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Exemplification Booklet

June 2009

GCE

GCE Design and Technology: Product Design: Resistant Materials Technology 6RM02

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June 2009

Contents

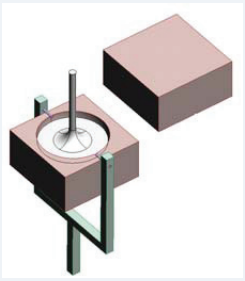
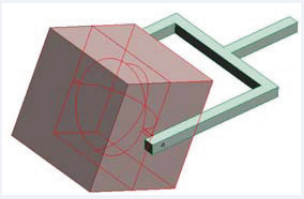
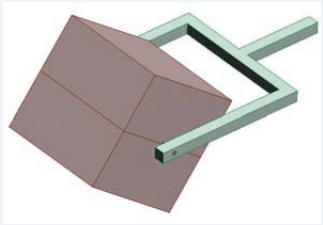
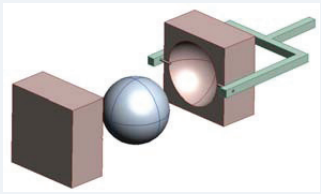
Introduction

Summer 2009 saw the first sitting of some AS units of the new GCE2008 specifications. As support for teachers, this booklet has been prepared as an exemplification of how marks were awarded to the written paper for GCE Design and Technology: Product Design: Resistant Materials technology 6RM02 during the Summer 2009 examination. It features work produced by the candidates in the actual examination. It contains the questions and mark schemes, together with examples of student answers. It gives the marks awarded for each exemplar response plus commentary by senior examiners. It does not include exemplars for every question on the paper, but only those where contrasting levels of response could be produced.

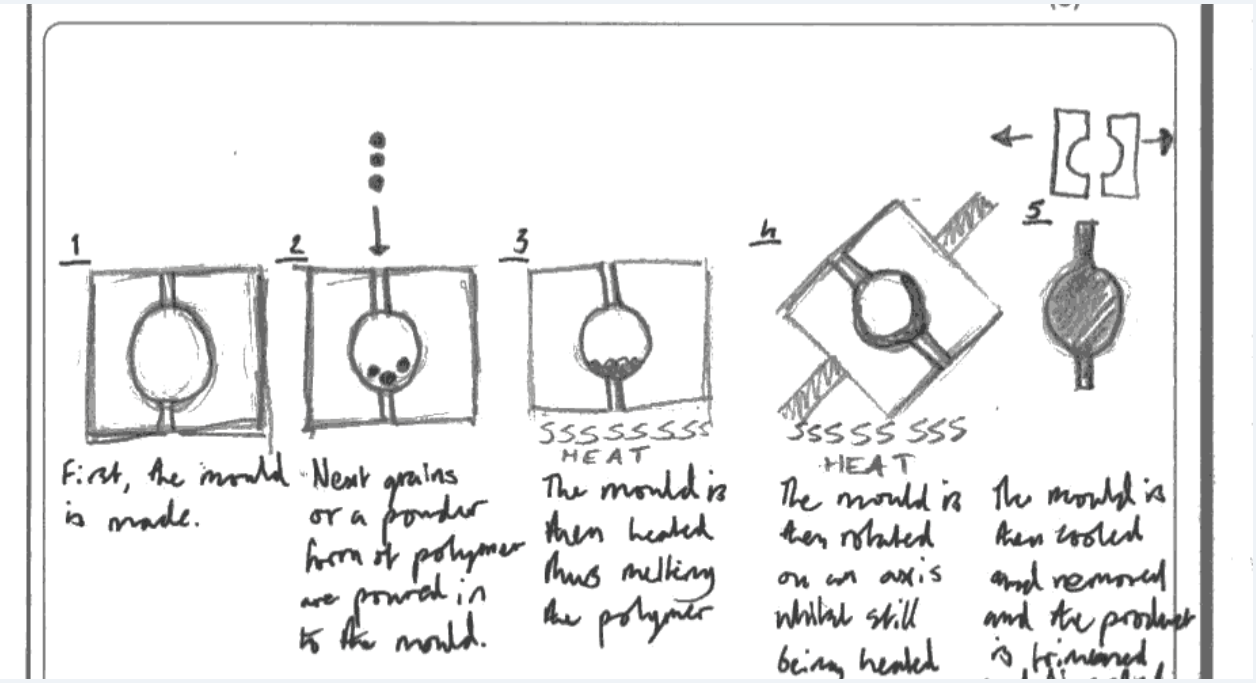
Question 1(b)

(b) Describe, using notes and/or sketches, the rotational moulding process.

