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

Thursday 18 June 2009 – 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.

Printer's Log. No.
H33948A
W850/R1974/57570 6/4/3/2

H 3 3 9 4 8 A 0 1 1 6

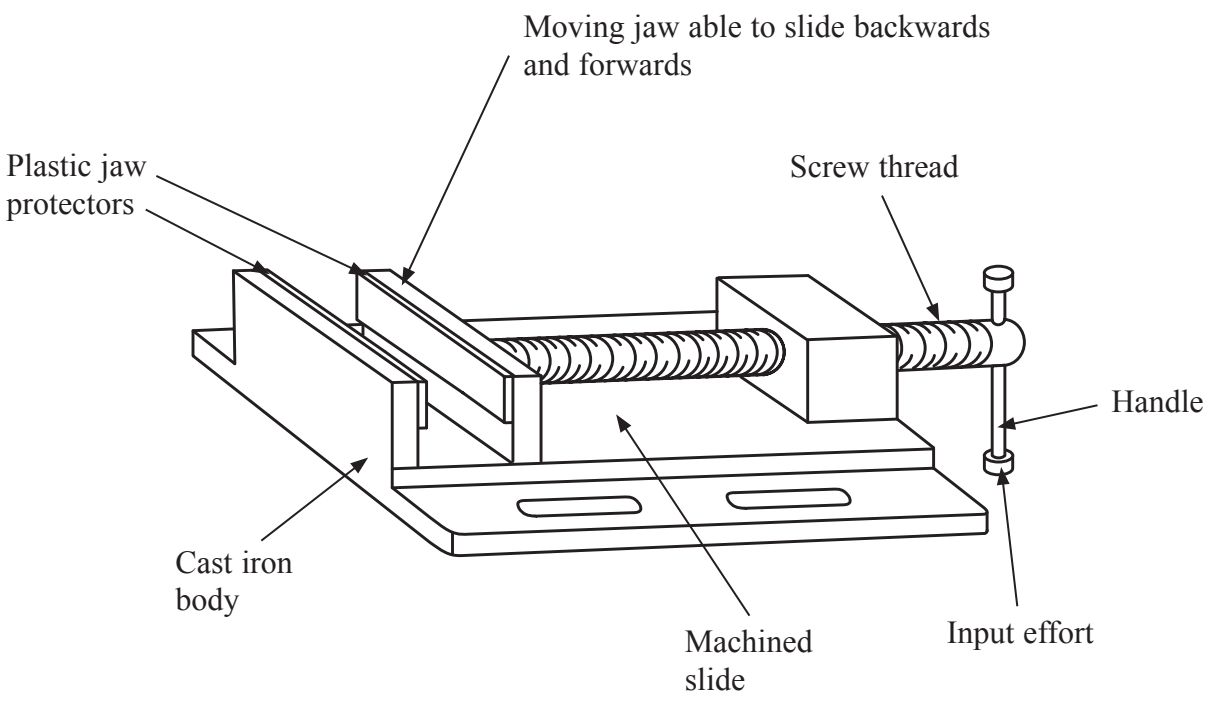
Turn over

edexcel
advancing learning, changing lives

Leave blank

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

1. The drawing below shows a vice.



(a) Two specification points for the vice are that it must have a mechanism that:

- allows the moving jaw to slide backwards and forwards
- allows the effort applied to the screw thread to be increased.

Under each of the following headings, give **one** more point that should be included in the specification for the vice.

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

(i) The needs of the user.

Point .....

Reason .....

.....

.....

(2)

Leave blank

(ii) Environmental considerations.

Point .....

Reason .....

.....

.....

(2)

(iii) Quality.

Point .....

Reason .....

.....

.....

(2)

(b) The screw thread is made from steel. One reason for using steel is that it is durable.

Give **two** other reasons why steel is a suitable material from which to make the screw thread.

1 .....

2 .....

(2)

(c) The slide of the cast iron vice has been machined.

Give **two** reasons why the slide has been machined.

1 .....

2 .....

(2)

Leave blank

(d) The body of the vice is made from cast iron.

Give **two** properties of cast iron that make it a suitable material for the body of the vice.
For each property give **one** reason why it makes cast iron a suitable material for the body of the vice.

Property 1 .....

Reason .....

.....

.....

Property 2 .....

Reason .....

.....

(4)

(e) Quality control checks are carried out at important stages during the manufacture of the screw thread.

Name **two** important quality control checks, other than safety, that should be made during the manufacture of the screw thread.

1 .....

2 .....

(2)

(f) The plastic jaw protectors are made in high volume using the injection moulding process.

Describe **one** reason why injection moulding is a suitable process for making the jaw protectors.

.....

.....

.....

(2)

Leave blank

(g) Two purposes of the vice are that it must have a mechanism that:

- allows the moving jaw to slide backwards and forwards
- allows the effort applied to the screw thread to be increased.

Explain under the following headings, how the vice achieves these purposes.

(i) Allows the moving jaw to slide backwards and forwards.

.....

.....

.....

.....

(2)

(ii) Allows the effort applied to the screw thread to be increased.

