



Cambridge National

Engineering

Unit **R101**: Engineering Principles

Level 1/2 Cambridge National Award/Certificate in Principles in Engineering and Engineering Business

Mark Scheme for June 2018

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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.

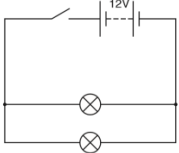
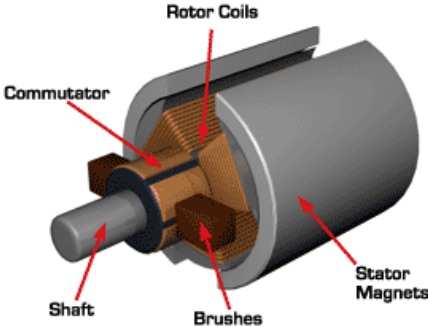
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These are the annotations, (including abbreviations), including those used in scoris, which are used when Marking

Annotation	Meaning of annotation
	Blank page
	Vague
	Tick
	Noted but no credit given
	Unclear
	Repeat
	Benefit of doubt
	Cross
	Development
	Example/Reference
	Knowledge
	Level 1
	Level 2
	Level 3

Question			Answer/Indicative content	Mark	Guidance
1	(a)	(i)	The lamp converts <i>electrical</i> energy to <i>light</i> energy. (2x1)	2	
		(ii)	Heat/Thermal (1x1)	1	
	(b)	(i)	$I=P/V$ $1800/230 = 7.8$ (A) (2x1)	2	No mark for stating the formula 1 mark for the substitution 1 mark for the correct value. 2 marks for just the correct answer
		(ii)	AC current constantly changes direction (1) from positive to negative and back (1) at a frequency which is the number of times per second the current changes direction (1). Current flows from positive to negative (1) at a rate called Hz (1) (3x1)	3	Accept a sine wave for 1 mark.
		(iii)	Example of AC powered product/ application e.g. Electric drill (1) Mobile phone/laptop charger (1) Washing machine (1) Kettle (1) Computer (1) Microwave (1) (1x1)	1	Accept any valid alternative Do not award 'light bulb' as this is a repeat of the stem
		(iv)	AC power supply is not/less portable (1) Requires nearby generator/grid (1) Not as safe as low voltage DC powered devices (1) (1x1)	1	
			Total	[10]	

Question			Answer/Indicative content	Mark	Guidance
2	(a)	(i)	Any appropriate answer showing understanding e.g. Moving Forklift with a load (1) Person walking carrying books (1) Pushing a wheelbarrow (1) Truck carrying a load/ with a container on (1) (1x1)	1	Accept any other valid response
		(ii)	Newton (1x1)	1	Do not accept 'N'.
	(b)	(i)	Work done = force x distance 780 x 1.5 = 1,170 Joules or J (2) (2x1)	2	No mark for stating the formula 1 mark for the correct answer 1 mark for the correct units.
		(ii)	Reduce the force/weight (1) or reduce the distance (1) (1x1)	1	
	(c)	(i)	Class 3 lever (1) (1x1)	1	
		(ii)	 <p>Fulcrum _____ Load</p> <p>(2x1)</p>	2	1 mark for each correct label
		(ii)	Correct statement ticked i.e. The stapler gives a mechanical disadvantage to the user ✓ (1x1)	1	
		(iv)	'Grams' is the unit of weight / Mass (1) (1x1)	1	
Total				[10]	

Question		Answer/Indicative content	Mark	Guidance	
3	(a)	 <p>2 Lamps drawn connected in parallel (1) Circuit will function correctly as a parallel circuit (1) All components used (1)</p> <p style="text-align: right;">(3x1)</p>	3		
	(b)	(i)	<p>Any two correctly labelled components i.e. Armature / rotor / copper winding (1) Permanent magnet field (1) Commutator (1) Shaft (1)</p> <p style="text-align: right;">(2x1)</p>	2	
		(ii)	<p>Current is applied to the brushes which travels through the armature coils creating a magnetic field (1) which repels (1) the permanent magnet field causing turning motion / it spins (1).</p> <p style="text-align: right;">(2x1)</p>	2	Accept two valid descriptive points.
		(iii)	<p>Correctly used terms i.e.</p> <p>An electric motor is a device that converts current into motion. The rotating force is called torque.</p> <p style="text-align: right;">(3x1)</p>	3	Terms are given in the question.
			Total	[10]	

