



**DESIGN TECHNOLOGY
 HIGHER LEVEL
 PAPER 2**

Wednesday 15 November 2000 (afternoon)

1 hour 30 minutes

Name

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Number

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INSTRUCTIONS TO CANDIDATES

- Write your candidate name and number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: Answer all of Section A in the spaces provided.
- Section B: Answer one question from Section B. You may use the lined pages at the end of this paper or continue your answers in a continuation answer booklet, and indicate the number of booklets used in the box below. Write your name and candidate number on the front cover of the continuation answer booklets, and attach them to this question paper using the tag provided.
- At the end of the examination, indicate the number of the Section B question answered in the boxes below.

QUESTIONS ANSWERED		EXAMINER	TEAM LEADER	IBCA
SECTION A	ALL	/32	/32	/32
SECTION B	/20	/20	/20
NUMBER OF CONTINUATION BOOKLETS USED	TOTAL /52	TOTAL /52	TOTAL /52

SECTION A

Candidates must answer **all** questions in the spaces provided.

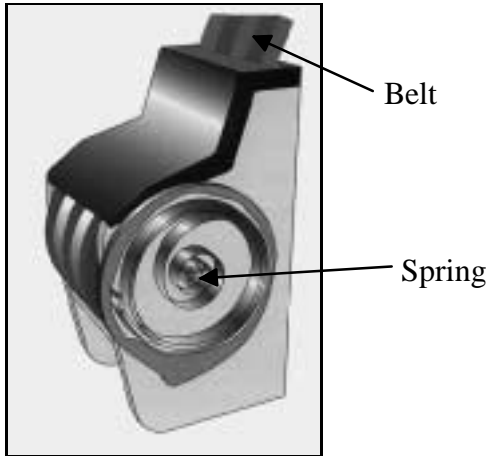


Figure 1: Wide coil spring in recoil mechanism inside housing at fixed end of seat belt

Figure 2: Seat belt in use.

1. The figures above show a wide coil spring being used in a car seat belt recoil mechanism. The spring is a strip of steel wound in a coil. When attached to a fixed point and pulled it exerts a restoring force which is able to rewind the seat belt.

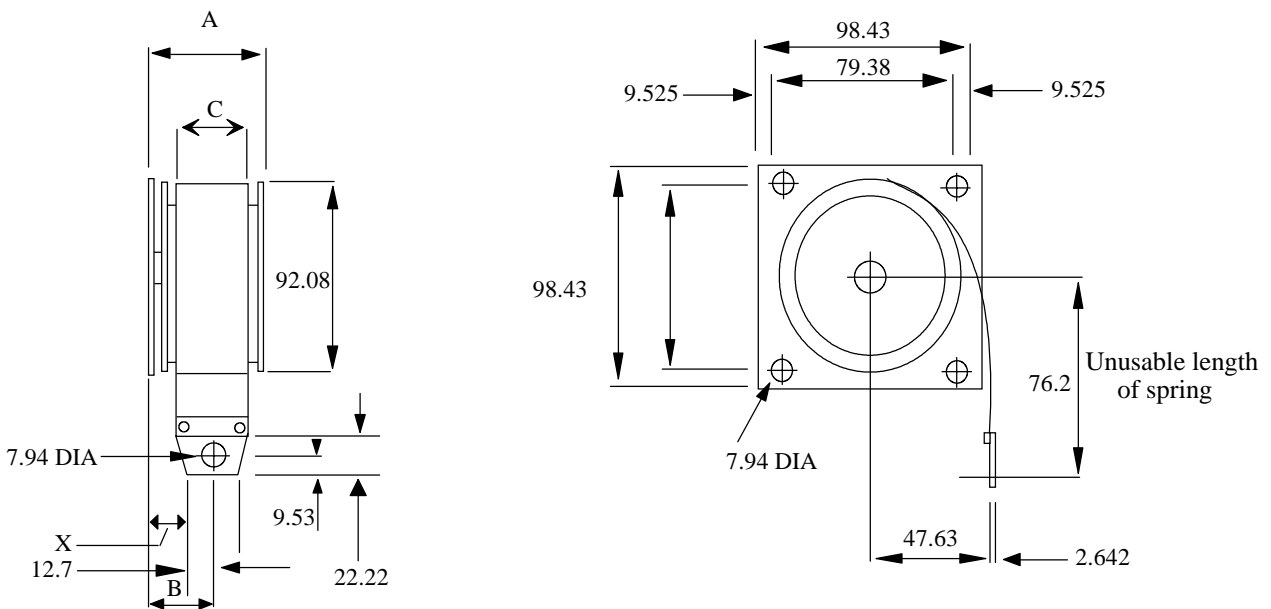


Figure 3: Orthographic drawing of a similar type of spring (Please Note: All dimension are in mm)

(This question continues on the following page)

(Question 1 continued)

The coil spring shown in the drawing opposite is made in a number of sizes to suit various requirements. The table below shows some data for four different size springs.

