Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE

General Certificate of Secondary Education

CYD-BWYLLGOR ADDYSG CYMRU

Tystysgrif Gyffredinol Addysg Uwchradd

142/02

DESIGN AND TECHNOLOGY

PAPER 2

FOCUS AREA: SYSTEMS AND CONTROL TECHNOLOGY

(Foundation Tier – Grades G to C)

P.M. TUESDAY, 6 June 2006

(1½ hours)

	Leave Blank
Question 1	
Question 2	
Question 3	
Question 4	
Question 5	
TOTAL MARK	

ADDITIONAL MATERIALS

You will need basic drawing equipment, a calculator and coloured pencils for this examination.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. Where the space is not sufficient for your answer, continue the answer at the back of the book, taking care to number the continuation correctly.

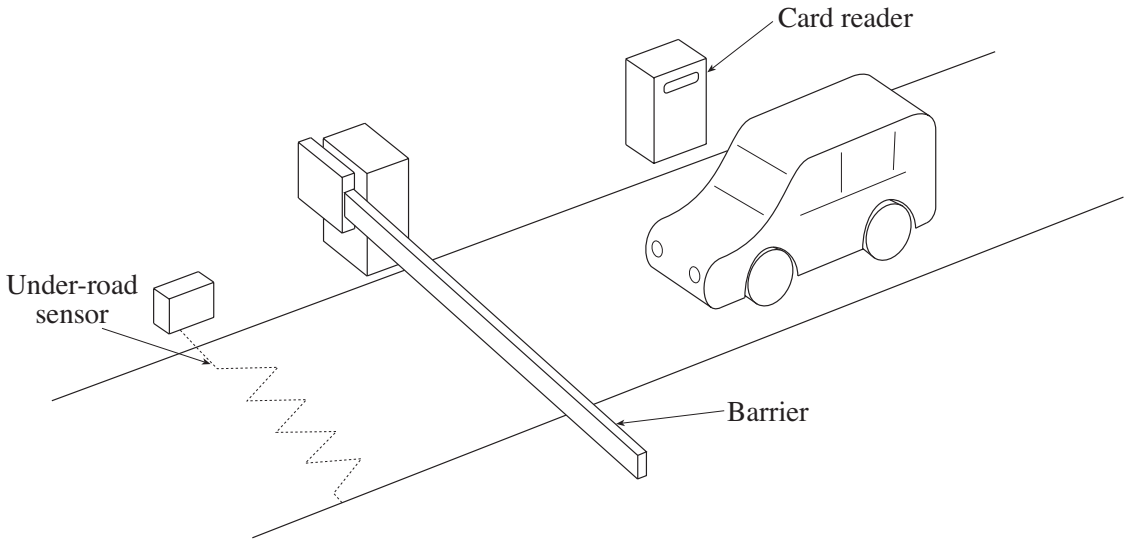
INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

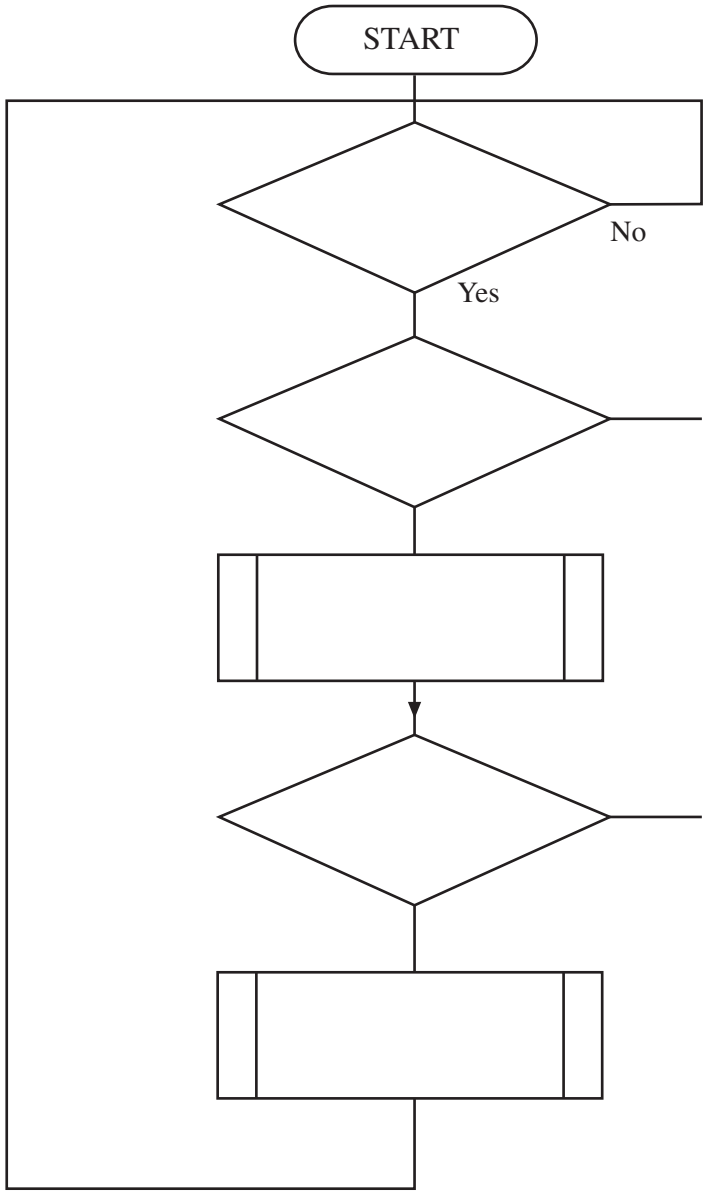
No certificate will be awarded to a candidate detected in any unfair practice during the examination.

