

Mark Scheme (Results)

Summer 2007

GCSE

GCSE Design and Technology: Systems & Control (Mechanisms) Foundation Tier (1974)

Marking Guidance

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.

Examiners must mark in red pen using ticks and crosses in the body of the script.

Design & Technology: Systems & Control (Mechanisms) (1974/3F)
Full Course Foundation Tier Mark Scheme

Question Number	Question		
1974_3F_Q01ai-ii	<p>The table below shows some tools, components and equipment.</p> <p>Complete the table by:</p> <p>(i) naming each tool, component or piece of equipment</p> <p>(ii) describing its use</p>		
	<p>Answer</p> <p>Name: pliers / wire cutters Task: gripping/wire cutting/doing-undoing nuts</p> <p>Name: cam/eccentric/follower Task: converting motion / in a child's toy / move up and down</p> <p>Name: bolt / screw Task: fixing/joining</p> <p>Name: micrometer Task: measuring</p> <p>Name: till / cash register (<i>do not accept 'cash machine'</i>) Task: register sales / record stock movements / store money / give receipts / calculates change</p>	<p>Part Mark</p> <p>1 1 1 1 1 1 1</p>	<p>Total Mark</p> <p>(10)</p>

Question Number	Question		
1974_3F_Q01bi	<p>The drawing below shows a hand drill.</p> <p>The handles are made from wood.</p> <p>Choose <u>one</u> surface finish from the list below which is suitable for the handles of the drill.</p>		
	Answer	Part Mark	Total Mark
	Varnish <i>(only answer)</i>	1x1	(1)
Question Number	Question		
1974_3F_Q01bii	<p>The hand drill has a small side handle.</p> <p>Give <u>one</u> reason why the drill needs the side handles.</p>		
	Answer	Part Mark	Total Mark
	<p>One reason given from:</p> <ul style="list-style-type: none"> to turn the gear/chuck/drill/output/arm / make the drill move / drill holes to act as the input <p><i>(do not accept 'to drill')</i></p>	1x1	(1)

Question Number	Question		
1974_3F_Q01biii	<p>The side handle is fixed to the arm with a rivet.</p> <p>Give <u>one</u> reason why a rivet is a suitable method of fixing the side handle to the arm.</p>		
	<p>Answer</p> <p>One reason given from:</p> <ul style="list-style-type: none"> • strong • durable • can allow handle to rotate • lends itself to automated assembly • permanent fixing • cost effective • they do not shake/vibrate loose 	Part Mark	Total Mark
		1x1	(1)
Question Number	Question		
1974_3F_Q01c	<p>The drill is used when drilling a hole.</p> <p>Give <u>two</u> safety precautions that should be taken when using the drill.</p>		
	<p>Answer</p> <p>Two precautions given from:</p> <ul style="list-style-type: none"> • wear glasses/goggles • make sure the work is clamped / work is on a flat/steady surface • backing wood on thin materials • tie hair back • ensure no loose clothing can be caught up • do not use drill bits which are too big • use both handles / keep fingers away from gears 	Part Mark	Total Mark
		2x1	(2)

Question Number	Question		
1974_3F_Q01d	<p>A manufacturer produces 5000 hand drills at a time.</p> <p>Choose terms from the list below to complete the statements about manufacturing the hand drill. Each term may be used once or not at all.</p>		
	<p>Answer</p> <p>1. batch production 2. production line <i>(only answers)</i></p>	Part Mark 2x1	Total Mark (2)
Question Number	Question		
1974_3F_Q01ei	<p>The wooden handles of the hand drill were designed using CAD.</p> <p>Explain <u>one</u> advantage to the manufacturer of using CAD to design the wooden handles.</p>		
	<p>Answer</p> <p>One advantage explained from:</p> <ul style="list-style-type: none"> • a CAD system can produce designs/drawings very quickly whereas manually drawn designs cannot • CAD designs are easily modified whereas manually produced drawings are difficult to modify • designs/drawings can be sent electronically therefore reducing costs/time delays • CAD produces great accuracy thus reducing possible errors in manufacture • CAD drawings can be easily and quickly converted into CAM files therefore saving time/makes them ready for manufacturing quicker • a 3D virtual image may be viewed therefore negating the need to make a model / saves cost of making a model 	Part Mark 2x1	Total Mark (2)