(6)

1(b)	Any 6 points from notes **and/or** diagrams  Stage 1 **Stage 2**  Heat → **Stage 3**  Cold → **Stage 4**  • Mould is opened and filled with plastic powder **(1)** • Mould is rotated around a central point**(1)** in three planes (360 degrees) **(1)** • Heated to melt the plastic powder **(1)** • Plastic is evenly distributed throughout the mould **(1)** • Mould continues to rotate **(1)** and is cooled to solidify the plastic **(1)** • Mould is opened and product removed **(1)**	**(6)**

Example 1: 4 marks



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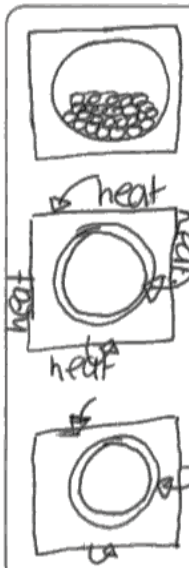
Examiner Comments

The sequential nature of the diagrams makes this a clear answer to understand. However there is not enough detail in the notes or diagrams to score full marks. Answers like, rotating the mould in several planes through 360 degrees and the plastic forms an even layer throughout the moulding are necessary.
Candidates can score full marks with just sketches or just notes, but a combination is 'preferable'.

Example 2: 6 marks

(b) Describe, using notes and/or sketches, the rotational moulding process.

(6) 6 Q01b



Thermo plastic (polymer) powder is fed into the mould.

The mould is then placed in a furnace where it is rotated in a tumbling action which causes the powder to melt and stick to the sides of the mould with a uniform thickness. The mould is the cooled in water or air whilst still tumbling/rotating to allow plastic to set. The product is then removed.

Plastic granules are fed into the mould which then closes. Mould is then heated (in oven or kiln) to melt the plastic granules (to liquid) The mould is rotated in both axis to allow the melted plastic to form a even coat around the inside of the mould. Once the plastic has reached the required thickness the mould is then removed and allowed to cool in air or water. Once plastic has cooled it hardens to the desired shape. Mould is then broken /split and the plastic is removed. Any flash marks are sanded off or flamed using torch. Mould is sprayed with are releasing agent before plastic granules are added to allow plastic component to be easily seperated after it hardens.

Question 1(c)

(c) Explain **two** reasons why rotational moulding is suited to batch production.

(4)

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2 .....

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1(c)	• Once the mould has been made, batches or continuous production can take place **(1)** at minimal cost per item **(1)** • Little waste material is produced (1) therefore minimal cost per item (1) • A range of colours can be produced **(1)** from the same mould therefore minimum down time **(1)** • After the initial high cost of setting up **(1)** numerous different moulds can be used **(1)** making the process very flexible **(1)** • The accuracy of the mould **(1)** results in the consistency of the product produced remaining high **(1)** • Due to relatively slow speed**(1)** less suitable for high volume production **(1)** (4 x 1)	**(4)**
	Total for question	**(12)**

Example 1: 0 marks

(c) Explain **two** reasons why rotational moulding is suited to batch production.

(4)

1 The mould is one full producted meaning it is a faster product to be created, with an overall good finish.

2 The mould can be done cheapily meaning the costs of producing will be low

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Examiner Comments

The answers are structured correctly i.e. making a point and giving an outcome. However the question asks about 'batch production' so candidates should focus their answers accordingly.
Answer 1 just focuses on 'features' of rotational moulding, but not necessarily correct ones, rather than advantages for batch production.
Answer 2 uses incorrect terminology which makes it difficult for the examiner to interpret how much understanding the candidate has.
The 'mould' is actually expensive to produce but once made, the 'mouldings' taken from it are at minimal unit cost.

Example 2: 4 marks

1 Moulds used in rotational moulding can be reused to create a large number of products to respond to demand. Moulds also ensures products are identical.

2 Allows customisations (such as colour, plastic) to be made. Gives process more flexibility and allows product to match more closely the client's specification.

Slow process, unsuited for mass production.

Question 2(a)

2 The Health and Safety Executive (HSE) sets the standards for risk assessment when using machinery.

Figure 2 shows a pillar drill.

Figure 2

(a) Give **three** safety checks which should be made prior to using a pillar drill.