Answer **all** *questions in the spaces provided.*

1. The diagram below gives some details of a barrier system.



(a) **Complete** the flowchart started below to show how the system operates. **Use all** the statements listed on the right. [7]



CARD CORRECT?

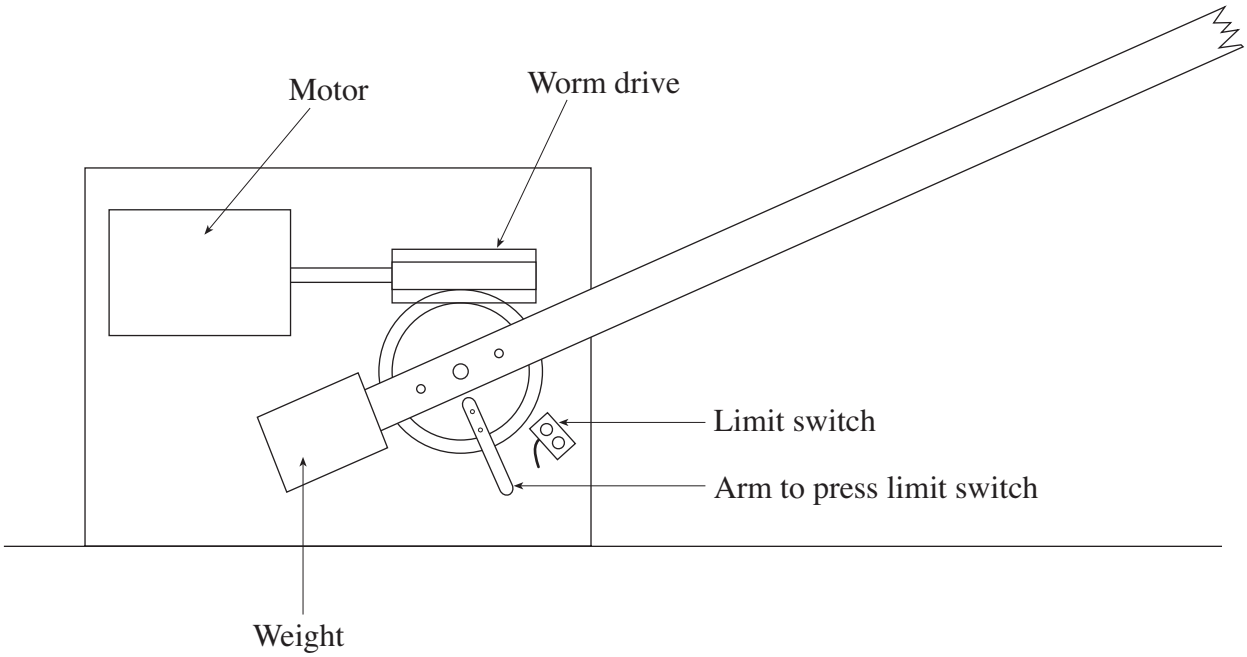
BARRIER DOWN

CARD INSERTED?

BARRIER UP

CAR OVER SENSOR?

(b) The barrier is moved by the motor and gear system shown below.