Question Number	Question		
1974_3F_Q01eii	<p>The wooden handles of the hand drill are manufactured using CNC machinery.</p> <p>Give <u>three</u> benefits to the manufacturer of using CNC machinery.</p>		
	<p>Answer</p> <p>Three benefits given from:</p> <ul style="list-style-type: none"> • can receive design from CAD • accuracy / reliability • repeatability • reduction of work force • flexible manufacture • designs easily modified • economy of scale • speed of production • runs 24/7 • works in a hostile environment / health and safety <p><i>(do not accept 'quicker'/'faster'/'cheaper' unless qualified)</i></p>	<p>Part Mark</p> <p>3x1</p>	<p>Total Mark</p> <p>(3)</p>
		(Total 22 marks)	
Question Number	Question		
1974_3F_Q02ai	<p>The diagram below shows a balancing toy.</p> <p>The balancing toy is made from a ferrous metal.</p> <p>Choose <u>one</u> metal from the list below which is a ferrous metal</p>		
	<p>Answer</p> <p>Steel</p> <p><i>(only answer)</i></p>	<p>Part Mark</p> <p>1x1</p>	<p>Total Mark</p> <p>(1)</p>

Question Number	Question	Part Mark	Total Mark
1974_3F_Q02aii	Give <u>three</u> properties of ferrous metals that make them suitable for making the balancing toy.		
	<p>Answer</p> <p>Three properties given from:</p> <ul style="list-style-type: none"> • compressive strength • tensile strength • shear strength • tough • durable/durability • ductile/drawn • malleable / easy to shape/bend • stiff • hardness <p><i>(Do not accept 'strong')</i></p>	3x1	(3)
Question Number	Question	Part Mark	Total Mark
1974_3F_Q02bi	<p>The balancing point on the toy is like a bearing.</p> <p>Give the specific name of the balancing point.</p>		
	<p>Answer</p> <p>Pivot or fulcrum</p> <p><i>(Only answers)</i></p>	1x1	(1)

Question Number	Question		
1974_3F_Q02bii	Name <u>two</u> other types of bearing.		
	Answer	Part Mark	Total Mark
	Two different bearings named from:		
	<ul style="list-style-type: none"> • journal • thrust • flat • ball/Ball race • roller • plain • taper • needle 	2x1	(2)
Question Number	Question		
1974_3F_Q02ci	The balancing toy is shown in a state of equilibrium. Explain what is meant by the term <u>equilibrium</u> .		
	Answer	Part Mark	Total Mark
	One explanation from:		
	<ul style="list-style-type: none"> • the moments on either side of the pivot are equal and so the toy balances • when the toy is at rest and not moving / doesn't fall over • a stable condition in which forces cancel out one another 	2x1	(2)

Question Number	Question	Part Mark	Total Mark
1974_3F_Q02cii	Describe the effect on the balancing toy if the weight of ball A is increased.		
	Answer		
	One description from:		
	<ul style="list-style-type: none"> it increases the anti-clockwise moment and makes the toy lean/move/tilt it causes the toy to lean/move/tilt to the left/A goes down/the other ball goes up 	2x1	(2)
1974_3F_Q02d	The metal parts of the balancing toy can be reclaimed when the toy is thrown away. Explain what is meant by the term <u>reclaimed</u> .		
	Answer		
	One explanation from:		
	<ul style="list-style-type: none"> reclaiming used materials to make new products/preserve natural materials materials can be converted into new products therefore saving precious new resources 	2x1	(2)
1974_3F_Q02e	The manufacturer introduces CAM to reduce the cost of making each balancing toy. Give <u>two</u> ways in which CAM will reduce the cost of making each balancing toy.		
	Answer		
	Two ways given from:		
	<ul style="list-style-type: none"> runs 24/7 in order to maintain high levels of production high level of accuracy reduces waste electronic files easily stored and retrieved used to machine complicated 2D/3D shapes less labour required 	2x1	(2)

