Candidate Name	Centre Number	Candidate Number
		0

WJEC CBAC

GCSE

142/04

DESIGN AND TECHNOLOGY

PAPER 2

FOCUS AREA: SYSTEMS AND CONTROL TECHNOLOGY

Higher Tier

A.M. MONDAY, 2 June 2008

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.

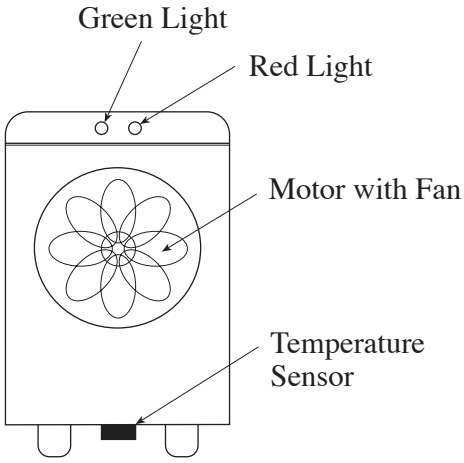
Write your answers in the spaces provided in this booklet. Where the space is not sufficient for your answer, continue the answer at the back of the book, taking care to number the continuation correctly.

INFORMATION FOR CANDIDATES

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

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

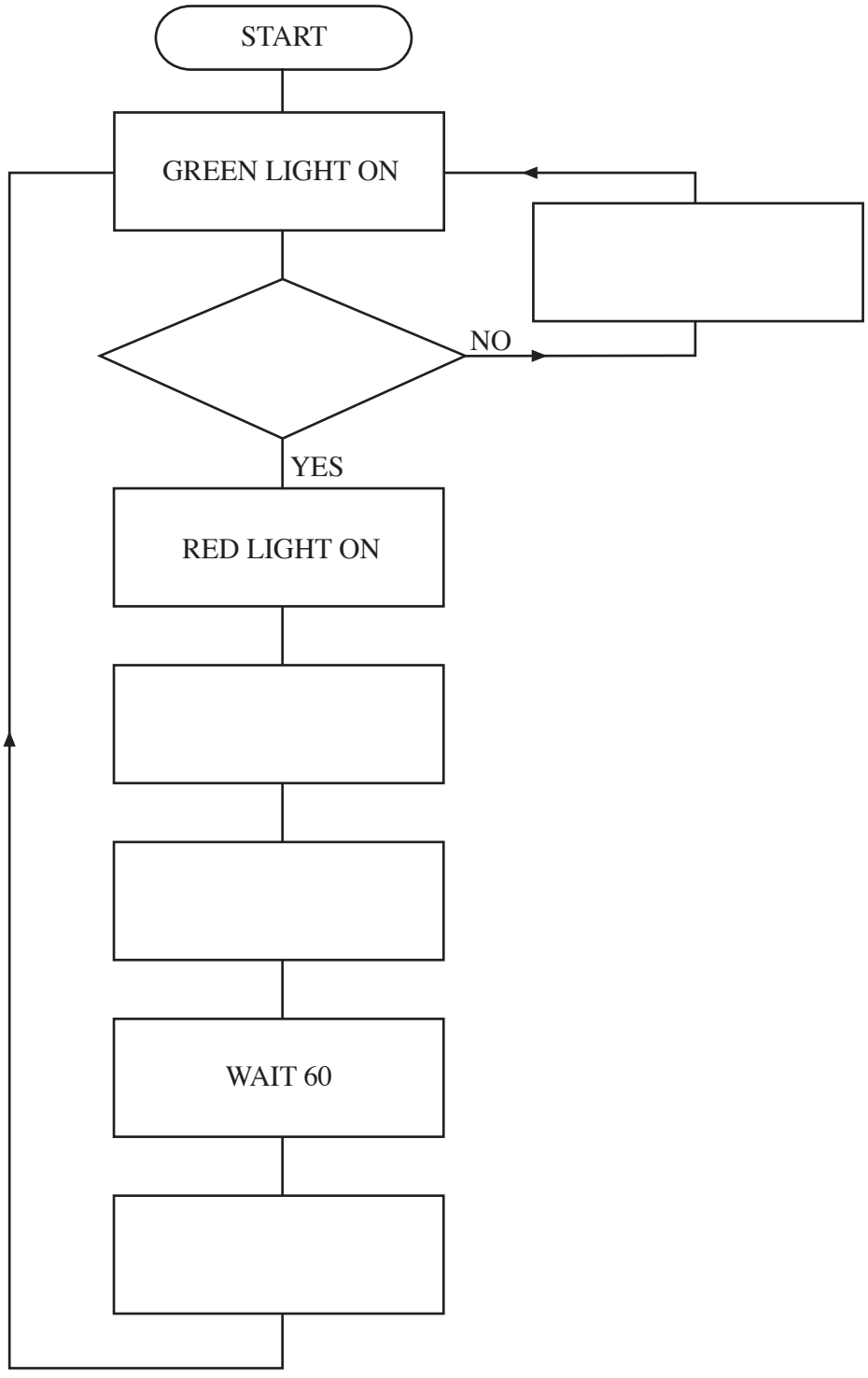
1. *(a)* An air conditioning unit activates a cooling fan when the room temperature reaches 75 °C.