(i) **Describe** the purpose of the limit switch. [2]

.....

.....

(ii) **Give one** reason why a worm drive is a good choice for this system. [2]

.....

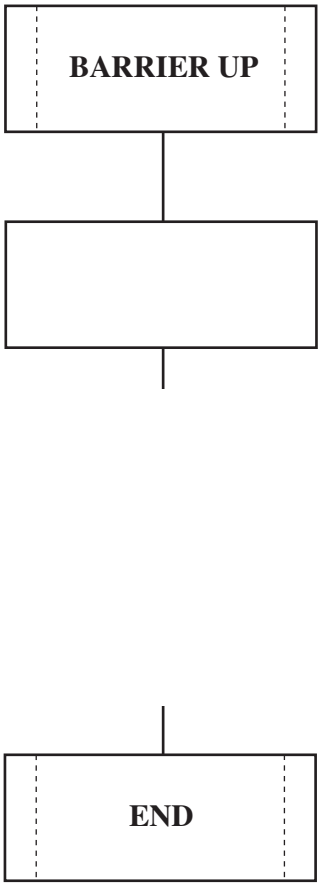
.....

(iii) **Explain** why the weight is needed. [2]

.....

.....

(iv) The upward movement of the barrier is controlled by the procedure or macro called BARRIER UP. **Complete** the flowchart for this procedure. Use all the commands listed on the right. [5]



IS LIMIT SWITCH PRESSED?

MOTOR STOP

MOTOR ON

(c) A programmable interface controller (PIC) could be used to control the barrier.

(i) **Name two** devices used in the barrier system that could form *inputs* to the PIC. [2]

Device 1 .....

Device 2 .....

(ii) **Name one** device used in the barrier system that would form an *output* of the PIC. [1]

Device .....

(iii) **List three** important points you would expect to see on the specification for such a barrier system. [3]
An example has been done for you.

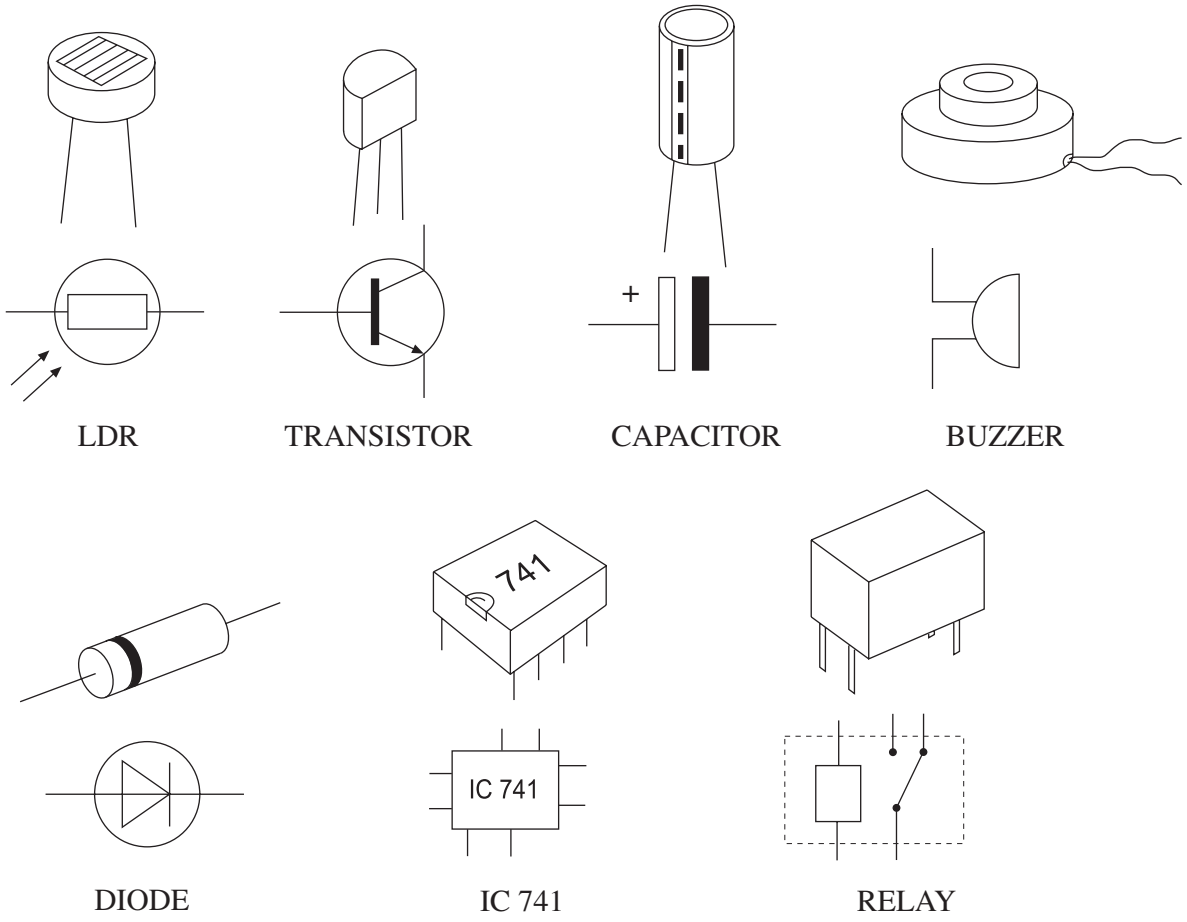
Example: The barrier system must be easy to maintain and repair.

