Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

1957/02

DESIGN AND TECHNOLOGY

Systems and Control Technology Core
Paper 2 (Higher Tier)

FRIDAY 11 JUNE 2010: Afternoon

DURATION: 1 hour 15 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the Question Paper

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

None

READ INSTRUCTIONS OVERLEAF

DC (CW/DJ) MEP60560 32264

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.**
- **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.**

1 (a) A 230V mains transformer is used to supply 12V DC to a toy train engine.
Give ONE reason why the train engine is powered by 12V DC.

_____ [1]

(b) Fig. 1 shows details of the drive unit for the train engine.

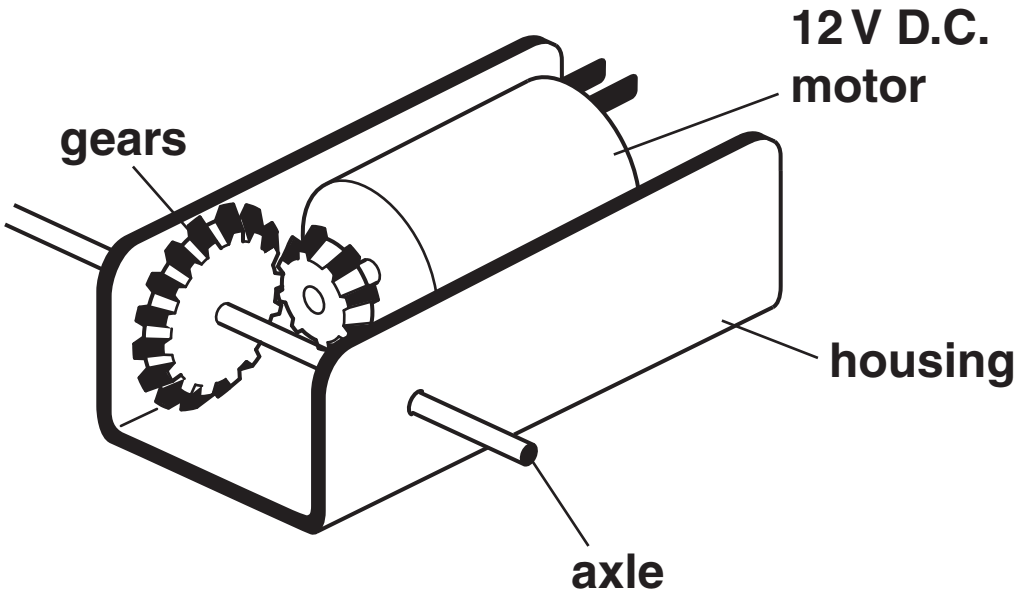


Fig. 1

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 <u>ONE</u> 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. 2 shows details of a stud.

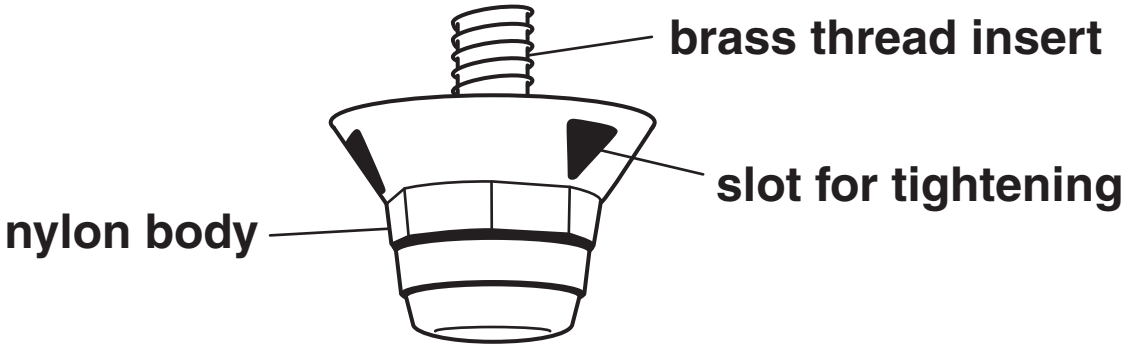


Fig. 2

(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 <u>ONE</u> 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 <u>ONE</u> reason why this process is suitable.