(3)

Question Number	Answer	Mark
2(a)	• Check that the drill bit is tight in the chuck **(1)** • Check that the speed is correct **(1)** • Check the work table is secure **(1)** • Check that the work is held securely **(1)** • Check the emergency stop mechanism works **(1)** • Check guards are in position **(1)** • Check correct safety clothing is worn **(1)** • Check for loose items/hair tied back **(1)** • Check chuck key is removed **(1)** • Check operator has had correct training **(1)** • Check regular maintenance has been carried out **(1)** • The area is clear of obstructions **(1)** • The use of dust extraction **(1)** (3 x 1)	**(3)**

Example 1: 3 marks

(a) Give **three** safety checks which should be made prior to using a pillar drill. **(3)**

1 Is the surrounding area free from trip or slip hazards?

2 Is the user wearing the appropriate safty equiptment? e.g. goggles, Apron...

3 Is there a working / effective gard around the chuck / drill bit.

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Examiner Comments

A good range of safety checks are shown here. Candidates should avoid using three similar examples i.e. all from one safety check of protective clothing e.g. gloves, dusk mask, goggles.

Example 2: 3 marks

(a) Give **three** safety checks which should be made prior to using a pillar drill. **(3)** 3 Q02a

1 Make sure it's set at the right speed

2 Make sure the drill is tightened properly to avoid the danger of flying out of the chuck.

3 Make sure working piece is clamped properly.

Question 2(b)

(b) Explain **two** reasons why the use of Computer Numerically Controlled (CNC) machines is generally safer than the use of manually operated machines.

(4)

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2 .....

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2(b)	• The CNC machines are generally fully enclosed **(1)** unmanned **(1)** therefore there is generally less direct manual contact with the machine **(1)** • CNC machines run simulations before machining commences **(1)** therefore the operator can tell whether the process is viable and safe to run **(1)** • Safety cut-out switches are fitted to the CNC machine doors **(1)** which means the operator cannot open the doors during production **(1)** • CNC machines often have built-in extraction **(1)** reducing the hazards associates with dust **(1)** • Human tiredness/error **(1)** can lead to injuries/accidents **(1)** (4 x 1)	**(4)**

Example 1: 1 mark

(b) Explain **two** reasons why the use of Computer Numerically Controlled (CNC) machines is generally safer than the use of manually operated machines.

(4)

1 Unlike manual labourers the machines do not succumb to tiredness. Therefore giving the products produced a consistent quality.

2 The machines are able to swap their tools quickly and more effectively than manual labourers. Thus making the best out of the time they are given for production.

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Examiner Comments

This answer scores only 1 mark as the rest of the answer is based on efficiency/ consistency and not on **safety** as specified in the question.

Example 2: 4 marks

(b) Explain **two** reasons why the use of Computer Numerically Controlled (CNC) machines is generally safer than the use of manually operated machines.

(4) 4 Q02b

1 As there's less human intervention with the machine when using CNC, users are less likely to get injured by the cutting tool, such as drills.

2 As when using CNC, all the working processes are being done with the protection of a safety guard (e.g. a plastic guard). So there's less danger users or other people around to get injured by the waste material (e.g. hot thin pieces of metal).

Question 2(c)

(c) The use of Computer Numerically Controlled (CNC) machines is particularly suited to batch production.

Give **five** benefits of using CNC machines for batch production.

(5)

2(c)	• Products can be manufactured at speed **(1)** • They provide operational flexibility **(1)** • They allow quick response manufacturing **(1)** • Production of complex shapes is possible **(1)** • Saved data can be downloaded whenever a new batch is required **(1)** • Orders and material requirements can be linked **(1)** • CAM allows automated materials handling **(1)** • CNC machines can run continuously 24/7 **(1)** • One person can supervise numerous machines **(1)** • Accuracy of production **(1)** • Reduced waste **(1)** • Reduced human error **(1)** (5 x 1)	**(5)**
	Total for question	**(12)**

Example 1: 5 marks

(c) The use of Computer Numerically Controlled (CNC) machines is particularly suited to batch production.

Give **five** benefits of using CNC machines for batch production.

(5)

1 CNC Machines are time efficient

2 CNC Machines are accurate

3 CNC Machines waste very little

4 CNC Machines eliminate human error

5 CNC Machines are economic (worker cost)

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Examiner Comments

Questions which require the candidate to 'give' a number of answers are best answered in a list/bullet point format like this. This also helps candidates not to repeat themselves and thus drop marks.

Example 2: 5 marks

(c) The use of Computer Numerically Controlled (CNC) machines is particularly suited to batch production.

Give **five** benefits of using CNC machines for batch production.

