RECOGNISING ACHIEVEMENT

GCSE

Design and Technology

General Certificate of Secondary Education

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

Mark Scheme for June 2011

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Question			Expected Answer	Mark	Rationale
Part A					
1	**(a)**	**(i)** **(ii)**	Flexible coupling, allow universal joint, allow dog clutch Allows rotation/rotary motion to be transmitted at a slight angle, allows for errors in axial alignment. If dog clutch, enables/allows drive to be engaged/disengaged	**[2]**	Answers must match each other.
1	**(b)**		A pulley/arrow/indication drawn touching the free bottom section of belt between motor and drum	**[1]**	
1	**(c)**		Any two from self adjusting, increases maintenance intervals, maintenance free (no checks required), takes up wear for you, always at the correct tension, should not slip, less worry, lower running/maintenance costs	**[2]**	
1	**(d)**		To increase the belt contact area / improve belt warp-around / improve grip / more grip of belt	**[1]**	
	(e)		Any two of: Improved service life, better power transmission / higher power transmission, 1 belt does all (drives more than one application - serpentine), compact solution (allowing a shorter engine), less energy wasted flexing belt / more efficient than v-belt	**[2]**	No ‘does not stretch’ or similar
	(f)		Arrow / line / indication pointing to any part of the outer ring of friction material	**[1]**	
	(g)	**(i)** **(ii)**	Spline ONLY Transmit drive or similar (1) whilst being able to move along a shaft (to allow for wear or release of clutch pressure) (1)	**[3]**	Allow mark for correct functional description
			TOTAL	**[12]**	

Question			Expected Answer	Mark	Rationale
2	(a)	(i) (ii) (iii)	Three words / letters with indication lines or arrows that indicate: Effort (handles) Fulcrum (pin in centre) and load (open jaws)	[3]	Allow lines indicating general direction so long as correct principle is illustrated, i.e. correct order
2	(b)		Class 1 / Class A	[1]	
2	(c)	(i) (ii) (iii)	Three words / letters with indication lines or arrows that indicate: Effort (handles) Fulcrum (heel of pincers on wood) and load (head of nail in jaws)	[3]	Must be precise especially the HEEL. Anywhere on nail is OK. Anywhere on handle is OK.
2	(d)		Compound (allow odd spelling so long as intention is clear)	[1]	Only
2	(e)		Rotary (rotational) into Linear OR oscillating into reciprocating	[2]	If mismatched but on correct line 1 mark.
	(f)		Rack and Pinion (allow odd spelling)	[1]	
	(g)		Class 2 / Class B	[1]	
			Total	[12]	

Question			Expected Answer	Mark	Rationale
3	(a)	(i)	Open cage Sealed Shielded		Allow other valid justifications 'don't jam' or 'go stiff' or 'sieze'.
		(ii)	Any of: reduce friction, keep metals apart, cool bearing surface, improve efficiency	[4]	Allow prevent rust/corrosion, Not 'lubricate' unless qualified
3	(b)	(i) (ii)	Low friction or hard wearing, does not need lubrication By the moulded in D shape/flat/positive location provided by D shape/locks to shaft	[2]	Must relate to suitability for drive/ properties of nylon, NOT reasons of manufacture, not 'lightweight'.
3	(c)		Discussion around energy used during raw material extraction, manufacture, delivery, processing of scrap materials/metals, energy used by a slightly less efficient older car compared to a new compact, new car types, hybrids, alternative fuels, non-metallic bodywork parts. **Level 1 (0-2 marks)** Basic description, showing some understanding of energy usage. 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 the issues involved during different phases of a cars life. 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		Looking for broad information about energy consumed, recycling issues, obsolescence, discarding adequate products just to own the 'latest'.

Question			Expected Answer	Mark	Rationale
			Level 3 (5-6 marks) Thorough description, showing clear understanding of the issues involved during different phases of a cars life and the impact these have on the environment. 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 A	**[36]**	

Question			Expected Answer	Mark	Rationale
Part B					
4	**(a)**		Correct numbers 40*4=60 * X. 2.66 NM	**[2]**	Any combination that uses the numbers correctly, allow 2.6, 2.67, 2.7 and 2 marks for correct answer alone. Units not required.
4	**(b)**		Bevel (gears), allow crown wheel (or wheel) and pinion	**[1]**	
4	**(c)**		Any advantage of grease over oil, will not run/leak away from bearing, will not endlessly run into bearing when machine is not in use, not prevent rust or simple lubrication answer.	**[1]**	Not 'prevent rust/corrosion' or simple 'lubrication' answer. Must state WHY grease….
4	**(d)i**		Substitution of numbers 10/110 Numerical answer 0.09 allow ecf from insertion of numbers	**[2]**	Allow expression of ratio (11:1, 1:11) and simple 11, if only correct fraction (10/110), 1 mark, if 1/11, 2 marks
4	**(d)ii**		(12*110)/10 132, allow	**[2]**	Numerical answer 2 marks, correct number not progressed 1 mark
	(e)		It will reverse the rotation / cause reverse rotation/direction, allow make it turn backwards/opposite compared to the engine (qualified)	**[1]**	
	(f)		Small(er) pulley, one on the engine, one without the Vee	**[1]**	
	(g)		Modification: Any of change pulley for a Vee pulley, tighten the belt, use bigger drive pulley, roughen the surface of slipping pulley, add a high friction surface, NOT reduce load Simple answer, 1 mark detailed/qualified answer with justification/reason why both marks	**[2]**	Allow suggestions of superior drive systems
			TOTAL	**[12]**	

Question			Expected Answer	Mark	Rationale
5	(a)	(i)	Nuts and bolts of some description, head shape not required nor mention of washer or self-locking capability, NOT welding or any permanent method	[1]	Do not allow 'chromium'.
		(ii)	Galvanising, plating (eg BZP bright zinc plating), painting but NOT Cadmium plating	[1]	
5	(b)		Connecting rod attached to bottom left side of bellows Connecting rod linked to waterwheel with slight offset from centre Indication that connecting rod/crank offset is 150 mm from centre of wheel Bearing or flexible joint at one or both ends of connecting rod	[4]	Alternative mechanisms that could work (assumption of spring in bellows allowed for return) can score up to full marks, e.g., cam. Separate drawing of mechanisms score 0
5	(c)		Discussion based around design requirements – size/gender of different children, height from ground, seating, something to hold / grip size, smooth surfaces painted to attract people / prevent corrosion / construction methods / rugged and long-lasting, other system related design considerations on merit. Safety issues such as limb damage on or under the roundabout are valid. **Level 1 (0-2 marks)** Basic description, showing some understanding of design requirements. 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 the issues involved designing for human usage (ergonomics and anthropometrics). 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		Must relate to the Playpump system, not wider social issues.

Question			Expected Answer	Mark	Rationale
			Level 3 (5-6 marks) Thorough description, showing clear understanding of issues involved designing for human usage (ergonomics and anthropometrics) with consideration of manufacturing methods and protection from corrosion. 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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