.....

.....

.....

.....

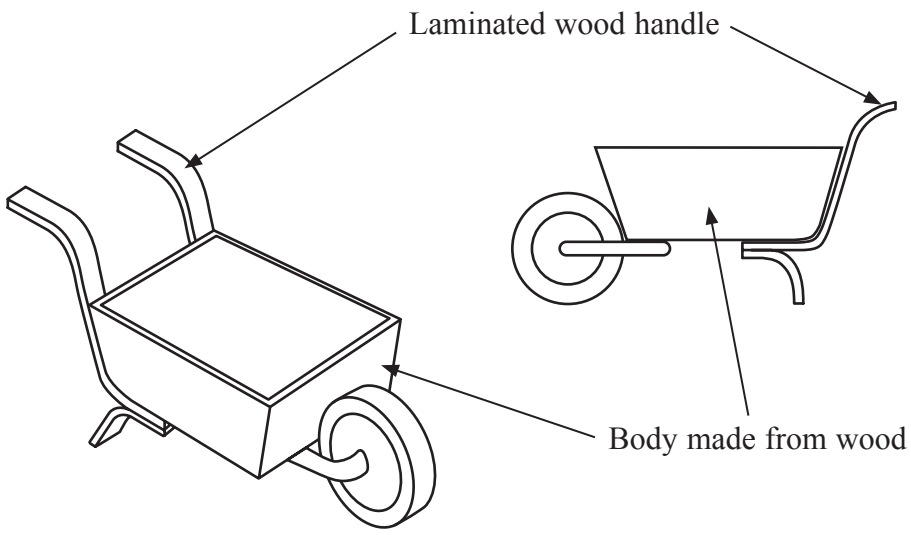
(2)

Q1

(Total 22 marks)

Leave blank

2. The drawings below show a wheelbarrow.



(a) (i) Each handle is made from laminated wood.

Give **two** reasons for using laminated wood to make each handle rather than a single piece of wood.

1 .....

2 .....

(2)

(ii) Name **two** finishing processes that could be applied to the laminated wood handles.

1 .....

2 .....

(2)

(b) State **one** mechanical effect lengthening the handles would have upon the use of the wheelbarrow.

.....

(1)

(c) The wheel of the wheelbarrow has a steel axle which turns on a bearing.

Name **two** materials from which it is suitable to make the bearing.

1 .....

2 .....

(2)

Leave blank

(d) The manufacturer of the wheelbarrow is considering using steel or glass reinforced plastic (GRP) for the body instead of wood.

(i) Give **one** advantage and **one** disadvantage of using steel for the body of the wheelbarrow instead of wood.

Advantage of steel .....

Disadvantage of steel .....

(2)

(ii) Give **one** advantage and **one** disadvantage of using GRP for the body of the wheelbarrow instead of wood.

Advantage of GRP .....

Disadvantage of GRP .....

(2)

(e) The design of the wheelbarrow is carried out in one country and its manufacture in another.

Give **two** ways in which ICT could be used to communicate between the designing and manufacturing departments in the different countries.

1 .....

2 .....

(2)

(f) Design changes are being made to the wheelbarrow in order to improve its appearance and strength.

Describe **two** advantages of using CAD to help improve the design of the wheelbarrow.

1 .....

.....

2 .....

.....

(4)

Leave blank

(g) The wheelbarrows could be assembled manually or by using pick and place machinery.

Give **three** advantages to the manufacturer of using pick and place machinery instead of manual assembly.

1 .....

2 .....

3 .....

(3)

(h) Computer control of stock can reduce manufacturing costs.

Explain **one** way in which computer control of stock can reduce manufacturing costs.

.....

.....

.....

(2)

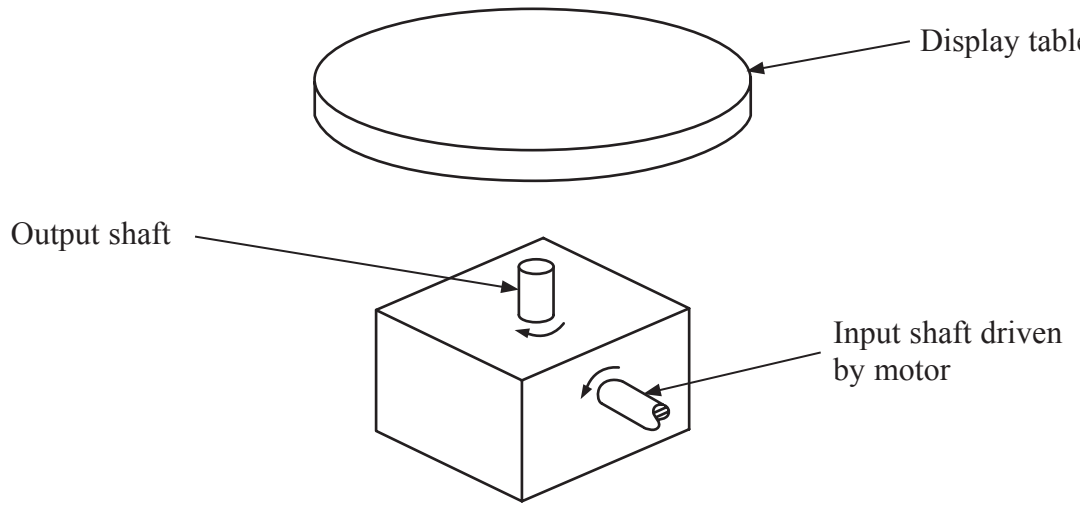
Q2

(Total 22 marks)