(5) 5 Q02c

1 Allows identical products to be made with great accuracy

2 High flexibility and can be reprogramme'd. Allows customisation of product.

3 Speeds up rate of production allowing products to be made quickly to respond to demand.

4 ~~Automatic and needs little human~~ Changes to designs can be made quickly electronically & from CAD drawings. Produce component directly from CAD drawing.

5 Less labour intensive than manual machines and reduces cost of labour. Can be left to work 24/7 with breaks only for maintenance.

Question 3(b)

(b) Discuss the advantages and disadvantages of quarter sawing compared with through and through (slab) sawing as a method of converting timber.

(6)

3(b)	6 individual points. Maximum of 5 marks for advantages or disadvantages only **Advantages** • More stable timber **(1)** due to the direction of cutting **(1)** • Better grain pattern (aesthetics e.g. figuring in oak) **(1)** due to the grain structure **(1)** • Better quality of timber **(1)** therefore increased value of timber **(1)** **Disadvantages** • More waste time/timber**(1)** • More complex sawing process **(1)** requires greater skill **(1)** and requires more time **(1)** • Timber costs more **(1)** • Board width is reduced **(1)** due to the direction of cutting **(1)** (6 x 1)	**(6)**
	Total for question	**(8)**

Example 1: 5 marks

(b) Discuss the advantages and disadvantages of quarter sawing compared with through and through (slab) sawing as a method of converting timber.

(6)

Using Quarter sawing will be more expensive than using Slap sawing. ~~Also it will be~~ Using slab sawing will be much quicker, cheaper and simpler than quarter sawing. However, the timbre produced from quarter sawing will be much more stabler.

But since the log is devided into four sections when using quarter sawing, much larger log will be ~~needed~~ needed to get ~~the same width~~ of a piece with the same width, in other words the slabs from slab sawing will be wider. (More waste from Quarter sawing.)

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Examiner Comments

Candidates must take great care when structuring this type of advantage/disadvantage type of question. It is preferable to stick to **either** quarter sawing **or** slab sawing and discuss the advantages and disadvantages. This question scores high marks, but is not ideally structured.

An example of a well structured answer as the advantages and disadvantages are clearly identifiable.
Quarter sawing produces more stable timber (1 mark), with a better grain pattern (1 mark), therefore increasing the value of the timber (1 mark).
However, quarter sawing produces more waste (1 mark), requires a greater skill level (1 mark) and is a longer process (1mark).

An example of a poorly structured answer, which often leads to repeat answers and lost marks:
Quarter sawing produces more stable timber (1 mark) as oppose to slab sawing where the timber is more prone to warping (0 mark). Quarter sawing generally give narrow boards (1 mark) but slab sawing gives more wide boards (0 mark). Quarter sawing takes a long time (1 mark) however slab sawing is much quicker (0 mark).

Example 2: 6 marks

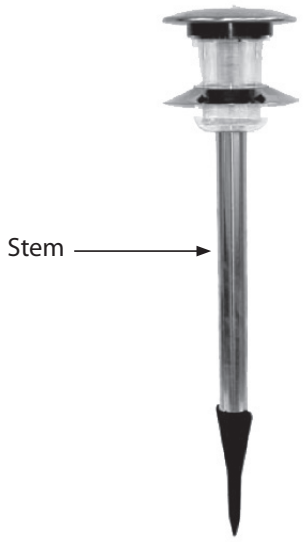
(b) Discuss the advantages and disadvantages of quarter sawing compared with through and through (slab) sawing as a method of converting timber.

(6) 6 Q03b

Quarter sawing produces timber which has smaller annual rings. This makes it less susceptible to caping, twisting, splitting and warping. However it is a very time consuming process and takes longer than slab sawing. Timbers produced are smaller in size/dimension compared to slab sawing. Due to the time consuming (labour) needed process costs for quarter sawn timber is often higher than slab sawn. More of the material is wasted in quarter sawing and is therefore less efficient than slab sawing. Quarter sawn timber is more stable than slab sawn timber, ~~also less likely~~ to ~~split~~. Quarter sawing is only possible with big trees with wide trunks, uneconomical with thin trees (timber produced is small in width).

Question 4(a)

4 Figure 3 shows an outdoor solar light which is made predominantly from stainless steel. The light is designed to be pushed into the ground.



(a) Explain **two** reasons why stainless steel is a suitable material for the stem of the solar light.

