



Rewarding Learning

General Certificate of Secondary Education
2010

Technology and Design

Foundation Tier

[G9501]

WEDNESDAY 26 MAY, AFTERNOON

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71	
Candidate Number	
<input type="text"/>	



TIME

1 hour 45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer all **fifteen** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 126, including a maximum of 6 marks for quality of written communication.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

For Examiner's use only	
Question Number	Marks
1	
2	
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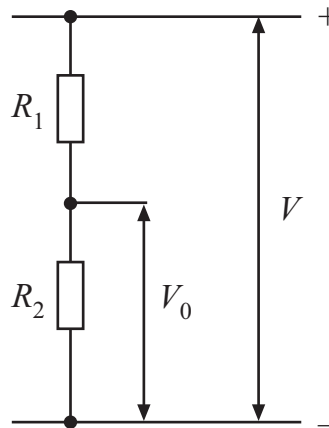
Formulae for GCSE Technology and Design

You should use, where appropriate, the formulae given below when answering questions which include calculations.

1 Work done = force \times distance moved in the direction of the force ($W = f \times d$)

2 Potential Difference = current \times resistance ($V = IR$)

3 For potential divider $V_0 = \frac{R_2}{R_1 + R_2} \times V$



4 Series Resistors $R_{\text{Total}} = R_1 + R_2 + R_3$ etc

Parallel Resistors $\frac{1}{R_{\text{Total}}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ etc

5 Gear ratio of a simple gear train = $\frac{\text{number of teeth on driven gear}}{\text{number of teeth on driver gear}}$
(NB for a compound gear train)

Total Gear ratio = the product of the gear ratios of all the subsystems

i.e. $G.R._T = G.R._1 \times G.R._2 \times G.R._3 \dots$


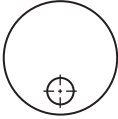

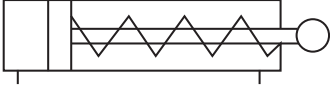

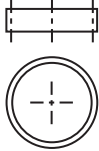
6 Mechanical Advantage = $\frac{\text{Load}}{\text{Effort}}$

7 Velocity Ratio = $\frac{\text{Distance moved by effort}}{\text{Distance moved by load}}$

8 Pneumatics Force = Pressure \times Area ($F = P \times A$)

1 **Table 1** shows a number of different symbols. Using the first row as a guide, complete the table.

Table 1

Sketch of Symbol	Type of Symbol	Name of Symbol
	Electronic Control	Lamp
	Electronic Control	Variable Resistor
	Mechanical Control	
	Safe Condition Sign	
		LDR
	Computer/Microprocessor Control	
		

[10]

Examiner Only	
Marks	Remark

3 (a) Fig. 3 shows a block diagram of a control system which contains input, process and output.

Name this type of system.



Fig. 3

Name of system: _____ [1]

(b) Fig. 4 shows a block diagram of a control system which contains input, process, output and feedback.

Name this type of system.

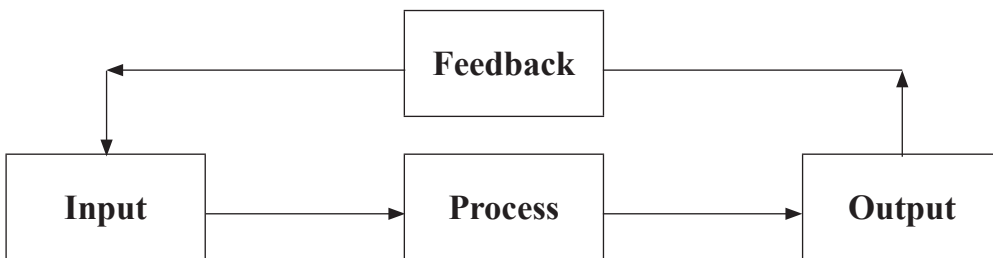


Fig. 4

Name of system: _____ [1]

(c) Explain the function of feedback in Fig. 4.

