Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						1	9	7	4	/	3	H	Signature	

Paper Reference(s)

1974/3H

Edexcel GCSE

Design and Technology: Systems & Control Technology (Mechanisms)

(Full Course – 1974)

Paper 3H

Higher Tier

Wednesday 13 June 2007 – Afternoon

Time: 1 hour 30 minutes

Materials required for examination
Nil

Items included with question papers
Nil

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
Total	

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 4 questions in this question paper. The total mark for this paper is 88.
There are 16 pages in this question paper. Any blank pages are indicated.
You may use drawing equipment. If pencil is used for diagrams/sketches, it must be dark (HB or B).
Coloured pens, pencils and highlighter pens must not be used.
All measurements are in millimetres (mm) unless otherwise stated.

Advice to Candidates

You are reminded of the importance of clear English and careful presentation in your answers.
Include diagrams in your answers where these are helpful.

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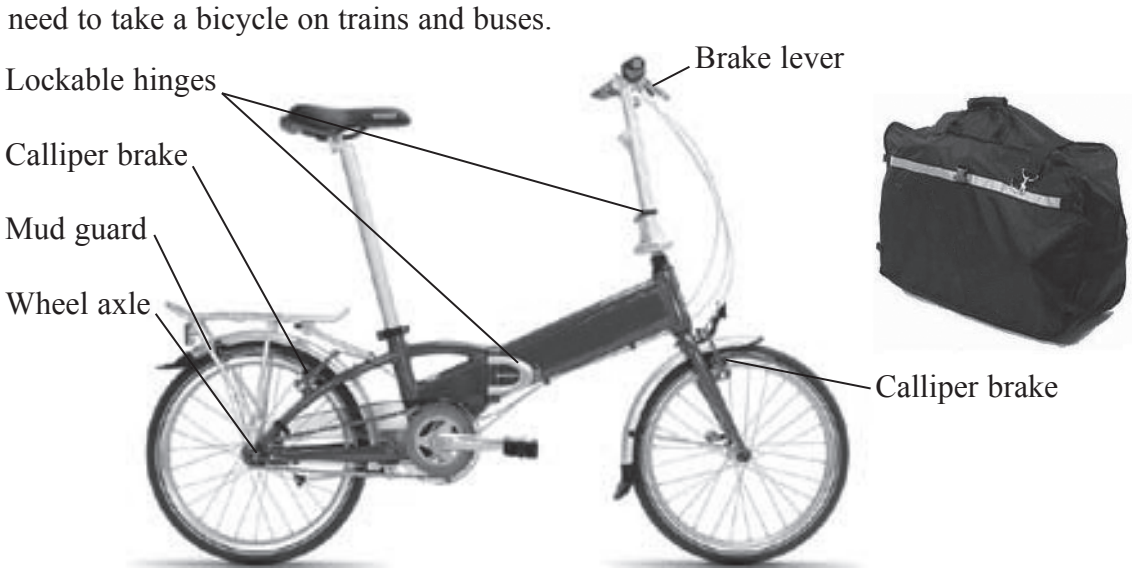
Leave blank

Answer ALL the questions. Write your answers in the spaces provided.

1. The drawing below shows a folding bicycle and its carrying bag. It is used by people who need to take a bicycle on trains and buses.



(a) Two specification points for the folding bicycle are that it must

- stop efficiently
- reduce in size to fit in a carrying bag

Under each of the following headings, give **one** more point which should be included in the specification for the folding bicycle.

For each point, give **one** reason why it should be included.

Market

Point .....

Reason .....

.....

.....

Environment

Point .....

Reason .....

.....

.....

Leave blank

Quality

Point .....

Reason .....

.....

.....

(6)

(b) The folding bicycle frame is made from an aluminium alloy.
One reason for the use of aluminium alloy is its good strength to weight ratio.

Give **two** other reasons why aluminium alloy is a suitable material for the frame.

1 .....

2 .....

(2)

(c) A bearing is used on the wheel axle.

Give **two** reasons for using a bearing on the wheel axle.

1 .....

2 .....

(2)

(d) The mudguards of the folding bicycle are made of a thermoplastic.

Give **two** properties of a thermoplastic that make it a suitable material for the mudguards.

For each property give **one** reason why it makes a thermoplastic suitable.

Property 1 .....

Reason .....

.....

Property 2 .....

Reason .....

.....

(4)

Leave blank

(e) The reflector on the rear mudguard is made from red coloured plastic.

