

GENERAL CERTIFICATE OF SECONDARY EDUCATION

DESIGN AND TECHNOLOGY

Systems and Control Technology Core

Paper 2 (Higher Tier)

1957/02

Candidates answer on the Question Paper

OCR Supplied Materials:

None

Other Materials Required:

None

Friday 11 June 2010

Afternoon

Duration: 1 hour 15 minutes



Candidate
Forename

Candidate
Surname

Centre Number

Candidate Number

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **50**.
- Dimensions are in millimetres unless stated otherwise.
- Marks will be awarded for the use of correct conventions.
- This document consists of **12** pages. Any blank pages are indicated.



1 Fig. 1 shows an electric train set.

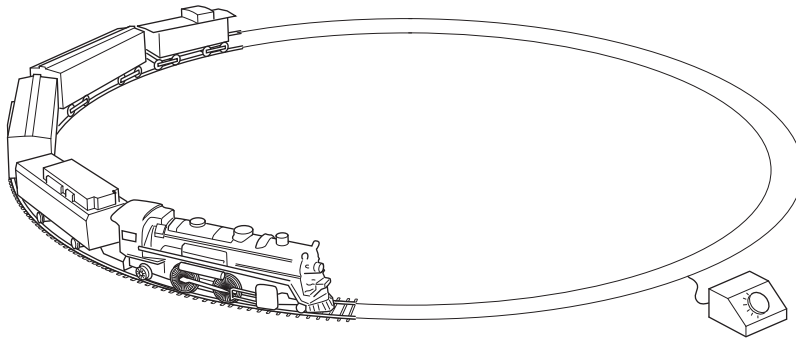


Fig. 1

- (a) A 230V mains transformer is used to supply 12V DC to the train engine.
Give **one** reason why the train engine is powered by 12V DC.

..... [1]

- (b) Fig. 2 shows details of the drive unit for the train engine.

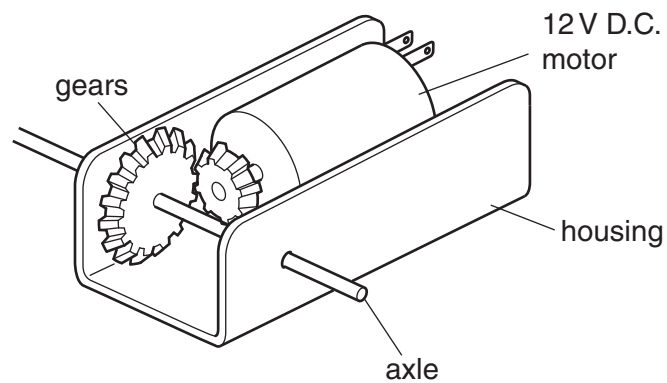


Fig. 2

Give **two** reasons why gears are needed in this drive unit.

Reason 1

.....

Reason 2

..... [2]

- (c) When the complete drive unit was tested the axle did not turn smoothly.
Give **two** possible reasons for the axle not turning smoothly.

Reason 1

.....

Reason 2

..... [2]

- (d) Computer simulations are often used when designing gear systems.
Give **two** benefits of using a computer simulation rather than real components when designing a gear system.

Benefit 1

.....

Benefit 2

..... [2]

- (e) At the end of its useful life the train set should be recycled.

- (i) Give **one** environmental problem to overcome when recycling materials from the train set.

..... [1]

- (ii) Describe how recycling information can be given on components made from plastics.

.....

.....

..... [2]

[Total: 10]

- 2 Boots with screw-in studs are worn for some sports. Fig. 3 shows details of a stud.

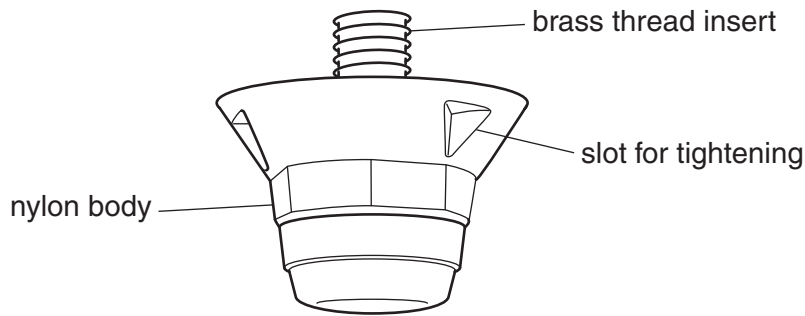


Fig. 3

- (a) The brass thread insert is machined using a CNC machine.

