

Annual Examinations for Secondary Schools 2022

YEAR 11	DESIGN & TECHNOLOGY	TIME: 1hour 45min
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Name: _____

Class: _____

----- **Note to students:** -----

You are required to answer all questions.

The 'Design Idea sheet' should be provided to answer question 9. Ensure this includes student name and class and is enclosed in the paper.

Use of calculator is allowed. Geometry drawing instruments are required.

FOR TEACHERS' USE ONLY

DISTRIBUTION OF MARKS

	Areas / sections corrected			Marks for Written Exam	Marks for Design Folio	TOTAL	FINAL MARK
	A Core D&T	B Design	C Technology				
Max. Mark	20	25	55	100	100	200	%
Student's mark							

Enter student's mark obtained in every section in the above table.

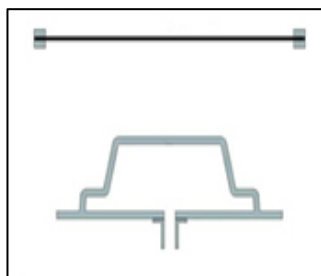
Core D&T is based on all the subject aspects; **Design** covers the Design aspect, and **Technology** covers Materials (20-25), Systems & Control (25-30) and Graphics (5-10), within the Technology aspect of D&T.

Section A: Core D&T

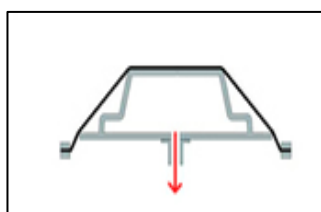
20 marks

1. Answer the following questions referring to figure 1.

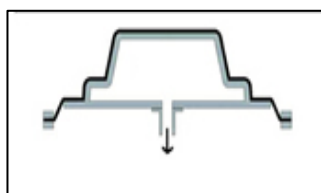
- a. In your own words, briefly explain what happens in every stage shown below, when using a vacuum former. One step has been given.



Step 1.



Step 2. *Heated sheet is sealed to the mould and vacuum is applied*



Step 3.

Figure 1

(2 marks)

- b. Mention the name of one suitable plastic material that is normally used for vacuum forming shells.

(1 mark)

2. Figure 2 shows an aluminium profile which is typically used to quickly assemble a metal structure. Underline the proper fabrication method used to produce such a profile.

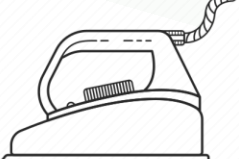
Injection moulding	Extrusion	Thermo bending
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Figure 2

(1 mark)

3. In the space provided, write the proper name of the following items and their use:

Tool	Name	Use
		
		
		
		
		
		

(6 marks)

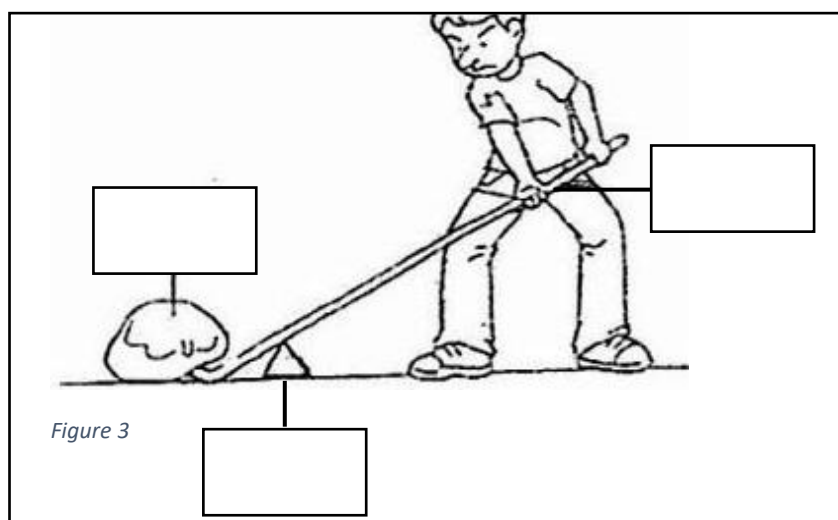
4. Complete the following sentence which refers to a particular heat treatment used for metals.

