mark	**4 marks**
4	**b**		Give **two** reasons why a mechanical system cannot be 100% efficient. How energy is lost (1) with reason (1) Example: Reason 1 Overcoming friction (1) causes energy loss (1) 2 marks Reason 2 Overcoming Momentum(1) causes energy loss (1) Etc 2 marks	**2 x 2 marks**
5	**a**	**i**	Describe in detail a system for producing oscillatory motion with a total movement of 90 degrees. The system should produce one complete oscillation every two seconds when driven by a 360 rpm electric motor. Reduction of speed 1 mark By correct factor 1 mark Suitable system for speed reduction fully explained 1 mark Conversion to oscillatory motion 1 mark Reference to 90 degrees 1 mark Explanation of movement (1) quantified (1) 2 marks	**7 marks**
5	**a**	**ii**	With the aid of diagrams show how it would be possible to make the angle of oscillation adjustable to any value between 30 degrees and 90 degrees. Adjustment system shown 1 mark Method of adjustment explained 1 mark 30 to 90 degree adjustment quantified 1 mark	**3 marks**

5	**b**		With the aid of annotated sketches describe a suitable test that could be carried out to compare the linear expansion of a range of metals for a 100 degree Celsius rise in temperature. Your answer should indicate: the approximate size of the sample, the method of producing the required temperature change, the data that needs to be collected, the method of collecting the data how the data is analysed Suitable sample size small cross-section compared to length 1 mark Heating method 1 mark Ensuring 100 degree rise for the whole bar 1 mark Reference to initial length 1 mark Reference to expanded length 1 mark Measuring system (1) required accuracy (1) explanation (1) 3 marks How extension is calculated 1 mark How extension is compared 1 mark	**10 marks**
6	**a**		With the aid of annotated sketches describe in detail a method of producing the equally spaced holes shown in Figure 1 in a piece of 6mm thick aluminium sheet to an accuracy of ±0.1mm. Figure 1  Determining position of holes either by marking out or CAD: PCD (1) Spacing (1) Equal (1) 3 marks How accuracy is assured: CAD - Use of Grid (1) Use of rotation (1) or Manual – Use of steel rule/dividers (1) stepping off on PCD (1) 2 marks	

			Suitable process selection: Suitable process (1) Eg. Drill, Punch, Laser, Plasma Etc. 1 mark Cutting of the holes including clamping: Positioning of material (1) Clamping (1) 2 marks Production of hole (1) with full explanation (1) 2 marks	**10 marks**
6	**b**		With the aid of an annotated sketch describe in detail how the artefact shown in the diagram could be produced from 1mm thick polystyrene sheet.  Production of the mould or Fabrication process Selection of material 1 mark Preparation of blank - Size 1 mark Production of taper 1 mark The processes, tools and equipment used for mould or fabrication. Some (1) most (2) All (3) 3 marks Selection of suitable production process 1 mark The stages in the production process Some (1) most (2) All (3) 3 marks The diagram can be interpreted as a hollow or solid object, marks will be awarded for any suitable production process using the material stated.	**10 marks**

7	**a**	**i**	A system is required to automatically deliver a pre-packaged portion of food to a pet.  3D View Material 1mm thick  Identify **two** hygiene and **two** safety requirements of an automated pet feeding system Hygiene 1…**Eg.**No Toxic, exclude bacteria, maintain food quality 1 mark Hygiene 2…Easily cleaned 1 mark Safety 1…**Eg.**Nothing to trap animal 1 mark Safety 2…No sharp surfaces, Low voltage, no sudden movement, stable 1 mark	**4 marks**
7	**a**	**ii**	With the aid of a diagram show a system that will produce an electrical pulse of 30 seconds duration once every 12 hours. Method of producing a pulse every 12 hours Capable of producing a pulse 1 mark Capable of producing a 30 second pulse 1 mark Produces an electrical pulse 1 mark Explanation of system Limited (1) majority (2) full and detailed (3) 3 marks	**6 marks**

7	**b**	**i**	With the aid of an annotated sketch, describe a system that will automatically produce an output of 100mm of reciprocating motion each time it receives a short electrical pulse. Input activation 1 mark Prime mover 1 mark Reciprocating motion 1 mark Range shown (1) quantified (2) 2 marks	**5 marks**
7	**b**	**ii**	With the aid of an annotated sketch, describe a system that will automatically produce an output of 90 degrees of rotary movement each time it receives a short electrical pulse. Input activation 1 mark Prime mover 1 mark Rotary motion 1 mark Range shown (1) quantified (2) 2 marks	**5 marks**

7	**c**		Produce a design for a complete system that will automatically deliver food to a pet. The system should be capable of providing food for a pet for a minimum of three days. Every 12 hours a new container of food should be presented and access to the previous containers prevented. Your diagrams should clearly show an integrated system with the interaction between the sub-systems explained. Marks will be awarded for: • the food presentation and denial system • the sensing and control system • the dimensioning of the system • the assembly and layout of the sub-systems. • the selection of materials, components and fixings methods The food presentation and denial system 2 x3 marks Holding of containers (1) Allowing access to food (1) to 6 containers (1) (2) Denial of access to old food (1) For all 6 containers (1) fully explained (2) The sensing and control system 6 marks Timing system (1) Prime movers (1) Control of prime movers (2) Links to presentation / denial system (2) Dimensioning of system 2 marks Sufficient space for food (1) Sufficient space for systems (1) Assembly and layout of the sub-systems. 3 marks Sensible layout (1) Interconnections of sub-systems Some (1) All (2) (2) Selection of materials, components and fixings methods 3 marks Materials to meet hygiene and safety requirements (1) Suitable joining methods (1) Fixing down of Prime movers, systems, components(1)	