(i) Place a tick (✓) in the correct column to indicate whether each of the parts listed is an input or output of the system. [3]

	Input	***Output***
Green Light		
Temperature Sensor		
Fan Motor		

(ii) The diagram below shows a flowchart which will activate the fan when the temperature is above 75 °C. The green light will be on when the room is cool and the red light will be on when the room is hot. Using the statements on the right, complete the flowchart. [5]



Statements:

Fan Motor on.

Green Light off.

Is Temperature >75 °C?

Fan Motor off.

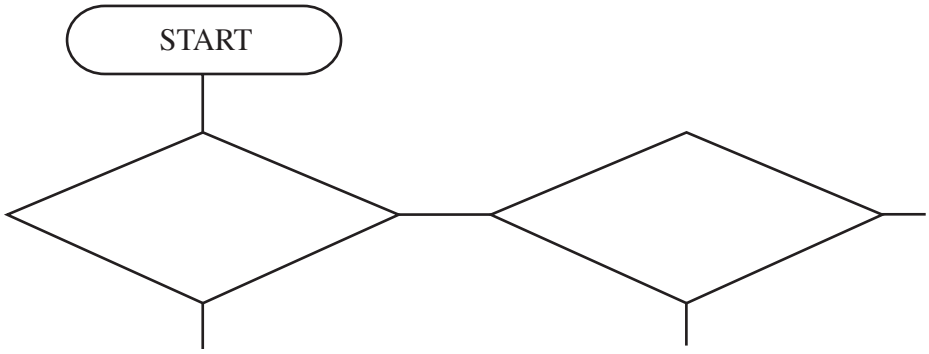
Red light off.

(iii) Explain the reason for the command **WAIT 60** in the flowchart. [2]

.....

.....

(b) (i) Complete the flow chart below so that the fan will run at full speed if the temperature is above 75 °C and at half speed if the temperature is above 65 °C but below 75 °C. [7]



(ii) A Programmable Interface Controller (PIC) could be used in the air conditioning unit. State **two** advantages of using this device. [4]

Advantage 1: .....

.....

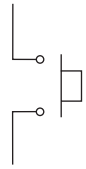
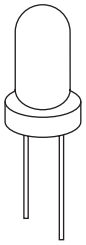
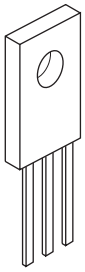
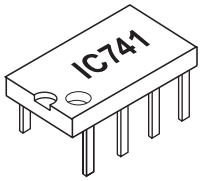
Advantage 2: .....

.....

