



1145-530 APRIL 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		24 April 2017
1 a)	State the mechanical property that is the ability of a material to absorb energy from an impact and plastically deform without fracturing.	(1 mark)
b)	State the word that means the potential to improve the resistance to penetration of a material by heat treatment.	(1 mark)
		(Total marks 2)
2 Exp	plain how annealing changes the properties of an aluminium alloy.	(5 marks)
		(Total marks 5)

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Complete the table below with your responses.

(4 marks)

24 April 2017

Mechanical test	Property measured
Tensile	
Brinell / Rockwell / Vickers	
Izod / Charpy	
Wohler	

(Total marks 4)

Identify two different risks to health and safety when manufacturing composite products.
For each, state an action that may be taken to reduce the risk.
Complete the table below with your responses.

(4 marks)

Health and safety risk	Action to reduce risk	

(Total marks 4)

b) Figure 1 shows a combination of an AND gate and an EX-OR gate.





Complete the truth table for this combination.

Input Output Α В С Q

(2 marks)

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C)	Explain how open and closed loop control affect the output of a system.	(4 marks)
d)	Explain how photonic devices are used in industrial instrumentation.	(4 marks)
	· · ·	
		 (Total marks 15)

1145-5	530		24 April 2017
6 8	a)	State what is meant by i) velocity ratio	(1 mark)
		ii) moment of inertia.	(1 mark)
I	b)	State the definition of a newton.	(1 mark)

(Total marks 3)

1145-530

Figure 2 shows the P-V diagram for the diesel cycle in an engine. 7





Explain the energy changes that are happening in the system during the cycle. (8 marks)

(Total marks 8)

114	5-530		24 April 2017	+
8	a)	State two precision casting techniques used for metals.	(2 marks)	
	b)	A manufacturer is checking parts for a helicopter. The parts are made in batches of 20. Explain why the manufacturer may use sampling rather than 100 % inspection.	(4 marks)	
0	Ņ		(Total marks 6)	
9	a)	State three types of need that are normally included in a product design specification.	(3 marks)	
	b)	Discuss the advantages and limitations of using rapid prototypes to test ideas.	(5 marks)	

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economic development.	(9 marks)
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	(Total marks 47)

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10 a) A piece of metal needs to be marked out for cutting. It is the shape of a right angled triangle as shown in Figure 3.

C 30 cm B	C Figure 3	
Calculate length c.		(2 marks)
) A container holds 8 kg of plast An injection moulding machin it makes. Estimate how many container showing your working.	tic pellets. e uses 0.62 kg of the pellets for each product that s of pellets would be needed to make 390 products,	(2 marks)
An engineer is designing a str mass M of 1640 newtons. If the safety factor for the stru should be designed to suppor	ucture to support a machine. The machine has a cture is 4, calculate the mass that the structure t.	(2 marks)
		(Total marks 6)

1145-530		24 April 201
1 a)	Multiply the complex numbers (3 + 2j) and (2 + 4j).	(3 marks
b)	The velocity (m s ^{-1}) of a piston in an engine is given by the equation x = $-2 \cos (50t)$. Using differentiation, find the acceleration of the piston after 0.8 seconds.	(3 marks
C)	The output signal V (volts) from an electronic circuit can be calculated at time t (seconds) using the equation $V = e^{t/5}$. Using logarithms, determine the time t when the signal V = 12 volts.	(3 mark:
		(Total marks 9

17.5	18	18.2	18.9	17.9	17.7	18.4	17.6	17.6	18.3
18.6	18.1	18.2	17.9	18.1	17.8	17.9	18.3	18.2	18.4
17.3	17.6	17.1	17.4	17.9	17.3	17.8	17.4	18.2	17.3

Table 1

a) Calculate the mean diameter.

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(2 marks)

b) The standard deviation of the sample is 0.434.
Calculate the probability that a part will have a diameter of > 18.4 mm.
The following standard normal (z) data may be useful when determining the answer.

(7 marks)

Ζ	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.981

(Total marks 9)

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manufacture of electronic products.	(12 ma

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Additional space

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