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MARKSCHEME

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DESIGN TECHNOLOGY

Standard Level

Paper 3

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Option A – Raw material to final product

A1. (a) *(**[1]** for **one** correct statement)*
Prevents the steel from rusting.
Safer – smoother texture.
Aesthetics – range of colours can help the fence blend into the environment *e.g.* dark green.

(b) *(**[2]** for **one** advantage referring to wood and metal. **[1]** only for a statement not an outline e.g. looks better)*
Aesthetics – gives a more traditional look than metal.
Easier to repair (DIY skills and equipment).
Privacy – can't see through it, unlike the metal ones.

(c) *(**[1]** for each correct statement to a maximum of **[3]**)*
Both fences need regular maintenance *i.e.* a preservative for the wooden fence and paint for the metal.
Wood is affected by parasites/insects but metal is not. Wood is easier to damage (splits) while metal is harder (dents).
Metal rusts whereas wood does not.

A2. *(Any **two** reasons, **[1]** each)*
Wide range of colours – more choice.
Light to carry.
High tensile strength (rip-stop).
Non-absorbent so dries out quickly.
Available in different densities or different applications.
Easy to manufacture.
Stretches tightly round a frame.

A3. *(**[1]** for each aspect)*
Binding agent required to bind the mycoprotein threads together.
Flavouring agent *e.g.* chicken flavour.
Shaping required *e.g.* chicken leg.
Colouring agent required.

A4. *(Any factor suitably explained **[2]**. **[1]** only for a statement)*
Expensive to produce because of sintering process.
The operating temperature has to be extremely low so the environmental control would be uneconomical to install or operate.
Current R & D limited but operating temperature continues to rise with the goal being room temperature.

Option B – Products in context

B1. (a) Before purchase / Phase 1. ***[1]***

(b) *(**[2]** for an outline which comments on the value to the customer. **[1]** only for merely a statement)*
Able to compare different products.
Assess performance.
Compare test results with manufacturer's claims.
Assess value-for-money.

(c) *(**[1]** each for **two** factors; **[1]** for using examples to illustrate the explanation)*
Depends on the purpose of the evaluation *e.g.* assessing safety. Some criteria may be more important than others in particular design contexts *e.g.* aesthetics for jewellery.
Depends on the needs of the evaluator *e.g.* manufacturers tests on a prototype or consumer testing.

B2. *(**[1]** each for **two** statements)*
Increased waste material.
Increased pollution.
Reduction of resources (energy or materials).

B3. *(**[1]** each for three correct outlines)*
No batteries required – cheaper.
No batteries – less environmental damage.
Convenience – no changing of batteries or winding up a mechanism.
Durability – no chance of batteries leaking or winding mechanism failing.
Reliability – do not have to remember to wind up the watch or buy batteries.

B4. *(**[2]** for each issue suitably discussed, **[1]** for a statement only. Maximum **two** issues × **[2]**. No full marks for statements only i.e. four statements, **[2]** maximum)*
Reduction in need for raw materials. recycled materials used instead.
Less energy resources used to extract, refine and convert raw materials.
Reduction in environmental damage in extracting raw materials.
World's reserves will last longer – less need to exploit them.

Option C – Mechatronics

C1. (a) Linkage ***[1]***

(b) *(**[1]** each, maximum of **[2]**)*
Durability
Reliability
Ease of maintenance
Simplicity
Manufacturing cost

(c) *(**[1]** for each correct statement. Maximum of **[3]**)*
Inclusion of 'pin-in-slot' eliminates oscillation of the table.
The mechanism will only move the table up or down.
The mechanism needs to be synchronised with another device for removing the object from the top of the table.
No mechanical advantage is apparent therefore the mechanism will only lift light loads.

C2. (a) Thermistor ***[1]***

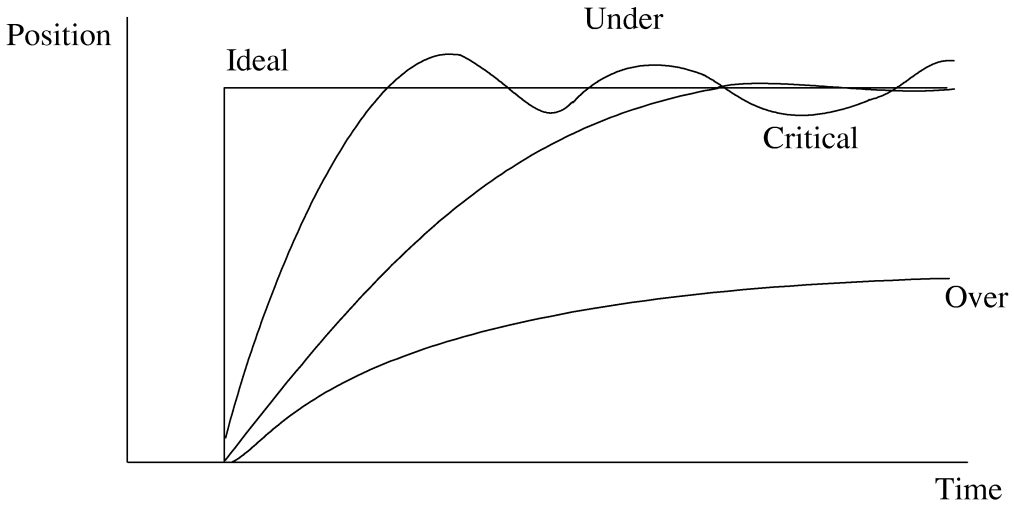
(b) $$V = \left[\frac{R\,1}{R1 + R2}\right] \times 15 = \left[\frac{18}{18 + 12}\right] \times 15 = 9 \text{ volts}$$