Specification Point 1 .....

Specification Point 2 .....

Specification Point 3 .....

2. A drawing and circuit symbol for some electronic components are shown below.



LDR TRANSISTOR CAPACITOR BUZZER

DIODE IC 741 RELAY

(a) (i) **Name** the component that has one leg called a base leg. [1]

.....

(ii) **Name** the component that changes its resistance as the light level changes. [1]

.....

(iii) **Name** the component that can store electrical energy. [1]

.....

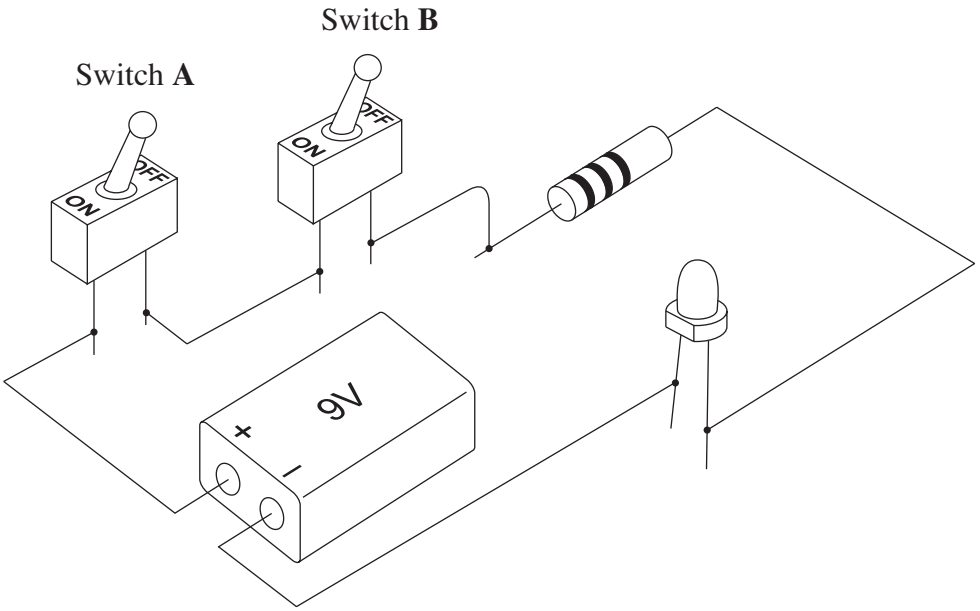
(iv) **Describe** briefly the function of a relay. [2]

.....

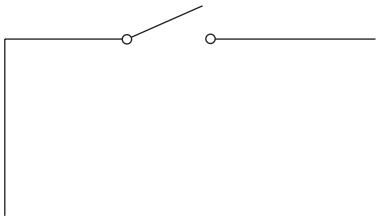
.....

.....

(b) A diagram of a simple circuit is shown below.



(i) **Complete** the circuit diagram of the system started below. **Use** the correct electronic symbols. [5]



(ii) **State** what needs to be done to cause the LED to light. [2]

.....

.....

