

Design and Technology

General Certificate of Secondary Education **A512**

Electronics and Control Systems: Sustainable Design

Mark Scheme for June 2010

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SECTION A

Question	Expected Answers	Marks	Rationale
1	<p>The symbol stands for:</p>  <p>(b) European conformity.</p>	[1]	
2	<p>Smart materials.</p> <p>(a) Respond to environmental changes.</p>	[1]	
3	<p>With reference to the 6R statements, which of the following is reuse:</p> <p>(d) Put materials or components to another purpose.</p>	[1]	
4	<p>A chemical store of electrical energy is:</p> <p>(c) Zinc chloride paste.</p>	[1]	
5	<p>Sustainable timber used in structures is:</p> <p>(b) Taken from managed forests.</p>	[1]	
6	<p>What does the abbreviation RoHS stand for?</p> <p>Restriction on use of hazardous substances. Accept explanation.</p>	[1]	
7	<p>What could be unsafe about the product shown?</p> <p>Lead in the solder (restricted under RoHS), may roll off desk (onto foot, it's 500 grams).</p>	[1]	
8	<p>How should the battery be disposed?</p> <p>Not a rechargeable so should be recycled, returned to vendor (most stores now offer this) or should be put in battery bank/correct recycling bin. No justification required.</p>	[1]	Do not accept any suggestion as vague as 'bin it'. Battery bins

Question	Expected Answers	Marks	Rationale
9	<p>Name one environmentally friendly packaging material. Card or paper from 100% recycled or renewable source manufactured locally or biodegradable as paper or plastic starch product. If re-useable (like glass) is suggested and it's re-use constitutes environmentally friendly practice, accept.</p>	[1]	
10	<p>Name one organisation which helps producers get a realistic price for their product. Any ethical trading organisation – Fairtrade, ETI (Ethical Trading Initiative).</p>	[1]	
11	<p>Putting rubbish into landfill site is a method of recycling. FALSE.</p>	[1]	
12	<p>Energy is saved by using a computer screensaver. FALSE.</p>	[1]	There may be confusion between a screen saver (originally to prevent screen burn) and power saving which is a separate concept.
13	<p>A bicycle dynamo uses a source of renewable energy for the lights. TRUE.</p>	[1]	
14	<p>Designers of new products should plan for recycling. TRUE.</p>	[1]	
15	<p>WEEE regulations cover the safe disposal of electronic products. TRUE.</p>	[1]	
	Section A Total	[15]	

SECTION B

Question		Expected Answers	Marks	Rationale
16	(a)	Consumers are encouraged to reduce energy use in the home.		
16	(a) (i)	Give two benefits of reducing energy use at home. Any two of: Reducing the energy costs of the home, making a contribution to reducing CO ₂ emissions, reduce the carbon footprint of household. Save money (which can then be spent on other things).	[1] [1]	Energy use at home No “environment”, “fossil fuels”
16	(a) (ii)	Give two everyday energy saving tips that a family can use in the home. Any two of: use low energy bulbs, reduce thermostat temperature, only boil required water in the kettle, turn off lights when room unoccupied, do not leave products on standby, reduce draughts by closing doors, use lids on pans, take showers rather than baths.	[1] [1]	Life style points
16	(b) (i)	List five possible improvements for the owner of a house which has no energy saving features. Any of: Roof insulation to 300mm, (allow add roof insulation) fitted carpet Cavity wall insulation, (allow add internal insulation to walls) Replace boiler with a condensing boiler, (allow “modern more efficient” or “sustainable boiler eg woodchip or bio-fuel unit that uses a carbon neutral energy source”, log burning, compressed newspaper, ground source heat pump. Mini hydroelectric Double or triple glazing, (allow thermal glass or low-E glass) Replace domestic appliances (eg freezer, fridge, washing machine) with products with a higher efficiency ratings. Others which could be included – tank and pipe work insulation, draft proofing, lower wattage/LED lights, movement sensing Solar panels	[1] [1] [1] [1] [1]	Home improvements Capital investment Not life style Any legitimate and worthwhile improvement, especially if justified how/why, deserves credit.

16	(b)	(ii)	From your answer in (b)(i) choose the most important improvement to save energy and justify your choice. Reason for choice: Justified explanation from the following: How energy is saved, type of energy, reduction in CO ₂ emissions, cost effective (cost savings against the cost of installation), carbon neutral	[1] [1]	House related Weak or vague answers score 1
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Question		Expected Answers	Marks	Rationale
16	(c)	<p>A new house could be built using sustainable materials. Describe the use of two sustainable building materials. Method described should not use finite materials, could be reuse of materials, eg recycled metals wood and plastic, timber frame building, straw bale house, wool insulation, living roof. Mud walls – wattle and daub Re-use – tyres walls, paper insulation, reclaimed bricks/timber/tiles/glass bottles.</p>	[2+2]	Vague answers limited to 1 mark each, justification or description required for 2
		Question 16 Total	[15]	