_____

_____ **[1]**

(c) Quality control checks are made during manufacture.
Give <u>TWO</u> quality control checks for the stud shown in Fig. 2.

Check 1 _____

_____

Check 2 _____

_____ **[2]**

(d) Fig. 3 shows a specially shaped tool for inserting and removing the studs.
Give <u>TWO</u> advantages of using this tool compared to a standard spanner.

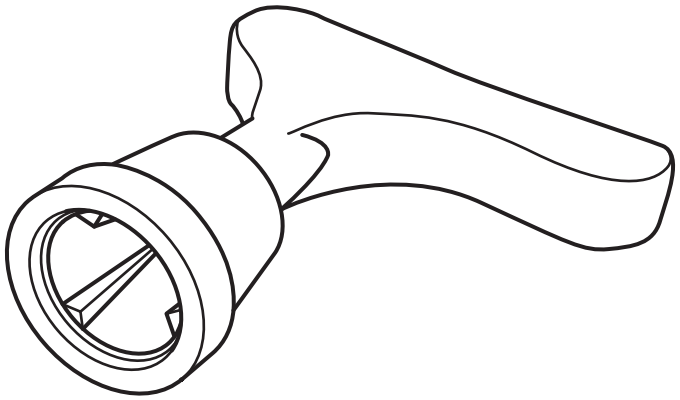


Fig. 3

Advantage 1 _____

_____

Advantage 2 _____

_____ **[2]**

[Total: 10]

3 Fig. 4 shows part of a car racing game.

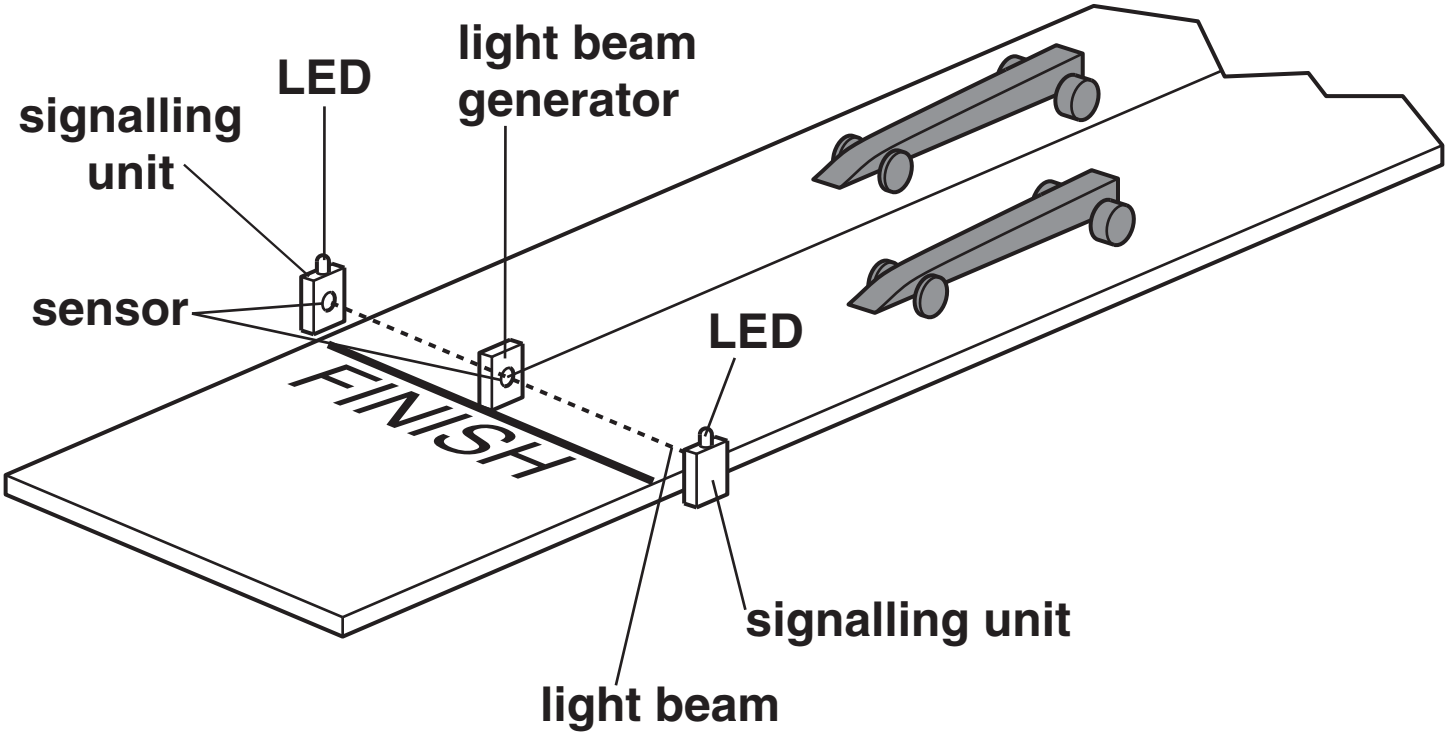
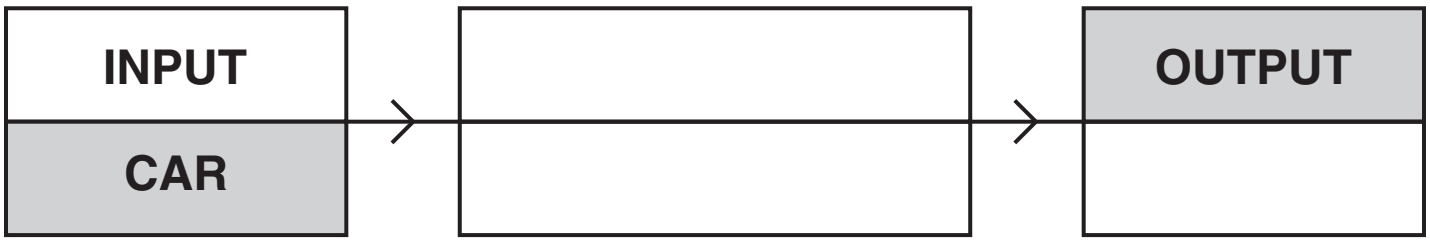