The process of heating a metal or alloy to an appropriate temperature for a certain period of time and then slowly cooling it down is called _____.

(1 mark)

5. Figure 3 shows a boy trying to lift a heavy stone by means of a long stick.
- Name the class of the lever being used: _____
 - Label correctly the diagram in figure 3 using the following key words.

Fulcrum – Load – Effort



(1 mark x 4 = 4 marks)

6. Categorise the following materials into their class or origin.

Use the given word bank to complete the table below:

Thermoplastic – Cellulose base – Mineral – Hardwood – Mineral

Material	Class	Origin
Cast iron	Ferrous	
Oak		Organic
Flax		Organic
Carbon fibre	Mineral base fibres	
ABS		Petroleum

(1 mark x 5 = 5 marks)

SECTION B: Design Aspect

25 marks

Read carefully the Thematic Situation presented below. While 'games' are the theme of both section B and C, all questions in Section B refer to the situation below.

Theme: **Games.** Situation: ***Escape-the-room toys***

Children play with toys that make them imagine situations in the real world. Games sometimes need special toys to be played and make us experience strong feelings of happiness, reward, competition and sometimes also fear or disappointment. An escape-the-room is a fun game challenging people of all ages to solve puzzles together and unlock different clues to 'escape' or exit from a room or open a door. A company called 'Think & Play' is exploring producing small, portable toy products based on this appealing game idea, for anyone over 12 years of age.

7. In order to start research on this situation, the following possible research areas were identified.

Puzzles, mystery games, mechanisms and secret compartments

- a. In the space provided below, draw a Web diagram around the given theme, showing these research areas. Add another TWO new research areas to your web diagram and ONE example for each area listed.

**Escape-the-room
Toy**

(4 marks)

- b. The toy will be aimed at people who like mystery and solving puzzles, ideally from 12 years upwards. From the data presented suggest who are the stakeholders that:

i) Will produce this device: _____

ii) Will design this product: _____

(2 marks)

8. Some specifications were written for this project.

- a. Write a specification based on the given keywords:

i) Collaboration: _____

ii) Health & Safety: _____

(1 mark x 2 = 2 marks)

- b. Mention ONE other specification that can be used for this project:

(1 mark)

9. **Design Ideas.** Some interesting design concepts for the toy are given below:

- *Reed switch magnetic door using a magnet hanging on a fishing line*
- *Twist 2 knobs using pulleys to open a lid*
- *Assemble a gear train to turn a lock open*

Using both sides of the Design Idea sheet provided, design **TWO completely different** design ideas, based on **ONE** of the concepts above. The sketches should include colour rendering or shading, annotations and dimensions, explaining further your designs. Briefly explain the need identified for each idea through annotations.

(4 marks x 2 = 8 marks)

10. Write a Final Design Brief for the design idea you identified as the chosen idea.

(3 marks)

11. During testing of the chosen idea a group of people were called to carry out some tests. The following test was carried out: **Product usability test**. Answer the following questions related to the test above:

- a. Underline who can be called to participate in this test:

0-11 year old kids, anyone over 12 years, professional gamers

(1 mark)

- b. 30 participants took part in the test. 10 groups took 1 hour, some took less than 30 minutes and only 1 group took less than 10 minutes to solve the game. Explain how such test results could help the design:

(1 mark)

