RECOGNISING ACHIEVEMENT

GCSE

Design and Technology

General Certificate of Secondary Education

Unit **A514/03** Technical aspects of designing and making Mechanisms

Mark Scheme for January 2011

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Question			Expected Answer	Mark	Rationale
Part A					
1	**(a)**		Zero emissions, quieter in use, can use renewable energy source, longer service life, lower maintenance costs, does not use fossil fuels, no greenhouse gas produced, allow no waste products like engine oil	**[1]** **[1]**	
1	**(b)**		Heat, allow sound, but NOT friction as this is the CAUSE,	**[1]**	
1	**(c)**		Chain & Sprocket Advantage: positive drive, high power capability/torque handling/larger force Disadvantage: must be in line, must be kept tight, needs lubrication Vee-belt & Vee Pulley Advantage: Soft drive take-up, does not need to be perfectly in line no need for lubrication Disadvantage: Slips, must be kept oil free, needs tensioner, has to be checked, wears down in time	**[2]** **[2]**	Not 'Harder to maintain' unless justified eg needs regular lubrication Not 'easier to maintain' unless justified eg belt will need tightening/regular inspection
1	**(d)**	**(i)**	Two arrows pointing to adjacent pins or any pair of points that represent the pitch of the chain	**[1]**	Needs to accurately show pitch
		(ii)	Grub screw (Allen key grub screw)	**[1]**	
		(iii)	Feature: a flat, or machined flat		
			Purpose: To help prevent rotation of grub screw/provide positive locking	**[2]**	
		(iv)	Cooling, allow heat to escape, additional airflow for cooling	**[1]**	
			TOTAL	**[12]**	

Question			Expected Answer	Mark	Rationale
2	(a)	(i)	Square, allow Acme	[1]	
2	(b)		Higher Mechanical Advantage, more leverage or adjustable leverage. Less effort to apply the same force, requires less effort. More force can be applied. Easier to rotate in limited space such as near another object (workbench). Allow uses less material, allow "cost" if qualified by saves raw materials or similar implied	[2]	Watch for the same thing said in a different way.
2	(c)	(i) (ii)	Cast Iron (allow Aluminium, steel (might be fabricated by pupil in w/s)) Sand casting, casting, allow die-casting (or pressure die-casting) only for aluminium	[2]	Look out for confusion with fig. 6 if they have not read the question
2	(d)		Class 1, Class one	[1]	
2	(e)		Consideration of issues relating to separating different materials - labour costs, specific tools or methods, labelling/marking of material type, was product designed for recycling. Both can be recycled subject to separating materials and undertaking some dismantling. Plastics may not maintain original performance. Energy usage in extraction, refining/manufacturing, re-processing and environmental harm from greenhouse gas/toxic fumes/mining activity if relevant **Level 1 (0-2 marks)** Basic description, showing some understanding of the problems of recycling mixed materials. 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. **Level 2 (3-4 marks)** Adequate description, showing some understanding of the problems of recycling mixed materials. 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		Environmental comments of a general nature not related to the stem should not be credited. List like answers score 2 marks maximum

Question			Expected Answer	Mark	Rationale
			Level 3 (5-6 marks) Thorough description, showing some understanding of the problems of recycling mixed materials. 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.	**[6]**	
			Total	**[12]**	

Question			Expected Answer	Mark	Rationale
3	(a)		Either of: Turning force, twisting force	[1]	
3	(b)		Correct substitution of numbers 2*94 188 NM allow without units	[2]	
3	(c)	(i) (ii)	An alloy is a compound of one or more metals or other elements Press or hammer into shape, fashion by heating and pressing/hammering	[1] [1]	Allow mixture as long as it involves two or more metals Not 'heat treatment'
3	(d)	(i) (ii)	To prevent corrosion, improve appearance, increase customer appeal, prevent rusting, add aesthetic appeal Chromium (allow chrome), Nickel,	[1] [1]	
3	(e)	(i) (ii) (iii)	ACROSS FLATS or ACROSS the FLATS Single Hex: Advantage: Improved grip on nut head/can contact face more than corners/ dual size metric/imperial/can be made stronger/ideal for impact wrench use, less likely to wear quickly Dual hex: Disadvantage: may slip on worn nuts, socket wall weaker/may split/less engagement with tight nut/may round off/less engagement/faster wear	 [1] [2] [2]	Not 'actual size' Allow credit where the deeper socket dual hex) would allow for better engagement on nyloc or castellated bolts. Ensure it matches description/picture
3	(h)		Less likely to slip/can be tightened up more/tamperproof/less tool wear	[1]	
			TOTAL	[12]	
			TOTAL SECTION A	[36]	

Question			Expected Answer	Mark	Rationale
Part B					
4	**(a)**		Crank, crank handle, NOT 'handle' or 'winder'	**[1]**	
4	**(b)**		Cam Followers, Follower, allow pushrod(s)	**[1]**	
4	**(c)**		Snail cam will only rotate in one direction	**[1]**	
4	**(d)**		Pear shaped – sudden rise and fall Circular cam – steady rise and fall snail cam – slow rise and sudden fall	**[3]**	
4	**(e)**		Drawing, sketches and notes that explain and show either a eccentric or pear shaped cam on axle or an angled swash plate on the bottom of the bird pole follower	**[3]**	[1] for cam shape, [1] suitable location, [1] could action work (all as described and/or drawn)
	(f)		By adding a rubber or similar high-grip covering, or sand/glass/abrasive material/paper that improves grip/friction between the two surfaces.	**[1]**	
	(g)		2 marks for a tri-lobed cam with a centre marked, 1 mark for just triangular or tri-lobed equivalent that could function	**[2]**	
			TOTAL	**[12]**	

Question			Expected Answer	Mark	Rationale
5	(a)	(i) (ii)	Computer Aided Design Computer Aided Manufacture	[2]	
5	(b)		Two comments about holding parts in the same location, repeatable, identical, speed of assembly, not very skilled labour needed, can withstand the high temperature of welding/won't melt/move during welding	[2]	Watch for reuse of stem as written. Some display of understanding required for a mark
5	(c)	(i) (ii)	Nyloc nut, allow self-locking nut To resist vibration from road/use, should not come undone or loose unintentionally, (as nylon grips thread)	[1] [1]	
5	(d)		Discussion around raw material source/costs/energy in production and the broader pros/cons of metals vs. plastic. Lighter car will use less fuel, may last longer if they does not rust. Plastic parts may fail sooner than metal, creating waste. Metal parts may corrode. Modern cars need dismantling into component parts far more than an old 'steel' one before recycling can take place, labour costs, who pays. **Level 1 (0-2 marks)** Basic description, showing some understanding of raw material source/costs/energy in production and the broader pros/cons of metals vs. plastic. 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. **Level 2 (3-4 marks)** Adequate description, showing an understanding of raw material source/costs/energy in production and the broader pros/cons of metals vs. plastic. 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		

Question			Expected Answer	Mark	Rationale
			Level 3 (5-6 marks) Thorough description, showing clear understanding of raw material source/costs/energy in production and the broader pros/cons of metals vs. plastic. 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.	**[6]**	
			TOTAL	**[12]**	
			TOTAL SECTION B	**[36]**	
			TOTAL PAPER	**[60]**	

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