*(**[1]** for the equation – **[1]** for calculating the right answer)*

(c) Adjusts the temperature at which the circuit switches. ***[1]***

C3. Moment is: force applied × perpendicular distance from the axis (pivot) to the line of action of the force. ***[1]***

C4.



Over damping causes the signal to take too long or not reach its target.
Under damping causes the signal to overshoot its target or oscillate.

Critical damping is the closest possible to ideal *i.e.* a trade-off between any two factors relating to friction, inertia, gain of amplifier.
*(**[1]** for each correct statement – maximum of **[3]**. An additional **[1]** for a correct diagram)*

Option D – Food technology

D1. (a) 15-22 years. ***[1]***

(b) In the early years (1-10) same requirement. ***[1]***
From 10 years onwards the gap between male and female widens as they get older until 19-22 years and then narrows ***[1]***

(c) *(**[1]** for each outline linking nutritional requirements to food choice; maximum of **[3]**)*
Taste preferences change with different experiences *e.g.* travel. ***[1]***
Body changes at different times of life *e.g.* lower metabolism. ***[1]***
Life style changes *e.g.* having a baby. ***[1]***
Diseases *e.g.* diabetes. ***[1]***
Become more knowledgeable about different foods and more experienced at preparing it. ***[1]***
Health issues linked to jobs / routines *etc.* ***[1]***

D2. Electro-magnet waves are passed through the food killing off microbes and unwanted pests. ***[1]***
The fruit does not go mouldy ***[1]*** and looks like fresh food but keeps longer. ***[1]***

D3. *(**One** issue × **[2]**. **[1]** for a statement only not specifically linked to lifestyle)*
Cook-chill products are linked to the increase in food poisoning.
Breakdown of the regular family meal occasion.
People pay less attention to nutritional requirements and a balanced diet.
'Exotic' dishes are readily available anywhere in the world.
People do not have to find a specialist restaurant to enjoy exotic food.
Cook-chill products are more expensive than buying fresh produce.
Speed – meals prepared in minutes.
More time available for other activities.
Reduction in skills / experience of preparing meals.
Diet may be more varied and cross-cultural.

D4. *(**[2]** for each aspect linking the organoleptic property to market segment – maximum **[4]**; **[1]** only each aspect as a statement)*
Flavourings are added to target different ages or cultures.
Different textures provided to offer variety and widen the market.
Very competitive market so consumer choice is important.

Option E – Computer aided design and manufacturing

E1. (a) *(**[1]** for an appropriate statement; **[1 max]**)*
More work done in less time. ***[1]***
More cost-effective. ***[1]***

(b) *(**[2]** for **one** correct response; **[1]** only for a statement)*
Less tedious to use than drafting using a drawing board.
Easier to make changes to drawings.
More scope for designers *e.g.* zooming in and out.
Gives a more high tech image to the company and designer.
Increased job satisfaction – better quality drawings.
Allows for more interface with other people, less isolation.
More training and staff development required.
Broader role for the designer – links to manufacturing *etc.*

(c) Accuracy:
Less errors due to the elimination of drawing skills.
Less errors due to ease of correction.
CAD allows for zooming in on drawings and enlarging *etc.*
Accuracy depends on the software and output devices rather than manipulative skills.

Consistency:
Fatigue does not affect the quality of the drawing so readily.
Different people can work on drawings with no indication of changes of style.
Software sets the parameters *e.g.* pull-down menus.

***[1]** for an aspect related to accuracy.*
***[1]** for an aspect related to consistency.*
***[1]** for identifying from the data that more than twice as many benefits relate to accuracy than consistency.*

E2. NC machines are controlled by punch tape or cards and therefore have limited functions. ***[1]***
CNC are controlled by computers and therefore have greater scope. ***[1]***

E3. *(**[2]** for any issue suitably linked to both types of models; **[1]** for using an example)*
Physical models are 3D and can be handled and are therefore more tangible representations of the intended object.
Computer simulations are 2D and cannot be handled and passed around.
Clients get a better idea of the final outcome from physical models than computer simulations.
Computer simulations are cheaper to create than physical models.
One simulation model can be used as the basis for changes to create other models but different physical models need to be created.