12. The Data from another product was recorded in table 1:

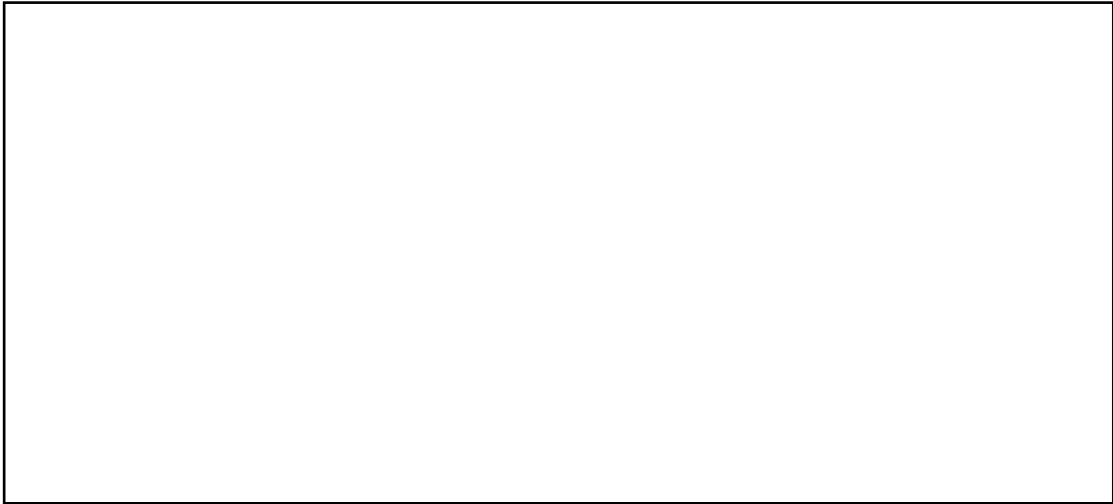
Part Name	Material	Cost each	Quantity	Overall cost
Handle 3	Wood	€3.0	1	€3
Long Axle	Steel	€0.25	4	€1
Arm cushion	Textile	€2.0	2	
Case Sides	Plastic	€0.50		€2

Table 1

- a. Complete the data above.

(1 mark)

- b. DRAW **freehand** any infographic 2D chart to illustrate how the OVERALL COST of Wood, Steel, Textile and Plastic parts compares in this product. Render each section with a simple texture pattern representing each material. The chart can be of any type and size but ratios need to closely represent the data above.



(2 marks)

Section C: Technology Aspect

55 marks

13. Figure 4 shows a sketch of a puzzle game for toddlers being submitted for amendments before manufacturing. The game is played by placing the correct cube having the correct initial letter, next to the correct picture. For each correct answer, an LED is lit and when all answers are answered correctly, a disc (A) showing a well-done note spins for few seconds.

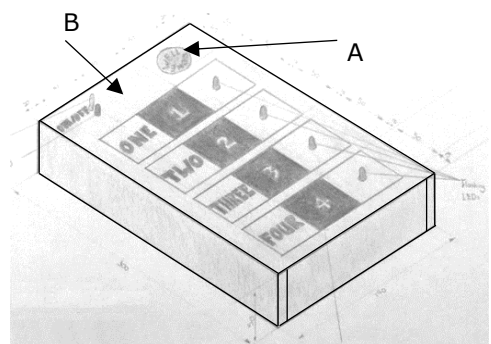


Figure 4

- a. The sides of the game case are made from 12mm MDF wood. The joining method used to join the sides of the game case is shown in figure W. Underline the correct type of joining method being used from the list given below.

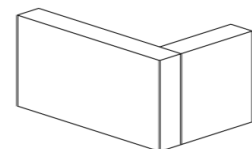


Figure W

Dovetail joint	Butt joint	Mitre joint	Housing joint
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(1 mark)

- b. State **ONE** standard form of supply and **ONE** suitable polymer material from which the top face (B) of the game can be made.

(2 marks)

- c. Mention **ONE** fastener that may be used to join the top face to the case of the game, knowing that the top face can be easily removed to access the inside of the game shown in figure 4.

(1 mark)

- d. State **ONE** safety amendment/improvement you would make to the game case shown in figure 4 and give a **valid reason** for your answer.

(2 marks)

14. Figure 5 shows one of the square blocks to be inserted in the puzzle game.

- a. In the space provided below, sketch in freehand Oblique projection the block shown in figure 5.

(3 marks)

- b. Colour all 3 faces of the block in your sketch using **TWO** complimentary colours to look more attractive.