Question			Answer/Indicative content	Mark	Guidance
4	(a)	(i)	Double acting cylinder (1) (1x1)	1	
		(ii)	One hose is used to supply (1) the cylinder with hydraulic fluid, the other is the return (1). Because one is the input and the other is the output (1) (2x1)	2	
		(iii)	A leak would result in loss of performance / not function correctly (1) Loss of pressure (1). Damage the environment (1) Fluid will spill into the workplace (1) The cylinder will retract over time (1) (1x1)	1	
	(b)	(i)	Description of a feasible means of driving the pump to deliver hydraulic pressure to the system. E.g. The pump is driven by the engine driven gearbox/uses the pump splines to connect to the vehicle gearbox (1). Hydraulic hoses connect the pump (1) to a control valve (1) which is used to control a bucket / hydraulic ram (1). (4x1)	4	
	(c)		Cross-sectional area = force/pressure =10/500 [or 10000/500,000] (1) =0.02m ² (1) (2x1)	2	No mark for stating the formula 1 mark for the correct application of the formula Or 2 marks for the correct answer with units. Only award one mark if the units are not given
			Total	[10]	

Question			Answer/Indicative content	Mark	Guidance
5	(a)	(i)	Anticlockwise arrow on gear D (1x1)	1	
		(ii)	Compound gear arrangement (1x1)	1	
		(iii)	Saves space/compact (1) Low input speed can increase the output speed (1) Allows the input gear and the output gear to rotate in the same direction (1) (1x1)	1	
		(iv)	It will increase the speed of the rotation of the output (1x1)	1	Accept 'faster'
	(b)		Description of a feasible means of connecting the motor to the gears e.g. The input gear shaft has a pulley/ another gear attached (1). The motor also uses a pulley/gear and a belt/chain connected between the motor and gear box pulley/chain gear(1) or The motor is mounted on top of the gearbox (1) and uses a worm gear (1). The gearbox has the input gear connected to the worm gear (1). (3x1)	3	
	(c)	(i)	Any appropriate application e.g. Steering system/rack (1) Pillar drill (1). Lathe (1) Mountain train (1) (1x1)	1	

Question		Answer/Indicative content	Mark	Guidance
		(ii) The input gear uses rotary motion (1) and the output gear travels in a linear /in line motion/action (1). A rotational movement is converted to linear movement (2) Input rotates and output moves back and forth (1) (2x1)	2	
		Total	[10]	
6	(a)	(i) Fluid power means either pneumatic air (1) or hydraulic fluid(1) used as a power source under pressure (1) used to move a load/actuate motion (1) (3 x1)	3	1 st mark is for mention of either pneumatic or hydraulic. 2 nd mark is for mention of using under pressure/create pressure/working under pressure. 3 rd mark is for mention of used to move a load/cylinder etc.
		(ii) Example of other any fluid power application e.g. PLC actuator/robotic arm (1) Scissor lift /lifting platform (1) Digger/excavator bucket/ram (1) Crane ram/boom (1) Hydraulic lift (1) (1 x 1)	1	

Question	Guidance	Marks	Answer
(b)*	<p>Award up to 6 marks for a discussion of the benefits of using fluid power in manufacturing.</p> <p>Level 3 (5 – 6 Marks) Detailed discussion showing clear understanding of the benefits of using fluid power in manufacturing.</p> <p>Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate can demonstrate the accurate use of spelling, punctuation and grammar.</p> <p>Level 2 (3 – 4 Marks) Adequate discussion showing an understanding of the benefits of using fluid power in manufacturing.</p> <p>There will be some use of specialist terms, although these may not be used appropriately. The information will be presented for the most part in a structured format. There may be occasional errors in spelling, punctuation and grammar.</p> <p>Level 1 (0 – 2 Marks) Basic discussion showing limited understanding of the benefits of using fluid power in manufacturing.</p> <p>There will be little or no specialist terms. Answers may well be ambiguous or disorganised. Errors of spelling, punctuation and grammar may be intrusive.</p> <p>0 = a response that is irrelevant and/or not worthy of a mark. Annotate with 'Seen' at the end of the response.</p>	6	<p>Examples and relevant points could include:</p> <ul style="list-style-type: none"> • Fluid power is efficient way of providing power. • Fluid power systems can operate quietly compared to some mechanical systems. • Heavy loads can be moved using hydraulics with precision to move large assemblies. Hydraulic presses are efficient to shape materials. • Pneumatics are often used in food manufacturing due to the high speed, accuracy and programmability. Pneumatics are clean which avoids contamination. • Fluid power applications include robotics, used in automation, but initial investment and maintenance is expensive. • Fluid power systems in manufacture have limited portability capacity. New installation of pipework/hoses is necessary to relocate equipment using fluid power, or supplementary sources such as an additional compressor/pump is required.
	Total	[10]	

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