Fig. 4

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.

LIGHT **MOVEMENT**

ELECTRICAL **SOUND**

[2]

Fig. 5 shows a simple circuit for controlling the LED.

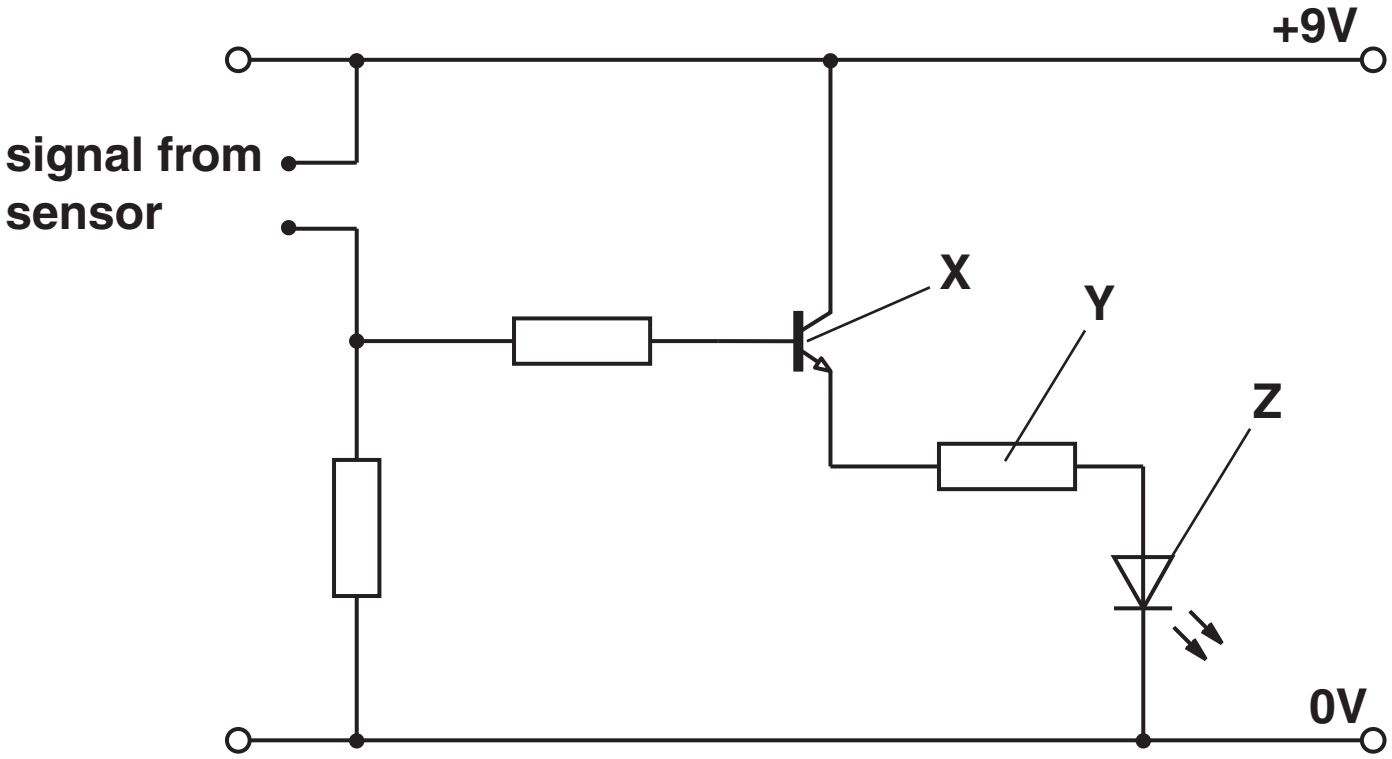


Fig. 5

(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;