(2 marks)

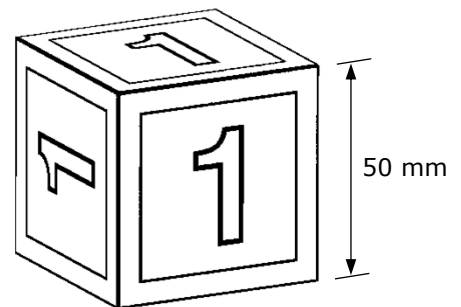
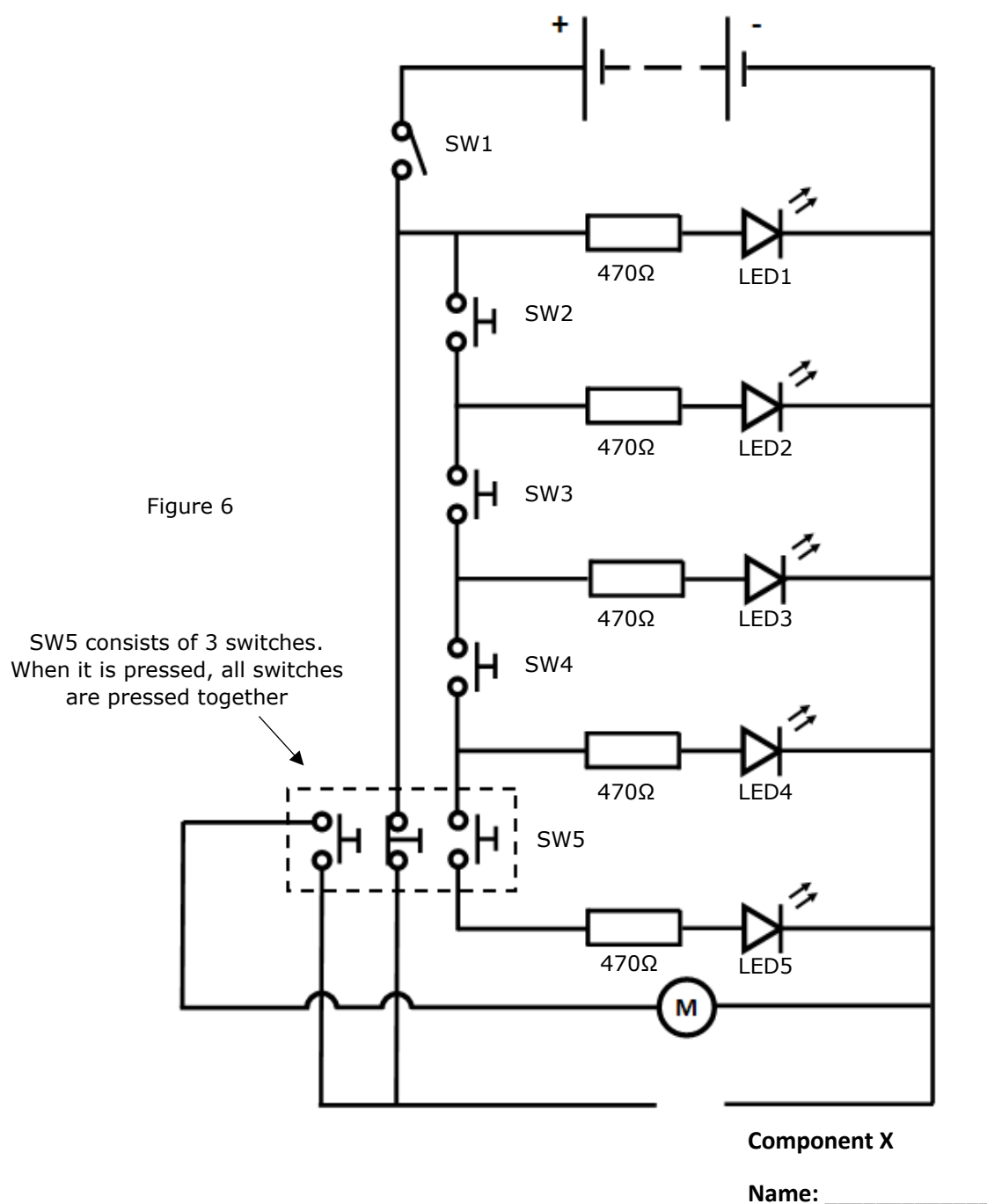