(i) Name the type of CNC machine that would be used to produce this thread.

..... [1]

(ii) Give **one** advantage to the manufacturer of using a CNC machine rather than a manual machine to produce a batch of 5000 studs.

..... [1]

(iii) Explain why brass is used rather than steel for the thread insert.

.....

..... [2]

- (b) The lower part of the stud is made from nylon.

(i) State a suitable process for forming the nylon body of the stud.

..... [1]

(ii) Give **one** reason why this process is suitable.

.....

..... [1]

- (c) Quality control checks are made during manufacture.
Give **two** quality control checks for the stud shown in Fig. 3.

Check 1

.....

Check 2

..... [2]

- (d) Fig. 4 shows a specially shaped tool for inserting and removing the studs.
Give **two** advantages of using this tool compared to a standard spanner.

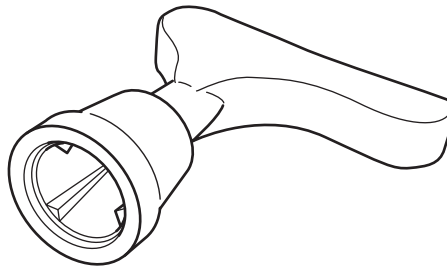


Fig. 4

Advantage 1

.....

Advantage 2

..... [2]

[Total: 10]

3 Fig. 5 shows part of a car racing game.

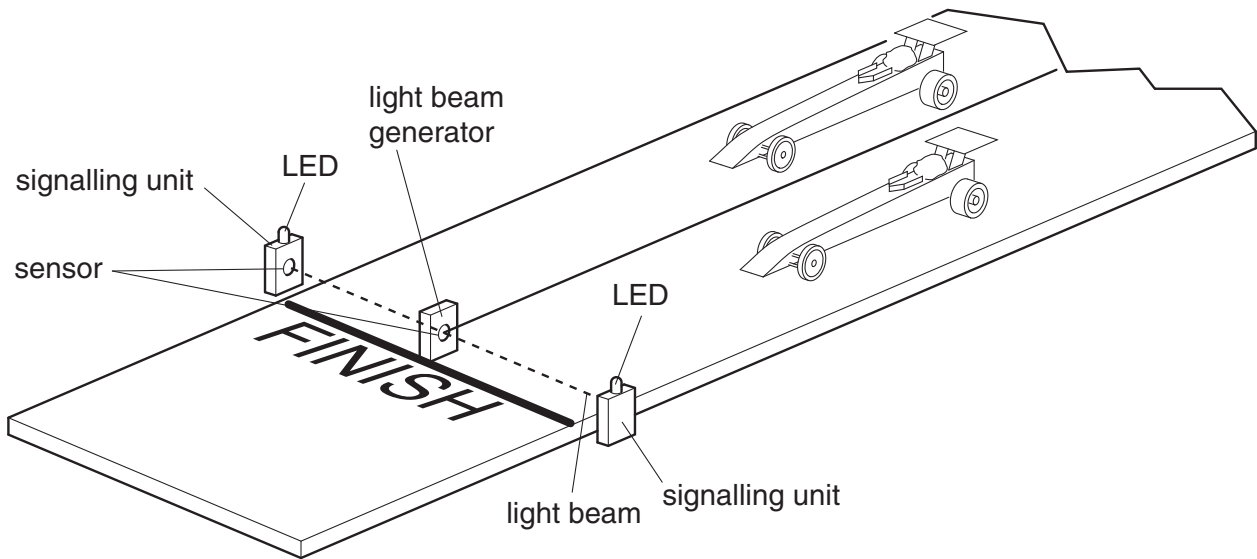
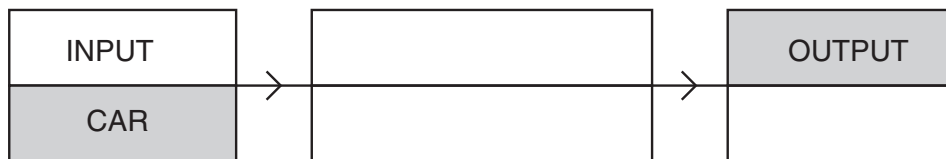


Fig. 5

The game uses a signalling unit with an LED output. The car that crosses the line first cuts a light beam and the LED next to that car lights up.