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

_____

_____

_____

_____ **[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]

4 Fig. 6 shows incomplete details of a toy roundabout.

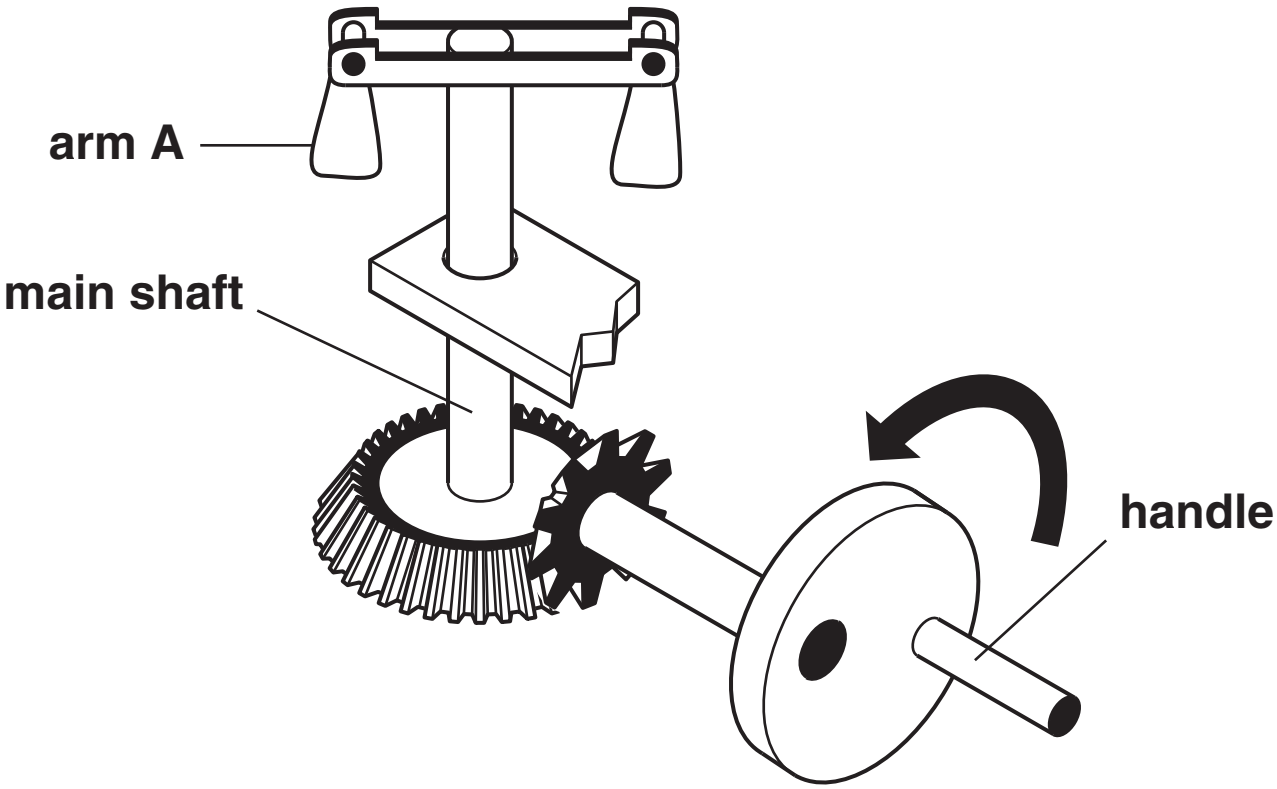


Fig. 6

(a) Draw an arrow on Fig. 6 to show the direction of movement of arm A when the handle is turned as shown. [1]