Explain **one** reason why the reflector is coloured red.

.....

.....

(2)

(f) A chain and sprocket system is used to transfer motion from the pedals to the rear wheel. The chain must be kept lubricated.

Explain **one** reason why the chain must be kept lubricated.

.....

.....

(2)

(g) Two purposes of the folding bike are that it must:

- stop efficiently
- reduce in size to fit in a carrying bag

Explain, under the following headings, how the folding bike achieves these purposes.

(i) Stop efficiently

.....

.....

.....

.....

(2)

(ii) Reduce in size to fit in a carrying bag.

.....

.....

.....

.....

(2)

Q1

(Total 22 marks)

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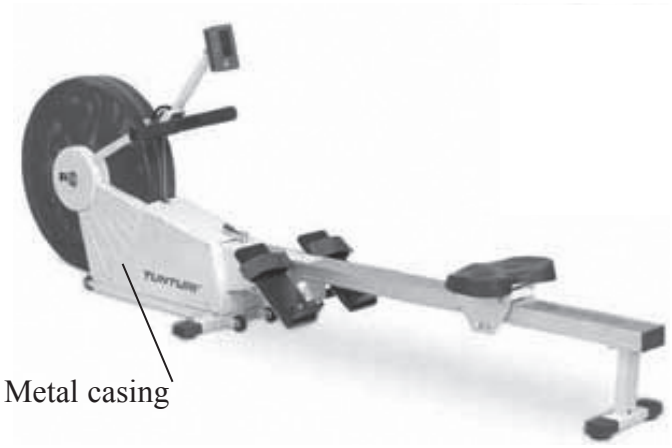
2. The drawing below shows a rowing exercise machine.



(a) The casing is made from sheet steel.

(i) Name **two** finishing processes that can be applied to sheet steel.

1 .....

2 .....

(2)

(ii) The sheet steel casing is joined together using rivets.

Give **two** advantages of using rivets to join the sheet steel.

1 .....

2 .....

(2)

(b) The casing can also be made from a carbon fibre composite.

Give **one** reason for using a carbon fibre composite.

.....

(1)

Leave blank

(c) The individual components of the exercise machine must be made to a tolerance.

Explain what is meant by the term **tolerance**.

.....

.....

.....

(2)

(d) The manufacturer is developing a prototype for a new exercise machine.

Describe **two** ways in which the manufacturer could use ICT to help develop a prototype.

1 .....

.....

2 .....

.....

(4)

(e) Computer integrated manufacturing (CIM) is used in the manufacture of the exercise machine.

Give **three** advantages to the manufacturer of using CIM.

1 .....

2 .....

3 .....

(3)

(f) Stock control of products can reduce the manufacturer's costs.

Describe **one** way in which ICT can be used in stock control to reduce the manufacturer's costs.

.....

.....

(2)

Leave blank

(g) ICT can be used to simulate the production and assembly lines used to make products such as the exercise machine.

Describe **one** way in which computers can be used to simulate a production or assembly line.

.....

.....

(2)

(h) 3D 'virtual' products are often created on screen before new products are made.

Explain **two** advantages to a manufacturer of creating 3D 'virtual' products on screen before new products are made.

1 .....

.....

2 .....

.....

(4)

Q2

(Total 22 marks)

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3. A company is designing a transport system to move a television (TV) within a school or college.

The specification for the transport system is that it must:

- provide a platform for the TV which is adjustable in height
- hold the TV securely
- have wheels that are held securely on the axle and allow steering
- be made from materials and processes that are suitable for high volume production

(a) In the spaces opposite, use sketches and, where necessary, brief notes to show **two different** design ideas for the transport system that meet this specification.

Do not evaluate your designs in part (a).

Candidates are reminded that if pencil is used for diagrams/sketches that it must be dark (HB or B). Coloured pens, pencils and highlighter pens must **not** be used.

Please do not write in the space below. Please write your answers in the spaces provided opposite.

Leave blank

Design Idea 1

(8)

Design Idea 2

(8)

Leave blank

(b) Three of the original specification points are repeated below.

Evaluate how **one** of your design ideas succeeds or fails to meet each of the specification points.

Write the number of your chosen design idea (1 or 2) here .....

(i) The transport system must provide a platform for the TV which is adjustable in height.

.....

.....

.....

.....

(2)

(ii) The transport system must have wheels that are held securely on the axle and allow steering.

.....

.....

.....

.....