 _____ [2]

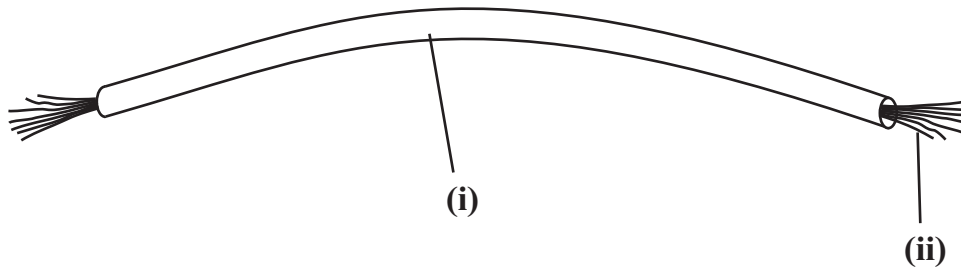
(d) Suggest a reason for using block diagrams for designing systems.

Reason:

 _____ [2]

Examiner Only	
Marks	Remark

- 4 A short length of cable used for building electronic circuits is shown below. The cable consists of two materials labelled (i) and (ii).



- (a) Name a suitable **material** for (i) and (ii) above.

Material (i) _____

Material (ii) _____ [2]

- (b) State the main **purpose** for using each material.

Main purpose (i) _____

Main purpose (ii) _____ [2]

Examiner Only

Marks Remark

- 5 (a) Plastics are commonly used in everyday life. Using the list below, complete **Table 2** by selecting the most appropriate **use** and **characteristic** for each plastic. [4]

List:
Toys
Scratch resistant
Kitchen work surfaces
Lightweight

Table 2

Plastic	Use	Characteristic
Melamine		
Rigid polystyrene		

- (b) Which of the two plastics listed in **Table 2** would be suitable for vacuum forming? Give a reason for your answer.

Name of plastic:

_____ [1]

Reason:

_____ [2]

Examiner Only	
Marks	Remark

6 Fig. 5 shows a mechanism for winding a cable on to a drum. The drum is turned by a system of gears using the handle as shown.

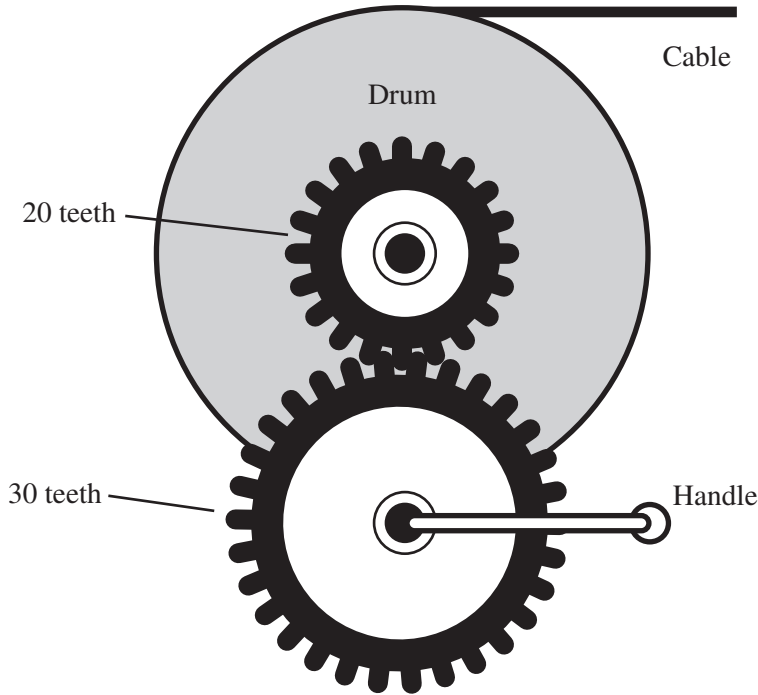


Fig. 5

- (a) (i) Mark on Fig. 5 the direction in which the handle should be rotated in order to wind the cable on to the drum. [1]
- (ii) If the handle is rotated at 80 rev/min, calculate the speed of the drum.

[2]

Examiner Only	
Marks	Remark

7 The circuit diagram shown in **Fig. 7** is incomplete and requires the inclusion of a resistor and a LDR to enable it to function as follows:

When the switch, labelled A, is closed, component D should operate in dark conditions.