Fig. 7 shows details of the gear mechanism.

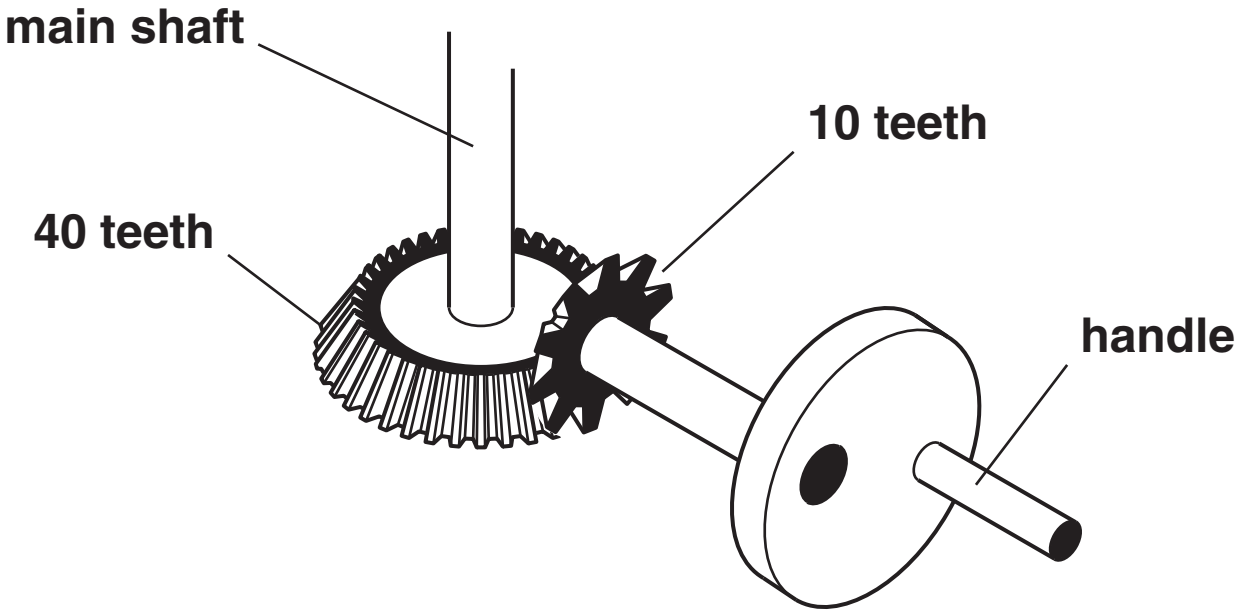


Fig. 7

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

(b) Calculate the rpm of the <u>MAIN SHAFT</u> on Fig. 7.

_____

_____

_____

_____

_____ **[2]**

Fig. 8 shows incomplete details of a moving face toy. The mouth is fixed but the eyes rotate.