(2)

(iii) The transport system must use materials and processes that are suitable for high volume production.

.....

.....

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.....

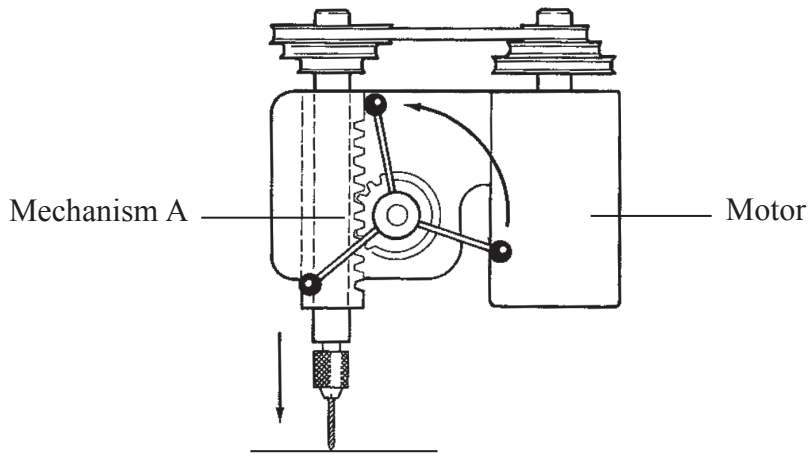
(2)

Q3

(Total 22 marks)

Leave blank

4. The drawing below shows part of a drilling machine.



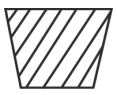
(a) Name Mechanism A used in the drilling machine to convert rotary motion into linear motion.

.....

(1)

(b) A pulley and belt system is used to transfer the rotary motion from the motor shaft to the drill shaft.

The type of belt used to do this is shown below.



Section through belt

(i) Name the type of belt shown above.

.....

(1)

(ii) Name **three** other types of belt used with pulleys.

1 .....

2 .....

3 .....

(3)

Leave blank

(c) Explain **two** advantages of using a pulley and belt system for the drilling machine rather than using a chain and sprocket system.

1 .....

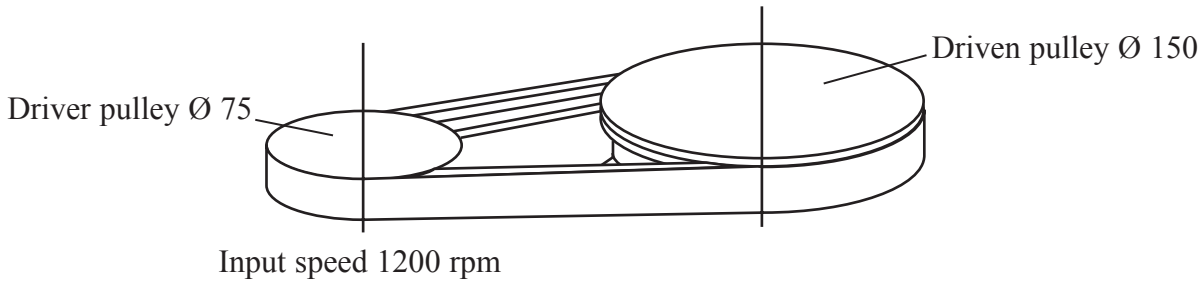
.....

2 .....

.....

(4)

(d) Details of the pulley and belt system used in a drilling machine are shown below.



Ø = diameter

Use the following formula to calculate the velocity ratio of the system and the output speed.

$$\text{Velocity ratio} = \frac{\text{driven pulley diameter}}{\text{driver pulley diameter}}$$

$$\text{Output speed} = \frac{\text{input speed}}{\text{velocity ratio}}$$

(i) velocity ratio

.....

.....

(1)

(ii) output speed

.....

.....

(1)

Leave blank

(e) Many of the mechanical systems of the drilling machine are produced using CAD/CAM.

Describe **two** effects that replacing manual machines with CAD/CAM machines has on workers.

1 .....

.....

2 .....

.....

(4)

(f) The manufacturing company wants to promote a more environmentally friendly image by improving its waste management.

Give **three** ways in which the environment will benefit from the company improving its waste management.

1 .....

.....

2 .....

.....

3 .....

.....

(3)

(g) Product reliability is important to consumers.

Explain **two** benefits to the consumer of product reliability.

1 .....

.....

2 .....

.....

(4)

Q4

(Total 22 marks)

TOTAL FOR PAPER: 88 MARKS

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