E4. *(**[2]** for each aspect suitably discussed. **[1]** for a statement only, not relating CAM to the role of the designer. Maximum **[4]**)*

Designer needs to know how CAM works.
Designer is more involved with production.
CAM dictates what can be achieved.
(DFM)
Designer can see prototypes more quickly.
More quality control built into the system.
Designer may receive feedback on any possible problems.
Can be very expensive if design faults are replicated on a large scale.
May be more scope for the designer *i.e.* accuracy and precision.

Option F – Invention, innovation and design

F1. (a) *(**[1]** for either an appropriate statement **[1 max]**)*
Use of new materials.
Use of new technology for manufacturing.
Style.

(b) *(**[2]** for a reason clearly related to an improvement for racing)*
Holding the redesigned handlebars pulls the rider forward ***[1]*** and creates a more aerodynamic riding position. ***[1]***
Changing the shape of the handlebars ***[1]*** gives the rider better grip. ***[1]***
*(**[1]** for identifying appropriate feature of redesign and **[1]** for outlining how it benefits the design.)* ***[2 max]***

(c) *(**[1]** for identifying an advantage; **[1]** for relating it to a particular design feature; **[1]** for explaining its relevance to the use of the bicycle)*
Lighter – especially beneficial for racing.
Increased durability *e.g.* for specialist activities such as mountain biking.
Less corrosion compared to the conventional use of steel.
Better image – more stylish.
Other opportunities for different manufacturing techniques *e.g.* monocoque design.
Less components possible.

F2. *(**[1]** for a suitable aspect of oven design; **[1]** for relating it to a market pull situation)*
More environmentally friendly *i.e.* use less energy; use recyclable materials – use reusable parts.
Appeal of classic designs *e.g.* Aga / Rayburn.
Development of microwave ovens which also operates as a conventional oven to make food taste traditional.
Design of ovens to fit into built-in kitchen designs *i.e.* integrate in relation to size, materials, colour.
Use of remote controls as with other products.
Incorporation of fuzzy logic as for other domestic products to make them easier to use.

F3. *(**[1]** for identifying an issue; **[1]** for relating the issue to the pace of change; **[1]** for using a suitable example)*
Rapid development of new technologies and materials.
New markets with increased globalisation.
Product life cycle becomes increasingly shorter.
More research and development taking place.
Effect of planned obsolescence on the product life cycle.
More competition spurring R&D and innovation.
Greater market pull situation for more innovative products.
More countries changing from developing to developed.

F4. *(Each issue suitably discussed, **[2]** each, maximum **two** issues. **[1]** only for merely stating an issue and not relating it to a context)*
Issues relate to:
Use of new materials *e.g.* ABS less durable than Bakelite.
New technologies *e.g.* micro electronics more sensitive to damage.
Cheaper products therefore cheaper to throw away than repair.
Influence of fashion – people buy phones to suit different environments.
Different security devices for mobile phones.
People like to upgrade mobile phones for ones with different features or capacity.
Change from analogue to digital telephone exchanges.

Option G – Health by design

G1. (a) Coloured ***[1]***

(b) *(**[1]** for identifying a correct factor. **[1]** for relating the factor to a context)*
More similar to spectacle lenses.
Natural evolution from what went before.
Easier to manufacture.
Suitable for people with the eye disease astigmatism.
Easier to handle by consumers.
Long lasting if maintained well.
Technology for developing soft lenses not yet established.

(c) *(**[1]** for each reason suitably outlined; maximum of **three** reasons)*
Wider choice for consumer, to suit different eye conditions, for cosmetic reasons *e.g.* change colour of the eye.
Different eye conditions require different lenses.
New materials and technologies constantly developing.
New markets – more widespread use of contact lenses.
Users purchase more than one type for variations in use / lifestyle issues.
Different lenses targeted at different market segments.

G2. *(**[1]** for each statement; maximum of **two** statements)*
Brittle so breaks easily and can be dangerous.
Expensive to produce.
Less easy to read than a digital read out.

G3. *(**[1]** for each benefit; maximum **[3]**)*
Possibility of use of measured doses more hygienic – no need to clean it.
Easy to use by patients themselves.
No need for expensive packaging for long term storage.
Can be used anywhere.

G4. *(**[2]** for each issue suitably discussed. Maximum of **two** issues. **[1]** for a statement rather than a discussion)*
Expensive to do, therefore uses financial resources.
Responding to pressures from society *e.g.* fashion trends.
Making judgements on the needs of patients.
Moral issues relating to divisions in society – treatments available for the advantaged / disadvantaged.
Issues relating to changes of appearance and changes of personality.