(iii) **State** whether the switches are arranged in series or in parallel. [1]

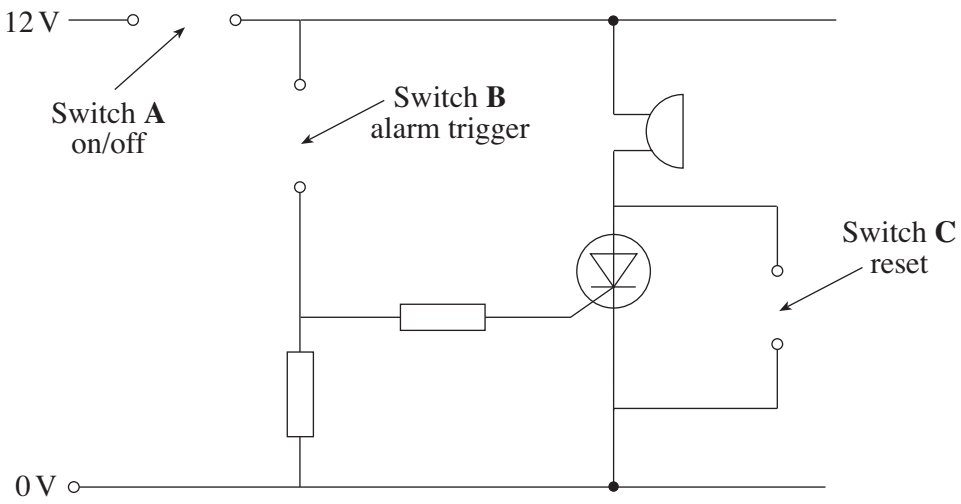
.....

(iv) **Describe** the function of the resistor in this circuit. [2]

.....

.....

(c) The circuit below shows details of a basic alarm system to be used to warn that a door has been opened. The position of three switches is shown.



(i) **Complete** the table below by placing a tick (✓) in the correct box to show which switch is the most suitable for **each** of the **three** positions in the alarm system. [3]

	Switch A On/off	**Switch B Alarm trigger**	**Switch C Reset**
Push to make			
Toggle switch			
Reed switch			

(ii) The system makes use of a thyristor as an electronic latch. **Describe** what is meant by *a latch*. [2]

.....

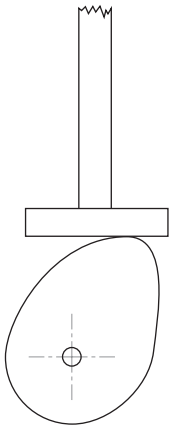
.....

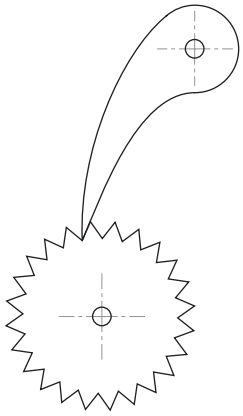
.....

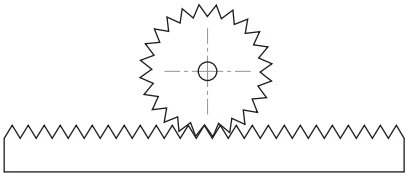
3. *(a)* Three basic mechanical systems are shown below.

(i) From the list shown below, **choose** the correct name for **each** system and **write** it in the space provided. [3]

RACK AND PINION
CAM AND FOLLOWER
PAWL AND RATCHET







Name ..... Name ..... Name .....

(ii) **Choose** any **one** of the systems and **describe** how it works. [2]

Name of system: .....

Description: .....

.....

.....

(iii) **Describe one** practical use for the system you have chosen. [2]

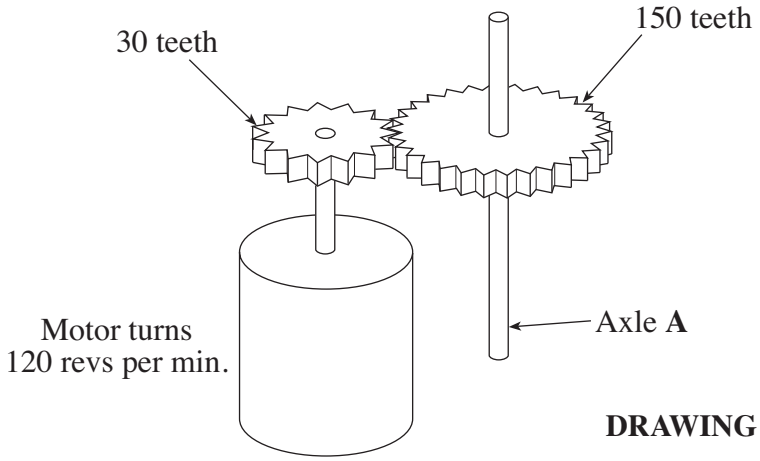
.....