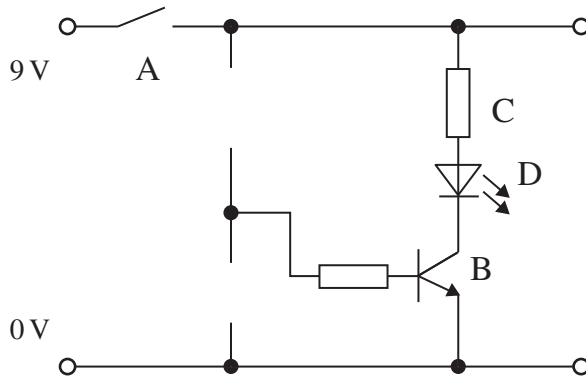


Fig. 7

(a) Complete the circuit diagram, **Fig. 7**, by inserting the symbols for the resistor and LDR in the correct positions. [4]

(b) Name the component symbols labelled B and D.

Component symbol B _____

Component symbol D _____ [2]

(c) Explain how the circuit operates.

 _____ [5]

Examiner Only	
Marks	Remark

(d) State a suitable use for this circuit.

Use: _____
_____ [1]

(e) What is the purpose of component C in this circuit?

Purpose: _____
_____ [1]

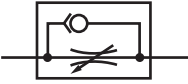

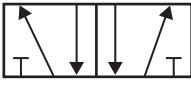
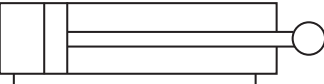

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

9 (a) Table 3 shows a number of pneumatic symbols.

Table 3

Symbol	Name of symbol
	
	
	
	
	

[5]

Complete Table 3 by inserting the correct name for each symbol from Table 4.

Table 4

5/2 valve
Double acting cylinder
3/2 valve
Single acting cylinder
Pressure source
Flow regulator
Exhaust

Examiner Only	
Marks	Remark

10 At the end of year 10, pupils normally select their study options for GCSE. Completed study option forms can be checked automatically by computer. Design a flowchart to show how the form can be checked automatically by computer. The flowchart should operate as follows:

- The form is checked electronically and if it is completed correctly, it will be accepted with the word 'CORRECT' appearing on a screen;
- If the form is not completed correctly, it will not be accepted and pupils will be directed to complete the form again by the words 'INCORRECT, RE-SUBMIT' appearing on screen. This process will continue until the form is completed correctly;
- The process ends when the form has been accepted.

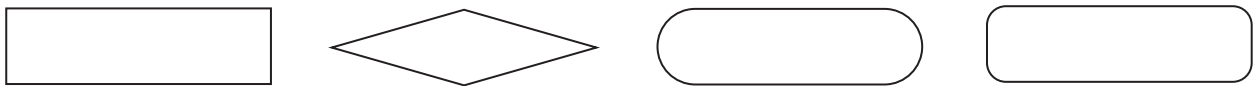
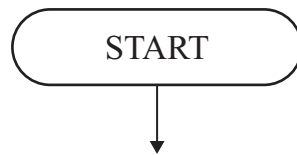


Fig. 9

Select and use the correct computer/microprocessor control symbols from Fig. 9 to complete the flowchart for this process.



Examiner Only	
Marks	Remark

[9]

12 A toy boat, used in a wall-mounted display, is fixed to an arm which is moved by a mechanism as shown in **Fig. 11**.

The driving mechanism moves the arm about the fixed point A.