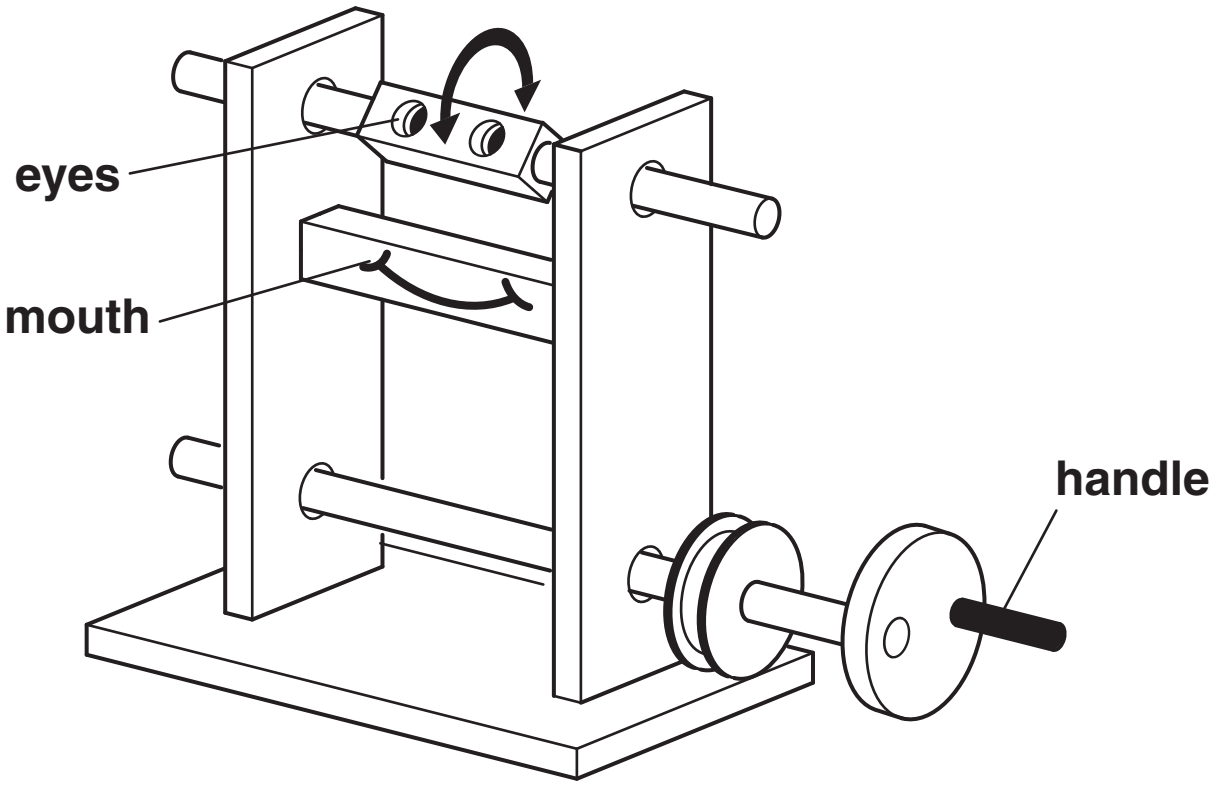


Fig. 8

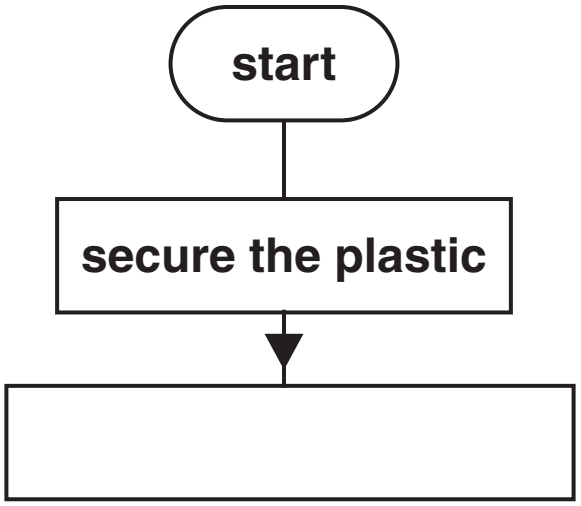
The eyes can be made to rotate using the handle. <u>ONE</u> rotation of the handle must produce <u>TWO</u> rotations of the eyes.