.....

.....

(b) A simple gear system is shown below. The driving motor turns at 120 revs per minute. **Calculate** the RV (rotational velocity) of axle **A**. [3]

***Show** all workings.*



DRAWING NOT TO SCALE

.....

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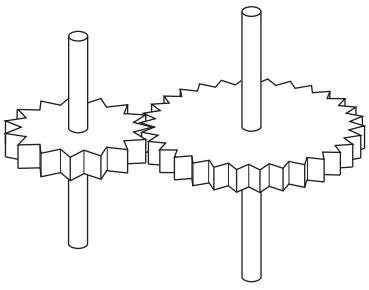
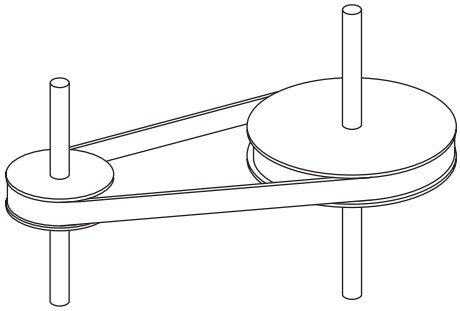
.....

(c) Two methods of transferring motion between parallel shafts are shown below.



GEARS



BELT AND PULLEYS

Give two advantages that belt and pulley systems have over gear systems. 2 × [2]

Advantage 1 .....

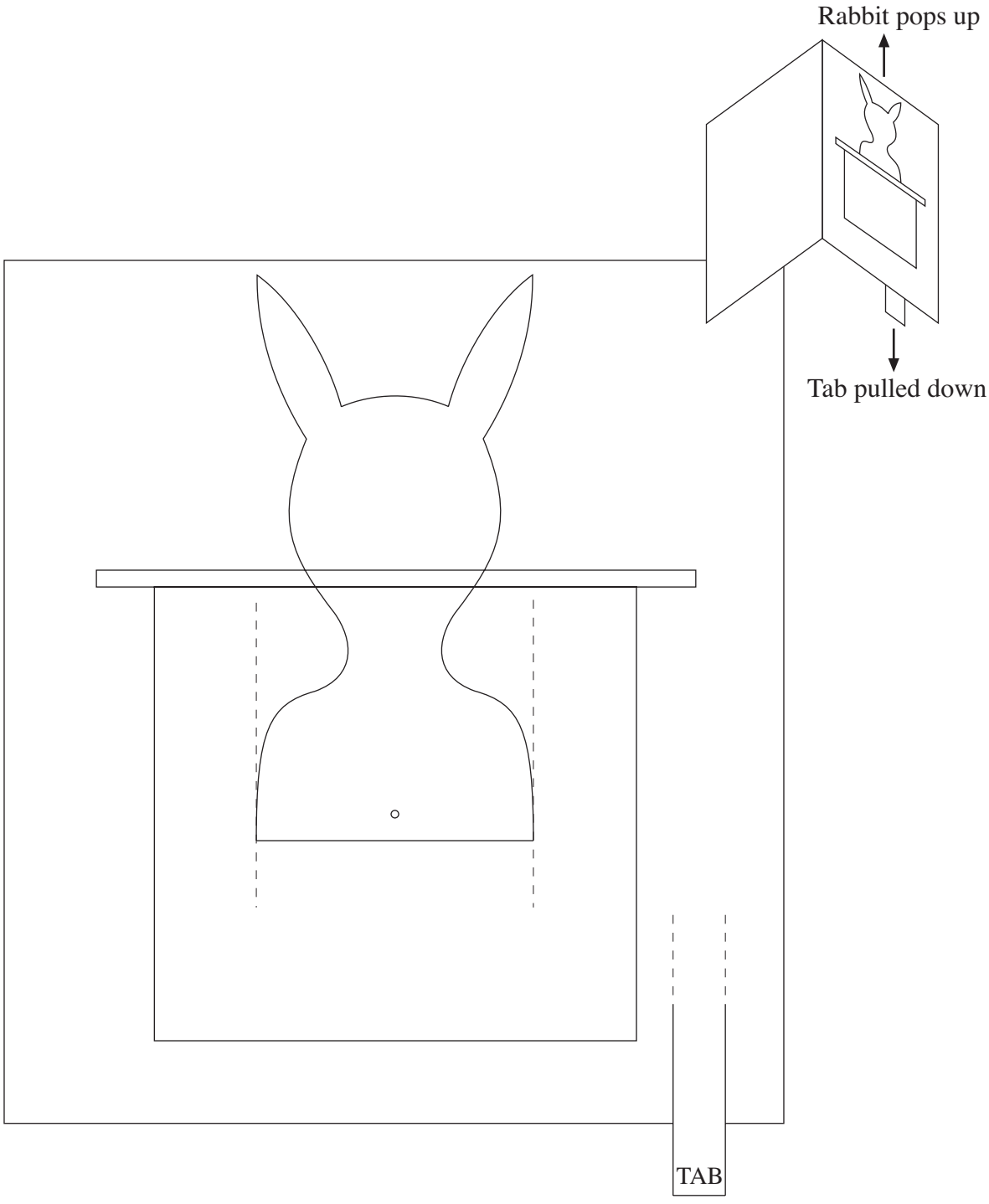
.....

