

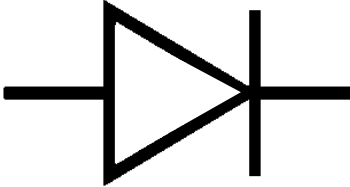
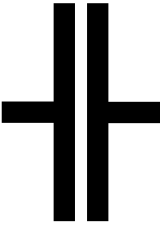
Qualification: 1145-21 Level 2 Technical Certificate in Engineering (360)

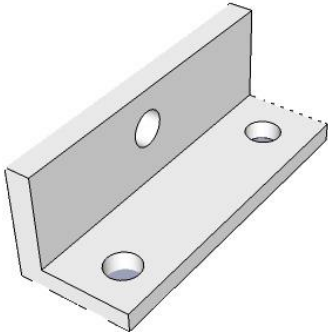
1145-520 Level 2 Engineering – Theory exam May 2018

Marking scheme

1a	State what is the meaning of a red safety sign.		
	Acceptable answer(s)	Guidance	Max mks
	The action is prohibited		(1 mark)
1b	State the shape of a safety sign used to show a warning.		
	Acceptable answer(s)	Guidance	Max mks
	Triangle		(1 mark)
2a	Describe what is meant by the 'tolerance' of a machined part.		
	Acceptable answer(s)	Guidance	Max mks
	Up to 2 marks: The variation in size of the part (1) that remains within an acceptable range (1)	Award 1 mark for a basic response e.g. variation or two marks for a full response e.g. variation within acceptable range	(2 marks)
2b	Give two characteristics of quality assurance that are different from quality control.		
	Acceptable answer(s)	Guidance	Max mks
	Up to 2 marks: <ul style="list-style-type: none"> • Measurement occurs during manufacture (not after completion) • Defects are prevented (not captured after) • Documentation/reports 	Accept alternative wording with similar meanings	(2 marks)

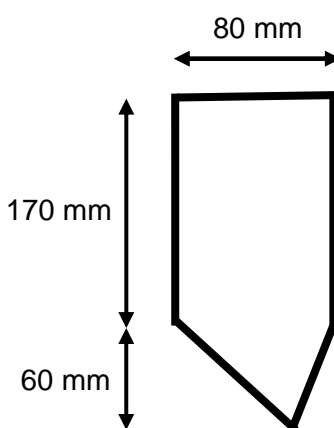
3a	Name a hand tool that could be used to cut a 10 mm diameter bar of steel.		
	Acceptable answer(s)	Guidance	Max mks
	Hacksaw		(1 mark)
3b	List three measuring instruments that could be used to measure the external diameter of a pipe.		
	Acceptable answer(s)	Guidance	Max mks
	Up to 3 marks: <ul style="list-style-type: none"> • Micrometer • Vernier calliper • Coordinate measurement machine (CMM) 	Any other acceptable response	(3 marks)
4a	State three different types of stakeholder in an engineering company.		
	Acceptable answer(s)	Guidance	Max mks
	1 mark each for up to 3 of: <ul style="list-style-type: none"> • existing clients/users • potential clients/users • board of directors • standards bodies • regulator for that industry • employees of the company • any other relevant response 		(3 marks)
4b	For each , name a different expectation that they may have of the company.		
	Complete the table below with your responses. The first line has been completed as an example.		
	Stakeholder	Expectation	
	External shareholders	Dividend payment	

	Acceptable answer(s)	Guidance	Max mks
	1 mark each for up to 3 of: <ul style="list-style-type: none"> • quality products that perform as expected • profit • salaries • safe products • conformance to legal requirements/ethical standards • any other relevant response 	Response must be applicable to the stakeholder given in part a)	(3 marks)
5a	Identify the electrical components represented by the following symbols. <div style="text-align: center; margin: 10px 0;">  </div>		
	Acceptable answer(s)	Guidance	Max mks
	diode		(1 mark)
5b	Identify the electrical components represented by the following symbols. <div style="text-align: center; margin: 10px 0;">  </div>		
	Acceptable answer(s)	Guidance	Max mks
	capacitor		(1 mark)
6	Explain how implementing a 5S approach can improve the performance of an engineering business.		
	Acceptable answer(s)	Guidance	Max mks
	1 mark each for up to 4 of: <ul style="list-style-type: none"> • 5S is a workplace organisation method • It comes from the Japanese terms seiri, seiton, seiso, seiketsu, and shitsuke • It translates roughly as sort, set in order, shine, clean, sustain • It involves organising the tools and processes in a workplace to make them as efficient as possible 		(4 marks)