Question Number	Question		
1974_3F_Q02f	<p>The designer of the balancing toy must be aware of environmental issues when selecting materials.</p> <p>Give <u>three</u> different environmental issues that the designers must consider when selecting materials.</p>		
	<p>Answer</p> <p>Three environmental issues given from:</p> <ul style="list-style-type: none"> • greater use of recycled materials • increased life expectancy of the product • greater waste management/control of material in production • conservation of materials • greater use of materials from managed/sustainable sources • biodegradable packaging materials • pollution during material processing - acid rain/noise/chemical • disposal of products • over use of timbers/deforestation • damage from mining/drilling/tipping/transportation 	Part Mark	Total Mark
		3x1	(3)
1974_3F_Q02g	<p>Products have to undergo strict testing to ensure that they meet safety standards.</p> <p>Explain <u>two</u> advantages for the consumer of being able to purchase products which have passed safety standard tests.</p>		
	<p>Answer</p> <p>Two advantages explained from:</p> <ul style="list-style-type: none"> • product is reliable therefore customers have greater confidence in the product • customer unlikely to be injured using product because risks/hazards will have been overcome/removed 	Part Mark	Total Mark
		2x1 2x1	(4)
			(Total 22 marks)

Question Number	Question
1974_3F_Q03a	<p>A clamping device is required to hold the steel tube shown below whilst drilling a hole using a pillar drill.</p> <p>The specification for the clamping device is that it must:</p> <ul style="list-style-type: none"> • clamp and release the tube • allow the centre for the hole to be seen and the hole drilled • be held on the drill table securely • be made from materials and processes used in a school workshop <p>In the spaces opposite, use sketches and, where necessary, brief notes to show two different design ideas for the clamping device that meet this specification.</p>

Answer	Part Mark	Total Mark
<p>Design idea 1</p> <p>Each point of the specification has two marking points.</p> <p>1 mark should be awarded for evidence of each point of the specification resolved in the design.</p> <p>Where an answer does not viably answer a specification point 0 marks</p> <p>For each specification point with only one element viably satisfied 1 mark</p> <p>For each specification point with both elements viably satisfied 2 marks</p> <p>Candidates may answer any specification point in either graphical form or by annotation.</p> <p>No marks are awarded for the quality of communication.</p> <p>Each specification resolved in design: Have a clamp and a release action</p> <ul style="list-style-type: none"> • Evidence given of clamp Screw thread/mech adv/G-clamp/horizontal thread • Evidence given of release cam/toggle/undo screw thread catch for quick release action. 	<p style="text-align: right;">1</p> <p style="text-align: right;">1</p>	