Figure 5

15. Figure I shows an incomplete circuit used in the puzzle game shown in figure 6.



- On the circuit provided figure 6, **circle** the motor in the circuit.
(1 mark)
- In figure 6 a missing component 'X' will provide a charge to make the LED light and the motor spin for a short period of time. On the circuit provided figure 6, **draw the symbol** of the missing appropriate analogue component (X), labelling it with its full name and polarity.

(3 marks)

16. Figures 7, 8, 9 show 3 designed parts of a toy windmill to be cut by a CNC machine.

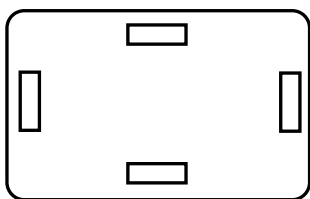


Figure 7

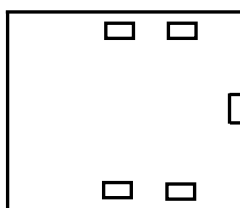


Figure 8

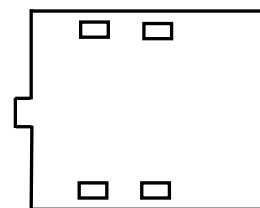


Figure 9

- a. From the list provided below, choose the correct CNC machine which should be used to cut the following designs from 3mm plywood.

Embroidery machine	Laser cutter	3D printer	Vinyl cutter
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(1 mark)

- b. Figure 10 below shows a piece of 3mm plywood. Sketch the outlines of figures 7, 8 and 9 on figure 10, below, as if they are going to be cut, taking care of wastage.



Figure 10

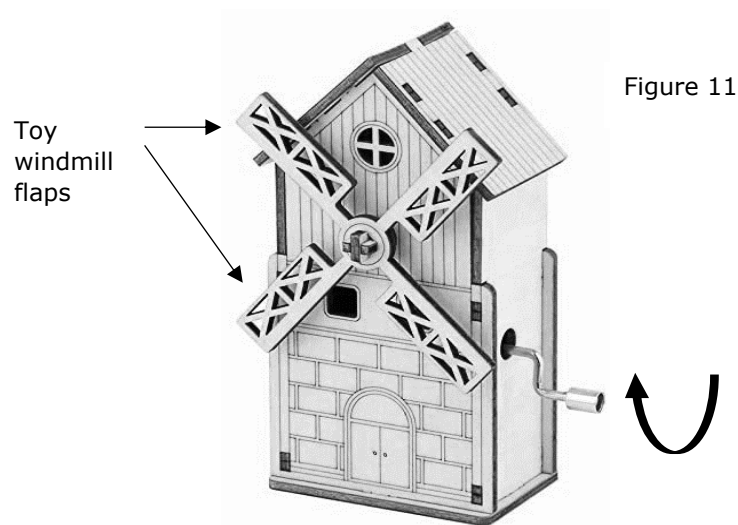
(3 marks)

- c. The parts cut from Figures 7,8 and 9 are made of 3mm plywood. From the list provided below, select the correct type of classification for plywood.

Natural wood	Man-made board	Hard wood	Soft wood
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(1 mark)

- d. Figure 11 shows the result when all the parts of the toy windmill are assembled together. In the space provided below, **sketch** in 2D or 3D and **label** a mechanism that enables the windmill flaps to turn when the crank is turned.



(3 marks)

- e. From the list provided below, underline the correct type of motion of the windmill flaps, when they are turned.

Linear	Reciprocating	Rotary	Oscillating
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(1 mark)

- f. Continue the following paragraph by inserting appropriate words and phrases in the spaces provided. A guide is written in brackets for each word or phrase.