(4)

Question Number	Answer	Mark
4(a)	• It will not corrode **(1)** which makes it ideal for outdoor use **(1)** • It does not require any surface treatment **(1)** therefore will not require regular maintenance **(1)** • Aesthetic qualities if stainless steel **(1)** plus it can be either polished or brushed **(1)** therefore giving a choice of finishes **(1)** • It is relatively strong/ durable **(1)** therefore withstand damage/ force **(1)** (4 x 1)	**(4)**

Example 1: 2 marks

(a) Explain **two** reasons why stainless steel is a suitable material for the stem of the solar light.

(4)

1 Stainless steel is corrosion resistant therefore, its durability is increased in an outdoor environment.

2 Stainless steel has also got good weather resistance meaning it is suitable for its outdoor environment.

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Examiner Comments

Answer 1 gives a clear reason and resultant advantage so scores 2 marks.
Answer 2 just repeats answer 1, but in different words.

Example 2: 4 marks

(a) Explain **two** reasons why stainless steel is a suitable material for the stem of the solar light.

(4) 4 Q04a

1 It's corrosion resistant. It's good and suitable as the solar light will be standing outdoor. This makes it more durable.

2 Stainless steel is fairly strong and tough. When the light is pushed into the ground, stainless steel can support the light at top well. It's also has shiny surface, which can reflect light. This can help lightening.

Question 4(b)

(b) As an alternative to stainless steel, polyvinyl chloride (PVC) could be used to manufacture the solar light.

Discuss the use of PVC as a suitable material for the stem of the light.

(6)

4(b)	6 individual points. Maximum of 5 marks for advantages or disadvantages only **Advantages** • Can be self finished **(1)** • Mechanical properties fit for purpose **(1)** • colour/texture/garden aesthetics an be manufactured into the material**(1)** • Can be moulded / extruded relatively easily **(1)** • Once the mould is made, cost per item to produce reduces with volume **(1)** • Relatively low cost compared to stainless steel **(1)** • Doesn't corrode/weather resistance **(1)** therefore giving it a long life outdoors **(1)** • The plastic can be given a 'wood effect' look to fit in with the garden **(1)** • Can be recycled **(1)** • Lighter in weight **(1)** therefore reducing transport costs/carrying home **(1)** **Disadvantages** • Lighter weight giving impression of being 'cheaper' quality **(1)**/ possibility of being blown over/away **(1)** • More brittle and prone to breaking **(1)** • Plastic possibly not in keeping with garden aesthetics **(1)** • PVC can become discoloured by UV rays **(1)** (6 x 1)	**(6)**

Example 1: 6 marks

(b) As an alternative to stainless steel, polyvinyl chloride (PVC) could be used to manufacture the solar light.

Discuss the use of PVC as a suitable material for the stem of the light.

(6)

It will be lighter in weight if PVC is used instead, as PVC is much lighter than stainless steel. Also the production cost will be reduced as material cost per unit is cheaper for PVC. Colour can be varied easily to change its aesthetics, which means that the manufacturer can be more flexible and respond accordingly to orders.

PVC is durable and resistant to corrosion. However it is less durable and stable than stainless steel. This means it can be broken far more often, requiring more frequent maintenance.

PVC is recyclable, which is environment friendly.

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Examiner Comments

This answer shows a good range of factors but only scores full marks because it contains at least 1 advantage or disadvantage. Many candidates show excellent knowledge but limit their answers to just advantages **or** disadvantages.

Example 2: 6 marks

PVC has high chemical resistance and will not corrode or break down in outdoor weather and environment. It is very stiff and rigid and will hold the solar light upright. Can be extruded to form the hollow ~~shape~~ channel shape needed. It comes in a wide variety of colours to improve aesthetics. It is lighter in weight compared to stainless steel making the solar light cheaper and easier to transport. PVC is a cheaper material than stainless steel and therefore reduces the overall cost of the solar light. Extrusion of PVC requires less energy than casting or rolling and welding of stainless steel. Extrusion of PVC is also quicker than stainless steel processes. The makes PVC cheaper (less energy and electricity needed) and quicker to process than stainless steel. However stainless steel has the chrome mirror like shiny finish which can not be achieved on PVC. uPVC is resistant to UV and will not break down in sunlight

Question 5(a)

5 Quality control systems are used in manufacturing processes.

(a) Explain what is meant by the term 'quality control'.

(4)

5(a)	• Quality control is the practical means of achieving quality assurance **(1)** by testing and inspection **(1)** • It is the monitoring of accuracy in relation to the specification **(1)** at critical control points during manufacture **(1)** • It ensures the manufacture of identical parts within tolerance **(1)** and provides feedback to the quality assurance system **(1)** • It guarantees a set standard to all products **(1)** therefore ensuring reliability **(1)** and continued customer confidence **(1)** (4 x 1)	**(4)**

Example 1: 3 marks

5 Quality control systems are used in manufacturing processes.

(a) Explain what is meant by the term 'quality control'.

