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Mark Scheme (Results)
Summer 2010

GCSE

GCSE Design and Technology: Systems and Control (3974)
Paper 3H
Higher Written Paper.

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Publications Code.

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Introduction:

Give / State / Name
Normally a one or two word answer, at the very most a short sentence.

Describe
Normally, one or two sentences which form a description, making reference to more than one point. All points must be linked for a complete answer.

Explain
Normally, one or two sentences which form an explanation. This requires a clear or detailed account of something and includes a relevant justification, reason or example.

Evaluate
Normally one or two sentences where the quality, suitability or value of something is judged. This can include both positive and negative points, with each point normally, requiring a relevant justification.

The mark scheme contains a range of possible answers for all questions. For some questions it is possible to provide a finite number of acceptable answers. However, in some instances it is not possible to provide every conceivable answer. In these instances objective guidance is provided.

For all answers candidates are not expected to give the exact wording contained in this mark scheme. However, to gain credit their answer must demonstrate the same meaning as detailed in the mark scheme.

It is the examiner's responsibility to apply their professional judgement in determining if what the candidate has written has the same meaning as the answer detailed in the mark scheme. For all answers the *'Key words'* have been written in bold text.

For describe and explain questions, candidates may give a different combination of the marking points listed in the mark scheme. In such instances candidates can be rewarded for the marking points provided that they are suitably linked. However, candidates cannot be rewarded for the same point repeated in two different combinations.

Question Number	Answer	mark
1974_3H_Q01a(i)	**Three** each of the following: Specification points Reasons (Do not accept repetition of the specification points) **<u>Quality</u>** **Point**: strong / rigid construction / handle (1) **Reason**: to withstand pressures / forces applied (1) **Point**: smooth edges (1) **Reason**: so no injury is caused to the user (1) **Point**: accurate fitting of the jaws (1) **Reason**: so they do not fall off and get lost (1) **Point**: materials suitable for exterior use (1) **Reason**: longer life span / greater reliability (1) **Point**: durable materials (1) **Reason**: so that it lasts a long time / low maintenance (1) **(2x1)**	**(2)**
1974_3H_Q01a(ii)	**<u>Environment</u>** **Point**: use of recycled materials (1) **Reason**: so existing materials / resources are preserved (1) **Point**: materials should recycled once the product has reached the end of its useful life (1) **Reason**: so that the materials may be used for something else / preserving resources (1) **(2x1)**	**(2)**
1974_3H_Q01a(iii)	**<u>Safety</u>** **Point**: easy to retract jaws (1) **Reason**: in case fingers get caught (1) **Point**: textured handle (1) **Reason**: so it is soft your hand will not slip in use (1) **Point**: strong materials (1) **Reason**: so that they do not break / fail / collapse when clamping heavy loads (1) **Point**: finished well (1) **Reason**: no sharp edges to injure users (1) **(2x1)** Some flexibility should be given as some points may cross over descriptions. *(do not accept/credit if already given in a(i))*	**(2)**

Question Number	Answer	mark
1974_3 H_Q01b	**Two** reasons given from: • readily available in range of sizes / shapes (1) • easily machined / cut (1) • can be finished in different ways / colours (1) • relatively cheap (1) • good compressive strength (1) • can be recycled once it reaches the end of its useful life (1) *(Do not accept can be easily joined by welding / brazing)* **(2x1)**	**(2)**

Question Number	Answer	mark
1974_3H _Q01c	**Two** reasons given from • good surface finish / self finishing / no additional surface finishing required (1) • suitable for mass / high volume production (1) • repeatability / identical (1) • many can be made in one mould (1) • high tolerance / very accurate (1) • colours can be changed (1) • unit costs are low once mould has been paid for (1) • can produce a complex form (1) *(Do not accept easy / quick / cheap / unless qualified)* **(2x1)**	**(2)**

Question Number	Answer	mark
1974_3 H_Q01d	**Two** properties and reasons given from: **Property**: good compressive strength (1) **Reason**: will withstand the large forces applied (1) **Property**: toughness / high impact strength (1) **Reason**: will stand up to knocks and bumps / will withstand things being dropped into it (1) **Property**: elasticity (1) **Reason**: will return to its original shape once deforming force has been removed (1) *(Do not accept strong)* **(2x1)** **(2x1)**	**(4)**

Question Number	Answer	Mark
1974_3H_Q01e	**One** reason explained from: • **To make sure that items are correct size / dimensionally accurate / within tolerances** (1) so that they **will all fit together** (1) • **To check that the item has been correctly assembled** (1) so that **it does not fall apart / collapse which might cause an injury to the user** (1) **(2x1)**	**(2)**