Question			Expected Answers	Marks	Rationale
17	(a)		Fig. 3 shows a wind up radio used in remote parts of the world where electrical power and batteries are not readily available.		
17	(a)	(i)	Give three benefits of having a wind up radio. Any three from: No need for replacing batteries/cells. Always ready to use, no running costs, super capacitor could replace battery meaning it never needs servicing, no running costs after purchase, environmentally friendly design, sustainable, no disposal problems of batteries.	[1] [1] [1]	Allow one environmental Not portable Not one word –eco friendly, sustainable, saves energy Should be related to the wind up aspects of the product, not the benefits of having a radio.
17	(a)	(ii)	Give one other application of wind up technology Torch, clockwork wind up toys or clocks/watches	[1]	Any reasonable and realistic application
17	(a)	(iii)	Describe how wind up products produce and store energy. Looking for linked technology, ie A handle, wheel or key (lever) drives a gear chain which drives a generator (allow motor) at high speed, producing electrical energy that can be used, or stored in a cell, battery or super-capacitor, alternatively, energy is stored in a spring/coil spring which can then be used either as source of energy directly or to drive the generator.	[1] [1]	Answers allowed from both mechanical and electrical means of generating and storing energy. Weak system description 1 mark, robust description 2 marks
17	(b)		In many parts of the world, energy from sustainable sources can contribute to the local economy. Give three sustainable energy sources. Any three from: Solar (heat & photovoltaic) power, wind power, water (allow wave) power generation to electricity or rotary/hydraulic power, hydro electric, geothermal including heat pump. Biomass energy with specially grown vegetable matter or woody waste materials (woodchips, straw, sugar cane) to convert to heat. Biogas, managed forest	[1] [1] [1]	Not water alone OK Wind, sun

Question		Expected Answers	Marks	Rationale
17	(c)	<p>New electrical products for the home should follow Eco-design principles.</p> <p>Give three Eco-design points the designer must consider.</p> <p>Any of: Energy use during the life/production of the product Environmental considerations for material use, water use, polluting emissions including transport and packaging issues Improving energy efficiency End of life and recycling. Take apart easily. Planned obsolescence, safe disposal, efficiency needs to be specified, upgradable.</p>	<p>[1] [1] [1]</p>	<p>Electrical products Only one environmental point</p> <p>Recycle Reduce repair Not – reuse, refuse, rethink Not - 6R's, sustainable, eco friendly</p>
17	(d)	<p>Describe the impact of television becoming readily available on the culture of remote areas of the world.</p> <p>Looking for an awareness of the impact (good and bad) of and suggestions of likely benefits/problems that might arise as a result. Good: potential for education, health awareness, public information (food drops, warnings of earthquakes, mobile clinic in area), Bad, cultural pollution, westernisation, drink/tobacco/advertising of consumer goods, loss of independence, inactivity, detrimental lifestyle changes.</p>	<p>[1] [1] [1]</p>	<p>Cultural points only</p> <p>Vague answers 1 mark, sound reasoning either for or against, 2 marks, robust reasoning involving for and against 3 marks</p>
Question 17 Total			[15]	

Question			Expected Answers	Marks	Rationale
18	(a)	(i)	<p>State two ways these controllers can contribute to safety and security in the home.</p> <p>Any two from: Putting on lights when people are not at home. Switching on the radio/music system/tv, creating an illusion of occupancy. Putting on a light in dark areas. Digital unit may be more versatile, different programs for different days.</p>	<p>[1] [1]</p>	<p>Security and safety points only</p> <p>Not used as alarms, energy monitor</p>
18	(a)	(ii)	<p>State three safety issues when using the controllers shown in Fig. 4.</p> <p>Any of: Danger of using a mains powered product, not for external use, not waterproof, may be limits on current drawn through unit. Power rating may limit the products the unit can switch on. Protection from power surges.</p>	<p>[1] [1] [1]</p>	<p>Controller specific</p>

Question	Expected Answers	Marks	Rationale
18 (b)	<p>*(b) Electricity can be generated in power stations using coal, gas or oil. Discuss how electricity generated by using these fuels contributes to global warming and pollution.</p> <p>Fumes produced from burning fossil fuels, CO₂, carbon monoxide, nitrous oxide, sulphur dioxide, fine ash dust. How gases are changed in the atmosphere – acid rain/smog.</p> <p>Steam produced by cooling towers, efficiency of electricity generation and transmission. Alternative power generation</p> <p>Level 1 (0-2) marks Basic discussion, showing some understanding of electricity generation – fuel burnt to make steam for turbines. Some comments on CO₂ and greenhouse gases with impact on atmosphere. 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> <p>Level 2 (3-4) Adequate discussion, showing understanding of CO₂ production and pollutant gases. Some mention of other pollutants and effects. 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>Level 3 (5-6) Through discussion, showing a clear understanding of carbon dioxide contribution to global warming. Effects of other gases on atmosphere, acid rain on Scandinavian forests, smog generation. There will be three or more clearly identified and explained points. 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>[2]</p> <p>[2]</p> <p>[2]</p>	

Question		Expected Answers	Marks	Rationale
18	(c)	<p>Industry must change to reduce the carbon footprint in the future. Give details of two changes industry should make to reduce the carbon footprint of products.</p> <p>Reducing the transport of raw materials and finished products, use sustainable materials, recycle where possible, generate energy on site, green energy, use energy efficiently, retaining/reusing any heat produced. Carbon neutral, use of recycled materials to cut down on raw.</p>	<p>[2] [2]</p>	Weak answer, eg just a change suggested, 1 mark, some sound justification of reason, 2 marks, per point.
		Question 18 Total	[15]	
		Section B Total	[45]	
		Paper Total	[60]	

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