The user decided to give the roof of the toy windmill a different smooth finishing. The user first removed the parts and put on a (PPE) _____ as a safety measure. To (technique) _____ the parts, the user used a glass paper. Before applying paint, as a safety precaution the user (safety measure) _____. Then (Type of paint) _____ was applied by using a (tool) _____ for a better finish.

(5 marks)

17. Figure 12 shows the power source used in various toys and games.

- a. Name the **type** of battery being illustrated in figure 12.

_____ (1 mark)

- b. State the difference between a Primary battery and a Secondary battery.

_____ (1 mark)



Figure 12

- c. State **ONE** advantage and **ONE** disadvantage of using a Secondary battery in toys and games. _____

(2 x 1 mark = 2 marks)

- d. Mention the name of an instrument used in electronics to measure voltages, currents and other readings related to electronic circuits. _____

(1 mark)

18. A teacher in a particular school set a situation for his students to design a digital board game to be played between two players. The game consists in being first to press a button and answering questions, like in a quiz.

Figure 13, below shows an incomplete circuit of the board game which includes a switch (SW2) and an output (D1) for player 1.

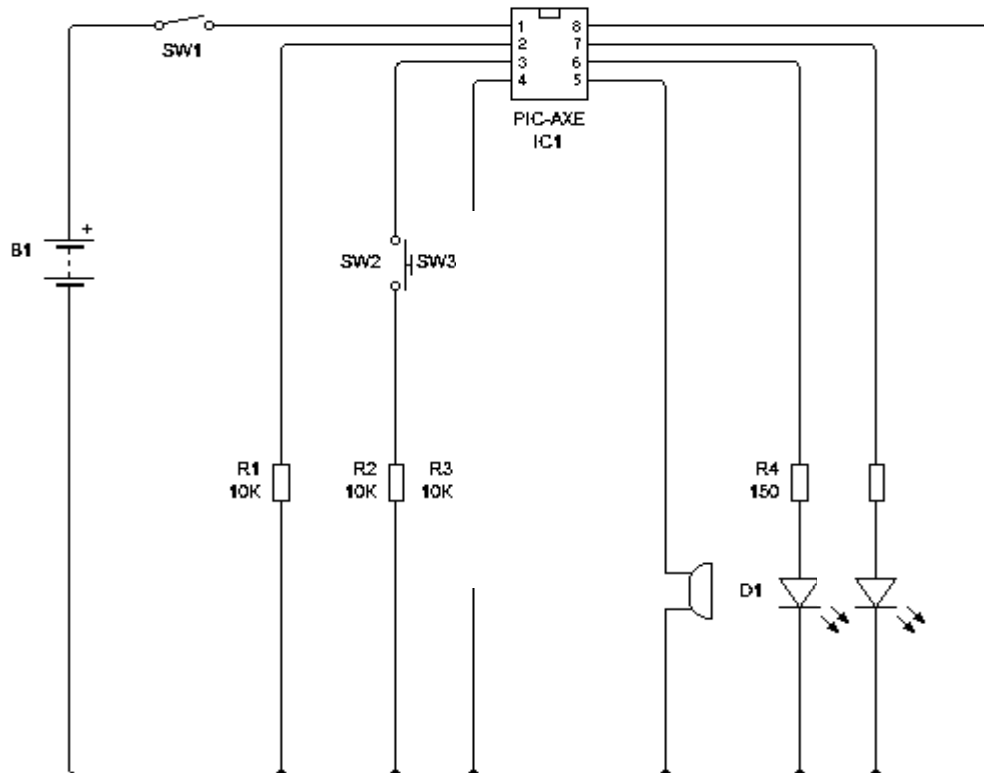


Figure 13 - Circuit

The data sheet shown in figure 14 below, gives more information about the IC pinouts.