Question Number		Mark
1974_3H_Q01f	**One** explanation from: • **Improves aesthetic appeal** (1) which will **attract users / purchaser** (1) • **Protective layer** (1) which means **that it will not rust / corrode** (1) **(2x1)**	**(2)**

Question Number	Answer	Mark
1974_3H_Q01g (i)	Be able to be used with only one hand **One** explanation from: • **The shape of the handle** (1) allows it to be **gripped / held and the trigger to be squeezed at the same time** (1) • **A squeezing / trigger action is required** (1) rather than **a turning action** (1) **(2x1)**	**(2)**
1974_3H_Q01g (ii)	Not cause any damage to the work being clamped **One** explanation from: • **The large surface area of the jaws** (1) allows the **force to be distributed over a larger area** (1) • **The nylon jaws are relatively soft** (1) and will therefore not **dig into / scratch the surface of the work being clamped** (1) **(2x1)**	**(2)**

Question Number	Answer	Mark
1974_3 H_Q02a	• Class 2 / two / 2 / second order lever / 2nd class (1) *(Only answer)* **(1x1)**	**(1)**

Question Number	Answer	Mark
1974_3 H_Q02b(i)	**Two** properties given from: • Good resistance to corrosion (1) • Acts as a good bearing material (1) • Resists wear (1) **(2x1)**	**(2)**

Question Number	Answer	Mark
1974_3 H_Q02c(i)	**Two** finishes given from: • Painting / 'Hammerite' (1) • Teflon (1) • Plating (1) • Polish (1) • Galvanising (1) • Anodise (1) • Oil / blacking (1) *(Do not accept plastic dip coating)* **(2x1)**	**(2)**

Question Number	Answer	Mark
1974_3 H_Q02c(ii)	**Three** reasons given from: • Stops it rusting **(1)** • Improve aesthetics / appearance **(1)** • Covers sharp edges **(1)** • Improves durability **(1)** • Easier to maintain / clean **(1)** **(3x1)**	**(3)**

Question Number	Answer	Mark
1974_3 H_Q02d	Clockwise moments = Anticlockwise moments Effort = $\frac{300 \times 200}{300}$ **(1)** Effort = 200 (1) N **(1)** **(3x1)**	**(3)**

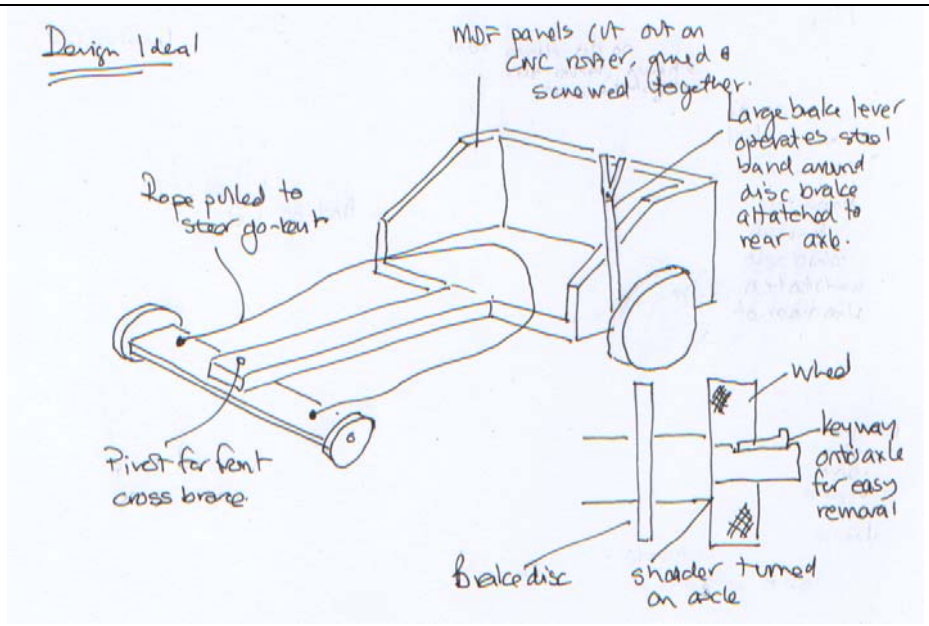
Question Number	Answer	Mark
1974_3 H_Q02e	**One** advantage described from: • Sales / turnover / takings are automatically recorded on a central system (1) which means a stock count is kept up to date (1) • Replacement orders are automatically sent to manufacturers for more stock (1) once stock levels fall below a certain level. (1) • Data is analysed (1) which means marketing strategies can be developed (1) **(2x1)**	**(2)**