Allow the centre of the hole to be seen and the hole drilled

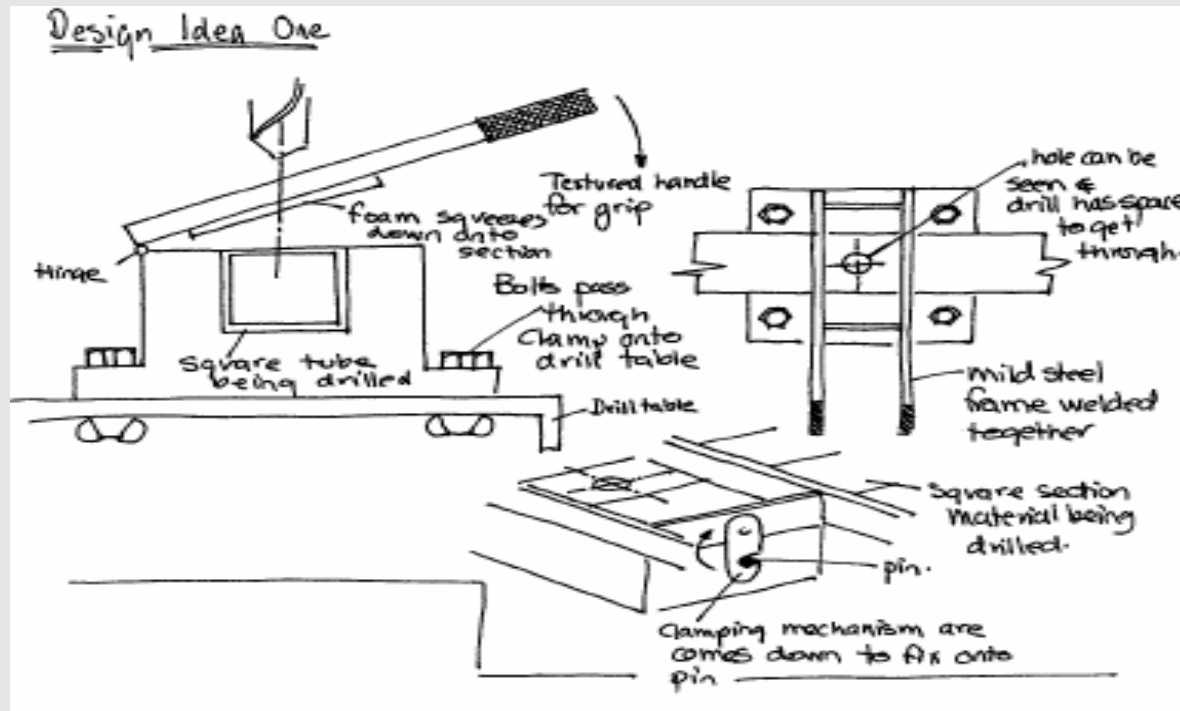
- Evidence that the centre of the hole can be seen 1
- Evidence that the hole can be drilled eg access for the drill to get to the mark 1

Be held on the drill table securely

- Evidence that it can be held on the table 1
- Evidence that it is secure on the table - nuts/bolts/toggle/g-clamp 1

Made from suitable materials and suitable w/shop processes.

- Evidence of suitable material; 1
Accept suitable material for any named part of the mechanism or fastening
- Evidence of a suitable process; 1
Accept suitable process for any named part of the mechanism or fastening



(8)

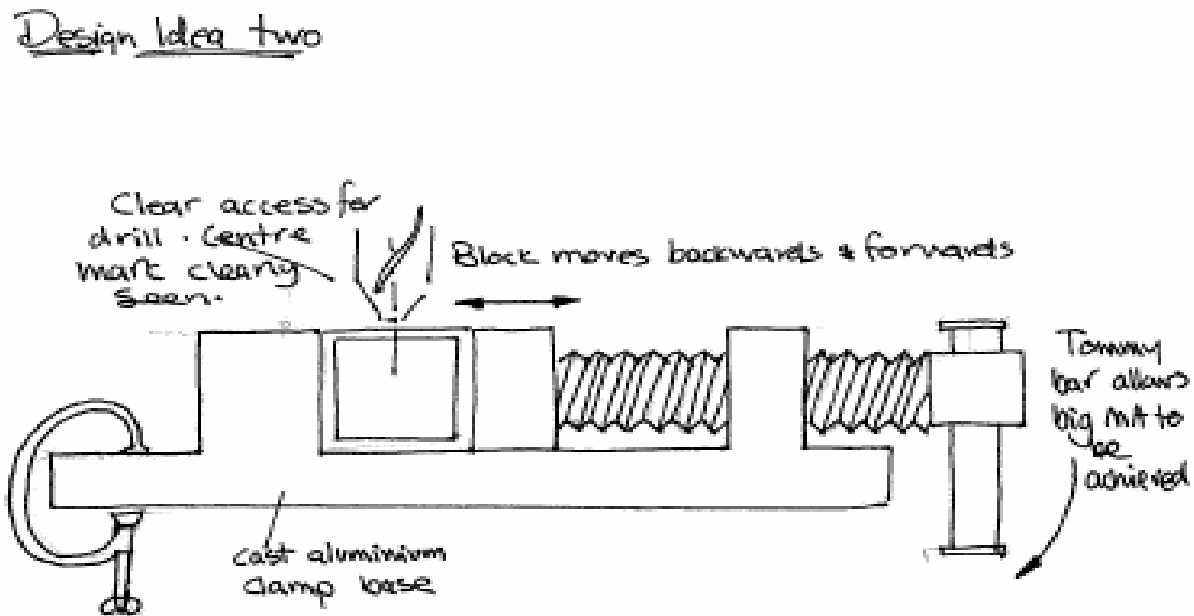
Design idea 2

To score a mark for Design Idea 2, each specification point must be resolved again in the second design idea but the second design **must be technically/conceptually different in design and construction** from the first to score a mark.

