Cambridge Technicals
Engineering

Unit 2C: Application of engineering principles

Level 2 Cambridge Technical Certificate/Diploma in Engineering
05887 - 05888

Mark Scheme for January 2023

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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.

Question			Answer	Marks	Guidance
1	(a)		Wear (and tear) Friction (or lubrication) Vibration OR noise Thermal (or heat) 4 x 1 marks	4	NOT weight, mass, gravity, balance etc NOT sound Allow assembly or maintenance issues with BOD
1	(b)		(P = (force x distance) / time = (300 x 4) / (2 x 60) = **10 W**	3	If 10 not calculated, award 1 compensation mark if 300x4 or 1200 seen. 10 scores 2 marks if unit incorrect or missing. 10W scores 3 marks Correct unit scores 1 mark
1	(c)		output (power) ÷ input (power) x 100 (%)	2	Award 1 mark if not multiplied by 100

Question			Answer	Marks	Guidance
2	(a)		Joining and assembly methods: Riveting Soldering Welding Chemical and heat treatment methods: Painting Electroplating Hardening 6 x 1 marks	6	
2	(b)	(i)	(Ability to transfer) heat or electric charge (or current or electricity) through a material.	2	First mark for reference to heat/ charge etc. Second mark for reference to material
		(ii)	Extent to which plastic deformation occurs before failure	2	First mark for reference to plastic deformation or equivalent. 2nd mark for reference to failure or equivalent. Award 1 mark for reference to ability to be drawn into wire or equivalent.
		(iii)	Energy to failure.	2	First mark for reference to energy (or Work done). 2nd mark for reference to failure or equivalent.

Question			Answer	Marks	Guidance
3	(a)	(i)	**A** Variable resistor **B** Light dependant resistor (LDR) **C** (Fixed value) resistor 3 x 1 marks	3	
	(a)	(ii)	(Variable resistor) – Controls or sets I or V (within a range) Light dependant resistor (LDR) – Resistance (or current) is determined by light level. OR In the dark the resistance is high or little current can flow through it. In bright light, the resistance is low or more current can flow through it. Fixed value resistor – Controls or sets I or V (at a particular value.) 3 x 1 marks	3	Or equivalent (e.g. adjusts or changes)
3	(b)		Contact arrangements: SPDT DPST DPDT Push to break Push to make 3 x 1 marks any 3 from 5	3	Allow momentary action or latching.

Question			Answer	Marks	Guidance
3	(c)		DC Motor applications (Series Motor) Traction system, cranes, air compressors, Vacuum Cleaner. (Shunt Motors) Centrifugal pumps, fans, blowers, conveyors, lifts, spinning machines. (Compound Motors) Presses, shears, rolling mills, heavy Planners. (Small DC Motors) Tools, toys, appliances 3 x 1 marks	3	Applications where DC motors could be used. Allow engine starter motor

Question			Answer	Marks	Guidance
4	(a)	(i)	Movement of fluid (through pump). Reference to a series of (working) cycles. Reference to a fixed amount of fluid (per cycle).	3	
4	(a)	(ii)	A variable-displacement pump has a series of piston cylinders fixed in a ring inside a barrel. The engine spins the barrel around so that the cylinders revolve. The cylinder pistons extend out the back of the barrel, where they are attached to an angled swash plate. As the swash plate pulls the piston out, the cylinder sucks in oil from the tank. As the plate pushes the piston in, the cylinder pumps oil out into the hydraulic system.	3	
4	(b)	(i)	Single acting actuator applications: Car hoist Car jack (OR Clamping Punching Positioning Rams etc) 2 x 1 marks	2	Accept applications where single acting actuator could be used.
4	(b)	(ii)	Double acting actuator applications Robot arms Excavator bucket (arm movement) (OR Large scale engines, Industrial furnaces, Digging machines, Lift shafts etc) 2 x 1 marks	2	Accept applications where double acting actuator could be used.
4	(c)		A check valve allows flow in **one** [1] direction only and automatically resists flow in the other direction. This is achieved by the valve seat being held against spring **pressure.** [1]	2	

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