



1145-530 JUNE 2017 Level 3 Advanced Technical Certificate in Engineering/ Level 3 Advanced Technical Diploma in Engineering (540)/ Level 3 Advanced Technical Extended Diploma in Engineering (720) Level 3 Engineering – Theory Exam (1)

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1145	-530		19 June 2017	+
1	Defi a)	ne each of the following terms. Plasticity.	(1 mark)	
	b)	Specific gravity.	(1 mark)	
			(Total marks 2)	

2 State the names of **two** different non-metallic materials, giving a typical application of **each**.

Complete the table below with your responses.

(4 marks)

Non-metallic material	Typical application

(Total marks 4)

3 A tensile test was carried out on a specimen of material with a cross sectional area of 78.55 mm and a gauge length of 90 mm. The results are shown in Figure 1.





Calculate the Young's modulus of the material. You may find the following equation useful: E = σ / ϵ

(5 marks)

(Total marks 5)

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4	Describe the stages involved in manufacturing a product from pre-preg composite materials.	(4 marks)
		 (Total marks 4)

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5	a)	State Faraday's Law.	(1 mark)
	b)	Name three types of safety sensor used in robotic systems.	(3 marks)
	c)	State the meaning of integral control of a controller output.	(1 mark)
	d)	Explain how a true value input can be used in a measurement system.	- (4 marks)
			-
			-

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Ex co	plain why the magnitude and stability of the current must be considered when meeting a controller to a circuit.	(6 marks)
		(Total marks 15)

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calculate the centripetal acceleration at the edge of the Wheel.	(4)	mar
A cylinder contains 1000 cm^3 of gas at a pressure of 2 bar and a t	emperature	
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7 a	a) State the first law of thermodynamics.	(1 mark)
k	b) State what is meant by i) static friction	(1 mark)
	ii) simple harmonic motion.	(1 mark)
		(Total marks 3)

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8 a)	Name two manufacturing techniques that use heat to mould plastic products.	(2 marks)	
b)	Explain why jigs and templates are more commonly used for batch manufacture than for bespoke (one-off) manufacture.	(4 marks)	
		(Total marks 6)	

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9	a)	Describe how to output a plot of a drawing from a 3D CAD package.	(3 marks)
			-
	b)	Explain, using examples, why a design specification may include conflicting requirements.	(5 marks)
			-
			-
			-

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and economic development.	(9 marl

 A trolley has been designed to support a maximum mass of 108 newtons. The maximum safe load is marked on the trolley as 18 newtons. Calculate the safety factor.

(2 marks)



Hours	0 < 10	10 < 20	20 < 30	30 < 40	40 < 50	50 < 60
Number of failed tools	1	5	12	12	14	6



Hours

Figure 2

i)	Calculate the mean number of hours until tool failure.	(2 marks)
ii)	Determine the median value of the tool life.	(1 mark)
iii)	To minimise the risk of damage to the product, the company have decided to change tools after a set time, before the average tool fails. They have decided that the operational life of the tool should be set at the value when 20% of the tools failed. Determine this value for the operational life of the tool.	(2 marks)
		(Total marks 7)

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11 a	ABC is a right angled triangle. For the angle at C, sin C = 0.8 and cos C = 0.6 Using the relationship between the sine and cosine, find the value of tan C.	(2 marks)
ł	o) Convert 4/3 π radians into degrees.	– (2 marks)
(c) Convert the polar coordinates (110, –35°) to Cartesian form.	(4 marks)
		 (Total marks 8)

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12	a)	Using the chain rule, differentiate $y = (2x - 4)^6$	(4 marks)
	b)	Divide $5x^2 + 4x - 6$ by (x + 1) and find the remainder using the remainder theorem.	(5 marks)
			(Total marks 9)

13 A company is designing the frame of a new bicycle. Discuss which factors are most important when selecting a material for the frame. (12 marks) (Total marks 12)

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Additional space

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