Use exactly the same criteria as design idea1 to mark design idea 2.

A different method of clamping	1
A different method of releasing	1
A different method of seeing the mark	1
A different method of accessing the mark	1
A different method of holding	1
A different method of securing	1
A different material	1
A different process	1

(8)



Question Number	Question		
1974_3F_Q03b	<p>Three of the original specification points are repeated below. Evaluate how one of your design ideas succeeds or fails to meet each of the specification points.</p> <ul style="list-style-type: none"> (i) The clamping device must clamp and release the tube (ii) The clamping device must allow the centre for the hole to be seen and the hole drilled. (iii) The clamping device must be made from materials and processes used in a school workshop. 		
	<p>Answer</p> <p>The evaluation of the design must contain reference to either positive or negative aspects not just simply a description of the design.</p> <p>Award 1 mark for a correct evaluation relating to each design feature and how it succeeds or fails to meet it.</p> <p>Repetition of original specification scores 0</p> <ul style="list-style-type: none"> (i) Evaluation of: Clamping and releasing Positive or negative statements relating to: <ul style="list-style-type: none"> • Reference to clamping • Reference to releasing (ii) Evidence of: seeing the centre for the hole and able to drill the hole Positive or negative statements relating to: <ul style="list-style-type: none"> • Reference to the ability to see the centre for the hole • Reference to the ability to access to drill the hole (iii) Evidence of: making from materials and by processes found in school workshops. Positive or negative statements relating to: <ul style="list-style-type: none"> • Reference to relevant materials • Reference to appropriate processes 	<p>Part Mark</p> <p>1 1 1 1 1 1</p>	<p>Total Mark</p> <p>(6)</p>
(Total 22 marks)			

Question Number	Question		
1974_3F_Q04a	<p>The drawing below shows a folding bicycle and its carrying bag. It is used by people who need to take a bicycle on trains and buses.</p> <p>Two specification points for the folding bicycle are that it must</p> <ul style="list-style-type: none"> • stop efficiently • reduce in size to fit in a carrying bag <p>Under each of the following headings, give <u>one</u> more point which should be included in the specification for the folding bicycle. For each point, give <u>one</u> reason why it should be included.</p>		
	<p>Answer</p> <p>Three specification points given: Three reasons given: It is essential that the points and reasons both fully relate to market, environment and quality. <i>(Do not accept repetition of the specification points given)</i></p> <p><u>Market</u></p> <p>Point: appropriate ergonomics Reason: to suit 95 percentile</p> <p>Point: hold bag/box/case Reason: consumer convenience and expectation</p> <p>Point: modern/high tech. aesthetic Reason: to be attractive to consumers</p> <p>Point: needs to be cost effective (cheap) Reason: so more people will buy them</p> <p>Point: needs to be light Reason: so they can be carried onto a train/bus/in work</p>	<p>Part Mark</p> <p>3x1 3x1</p>	<p>Total Mark</p> <p>(6)</p>

Environment

Point: a 'green' product - manual power

Reason: no emissions

Point: recyclable materials

Reason: reduce use of raw materials and energy in conversion

Point: reduced road congestion

Reason: alternative mode of transport

Quality

Point: folding frame

Reason: takes up little space on mass transport

Point: welded alloy structure

Reason: strong and durable structure

Point: no sharp edges

Reason: safety in use

Point: needs to be durable

Reason: reliable to get to work

Point: must have a weatherproof finish

Reason: to prevent rust

Point: bag must be strong

Reason: does not break open whilst carrying

Point: hinges need to be robust/strong/reliable

Reason: so bike does not fold when it is used

Some flexibility should be given as some points may cross over descriptions.