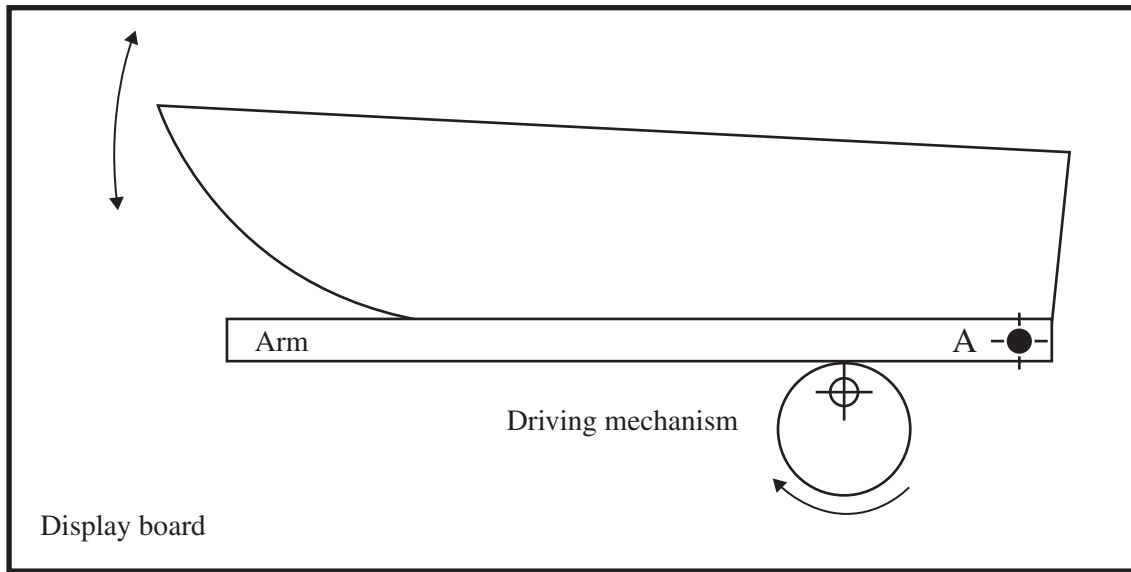


Fig. 11

(i) Label the following in **Fig. 11**:

- The lever
 - Its fulcrum
- [2]

(ii) Label and name the type of cam shown.

_____ [2]

(iii) Explain what keeps the arm in contact with the driving mechanism.

_____ [1]

(iv) Name a method which could be used to ensure that the arm is always in contact with the driving mechanism.

_____ [1]

(v) Suggest **one** change which could be made to **Fig. 11** to **increase** the movement of the boat.

Change: _____ [1]

Examiner Only	
Marks	Remark

- 13 (a) Materials can be joined together by either **permanent** or **semi-permanent** means. Complete **Table 5** below by identifying whether the joining method is permanent or semi-permanent. [4]

Table 5

Joining method	Permanent/semi-permanent
Adhesives	
Panel pins	
Nuts and bolts	
Brazing	

- (b) A pencil holder made from acrylic is to be attached to a mahogany base as shown in **Fig. 12**. Suggest a suitable method of attaching the two pieces together that is different to any in the above Table.

Suitable method:

[2]

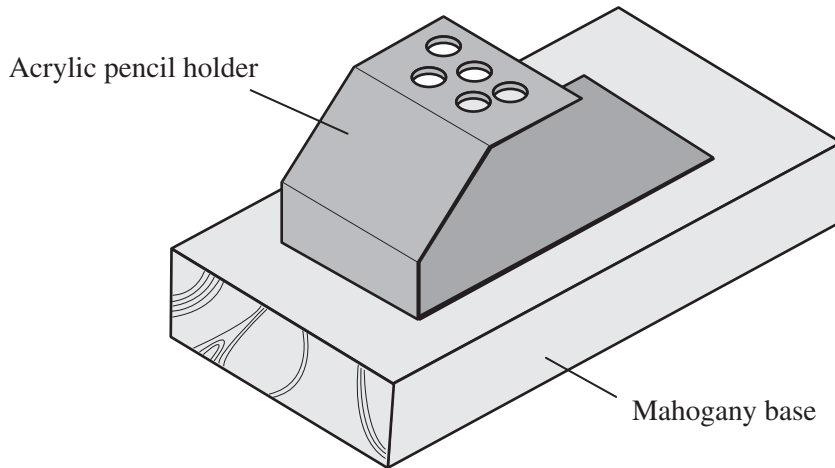


Fig. 12

- (c) How is the acrylic shaped as shown in **Fig. 12**?

[2]

Examiner Only	
Marks	Remark

14 (a) Fig. 13 shows different methods of operating pneumatic valves.