(c) Draw on Fig. 8 a method of rotating the eyes by using the handle.
Label all parts used.

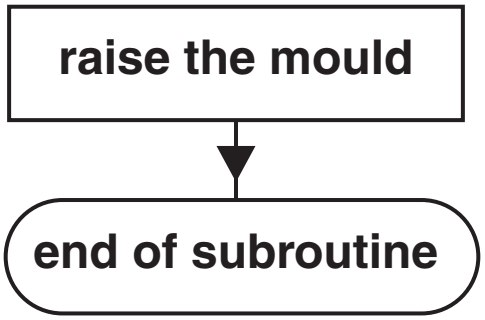
[4]

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. 9 using standard symbols and labels.



is the plastic soft enough



[3]

Fig. 9

[Total: 10]

5 Fig. 10 shows some components for a toy robot.

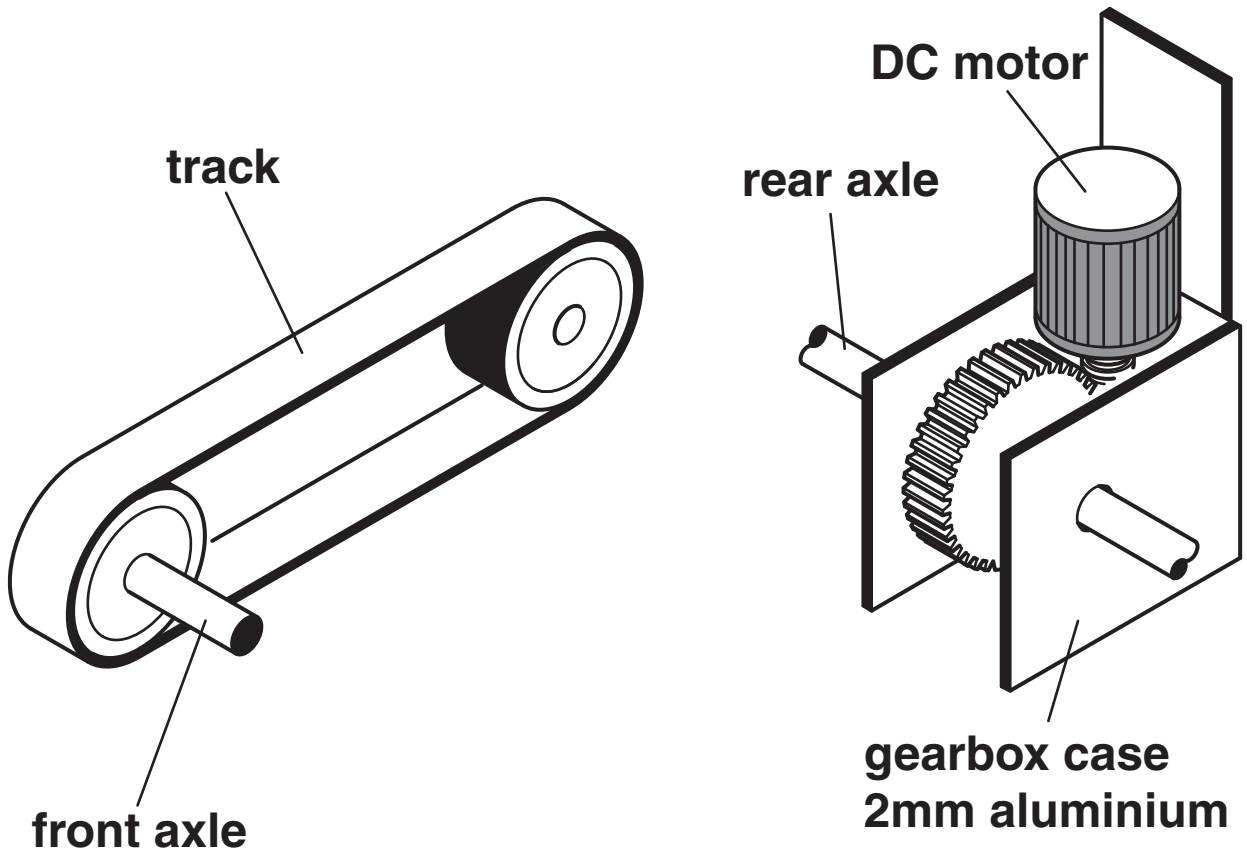


Fig. 10

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 3 mm resistant material.