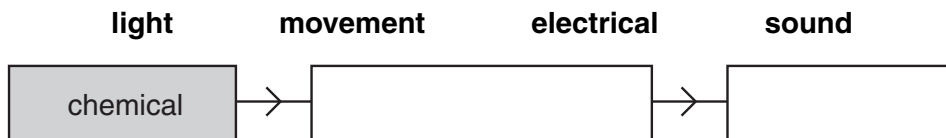
(a) Complete the possible block diagram for the racing game.



[3]

The signalling unit is battery powered.

(b) Complete the block diagram, by choosing from the list below the energy conversions which take place when the signalling unit is operated.



[2]

Fig. 6 shows a simple circuit for controlling the LED.

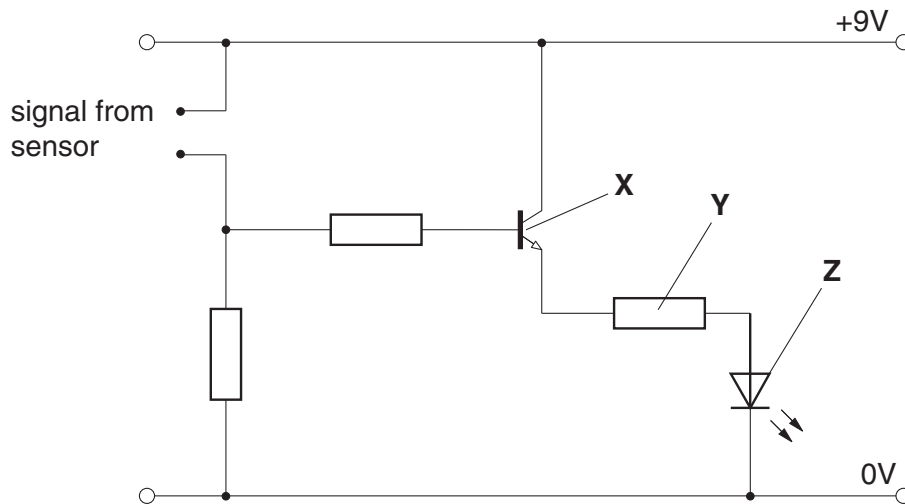


Fig. 6

(c) Name component **X**.

..... [1]

Component **Z** is a 2V, 0.02 A (20 mA) LED. Component **Y** is a resistor.

(d) Calculate the value of resistor **Y** using the formula;

$$R_{\Omega} = \frac{V(\text{supply}) - V(\text{LED})}{I(\text{LED amps})}$$

.....

 [2]

(e) Complete the table below to show an alternative component that could be used as a signal indicator. Draw the circuit symbol for the component chosen.

component	circuit symbol

[2]

[Total: 10]

Turn over

4 Fig. 7 shows incomplete details of a toy roundabout.

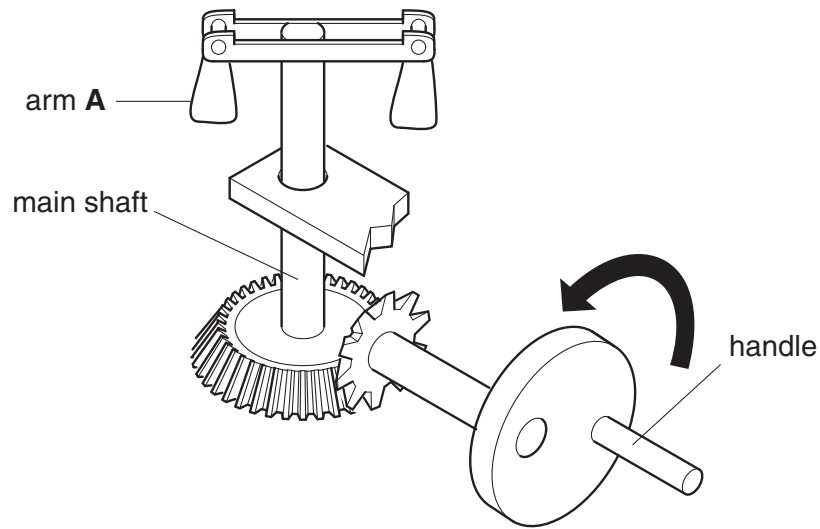


Fig. 7

- (a) Draw an arrow on Fig. 7 to show the direction of movement of arm **A** when the handle is turned as shown. [1]

Fig. 8 shows details of the gear mechanism.