	<ul style="list-style-type: none"> • It eliminates waste • It reduces time looking for tools and resources • It prevents accumulation of unnecessary items • This means that a higher proportion of labour time is spent on activities that add value • Any other relevant response 		
7	<p>A company needs to manufacture a one-off part, Figure 1. This is a bracket used to reinforce the joint between two sides of a cupboard. It will be attached to the sides of the cupboard using screws.</p> <p>The maximum dimensions of the part are 150 mm x 50 mm, with a thickness of 5 mm. This will be made using a material chosen by the company.</p>  <p style="text-align: center;">Figure 1</p> <p>Suggest a suitable material to make the bracket. Give reasons for your suggestion and describe how the bracket will be made.</p>		
	Acceptable answer(s)	Guidance	Max mks
	<p>Award up to 6 marks:</p> <ul style="list-style-type: none"> • A suitable material type (1), e.g. ferrous metal such as angle iron • A suitable reason for its use (2 x 1 mark): e.g. available form, relative low cost, strength, ease of manufacture, recyclability etc. • Suitable manufacturing process (up to 3 x 1 mark): e.g. marking out, cutting, filing, drilling, bending etc. • Any other appropriate response. 	<p>Award 1 mark for a suitable material, and up to 2 marks for reasons for its use.</p> <p>Award 1 mark for each appropriate manufacturing process given, and 1 mark for each reason given, up to a maximum of 3 marks.</p> <p>Marks for the manufacturing process can be awarded even if the material recommended was not appropriate.</p>	(6 marks)

8a	Describe what is meant by the scientific term 'moment', with reference to a force.		
	Acceptable answer(s)	Guidance	Max mks
	The product of force and distance (1) that causes a body to rotate about a specific point [or axis] (1)	1 mark for a limited/simplistic response, 2 marks for a detailed/comprehensive definition	(2 marks)
8b	State the mechanical property of a material that allows it to return to its original shape after it has been deformed.		
	Acceptable answer(s)	Guidance	Max mks
	elasticity		(1 mark)
8c	Describe what is meant by the term 'creep resistance'.		
	Acceptable answer(s)	Guidance	Max mks
	The materials ability to resist permanent [or progressive] deformation when under a load (1) over an extended period of time (1)	1 mark for a limited/simplistic response, 2 marks for a detailed/comprehensive definition	(2 marks)
9a	Describe how a tensile test is carried out.		
	Acceptable answer(s)	Guidance	Max mks
	Up to 4 marks: <ul style="list-style-type: none"> • A standard sample is prepared (1) of known cross section area (1) • The specimen is placed in the test machine and slowly extended (1) until it fractures (1) • During this process the elongation of the test piece is recorded against the applied load (1) • Any other relevant point 		(4 marks)

9b	Explain what is meant by galvanic corrosion and how this can be prevented.		
	Acceptable answer(s)	Guidance	Max mks
	Up to 4 marks: <ul style="list-style-type: none"> Galvanic corrosion is an electrochemical process It occurs where two (or more) metals are in electrical contact with one another There must be an electrolyte present One metal corrodes preferentially It can be prevented by avoiding the electrochemical contact (1), removing the electrolyte (1), or using materials with similar electrochemical series (1) Any other appropriate response 	A max of 3 marks for explanation of what is meant by galvanic corrosion or how it can be prevented.	(4 marks)

10	A template is needed to mark out a batch of material, Figure 2. The shape is a rectangle with a triangle at the end.		
	<div style="text-align: center;">  <p>Figure 2 – NOT TO SCALE</p> </div> <p>Calculate the area of the template.</p>		

	Acceptable answer(s)	Guidance	Max mks
	1 mark per line up to 5 marks: Area of the square section = 80×170 $= 13600 \text{ mm}^2$ Area of the triangle = $bh/2 = 60 \times 80 / 2$ $= 2400 \text{ mm}^2$ Total area = $13600 + 2400 = 16000 \text{ mm}^2$		(5 marks)

11a A class one lever is being used to raise a load of 80 N. The effort needed to move the load is 32 N.