Question Number	Answer	Mark
1974_3 H_Q02f	**Three** advantages given from: • They can work 24/7 / all day (1) • They are reliable (1) • They are more flexible / can be reprogrammed (1) • They are faster than manual labour (1) • Easy to recall previous programmes (1) • Accurate / repeatability (1) **(3x1)**	**(3)**

Question Number	Answer	Mark
1974_3 H_Q02g	**Two** reasons explained from: • **Cheaper to produce batches (1)** because **materials can be purchased in bulk / batches (1)** • **Less money is tied up (1)** if products **are not selling well (1)** • **Greater flexibility of machines (1)** therefore allows **a wider variety of jobs to be undertaken (1)** • **Once tooling has been set up (1)** further **batches can be produced quickly in response to customers needs / demands (1)** • **Any problems with a batch can be easily corrected / recalled (1)** therefore **not much money / material wasted (1)** *(Do not accept quick / easy unless qualified)* **(2x1)** **(2x1)**	**(4)**

Question Number	Answer	Mark
1974_3 H_Q02h	**One** way described from: • **Allows for fast and easy communication (1)** between **themselves and the retail outlets (1)** • **Barcode labelling (1)** would allow them **to speed up service / stock control (1)** • **Databases / spreadsheets (1)** for **keeping records / sales / VAT (1)** • **Websites for gathering information (1)** and **advertising new products / new retail stores (1)** **(2x1)**	**(2)**
	Total for question 2	22 marks

Question Number	Answer	Total Mark
1974_3H_Q03a	**Design Idea 1** Each point of the specification has two marking points. 1 mark should be awarded for evidence of each point of the specification resolved in the design. When an answer does not viably answer a specification point 0 marks For each specification point with only one element viably satisfied 1 mark For each specification point with both elements viably satisfied 2 marks Candidates may answer any specification point in either graphical form or by annotation. **No marks are awarded for the quality of communication** Each specification resolved in design **Specification point 1** The battery powered go-kart must have brakes which are easy to operate • Evidence given / that there are brakes **(1)** Eg. Disc / steel band / calliper / hydraulics / electrogenerative • Evidence given / shown that it is easy **(1)** Eg. Foot pedal / large handle / mechanical advantage **Specification point 2** The battery powered go-kart must be easy to steer • Evidence given / shown that it easy **(1)** Eg. Steering wheel / levers / rope to pull / feet • Evidence given / shown that it can be steered **(1)** Eg. Rack and pinion / worm gear / pivots **Specification point 3** The battery powered go-kart must have wheels fixed to the axle but allows them to be easily removed • Evidence given / shown that wheels are fixed to the axle **(1)** Eg. Method of fixing to the axle must allow to wheel to rotate on the axle as it rotates *(could be welded 1 mark but would not score 2nd mark because it would not be easy to remove)* • Evidence given / shown that the wheels can be easily removed **(1)** Eg. keyway / cotter pins / grub screws **Specification point 4** The battery powered go-kart must be made using materials and processes suitable for batch production • Specific material named **(1)** • Process given **(1)** Eg. tools / process / machinery	**(8)**



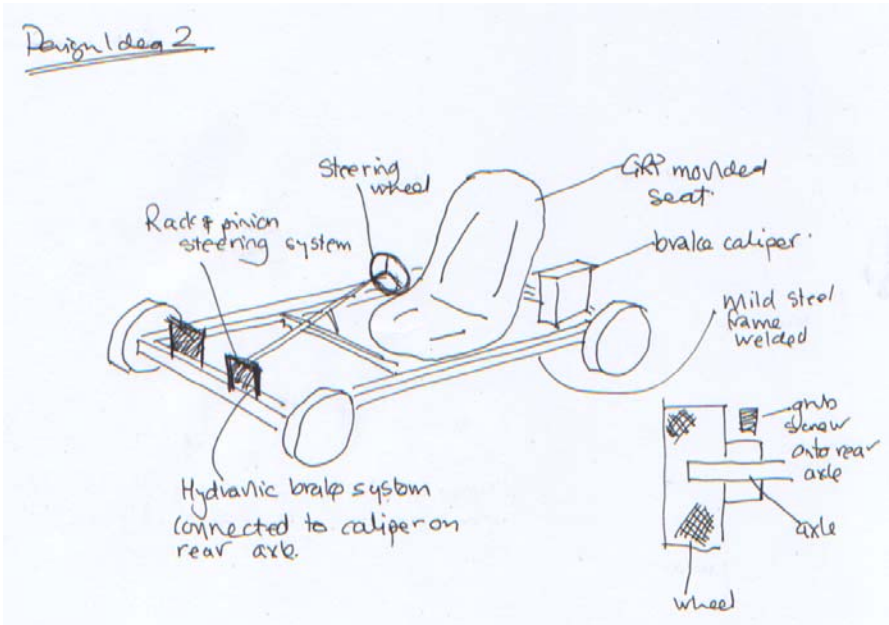
Design Idea 2

To score a mark for Design Idea 2, each specification point must be resolved in second design idea but the second design idea **must be technically / conceptually different in design and construction** from the first and not a simple variation on a theme to score the mark.