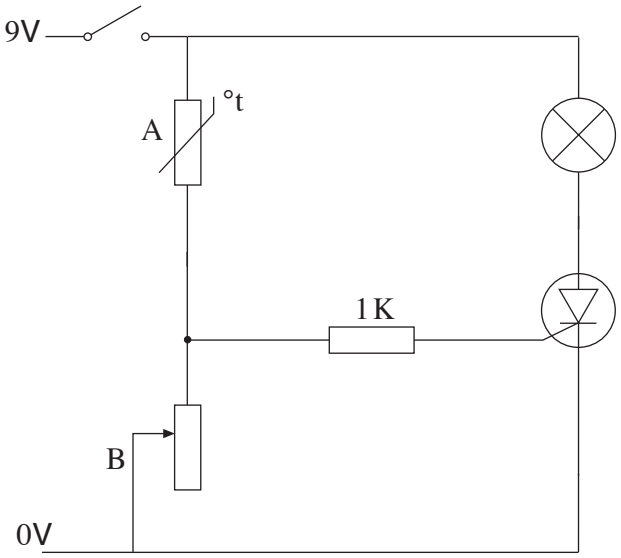
BLANK PAGE

2. Study the electronic components below.

(a) Fill in the spaces in the table to complete the missing electronic symbols or drawings. [5]

Electronic Symbol					
Sketch of actual Component					

(b) (i) The circuit shown below has been designed for use in a greenhouse to warn a gardener that frost is likely. Name components A and B and describe their function in this circuit.



Name Component A: ..... [1]

Function: .....

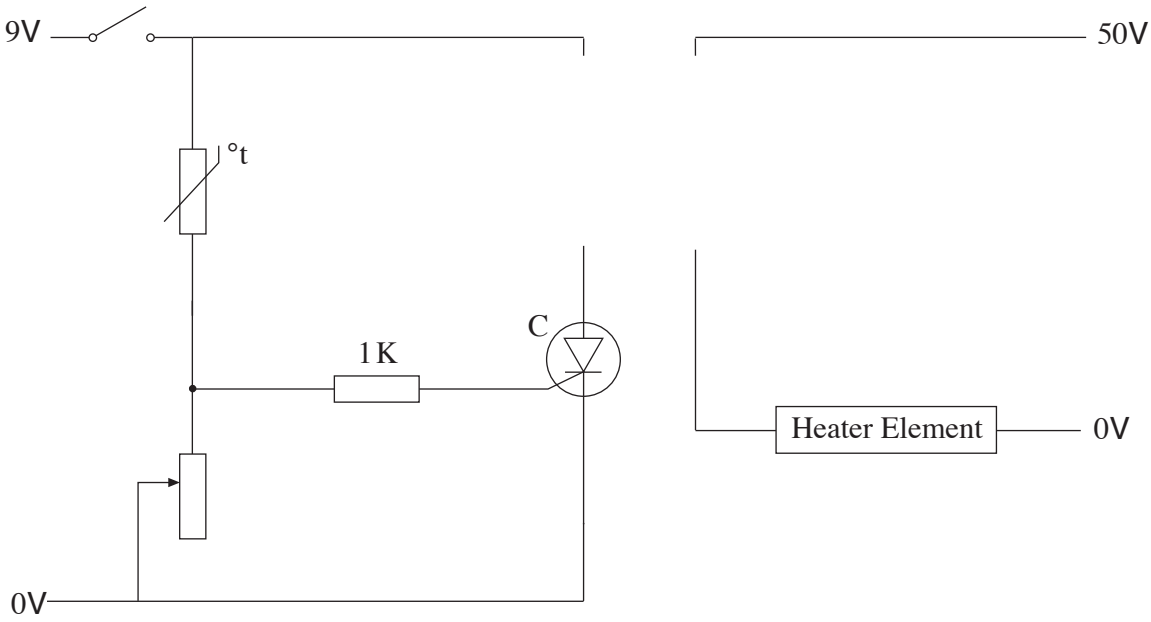
..... [2]

Name Component B: ..... [1]

Function: .....