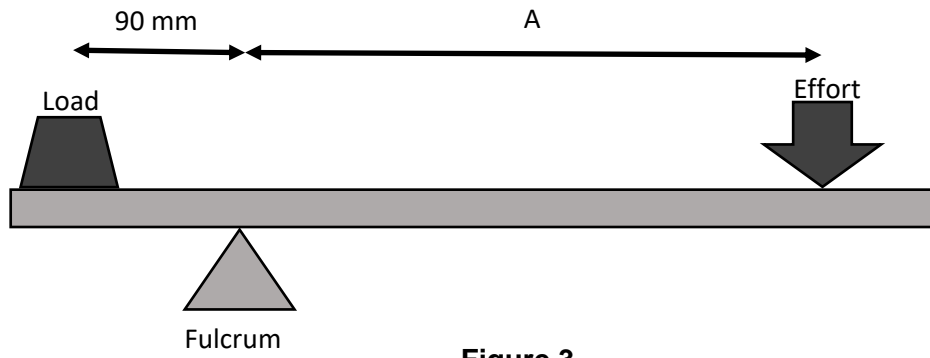


Figure 3

Calculate the mechanical advantage.

Acceptable answer(s)

Guidance

Max mks

1 mark per line up to 2 marks:
 Mechanical advantage = load / effort
 = 80 / 32 = 2.5

(2 marks)

11b A class one lever is being used to raise a load of 80 N. The effort needed to move the load is 32 N.



Figure 3

Calculate length A, the distance from the fulcrum at which the load was applied.

Acceptable answer(s)

Guidance

Max mks

1 mark per line up to 5 marks:
 For a class one lever mechanical advantage = $A / 90$,
 rearranging $A = \text{mechanical advantage} \times 90$
 = $2.5 \times 90 = 235 \text{ mm}$

(3 marks)

12	<p>A company is designing a wheelchair that will be used by an athlete for paralympic sports.</p> <p>The wheelchair will be manufactured as a one-off to the individual requirements of the athlete.</p> <p>Discuss which factors are most important when selecting the materials and manufacturing processes to make the wheelchair.</p>		
	Acceptable answer(s)	Guidance	Max mks
	<p>Intention:</p> <p><i>To elicit responses that demonstrate how knowledge and understanding across the full range of technical content of the applied units relate to the question context. For example, this may involve application of knowledge and understanding of how the material selection affects the overall cost and manufacturing options, how the scale of manufacture affects process selection, and the influence of user and performance requirements.</i></p> <p>Level 1 (1-3 marks)</p> <p>Descriptive response based on recall of knowledge, relating only to a single consideration, e.g. manufacturing constraints or performance requirements.</p> <p>Candidates at the top of this level may be characterised by showing some understanding of one reason that facilitated the development.</p> <p>Level 2 (4-6 marks)</p> <p>Mainly descriptive response showing knowledge recall relating to a range of different influences on the choice of materials and manufacturing processes for the wheelchair.</p> <p>Candidates at the top of this level may demonstrate understanding of the reasons how or why some of the influences affected the choice of material or manufacturing process.</p> <p>Level 3 (7-9 marks)</p> <p>Detailed response, showing both knowledge recall and understanding of how both material and process choice could be affected by a variety of different contributing considerations.</p> <p>Candidates at the top of this level may be characterised by considering the relative impact of different types of factor on the selection of the material and the process.</p>	<p>Indicative content:</p> <ul style="list-style-type: none"> • Performance requirements • Material properties, such as strength, elasticity, toughness, density, etc. • Ergonomics, including comfort of the user • Aesthetic requirements of the customer • Material cost (direct and manufacturing) • Strength to weight ratio • Impact of relevant standards • Influence of the scale of manufacture on process selection • Consideration of manufacturing tolerances <p><i>For no awardable content, award 0 marks.</i></p>	(9 marks)
		Total marks	60