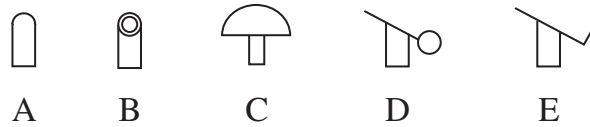


Fig. 13

(i) Complete Table 6 by inserting the correct letter to represent each of the methods listed.

Table 6

Method of operation	Letter
Roller trip	
Push button	
Lever	
Plunger	

[4]

(ii) Which method would be used in a valve to confirm the outstroke position of a piston rod?

Method: _____ [1]

Examiner Only	
Marks	Remark

(b) Fig. 14 shows a pneumatic circuit used in a parcel sorting process.

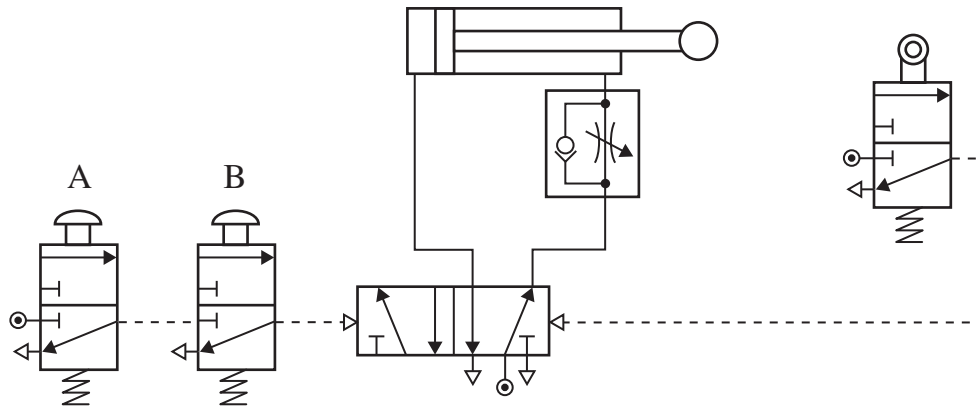


Fig. 14

(i) State the type of logic connection used for valves A and B.

_____ [1]

(ii) Suggest a reason for using this type of connection.

_____ [1]

Examiner Only	
Marks	Remark

(c) Fig. 15 shows a similar circuit used in baggage handling.

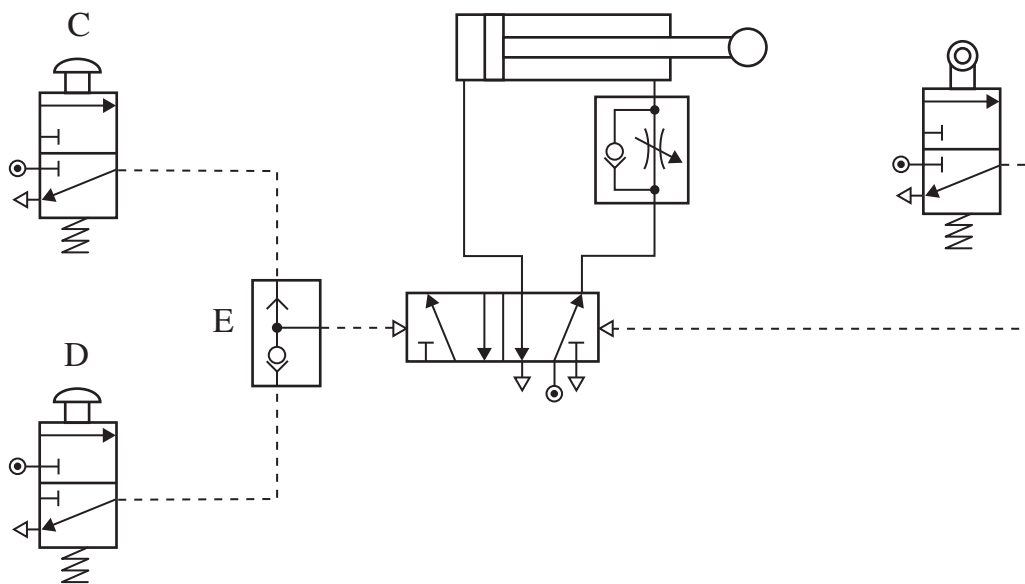


Fig. 15

(i) State the type of logic connection used for valves C and D.