..... [2]

(ii) The previous circuit in *(b)*(i) controls a low current lamp. Complete the circuit started below so that it can control the 50 V Heater element. Show and label all additional components. [3]



(iii) Describe why component C would not be the most suitable component to use in this circuit. [2]

.....

.....

(iv) Describe **two** different methods that the designer could use to model this circuit to check it works before constructing it. [2 × 2]

Method 1: .....

.....

.....

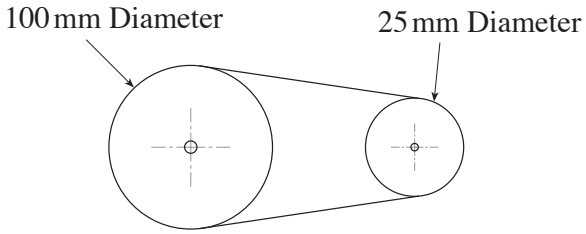
Method 2: .....

.....

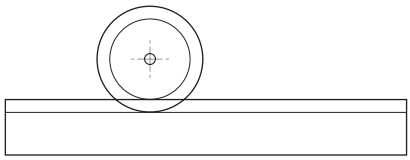
.....

Examiner only

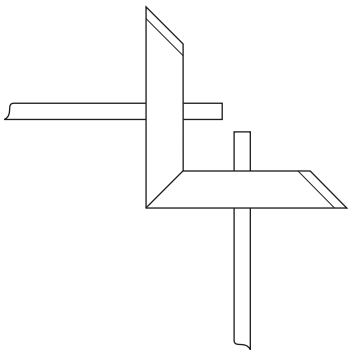
3. *(a)* Study the mechanisms below and complete the sentences that follow.



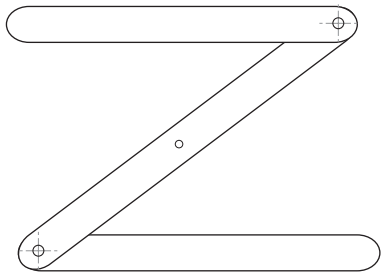
Pulley and Belt



Rack and Pinion



Bevel Gears



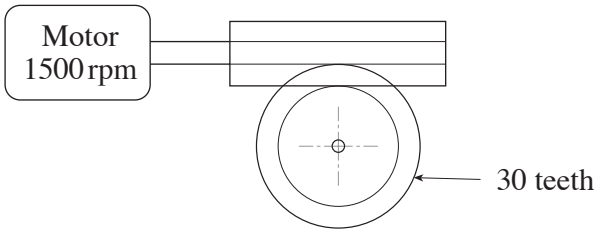
Linkage

(i) The ratio of the pulley and belt system is ..... . [1]

(ii) The ..... transfer rotary motion through 90 degrees. [1]

(iii) A ..... system converts rotary to linear motion. [1]

(b) Calculate the speed of the spur gear in the worm drive system in the space below. *(show all workings)* [3]



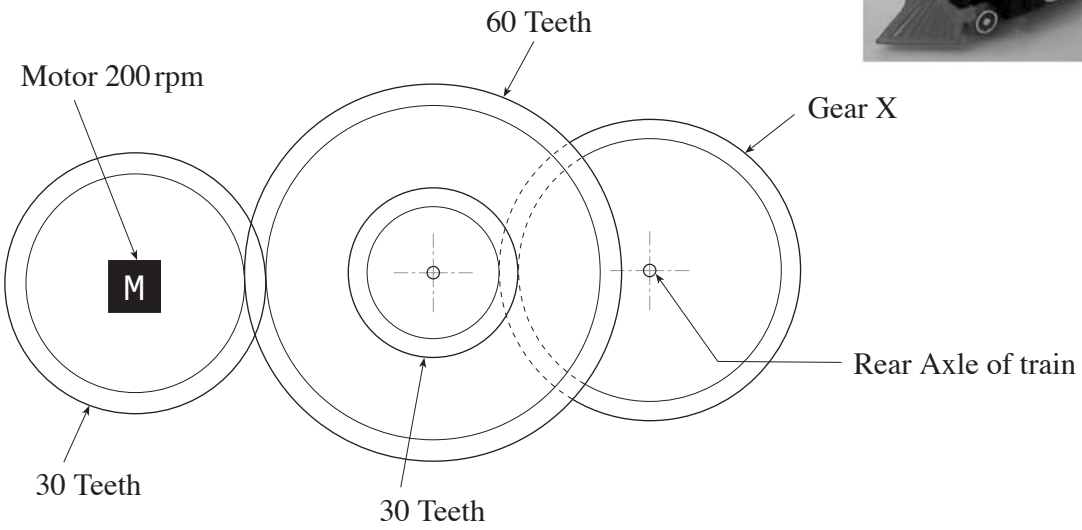
.....