BLANK PAGE

Leave blank

3. A company is designing a motor driven shop window display unit.



The specification for the shop window display unit is that it must:

- have a mechanism that drives the output shaft at 90° to the input shaft
- have a mechanism that rotates the output shaft 10 times slower than the input shaft
- have a method of fixing the display table to the output shaft and also allow it to be easily removed
- 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 shop window display unit that meet this specification.

Do **not** evaluate your designs in part (a).

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

PLEASE DO NOT WRITE OR DRAW IN THIS SPACE.

PLEASE USE THE SPACES OPPOSITE FOR YOUR DESIGNS.

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 these specification points.

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

(i) The shop window display unit must have a mechanism that rotates the output shaft 10 times slower than the input shaft.

.....

.....

.....

.....

(2)

(ii) The shop window display unit must have a method of fixing the display table to the output shaft and also allow it to be easily removed.

.....

.....

.....

.....

(2)

(iii) The shop window display unit must be made from materials and processes that are suitable for high volume production.

.....

.....

.....

.....

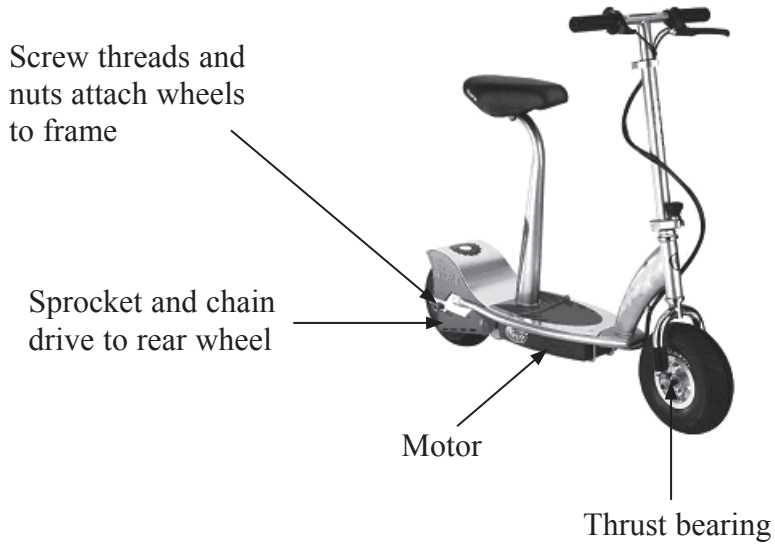
(2)

Q3

(Total 22 marks)

Leave blank

4. The drawing below shows an electric scooter.



(a) The front wheel of the scooter is fitted with a thrust bearing.

Give **two** reasons why the front wheel of the scooter is fitted with a thrust bearing.

1 .....

2 .....

(2)

(b) Screw threads and nuts are used to attach the wheels to the frame.

Explain **one** reason why screw threads and nuts are used to attach the wheels to the frame.

.....

.....

.....

(2)

Leave blank

(c) A sprocket and chain mechanism is used to drive the rear wheel from the motor.

(i) Explain **two** reasons why a sprocket and chain is used in preference to a pulley and V belt drive between the motor and rear wheel.

1 .....

.....

2 .....

.....

(4)

(ii) A key and keyway are used to fix the sprocket to the drive shaft.

Give **one** reason why a key and keyway is a suitable method of fixing the sprocket to the drive shaft.

.....

(1)

(d) The motor sprocket has 18 teeth and the rear wheel sprocket has 54 teeth.

Use the following formula to calculate the velocity ratio of this arrangement. (Show all working out.)

$$\text{Velocity ratio} = \frac{\text{Number of teeth on driven sprocket}}{\text{Number of teeth on driver sprocket}}$$

.....

.....

.....

(2)

(e) Product reliability of the electric scooter is important to consumers.

Explain **one** advantage to the consumer of the electric scooter being reliable.

.....

.....

.....

(2)

Leave blank

(f) Each year the manufacturer plans to replace the electric scooter with a new 'trendy' model.

Give **three** moral issues relating to the manufacturer's plans to replace the electric scooter each year with a new 'trendy' model.

1 .....

2 .....

3 .....

(3)

(g) CAM is used to manufacture the electric scooter.

Explain **one** effect on the workforce of using CAM to manufacture the scooter.

.....

.....

(2)

(h) A bicycle is an environmentally friendly form of transport.

Describe **two** environmental advantages of using a bicycle instead of taking car journeys.

1 .....

.....

.....

2 .....

.....

.....

(4)

Q4

(Total 22 marks)

TOTAL FOR PAPER: 88 MARKS

END

BLANK PAGE