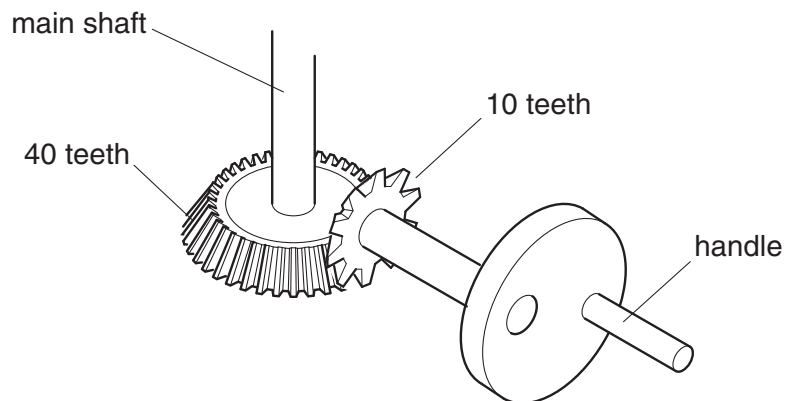


Fig. 8

The handle is turned at 60 revs per minute (rpm).

- (b) Calculate the rpm of the **main shaft** on Fig. 8.

.....

.....

.....

.....

..... [2]

Fig. 9 shows incomplete details of a moving face toy. The mouth is fixed but the eyes rotate.

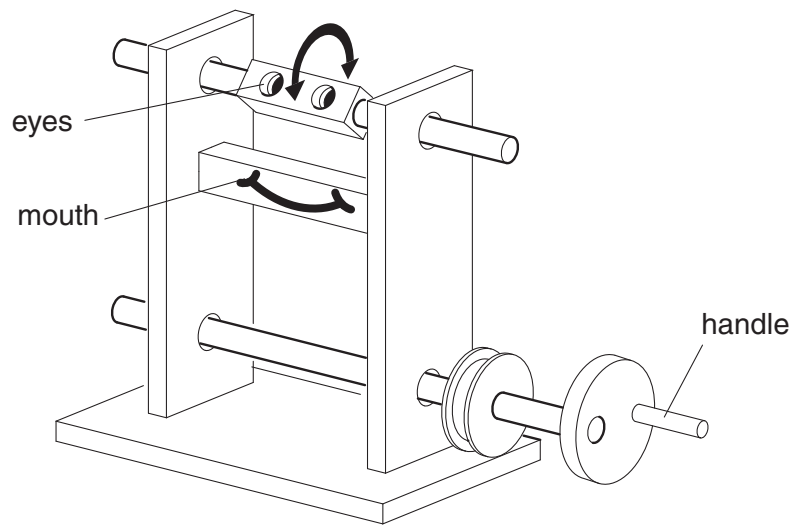


Fig. 9

The eyes can be made to rotate using the handle. **One** rotation of the handle must produce **two** rotations of the eyes.

- (c) Draw on Fig. 9 a method of rotating the eyes by using the handle.
Label all parts used.

[4]

10

The parts for the moving face toy are stored in a plastic tray made by the vacuum forming process.

- (d) Complete the part of the flowchart for the vacuum forming process shown in Fig. 10 using standard symbols and labels.

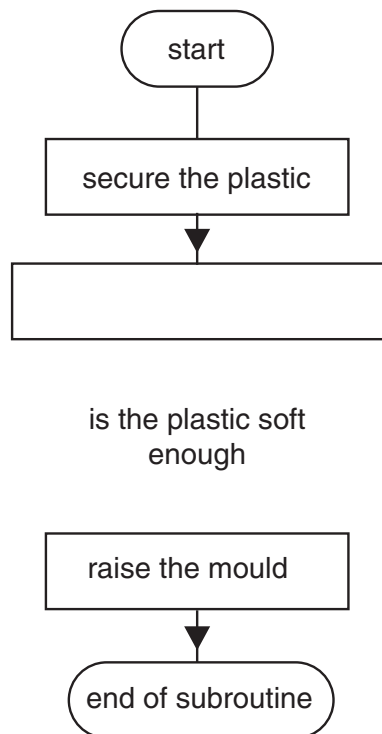


Fig. 10

[3]

[Total: 10]