_____ [1]

(ii) Suggest a reason for using this type of connection.

_____ [1]

(iii) Name valve E.

_____ [1]

(iv) Explain why valve E is necessary in the circuit.

 _____ [2]

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

15 Fig. 16(a) shows a child's toy which is to be made from MDF. When the strings are pulled the legs and arms move as shown.

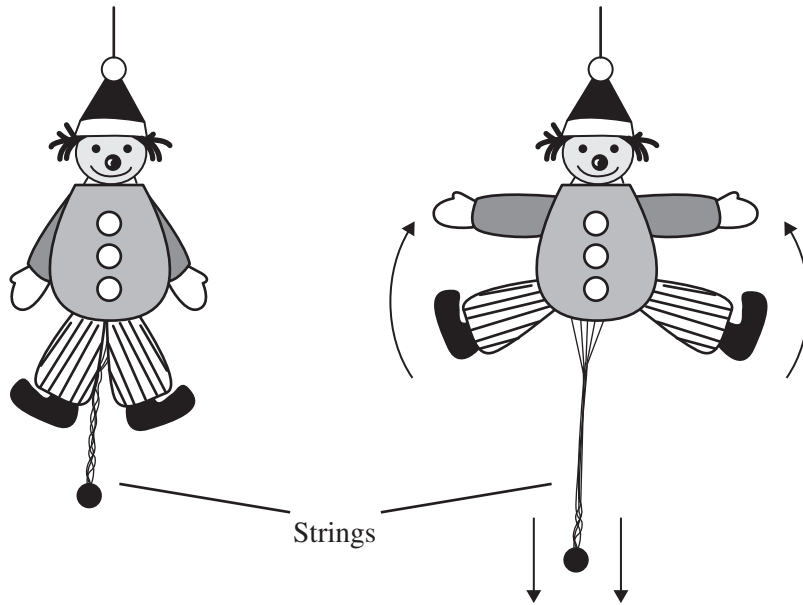


Fig. 16(a)

Fig. 16(b)

(a) On Fig. 16(b), label the **input** motion and the **output** motion. [2]

(b) (i) Is MDF a natural or manufactured material?

_____ [1]

(ii) Give **two** reasons, other than cost, why MDF is used as the main material for the toy.

Reason 1: _____ [1]

Reason 2: _____ [1]

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Marks	Remark

(c) Fig. 17 shows the rear view of the child's toy.

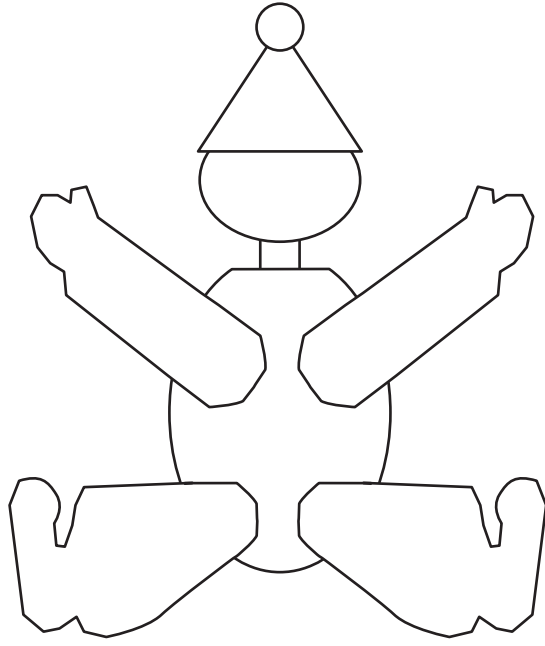


Fig. 17

Clearly mark and label on Fig. 17:

- (i) The pivot points for the arms and legs.
- (ii) The fixing locations of the strings on each arm and leg to enable the toy to operate as in Fig. 16(b). [8]

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Marks	Remark

(d) Describe how the arms and legs of the toy return to the original position when the strings are released.

[2]

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Marks	Remark
Quality of written communication	

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