.....

.....

.....

(c) A toy train, like the one shown, is driven by the gear system below. Study the gear system and answer the questions that follow.



(i) Circle the correct word in the statement below. [1]

The gears are arranged in a **simple / compound** system.

(ii) Gear X has a rotational velocity (RV) of 60 rpm. Calculate the number of teeth gear X must have to achieve this. *(Show all workings)* [3]

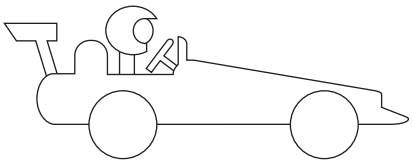
.....

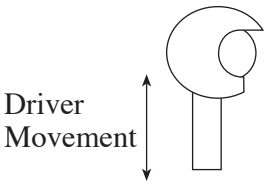
.....

.....

.....

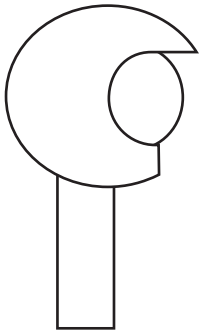
(d) The toy car shown can be pulled or pushed by a child.



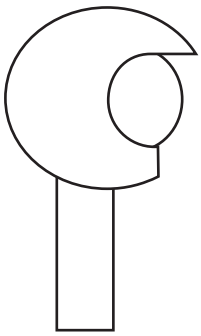


(i) As the car moves, the driver is required to rise and fall. Complete the diagrams below to show **two** different mechanisms to achieve this. [4]

Method 1



Method 2



(ii) Name a suitable wood for making the wheels and give a reason for your choice.

Material: ..... [1]

Reason for choice: .....

..... [2]

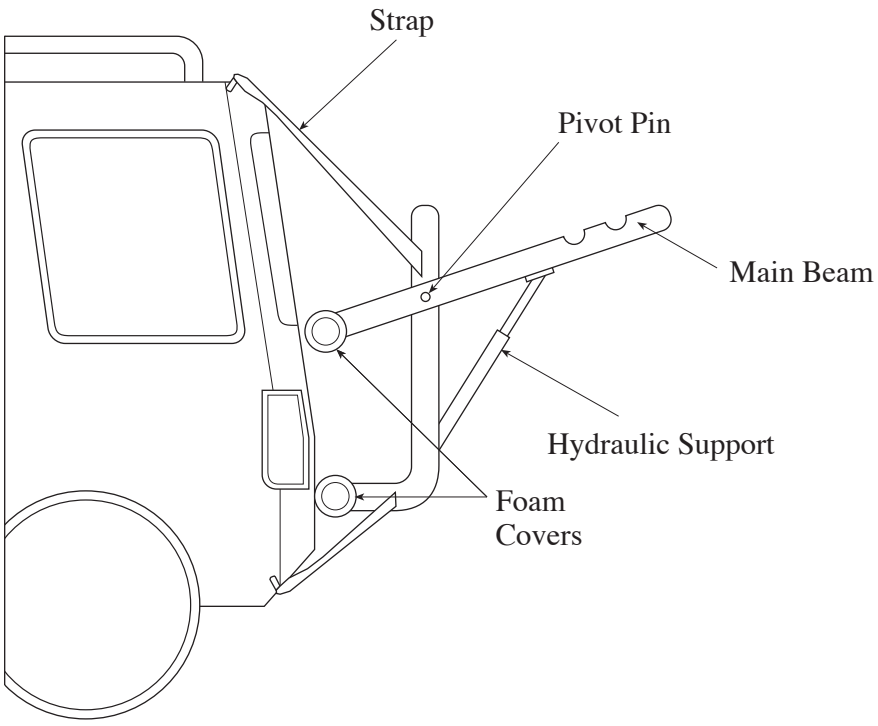
(iii) Explain briefly a method of manufacturing which could be used to make four identical wheels. [2]

