

**Cambridge Technicals
Engineering**

Unit 2: Application of engineering principles

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

Mark Scheme for January 2019

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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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Annotations




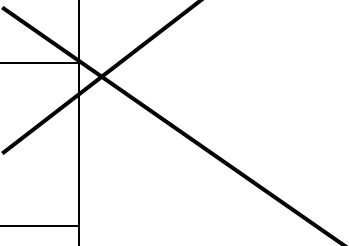





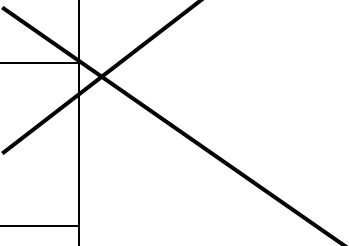





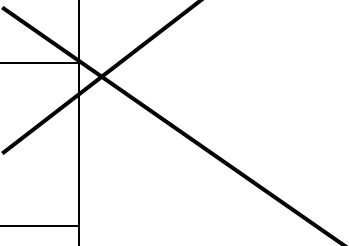


Annotation	Meaning
	Correct point made
	Incorrect
	Error carried forward in calculation questions
	Seen but attracts no credit / Blank answer space
	Response unclear
	Benefit of doubt given
	No benefit of doubt given
	Correct example or application given
	Identification/knowledge point made
	Understanding shown
Level of response annotations	
	Level 1
	Level 2
	Level 3

Question			Answer	Marks	Guidance
1	(a)	(i)	Torque = $0.3 \times 100 = 30$ (1) Nm (1)	2	One mark for correct answer. One mark for unit
	(a)	(ii)	Radius = torque /force = $15/100$ = 0.15 m	3	Award one mark for re-arrangement of formula. Award one mark for $15/100 = 0.15$ Award one mark for unit m.
	(b)		Losses due to friction (1) caused by thermal/noise/wear (1) Losses due to imbalances (1) caused by friction/vibration (1)	4	Award up to two marks for each correct response up to a maximum of four marks.

Question		Answer	Marks	Guidance							
2	(a)	Properties of carbon fibre: <ul style="list-style-type: none"> • Corrosion resistant • Chemically stable • High tensile and compressive strength • Strong • Lightweight 	3	Award one mark for each correct response up to a maximum of three.							
	(b)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="background-color: #cccccc;">Property</th> </tr> </thead> <tbody> <tr> <td>Durable</td> </tr> <tr> <td>Smart properties</td> </tr> <tr> <td>Resists abrasion</td> </tr> <tr> <td>Brittle</td> </tr> <tr> <td>Sunlight resistant</td> </tr> <tr> <td>Magnetic</td> </tr> </tbody> </table>	Property	Durable	Smart properties	Resists abrasion	Brittle	Sunlight resistant	Magnetic	3	Award one mark for each correct response selected (highlighted) up to a maximum of three.
Property											
Durable											
Smart properties											
Resists abrasion											
Brittle											
Sunlight resistant											
Magnetic											
	(c)	Methods of joining metal e.g.: Riveting Soldering Welding Adhesive bonding Do not accept threaded fastenings (as given in question).	2	Award one mark for each correct response up to a maximum of two. Accept other correct responses.							

Question		Answer	Marks	Guidance
	(d) (i)	<p><i>Laminating is the technique of laying a material on top of the same or another material.</i></p> <p><i>The materials are then stuck together by an adhesive or heated or put under pressure or welded to form to form a single composite material.</i></p> <p><i>This process gives the composite material increased strength, stability and greater sound insulation.</i></p>	2	<p>Award one mark for each correct response up to a maximum of two.</p> <p>Accept other correct responses.</p>
	(d) (ii)	<p>Electroplating is the process of using electric current to coat the outside of a component with a thin layer of metal.</p>	2	<p>Award one mark for 'electric current to coat the outside of a component'.</p> <p>Award one mark for 'thin layer of metal'.</p> <p>Accept other correct responses.</p>