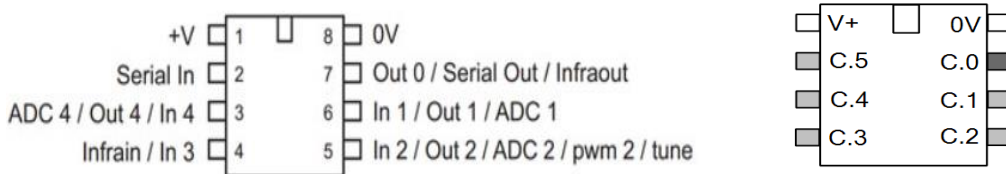


Figure 14 – Data sheet

- a. On the circuit above, figure 13, complete the schematic circuit by:
- Drawing the 2nd player input components at SW3 and R3.
 - Labelling the 2nd player light output components as D2 and R5 150.
 - Labelling the common output buzzer as BZ1.

(5 marks)

b. For resistor R4, what unit should the number/value 150 use? _____

(½ mark)

c. From the given circuit, what type of switch is SW2? _____

(½ mark)

d. What is the voltage needed to operate a PIC? _____ V. (1 mark)

19. Figure 15 shows an incomplete flowchart program for the circuit in figure 13, for **PLAYER 1** only. Player 2 section is identical to P1 and is shown as P2 connector.

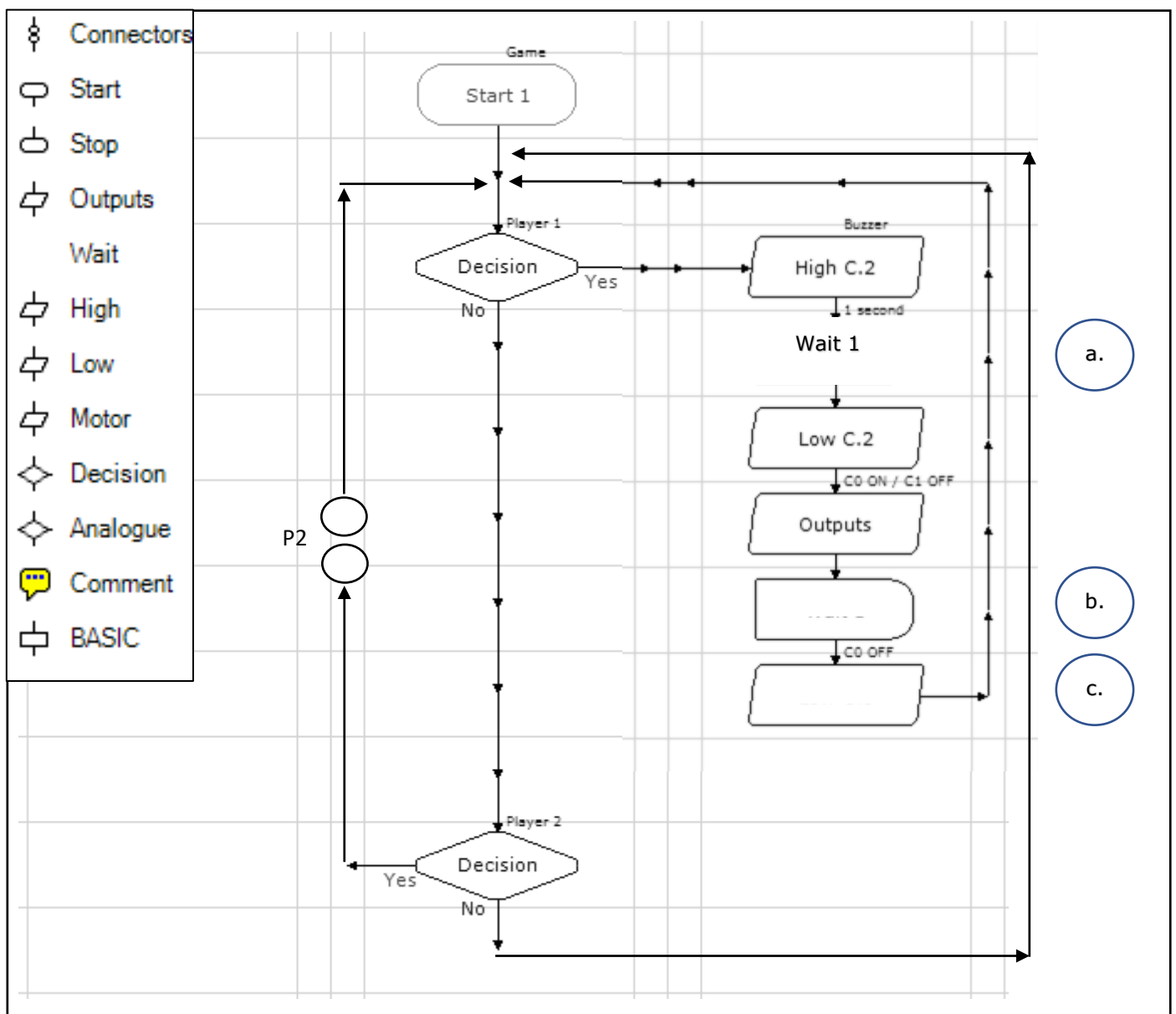
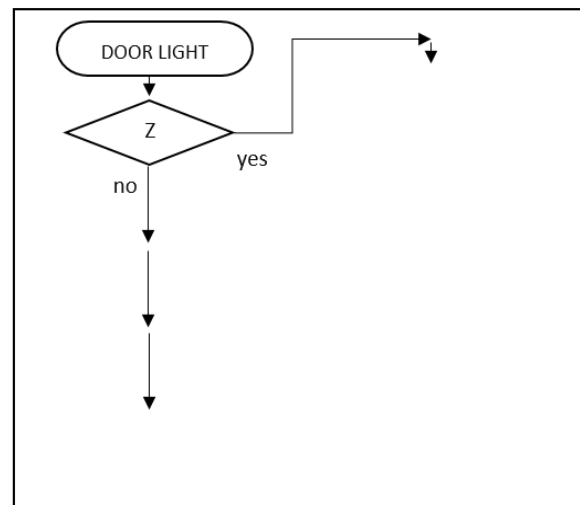