Advantage 2 .....

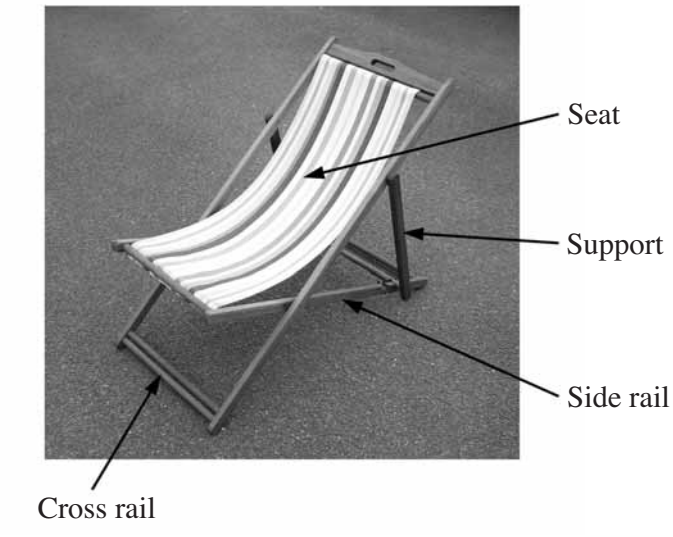
.....

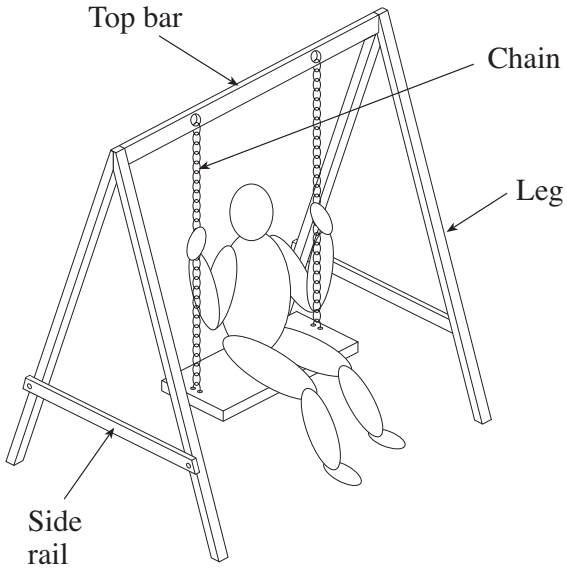
(d) A child's birthday card has a rabbit popping up from a hat when a tab is pulled down.

Complete the design for the card by **adding** a simple system of links to cause this to happen. **Label** clearly all fixed and moving pivots. [4]



4. A deckchair and a swing are shown below. Some parts of each product are labelled.



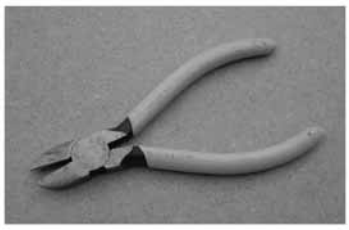


(a) **Complete** the table below by writing in the name of a part that is subject to the forces listed. *An example has been done for you*. [5]

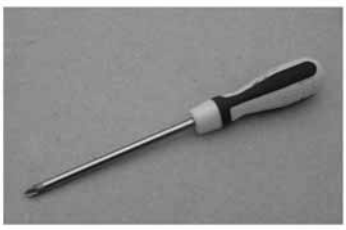
FORCE	DECKCHAIR	SWING
Tension		**Chain**
Compression		
Bending		

