

# **Design and Technology**

General Certificate of Secondary Education

Unit **A512** Electronics and Control Systems: Sustainable Design

## **Mark Scheme for January 2013**

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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## SECTION A

Question		Answer	Marks	Guidance
1		(c)	1	
2		(d)	1	
3		(b)	1	
4		(d)	1	
5		(a)	1	
6		The Mobius loop "Recycle" logo, designed to encourage people to recycle	1	Allow any reference to recycling, encourages recycling
7		Coal, Gas, Oil, crude oil, natural gas.	1	Any 'fossil fuel' and derivatives e.g. petrol, oil, diesel, heating oil. Not 'Fossil Fuel(s)' alone, Allow Nuclear ONLY if mention made of building or de-commissioning.
8		To analyse the function of a product, to look at how well does it do its job	1	Evaluate a products function. 'Evaluate' / 'Function. Key word Evaluate
9		Reduce	1	Only
10		Ethical Trading Initiative	1	Allow misspelling as long as meaning is clear
11		True	1	
12		False	1	
13		True	1	
14		False	1	
15		True	1	
		<b>Total</b>	<b>15</b>	

## SECTION B

Question			Answer	Marks	Guidance
16	(a)	(i)	<ul style="list-style-type: none"> <li>• Wind energy/wind turbine</li> <li>• Solar energy – photoelectric</li> <li>• Other genuine sustainable and realistic source</li> </ul>	2	These should be accessible to most candidates. Allow odd solutions such as fuel cell or even HEP. 'POWER' is the key, so explanations about 'not always on so saving energy' do not score.
		(ii)	Provide: <ul style="list-style-type: none"> <li>• A reserve of electrical energy stored in cells/batteries</li> <li>• provide a mains backup facility that switches in if needed</li> </ul> stand-by generator that only runs when required.	2	Not vague suggestions like 'spare power'. 'Connect to mains', 'mains', 'generator'. Allow 'non-renewable' or similar concept.
	(b)		<ul style="list-style-type: none"> <li>• Low power consumption</li> <li>• means less energy is used during products lifespan</li> <li>• Reduced carbon footprint</li> <li>• Long service life means less time spent servicing the product</li> <li>• less travel/transport needed to visit and service</li> <li>• less fuel consumed over lifetime of product due to lower servicing needs.</li> </ul>	4	Must be Environment/environmental. Watch for the same thing described using different words.
	(c)		No chemical cleaners or detergents required so less pollution generated, operative will not need to drive around cleaning the signs.	1	Either route acceptable so long as statement leads to a reduction or non-use of anything potentially harmful including travel fuel. Accept legitimate answers with justified benefit.

Question	Answer	Marks	Guidance
(d)	<p>Level 1 candidates are expected to talk very generally about:</p> <ul style="list-style-type: none"> <li>• how this is a waste of resources</li> <li>• may put toxic items into landfills</li> <li>• whole range of other very general suggestions.</li> </ul> <p>Level 2 and 3 candidates will be able to flesh out their discussion with more in-depth information to include information about:</p> <ul style="list-style-type: none"> <li>• how items should be disposed of</li> <li>• including information about WEEE.</li> </ul> <p>Higher level candidates will add information about:</p> <ul style="list-style-type: none"> <li>• what is or might become toxic</li> <li>• how it may be recovered e.g. by tertiary recycling.</li> </ul> <p>Key phrase 'harm to the environment'.</p>	6	<p><b>Level 3 (5–6 marks)</b> Thorough discussion, showing clear understanding of safe and appropriate disposal. Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate will demonstrate the accurate use of spelling, punctuation and grammar.</p> <p><b>Level 2 (3–4 marks)</b> Adequate discussion, showing an understanding of safe and appropriate disposal. There will be some use of specialist terms, although these may not always be used appropriately. The information will be presented for the most part in a structured format. There may be occasional errors in spelling, grammar and punctuation.</p> <p><b>Level 1 (0–2 marks)</b> Basic discussion, showing some understanding of safe and appropriate disposal. There will be little or no use of specialist terms. Answers may be ambiguous or disorganised or 'list like'. Errors of grammar, punctuation and spelling may be intrusive.</p>
	<b>Total</b>	<b>15</b>	

Question	Answer	Marks	Guidance
17 (a)	Any of: <ul style="list-style-type: none"> <li>• Large clear digital readout</li> <li>• backlit display for use in low light or at night,</li> <li>• low power consumption</li> <li>• memory recall</li> <li>• ease of dismantling at end of life</li> <li>• comfortable handheld rubberised grip (reference to ergonomics and anthropometrics)</li> <li>• shower/rain-proof</li> <li>• easy to use buttons</li> <li>• start/stop &amp; on/off / sleep mode</li> <li>• neck cord.</li> </ul> Sustainable aspects e.g. solar/recyclable	4	Can relate to features, serviceability, end-of-life issues, materials used and where manufactured. Allow: Shockproof, lightweight, operates with one hand, easy to use, manufacturing method IF qualified/relevant e.g. injection moulding for low waste, surface textures etc.  Not 'colourful' or 'attractive' unless qualified by e.g. for a child/boy/girl.
(b)	Any 2 features that would help an elderly person be it visual, physical or otherwise: <ul style="list-style-type: none"> <li>• Large clear numbers</li> <li>• Easy to feel/touch/press buttons</li> <li>• Controls well laid out</li> <li>• Neck cord with safety snap link if caught or pulled</li> <li>• Rubberised grip</li> <li>• Colourful</li> <li>• Sound and light indicators.</li> </ul>	2	Should relate to a likely improvement for an elderly person who may suffer from reduction in sight, hearing or grip capability.
(c)	Any three of: <ul style="list-style-type: none"> <li>• Product may then be discarded when first set of cells flat</li> <li>• waste of resources / energy used to make/distribute</li> <li>• Running costs to user – cell purchase and replacement</li> <li>• Disproportionate to initial purchase cost</li> <li>• Disposal of old cells needs specialist treatment/collection points</li> <li>• 'Too small to bother' leading to waste</li> <li>• Product needs servicing by an unqualified user.</li> </ul>	3	Credit any valid reference to built-in obsolescence (caused by discarding the unit due to unavailability of tools/cells or inability of end user to service product). Plenty of choice so watch for repetition.  Don't allow 'not recyclable' unless qualified e.g. tertiary.