Figure 15

- a. Answer the following related questions on figure 15:
- Draw the flowchart symbol needed at hint 'a.'
 - Label the command needed at hint 'b.' for a duration of 1 second.
 - Using the written instruction 'C.0 OFF' at hint 'c.', label the command needed. **(3 marks)**
- b. In which of the following cases should the player 1 programme start? Refer to data sheet in figure 14. Underline the correct answer: **(2 marks)**
- When SW1 is pressed
 - When IC pin C.1 is high
 - When IC pin C.4 is high
- c. '**DOORLIGHT**' is a different flowchart using a similar IC.

- Complete the flowchart by adding the 3 commands that would make an output called 'X' ON for 10 seconds, then switch OFF. Assume that input 'Z' is a latching switch set on 'ON'.
- Draw additional arrows that make this command loop until input Z is 'ON'. **(5 marks)**



d.

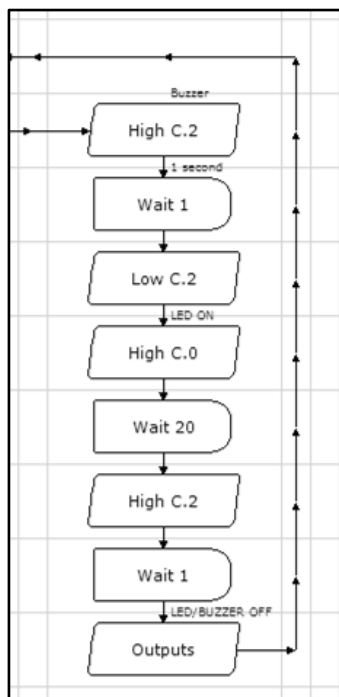


Figure 16

Referring back to the game from figure 13, study carefully the following modified circuit shown in figure 16, for player 1 and answer the following questions:

- What is the function of the 'High C.2' command shown near hint 'i.'?
_____ **(1 mark)**
- When do we use the 'OUTPUTS' command?

_____ **(1 mark)**
- The 20 sec wait will make the game better. How?

_____ **(2 marks)**