(a) Complete Fig. 11 to show:

(i) how <u>ONE</u> 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 <u>TWO</u> materials or components used. [2]

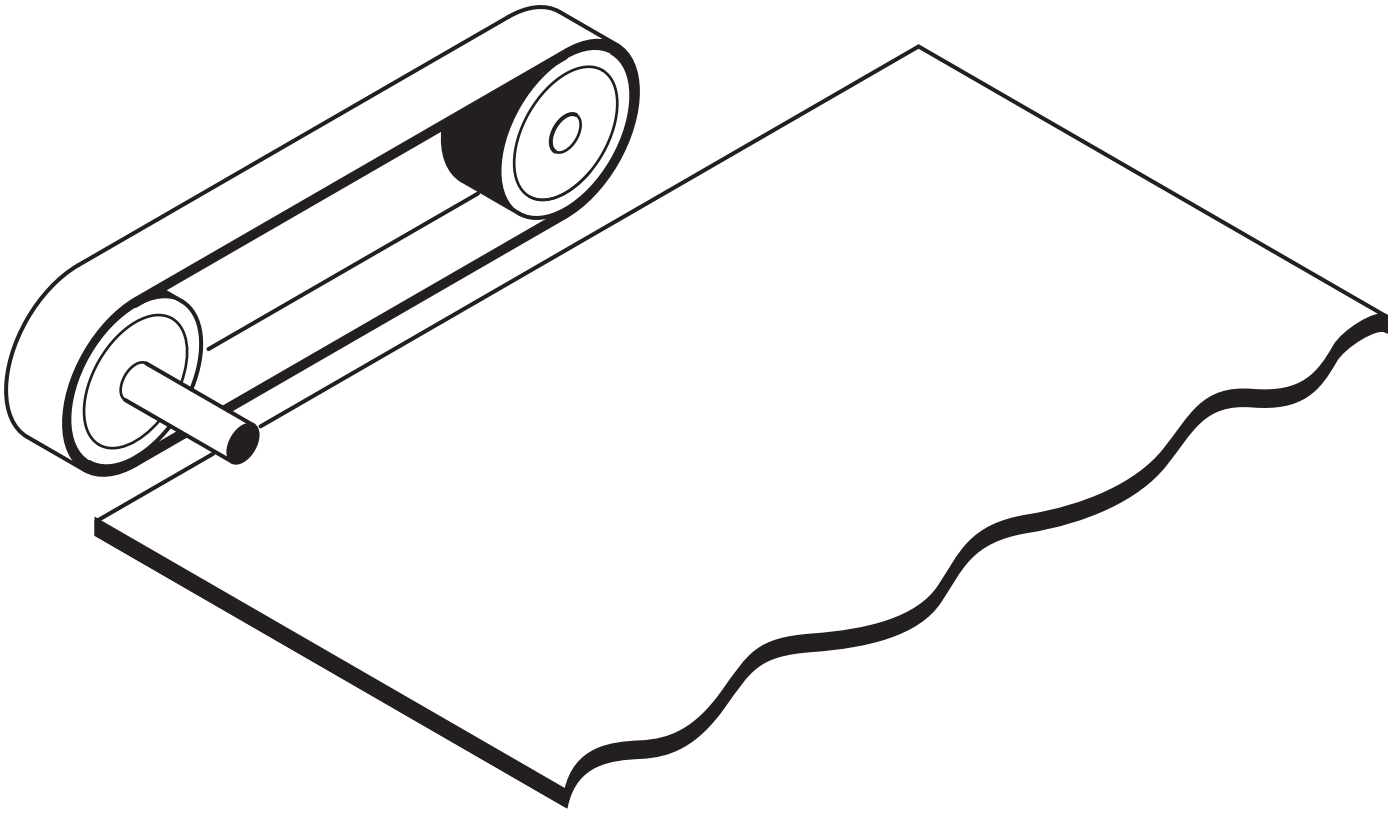


Fig. 11

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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