Question		Answer	Marks	Guidance
	(d)	<ul style="list-style-type: none"> <li>• Tools may not be available</li> <li>• User needs knowledge and skills/feel confident enough to replace cells</li> <li>• may have to pay someone to replace cells (like in watches)</li> <li>• Some users may not have any suitable tools to remove/replace the cell cover so further expense to replace.</li> </ul>	2	Allow 'time consuming'. Could loose screw or tool, Possible damage to product inept servicing. Watch repetition regarding initial acquisition of tool. 'Can't be done on the go' or similar.
	(e)	Sketches and notes showing solutions that: <ul style="list-style-type: none"> <li>• Use a spring-loaded tab</li> <li>• plastic tang based clip/cover</li> <li>• slide-on lid to secure the cells</li> <li>• some sort of 'snap' action to retain</li> <li>• coin slot – twist to release</li> <li>• clamshell 'snap' together.</li> </ul>	4	Like the majority of IR TV/DVD remote control units and multi-meters or any product that 'uses' cells. coin slot allowed although technically a tool Can be 2 sketches with additional explanations (solution and reason), 4 separate worthy features or combination of sketches and/or notes.
		<b>Total</b>	<b>15</b>	

Question			Answer	Marks	Guidance
18	(a)	(i)	<p>Tells the consumer any of the following:</p> <ul style="list-style-type: none"> <li>• Cost per unit</li> <li>• cost per day</li> <li>• instantaneous usage</li> <li>• average usage</li> <li>• total usage</li> <li>• time of day</li> <li>• target usage</li> <li>• historical usage (yesterday).</li> </ul> <p>Allowing them to:</p> <ul style="list-style-type: none"> <li>• Reduce usage of expensive items eg fan heaters</li> <li>• Learn to switch things off including not using standby</li> <li>• Buy more energy efficient appliances/bulbs</li> <li>• Reduce household base load to lowest possible value</li> <li>• Learn responsibility for their actions</li> <li>• Realise the cost of what they are consuming/set targets</li> <li>• And their carbon footprint</li> <li>• becoming a 'turn-it-off' nag.</li> </ul>	4	<p>Allow one mark only for repeated references to a change of lifestyle reason unless well-reasoned/explained/justified</p> <p>"information then action"</p>
	(b)		<p>Any of:</p> <ul style="list-style-type: none"> <li>• Coal</li> <li>• Lignite</li> <li>• Natural gas</li> <li>• Oil</li> <li>• Shale Oil/gas</li> <li>• Peat</li> <li>• Fracking derived fossil fuels</li> </ul>	2	Not Bio-fuel such as wood waste/pellets, corn husk waste or other plant derived bio-fuel.

Question	Answer	Marks	Guidance
(c)	Any of: <ul style="list-style-type: none"> <li>• Damaged appliance (broken casing)</li> <li>• frayed/cut/burnt/damaged mains lead</li> <li>• touching mains plugs/pins of mains plug and appliances with wet hands / near water</li> <li>• Cutting/piercing a mains cable with e.g. an electric lawn mower, strimmer.</li> <li>• by drilling/knocking a nail into a wall with a hidden cable.</li> </ul>	3	Any three. Expect a variety of unusual, unlikely and basically wrong suggestions along with all the correct suggestions. Watch for repetition. 'Using mains (powered) appliances near water'. Don't allow anything relating to 'static electricity'.
(d)	(i) Any three of: <ul style="list-style-type: none"> <li>• No fragile glass bulbs to break</li> <li>• shielded anyway by a plastic screen</li> <li>• Rechargeable product means lead-free operation in remote situations</li> <li>• Low voltage only presents no shock hazard even if product becomes damaged in use or by accident or by water ingress</li> <li>• Negligible explosion/fire risk from LEDs.</li> <li>• Better quality of light</li> </ul> (ii) Compared to the problems: <ul style="list-style-type: none"> <li>• Trailing mains cable may cause trip hazard or pull light onto floor</li> <li>• Poorly shielded fragile glass bulb may break</li> <li>• Presence of mains voltage and a metal frame represents a shock hazard</li> <li>• Especially in the presence of moisture (damp garage, left outside/working in rain)</li> <li>• Breaking or broken mains bulb from impact, broken glass, possible fumes, shock hazard from bare wires in bulb</li> <li>• Ignition hazard if bulb breaks exposing filament.</li> </ul>	6	Advantage and why/reason/disadvantage of what it replaces.  Be aware of repetition and reversal of reasons in attempt to supply 3 genuine advantages especially restating information provided in the stem, e.g. LEDs.....  Allow references to improved portability of LED unit / no trailing wire hazard etc.  Smaller so improved access, easier to store, compact, lighter.  Don't allow general answers that relate to environmental aspects. Not generic environmental catch-alls.  The answer should focus on benefits the user/in use.  If and environmental answer is offered, it must qualify how the stated benefit is accrued.  List like answers score 3 only.
	<b>Total</b>	<b>15</b>	
	<b>Paper Total</b>	<b>60</b>	

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