(4)

Tests carried out either at the end of manufacturing a product or during all the manufacturing processes. The aim is to ensure that the product that is being manufactured is being done at the satisfactory standard that is being promised by the manufacturer. Any part of the product that does not reach the set standard will have to be redone.

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Examiner Tip

This type of question can be answered either as two justified points or four individual facts (or a mixture). This gives candidates flexibility, but they should be aware of 'clarity of response'!

Example 2: 4 marks

5 Quality control systems are used in manufacturing processes.

(a) Explain what is meant by the term 'quality control'.

(4) 4 Q05a

Quality Control is the testing and supervision / inspection of a product during the manufacture stage to include dimensional checks with tolerances, visual checks of surface finish + colour, destruction tests and random sampling etc. It is the actual carrying out of the specification lined out in the quality assurance plan. It ensures that the quality of product coming off the assembly line achieves all laid out goals, so that customers are guaranteed to be satisfied.

Question 5(c)

(c) Quality control is a feature of total quality management (TQM). Explain **two** further features of TQM.

(4)

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2 .....

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5(c)	• TQM is the system used to ensure continuing improvement **(1)** for the complete life cycle of a product **(1)** • Computer aided systems are used at all levels **(1)** therefore improving all aspects of manufacturing quality **(1)** • In manufacturing, 'thinking tools' are equally as important as the physical tools **(1)** and they are 'purpose driven' long-term processes **(1)** • Applying quality assurance procedures and testing **(1)** at every stage of the design/development/manufacturing process **(1)** achieving (BSI/CE) standards (1) • An approach to quality assurance that emphasises a thorough understanding / contribution of all members of a production unit **(1)** of the needs and desires of the ultimate service recipients **(1)** • TQM emphasises constant measures and statistical techniques **(1)** to help and then maintain the output quality of production **(1)** • Have in place a customer services department **(1)** which responds to customer feedback. **(1)** (4 x 1)	**(4)**

Example 1: 2 marks

(c) Quality control is a feature of total quality management (TQM). Explain **two** further features of TQM.

(4)

1 It ensures apropiate quality control checks are made throughout the manufacturing of the product.

2 It ensures that any unsuitable / unsafe / un-correct products are quarintened and not sold.

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Examiner Comments

The first answer demonstrates a correct fact with a linked point so scores 2/2. However the second point is just a repeat point but using alternative wording so scores 0/2.

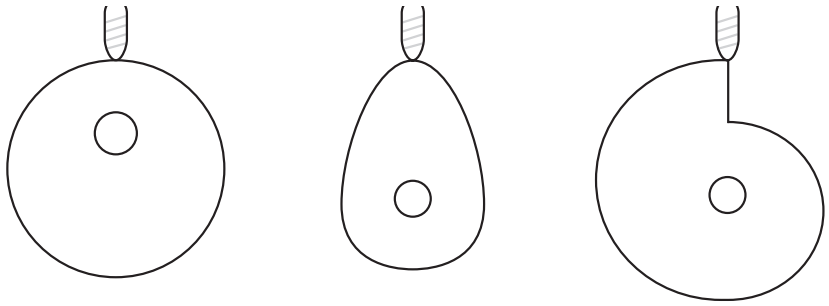
Example 2: 4 marks

1 It's a strategic ~~of~~ way management which quality assurance is applied to every ~~first~~ procedure in order to meet customer satisfaction.

2 Every department treat the other department like clients therefore needs to produce high quality ~~product~~ component. As a result, the whole product will have a high quality.

Question 6(a)

6 Figure 4 shows the profiles of three types of cam which all generate reciprocating motion in their respective followers.



Eccentric (circular) cam Pear shaped cam Snail cam

Figure 4

(a) Describe the characteristic movement each cam generates in its follower.

(i) Eccentric (circular) cam

(2)

(ii) Pear shaped cam

(2)

(iii) Snail cam

(2)

6(a)	For the eccentric and pear cams – do NOT accept 'can rotate in either direction' • Eccentric cam – rise and fall which are of equal length **(1)** Smooth motion **(1)** Simple Harmonic Motion S.H.M. **(1)** • Pear shaped cam – rise and fall are rapid **(1)** with a dwell **(1)** • Snail cam – a smooth continuous rise (for almost 360 degrees) **(1)** rapid fall **(1)** can only rotate in one direction **(1)** (3 x 2)	**(6)**

Example 1: 0 marks

(a) Describe the characteristic movement each cam generates in its follower.