Use exactly the same criteria as design idea 1 to mark design idea

A different method of braking **(1)**
A different method of ease of operation **(1)**
A different method of steering **(1)**
A different method of ease of steering **(1)**
A different method of fixing **(1)**
A different method of easy removal **(1)**
A different specific material named **(1)**
A different suitable process **(1)**

(8)



Question Number	Answer	Mark
1974_3H_Q03bi-iii	Each point clearly evaluated. If a candidate has indicated design idea 1 and then evaluates design idea 2 for all or part of (i), (ii) or (iii) then the idea in greater evidence should be marked. The evaluation of the design must contain reference to either positive or negative aspects not simply just a description of the design. Award 1 mark for a correct evaluation / justification relating to each design feature and how it succeeds or fails. Repetition of original spec scores 0.	
(i)	The battery powered go-kart must have **brakes** which are **easy to operate** • What brakes do they have **(1)** • How easy are they to use **(1)** **(2x1)**	**(2)**
(ii)	The battery powered go-kart must be **easy** to **steer** • How easy is it to use **(1)** • What method of steering does it use **(1)** **(2x1)**	**(2)**
(iii)	The battery powered go-kart must have **wheels fixed to the axle** but **allow them to be easily removed** • Method of fixing **(1)** • Ease of removal **(1)** **(1x1)**	**(2)**
	Total for question 3	22 marks

Question Number	Answer	Mark
1974_3H_Q04a	• Rotary / rotational / circular **(1)** **(1x1)**	**(1)**

Question Number	Answer	mark
1974_3H_Q04b(i)	• Part A Pawl **(1)** • Part B Ratchet **(1)** (only answers) **(2x1)**	**(2)**

Question Number	Answer	mark
1974_3H_Q04b(ii)	**One** description given from: • As the crank handle is rotated the **ratchet (part B) rotates (1)** and pushes the **pawl (part A) out (1)** / the **pawl (part A) snaps back** in when it passes the tooth on the ratchet **(1)** • The **pawl (part A) allows the winch drum to rotate anticlockwise (1)**, but **prevents clockwise movement (1)** **(2x1)**	**(2)**

Question Number	Answer	mark
1974_3H_Q04c(i)	• Gear train / simple gear train **(1)** (only answer) **(1x1)**	**(1)**

Question Number	Answer	mark
1974_3H_Q04c(ii)	$\frac{21}{14}$ **(1)** V.R. = 3:2 **(1)** **(2x1)**	**(2)**

Question Number	Answer	mark
1974_3H_Q04c(iii)	$\frac{2}{5} \times 125$ **(1)** 50 rpm **(1)** *(possible 2 marks for answer only)* **(2x1)**	**(2)**

Question Number	Answer	mark
1974_3H_Q04c(iv)	**One mechanism named from** • Belt and pulley **(1)** • Pulley system **(1)** • Chain and sprocket **(1)** • Bevel gears **(1)** • Compound gear train **(1)** • Belt drive **(1)** • Worm gear **(1)** **(1x1)**	**(1)**

Question Number	Answer	mark
1974_3H_Q04d	**Three** disadvantages given from: • Increased demand on oil reserves **(1)** • Increased drilling / oil exploration / pollution created through processing **(1)** • Fume pollution **(1)** • Noise pollution **(1)** **(3x1)**	**(3)**

Question Number	Answer	mark
1974_3H_Q04e	**Two** benefits described from: • **Less demand on resources (1)** which means **what we do have will last longer (1)** • **Reduced amount of waste being dumped into landfill sites (1)** which mean **landfill sites will last longer (1)** • **Less pollution caused / created in the production of new materials (1)** which means **less pollution is being put into the atmosphere (1)** • **Less waste having to be incinerated (1)** and so **less pollution / fumes created (1)** **(2x1)** **(2x1)**	**(4)**

Question Number	Answer	mark
1974_3H_Q04f	**Two** reasons explained from: • **Products need to be continually serviced (1)** so that manufacturers / companies **continue to make money (1)** • **As parts break / wear out the replacement / spare parts (1)** continue to **generate sales / revenue (1)** • **Continued demand means that the manufacturers / companies can retain staff (1)** which means that **they create wealth / jobs / employment for local people (1)** **(2x1)** **(2x1)**	**(4)**
	Total for question 4	**22 marks**
	Total for paper	**88 marks**

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