Question		Answer	Marks	Guidance
3	(a)	<p>Fixed resistor e.g.: Current control Voltage control</p> <p>Variable resistor e.g.: Temperature sensor Light sensor</p>	4	<p>Award one mark for each correct application of a fixed resistor up to a maximum of two marks.</p> <p>Award one mark for each correct application of a variable resistor up to a maximum of two marks.</p> <p>Accept other correct responses.</p>
3	(b)	(i) <p>An induction motor has a fixed stator and a movable rotor. The rotor can be either wound type or squirrel-cage type. (1)</p> <p>When the motor is switched on a current will create a magnetic field. (1)</p> <p>Electromagnetic induction is now produced from the magnetic field of the stator winding. (1)</p> <p>An electric current is now produced in the rotor which in turn produces a torque. The rotor will now rotate.(1)</p>	4	Award one mark for each correct response up to a maximum of four.
	(b)	(ii) <p>Induction motor applications: Lifts, cranes, hoists, large capacity exhaust fans, crushers, oil extracting mills, driving pumps, compressors, vacuum cleaners, electric shavers, drilling machines etc.</p>	1	<p>Award one mark for a correct response.</p> <p>Accept other correct responses.</p>

Question	Answer	Marks	Guidance																		
(c)	<table border="1"> <thead> <tr> <th>Circuit symbol</th> <th></th> <th>Switch name</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td>Single pole double throw switch</td> </tr> <tr> <td>  </td> <td>  </td> <td>Double pole double throw switch</td> </tr> <tr> <td>  </td> <td>  </td> <td></td> </tr> <tr> <td>  </td> <td>  </td> <td></td> </tr> <tr> <td></td> <td></td> <td>Single pole single throw switch</td> </tr> </tbody> </table>	Circuit symbol		Switch name			Single pole double throw switch			Double pole double throw switch									Single pole single throw switch	3	<p>Award one mark for each correct connection up to a maximum of three.</p> <p>Push to make symbol has been done for the candidate.</p>
Circuit symbol		Switch name																			
		Single pole double throw switch																			
		Double pole double throw switch																			
																					
																					
		Single pole single throw switch																			

Question		Answer	Marks	Guidance
4	(a)	<p>Name: Linear single acting i.e. Single acting cylinder. Application: car hoist, car jack</p> <p>Name: Linear double acting i.e. Double acting cylinder. Application: robot arm control mechanism, excavator bucket arm movement.</p>	4	<p>Award one mark for each actuator named up to a maximum of two.</p> <p>Award one mark for each correct application given up to a maximum of two.</p> <p>Accept "reciprocating"</p> <p>Accept other suitable applications.</p>
	(b)	<p>An example of the use of a poppet valve is to control the timing and quantity of gas or vapour flow into an engine.(1)</p> <p>The poppet of the safety relief valve is seated on the valve inlet. A spring holds the poppet firmly on its seat. Gas or vapour cannot pass through the valve until the force of the spring biasing the poppet is overcome.(1)</p> <p>Gas or vapour pressure at compressor outlet is sensed directly on the bottom of the poppet. (1)</p> <p>When the gas or vapour pressure is at an undesirably high level, the spring will be compressed, the poppet will move off its seat, and gas or vapour will exhaust through the valve.(1)</p>	4	<p>Award one mark for stating a correct example for the use of a poppet valve.</p> <p>Award one mark for each operational point made up to a maximum of three.</p> <p>Accept other correct responses.</p>

Question		Answer	Marks	Guidance
	(c) (i)	<p>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. (1)</p> <p>The cylinder pistons extend out the back of the barrel, where they are attached to an angled swash plate. (1)</p> <p>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. (1)</p>	3	Award one mark for each operational point made up to a maximum of three.
	(c) (ii)	<p>Applications:</p> <ul style="list-style-type: none"> Deck cranes Winches Excavators Feeder mixers Drill rigs Tunnelling equipment Shuttle cars Vacuum trucks Pumping concrete Swimming pool pumps Pressure washing 	1	<p>Award one mark for a correct response.</p> <p>Accept other correct responses.</p>

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 **Cambridge
Assessment**