(i) Eccentric (circular) cam

(2)

The eccentric cam produces a continuous motion due to there being no flaws in the circular profile. The follower will continue to consistently stay at the same height.

(ii) Pear shaped cam

(2)

The pear shaped cam will cause the follower to rise and fall gradually. The pip at the top will lead to a fall and the flatter base to a rise.

(iii) Snail cam

(2)

The snail causes a dramatic fall and rise, yet it only falls once per turn. This gives the follower the motion of bobbing.

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Examiner Comments

This question required the candidate to focus on the movement of the follower. The lack of technical terminology in this answer doesn't help the candidate explain clearly what is happening to the follower throughout each revolution.

The 2 marks gained for each require:

i. equal length rise and fall + smooth/regular/consistent speed of rise and fall

ii. rapid rise and fall + dwell angle so no movement of follower

iii. smooth continuous rise + rapid drop.

Example 2: 5 marks

(a) Describe the characteristic movement each cam generates in its follower.

(i) Eccentric (circular) cam

(2) 2 Q6ai

It gives a smooth rise and fall.
It gives a constant acceleration and retardation.

(ii) Pear shaped cam

(2) 1 Q6aii

It will have a dwell time. (A period of time that the follower stays at the same position).
The time of rise and fall is identical as it's symmetric.

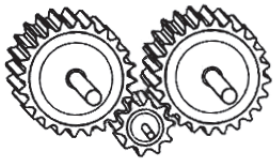
(iii) Snail cam

(2) 2 Q6aiii

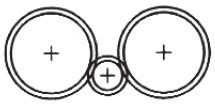
It gives continous acceleration and there will be a sudden drop.

Question 6(b)

(b) Figure 5 shows a diagram and schematic drawing of a simple gear train.



Idler gear



Schematic drawing

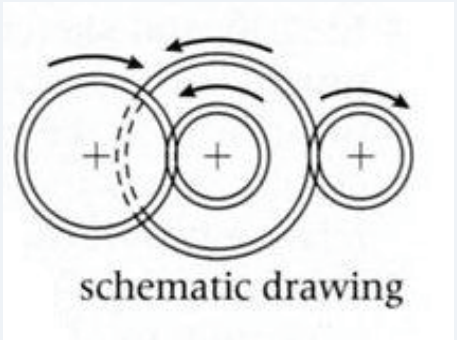
Figure 5

(i) Explain the reason for using an idler gear in this gear train.

(2)

(ii) Draw a schematic drawing of a compound gear train showing direction of rotation for all gears.

(2)

6(b)i	• The idler gear links the two main gears **(1)** and enables the main gears to rotate in the same direction as each other **(1)** and at same speed. **(1)** (2 x 1)	**(2)**
6(b)ii	Compound gear train must show minimum of 4 gears with two meshing pairs. • diagram of correctly meshing gears **(1)** • direction of rotation **(1)**  (2 x 1)	**(2)**

Example 1: 3 marks

(b) Figure 5 shows a diagram and schematic drawing of a simple gear train.

Idler gear Schematic drawing

Figure 5

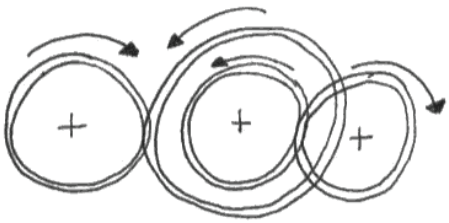
(i) Explain the reason for using an idler gear in this gear train.

(2)

An idler gear is introduced in a gear train to make the driver gear and driven gear turn in the same direction. The size of the idler gear does not have an effect on the gear train.

(ii) Draw a schematic drawing of a compound gear train showing direction of rotation for all gears.

(2)



more than one gear on a shaft.

ResultsPlus

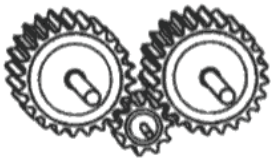
Examiner Comments

i. Only one point given without a justification/ linked point/second valid point so only 1 of 2 marks awarded.

ii. A number of candidates produced similar diagrams which scored a mark, but neglected to show the direction of rotation so lost a mark

Example 2: 4 marks

(b) Figure 5 shows a diagram and schematic drawing of a simple gear train.