Spring	A mm	B mm	C mm	Load supported by spring N	Maximum length of spring mm
1	35.81	20.57	28.4	10.0	915
2	48.51	26.92	38.1	20.7	1118
3	61.21	33.27	50.8	32.3	1321
4	61.21	33.27	50.8	93.5	2235

(a) (i) State the diameter of the fixing holes for mounting the unit to the car body. [1]

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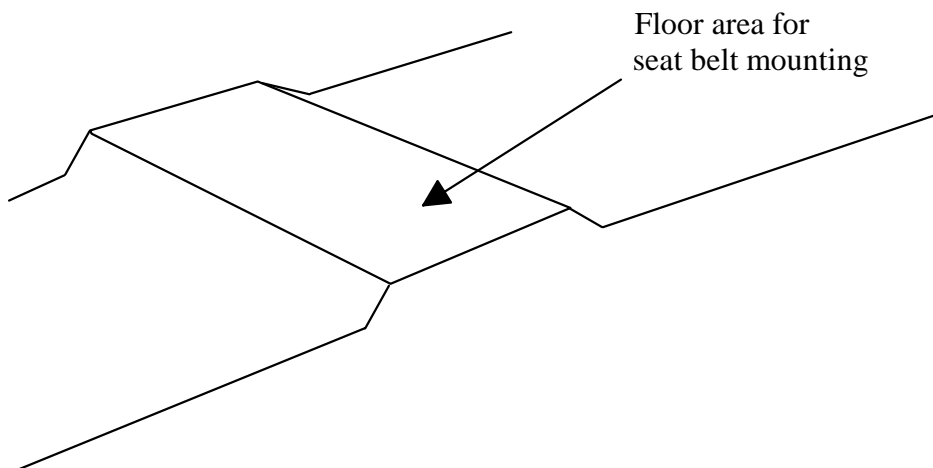
(ii) State the distance between the fixing holes. [1]

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(iii) Calculate the distance marked X on the drawing for spring 3 (show your working). [3]

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(b) The spring mechanism needs to be mounted at right angles to the floor of the car in the shaded area. Draw a 3D sketch on the diagram below to show how this can be done. [3]



(This question continues on the following page)

(Question 1 continued)

- (c) Explain **two** reasons why the designer chose this belt mechanism. [4]

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- (d) The seat belt is made from woven nylon fibres. Outline **four** advantages of nylon which make it suitable for this purpose. [4]

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2. State the word used to describe some metals and plastics which have a glossy appearance but do not have a regular structure or crystalline pattern. [1]

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3. Explain, with reference to their structure and bonding, why thermoplastics are often recycled and thermosets are rarely recycled. [4]

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4. Outline **one** way in which one-off production contributes to the volume production of injection moulded plastic products. [2]

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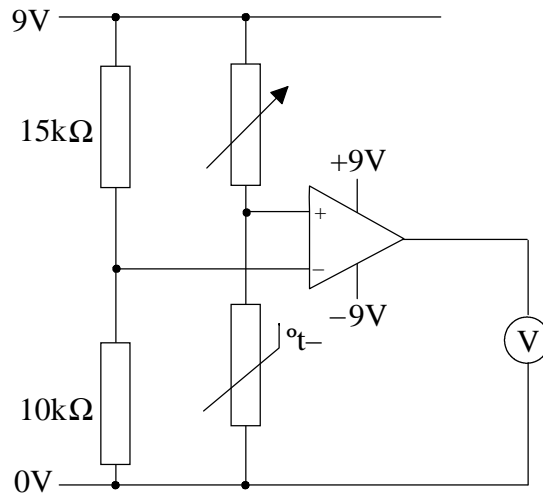
5. (a) Outline **one** reason for the redesign of products from the manufacturer's point of view. [2]

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(b) Outline **one** reason for the redesign of products from the consumer's point of view. [2]

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6.



(a) (i) State the op-amp arrangement shown. [1]

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(ii) Calculate the voltage at the inverting terminal of the op-amp. [2]

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(b) Outline the function of the variable resistor in this circuit. [2]

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SECTION B

Answer **one** question. Up to three additional marks are available for the construction of your answer. You may use the lined pages at the end of this paper or continue your answers in a continuation answer booklet. Write your name and candidate number on the front cover of the continuation answer booklets, and attach them to this question paper using the tag provided.

7. Toys have become very sophisticated and often contain electronic and mechanical aspects to amuse children.
- (a) (i) Outline how **one** form of renewable energy could be used to power the electric motor of a toy truck. [2]
 - (ii) Describe **one** purpose of evaluation during the manufacture of the prototype of the toy truck. [2]
 - (b) (i) Small magnets are used in the motors of toy trucks. These magnets are sintered. Identify **two** advantages of sintering in this context. [2]
 - (ii) Describe **one** requirement of the surface finish for the safe use of a small toy truck body made from mild steel. [2]

A designer had been provided with the following brief:

“A hand-held game, powered by rechargeable batteries, to keep a 10 year old child amused on a car journey”

- (c) Explain, with justification, a suitable specification for a toy to meet the requirements of the brief. [9]
8. Cutlery can be made from thermoplastics and metals.
- (a) (i) Describe, with the use of a diagram, a metallic bond. [2]
 - (ii) State **one** property of stainless steel that makes it suitable for use in the manufacture of cutlery. [1]
 - (b) (i) Draw a diagram of a table knife being used as a Class 3 lever, and annotate it to show the load, effort and fulcrum. [3]
 - (ii) Describe the relationship between deflection and stiffness as applied to a knife. [2]
 - (c) Compare a piece of cutlery from a thermoplastic with one made from stainless steel from the points of view of the manufacturer and the user. [9]

9. (a) (i) Define the product cycle. [1]
- (ii) Outline the role of the designer in the product cycle. [3]
- (b) The designer is working for a volume car manufacturer. Outline **two** ways in which capital costs act as a design constraint. [4]
- (c) Discuss the relative merits of mild steel, plastic and composites for the manufacture of car bodies with reference to the properties of these materials. [9]
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