Question Number	Question		
1974_3F_Q04b	<p>The folding bicycle frame is made from an aluminium alloy. One reason for the use of aluminium alloy is its good strength to weight ratio.</p> <p>Give <u>two</u> other reasons why aluminium alloy is a suitable material for the frame.</p>		
	<p>Answer</p> <p>Two reasons given from:</p> <ul style="list-style-type: none"> • low levels of corrosion • easy to machine/cut/join • needs no finishing • attractive appearance when polished / aesthetic • can be easily plated/sprayed/polishes • lightweight 	2x1	(2)
Question Number	Question		
1974_3F_Q04c	<p>A bearing is used on the wheel axle.</p> <p>Give <u>two</u> reasons for using a bearing on the wheel axle.</p>		
	<p>Answer</p> <p>Two reasons given from:</p> <ul style="list-style-type: none"> • reduces friction / allows wheels to turn / easier to move • gives a smoother ride • increases efficiency • reduces wear/prolongs life 	2x1	(2)

Question Number	Question		
1974_3F_Q04d	<p>The mudguards of the folding bicycle are made of a thermoplastic.</p> <p>Give <u>two</u> properties of a thermoplastic that make it a suitable material for the mudguards. For each property give <u>one</u> reason why it makes a thermoplastic suitable.</p>		
	<p>Answer</p> <p>Two properties with reasons given from:</p> <p>Property: self coloured Reason: range of colours can be achieved</p> <p>Property: durable/tough/elastic/flexible Reason: long chain molecule structured plastic</p> <p>Property: plasticity Reason: easily moulded</p> <p>Property: low melting point Reason: chemical/molecular structure</p> <p>Property: self finishing Reason: chemical/molecular structure</p>	<p>Part Mark</p> <p>2x1 2x1</p>	<p>Total Mark</p> <p>(4)</p>

Question Number	Question	Part Mark	Total Mark
1974_3F_Q04e	<p>The reflector on the rear mudguard is made from red coloured plastic.</p> <p>Explain <u>one</u> reason why the reflector is coloured red.</p>		
	<p>Answer</p> <p>One reason explained from:</p> <ul style="list-style-type: none"> • red is internationally recognised as the colour for warning signage • red reflective covers are used on all road going vehicles to indicate that it is the rear of the vehicle so that you can show caution as you approach 	2x1	(2)
Question Number	Question	Part Mark	Total Mark
1974_3F_Q04f	<p>A chain and sprocket system is used to transfer motion from the pedals to the rear wheel. The chain must be kept lubricated.</p> <p>Explain <u>one</u> reason why the chain must be kept lubricated.</p>		
	<p>Answer</p> <p>One reason explained from:</p> <ul style="list-style-type: none"> • to make the bicycle efficient because lubrication reduces friction • to make the chain last longer because lubrication reduces wear / stops rusting 	2x1	(2)

Question Number	Question		
1974_3F_Q04gi-ii	<p>Two purposes of the folding bike are that it must</p> <ul style="list-style-type: none"> • stop efficiently • reduce in size to fit in a carrying bag <p>Explain under the following headings, how the folding bike achieves these purposes.</p>		
	<p>Answer</p> <p>One reason explained from: Stop efficiently</p> <ul style="list-style-type: none"> • a small input force from the lever results in a large force being applied to the wheel by the brake • the friction between the rubber block and the wheel is high therefore the bicycle slows quickly <p>One reason explained from: Reduce in size to fit in a carrying bag</p> <ul style="list-style-type: none"> • small diameter wheels reduces the overall size of the product once folded down allowing it to fold away into the bag • frame folds down into a smaller section which means it is more compact • saddle post drops down through the column which allows it to fold away into the bag • handle bars and steering tube collapse/fold which makes it easier/smaller to fit into the bag 	<p>Part Mark</p> <p>2x1</p> <p>2x1</p>	<p>Total Mark</p> <p>(2)</p> <p>(2)</p>
		(Total 22 marks)	
TOTAL FOR PAPER: 88 MARKS			