(b) Three common hand tools are shown below. **Name** the tool that experiences *torsion* when in use. [1]

Hammer



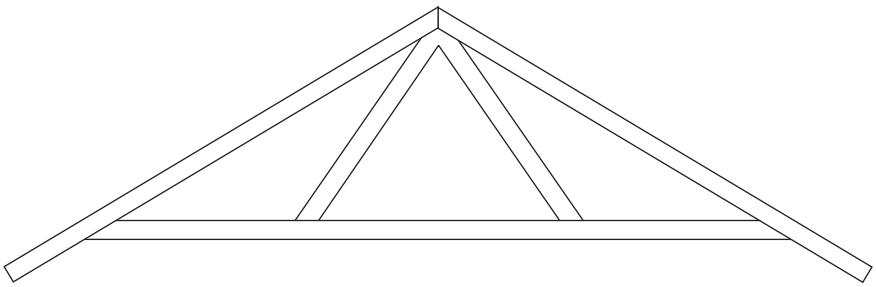
Wire Cutters

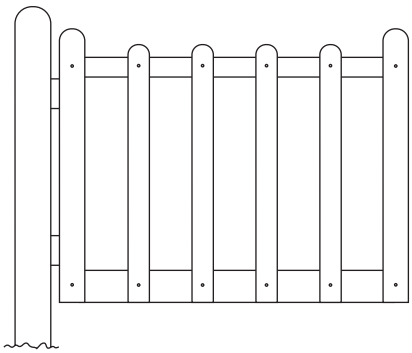


Screwdriver

Name of tool: .....

(c) Diagrams of a roof truss and a garden gate are shown below.





(i) The roof truss is more rigid than the gate. **Explain** why this is so. [2]

.....

.....

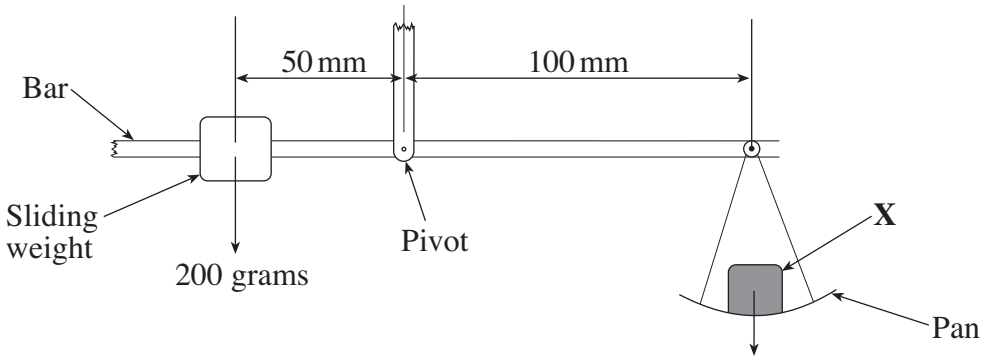
(ii) **Explain** what can be done to the gate to make it more rigid. [2]
You may draw on the diagram to help your answer.

.....

.....

(d) The diagram below shows a simple balance weighing scales. **Calculate** the weight of the object marked **X**. Ignore the weight of the bar and pan. [3]

***Show** all your workings*.



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PLEASE TURN OVER FOR QUESTION 5.

5. Very young children are sometimes frightened if it is too dark in their bedrooms. **Design** an automatic night-light for a young child's bedroom.

SPECIFICATION

- The night-light must switch itself on when the room gets dark.
- The night-light must be designed so that it will comfort or amuse a young child.
- The night-light must be battery powered or make use of a small mains transformer/adapter.
- The night-light must fix to a wall, cot or ceiling.

Sketch your designs in the boxes that follow.

Marks will be awarded for:

(i) a labelled sketch to show the general look of the night-light; [6]

(ii) a clear block diagram based on INPUT, PROCESS and OUTPUT of the control system for the night-light; [4]

(iii) fully labelled details of the electronic circuit used in the night-light; [6]

(iv) a clear sketch to illustrate how the night-light is fixed to the wall, ceiling or cot; [3]

(v) quality of communication. [6]

(i) Show the general look of your design.

(ii) Draw a clear BLOCK diagram showing the INPUT, PROCESS and OUTPUT of the control system.

(iii) Draw a fully labelled circuit diagram of your system.

(iv) Show details of how the night-light is fixed in position.

For continuation only.