5 Fig. 11 shows some components for a toy robot.

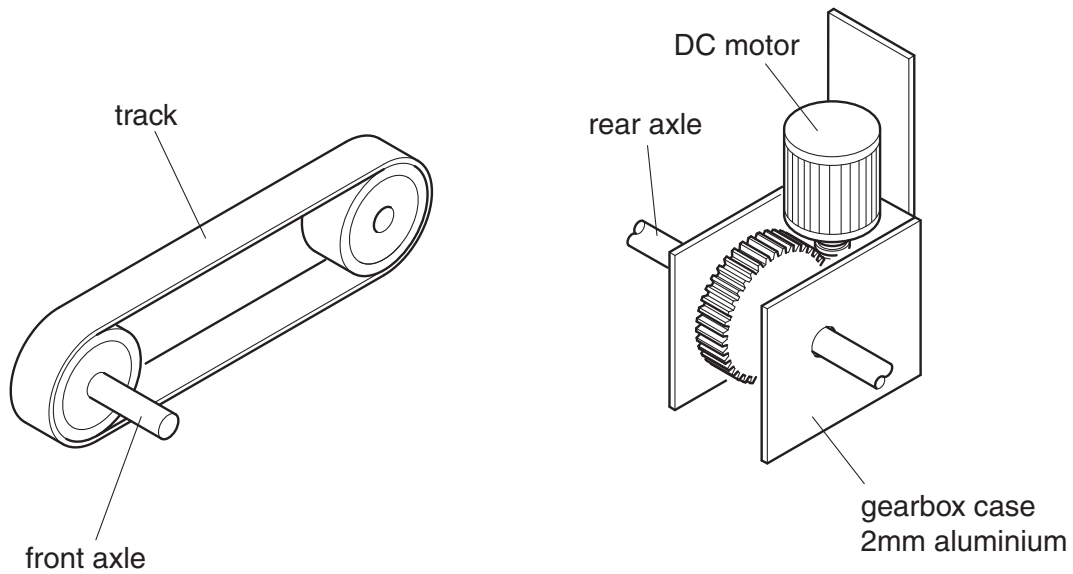


Fig. 11

The toy robot is driven by two tracks. Each track is driven by a separate motor gearbox.

The gearboxes are attached to a chassis made from a sheet of 3mm resistant material.

(a) Complete Fig. 12 to show:

- (i) how **one** motor gearbox can be attached to the chassis [3]
- (ii) how the front axle can be attached to the chassis. [1]
- (iii) Give specific names for any **two** materials or components used. [2]

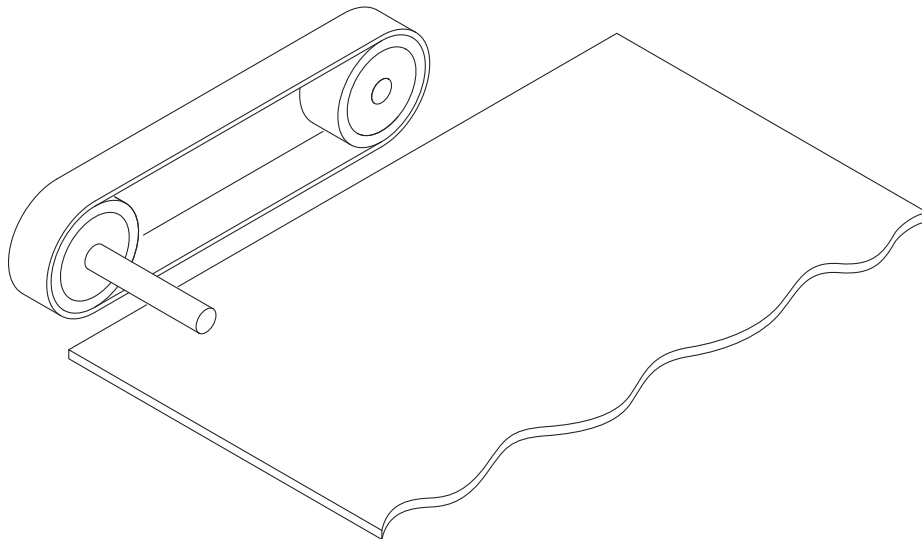


Fig. 12

The motors of the toy robot are operated by a hand held controller. A single flexible tube carries the wires connected from the hand controller to the toy robot.

(b) Use sketches and notes to produce a design idea for a hand held controller that:

- allows each motor to go forwards, stop and reverse [3]
- has an ergonomic feature. [1]

[Total: 10]

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