.....

.....

BLANK PAGE

4. A bicycle rack for a car is shown below.



(a) When the bicycle rack is loaded a range of forces act on different parts. Study the diagram and complete the statements that follow.

(i) The force acting on the straps is in ..... . [1]

(ii) The ..... will experience a compression force. [1]

(iii) A shear force will be acting on the ..... . [1]

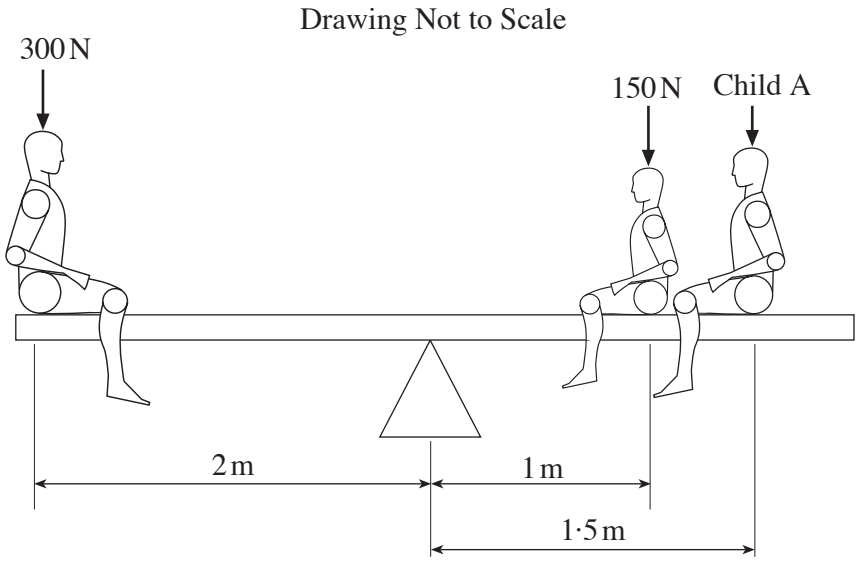
(iv) The main beam will experience a ..... force. [1]

(b) Complete the table below by naming a suitable material for each part giving reasons for the materials selected. [2 × 3]

Part	***Material***	***Reason for selection***
Straps	.....	....
Main Beam	.....	....

(c) The diagram below shows three children on a see-saw. The see-saw is exactly in balance.

(i) The see-saw is an example of a ..... class lever. [1]



(ii) Using the principle of moments, calculate the downward force produced by child A. *(Show all workings.)* [4]

.....

.....

.....

.....

5. A clown who works as a children's entertainer, requires an animated / moving advertisement to promote his act.

SPECIFICATION

The system must:

- start when a switch is pressed;
- be free standing, portable and battery powered;
- produce a fun / novelty movement to promote the entertainer.

Sketch your design in the boxes given.

Marks will be awarded for:

(i) labelled sketch showing the front of the advertisement; [5]

(ii) a labelled circuit diagram showing details of any electronic components used; [4]

(iii) labelled details of the mechanical system used to create movement; [4]

(iv) including three important dimensions; [3]

(v) names of any materials used; [3]

(vi) quality of communication. [6]

(i) Labelled sketch showing the front of the advertisement.

(ii) Labelled circuit diagram.

(iii) Labelled details of the mechanical system.

Examiner only

For continuation only

(142-04)