Idler gear

Schematic drawing

Figure 5

(i) Explain the reason for using an idler gear in this gear train.

(2) 2 Q06bi

Using an idler gear has not affected the driven gear speed as the ratio is the same as the driver gear. It has made the driven gear rotate in the same direction as the driver gear with the same speed.

(ii) Draw a schematic drawing of a compound gear train showing direction of rotation for all gears.

(2) 2 Q06bii

Question 7(a)

7 Solar panels are increasingly being used as an alternative to fossil fuels for providing domestic electrical energy.

(a) Discuss the advantages and disadvantages of using solar panels compared with fossil fuels for this purpose.

(5)

7(a)	Maximum of 4 marks if advantages or disadvantage only **Advantages** • Relatively low running costs **(1)** • Relatively low maintenance **(1)** • Low/zero emissions **(1)** • Surplus energy can be sold back to the national grid/stored in batteries **(1)** • Use in remote areas **(1)** • Infinite/ renewable/ sustainable resource **(1)** **Disadvantages** • High initial cost **(1)** • Function efficiency is dependent on climate/ orientation **(1)** • Aesthetic impact **(1)** • The low output of each panel means a large number of panels are needed to get the equivalent (to fossils fuel) amount of energy **(1)**	**(5)**

Example 1: 5 marks

7 Solar panels are increasingly being used as an alternative to fossil fuels for providing domestic electrical energy.

(a) Discuss the advantages and disadvantages of using solar panels compared with fossil fuels for this purpose.

(5)

Advantages of Solar panels

* renewable energy source means that it will never run out
* easy to gain the energy at any time of the day.
* Doesn't create Co^2 gasses
* Can fit into your homes on the roofs.

Disadvantages of solar panels

* High start up costs therefore very expensive
* Only can be used when the Sun is out
* Doesn't create alot of energy in realtion to the family.
* relubility
* high maintence.

ResultsPlus

Examiner Comments

This answer is structured so that the advantages and disadvantages are clearly set out. However many candidates did not score full marks as their answers contained only advantages or disadvantages.

Example 2: 5 marks

7 Solar panels are increasingly being used as an alternative to fossil fuels for providing domestic electrical energy.

(a) Discuss the advantages and disadvantages of using solar panels compared with fossil fuels for this purpose.

(5) 5 Q07a

The advantages are: Solar panels are cleaner ~~resources~~, meaning it doesn't (really) pollute the environment, and use ~~renewable~~ renewable (resources), sunlight. Solar panels can be used longer than fossil fuels, as fossils will run out one day, where sunlight won't.

However, Solar panels can only generate electricity in areas ~~the~~ with sunshine. Fossil fuels can be used anywhere. Solar panels can't (be) used during night time, either. In comparison with fossil fuels, Solar panels generate less amount of energy under most circumstances. It's also more expensive to use solar panels.

Question 7(b)

(b) Quantum tunnelling composites (QTCs) change from being electrical insulators to electrical conductors depending on the pressure applied to them.

Give **three** advantages of using QTCs.

(3)

1 .....

.....

.....

2 .....

.....

.....

3 .....

.....

.....

7(b)	**Three Advantages** • The high speed of reaction in the composite **(1)** • The small size of the composite required **(1)** • Low cost **(1)** • Simple to integrate **(1)** • High reliability **(1)** • Proportional response **(1)** • Range of sensitivities **(1)** • Easy to manufacture **(1)**	**(3)**

Example 1: 2 marks

(b) Quantum tunnelling composites (QTCs) change from being electrical insulators to electrical conductors depending on the pressure applied to them.

Give **three** advantages of using QTCs.

(3)

1 It is a lot easier to control the amount of electricity let through if you control the pressure as you can acquire the amount

2 They can do both jobs so it cuts down on materials (conducting and insulating)

3 They also do not take up a lot of room and could be useful in smaller products.

ResultsPlus

Examiner Comments

Three bullet point style answers were required. Candidates should guard against 'explaining' their answers as there is no extra mark once the advantage has been correctly identified.

Example 2: 3 marks

(b) Quantum tunnelling composites (QTCs) change from being electrical insulators to electrical conductors depending on the pressure applied to them.

Give **three** advantages of using QTCs.

(3) 3 Q07b

1 Varying resistance due to varying pressure allowing the strength of the compression to be detected. (i.e distinguish accidental contact with intentional contact and pressure).

2 Can be very small in size and be incorporated into products and clothing (does not take up a lot of space).

3 Reliable and generally won't fail if used correctly. (very simple so less prone to malfunction).

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