

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2017 SESSION

SUBJECT: **Design and Technology**
 PAPER NUMBER: IIA
 DATE: 2nd May 2017
 TIME: 4:00 p.m. to 6:05 p.m.

Instructions and Information

Answer **ALL** ten questions. Each question carries 10 marks.

Non-programmable calculators are allowed

Formula:

$P=IV$

Resistor colour code chart:

Colour	Band 1	Band 2	Band 3 (No. of 0s)	Band 4 (Tolerance)
Black	0	0	None	
Brown	1	1	0	
Red	2	2	00	
Orange	3	3	000	
Yellow	4	4	0000	
Green	5	5	00000	
Blue	6	6	000000	
Violet	7	7	-	
Grey	8	8	-	
White	9	9	-	
				Gold = $\pm 5\%$
				Silver = $\pm 10\%$

DESIGN PROCESS

Situation: A new science centre called ‘Discovery Centre’ is seeking a technology-related souvenir that shall be sold in its gift shop. The scientific theme suggested for this design shall be ‘Mechanisms are Fun’.



The Discovery Centre logo is given here for reference:

Question 1

a. Write a Design Brief for the design and make of this souvenir with reference to the above situation.

(2)

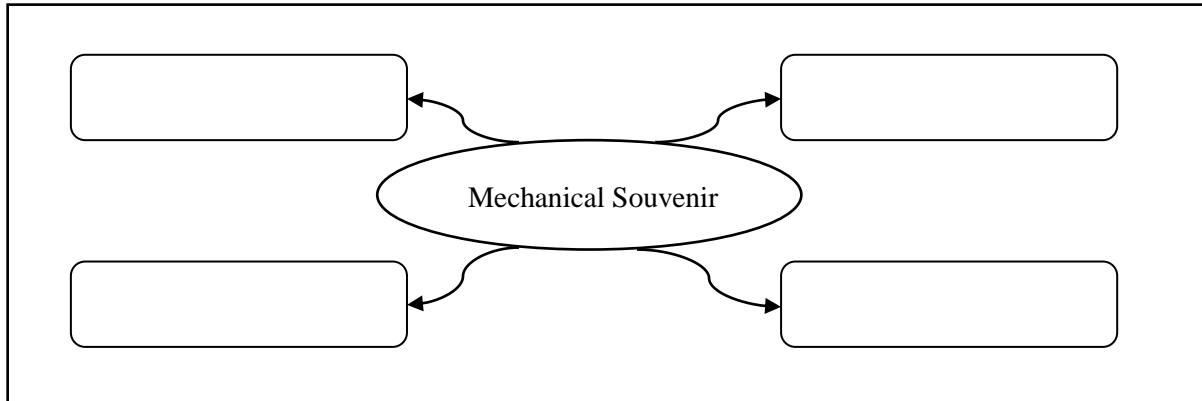
b. In order to carry out some research, mention **TWO** primary sources that could be used to learn more about the design of the souvenir. Explain why these sources are useful.

- i. Source: _____
Explanation: _____
- ii. Source: _____
Explanation: _____ (3)

c. Complete the following Specifications by defining them further in order to guide your design.

- i. The souvenir shall be suitable for a target visitor of ages between _____.
- ii. The _____ to manufacture should not exceed €2.
- iii. The _____ - _____ should be not more than €4.
- iv. The maximum _____ for the item should be L20 cm × W10 cm × H10 cm.
- v. The item must have at least two moving _____ and be safe to use.
- vi. The item needs to be attractive and show the Discovery Centre logo. (3)

d. In order to explore the product further, complete the following (web) diagram with any **FOUR** main aspects you should consider in your design:



(2)

(Total: 10 marks)

Question 2. This question refers to the Situation in Question 1.

- a. In the space provided on pages 4 and 5, sketch **TWO** ideas for the Design Brief. Add colours, annotations, dimensions, and other information which describes the features of this design. (6)
- b. Identify which idea you want to choose from part (a) and discuss **ONE** advantage and **ONE** disadvantage this offers.

Chosen Idea: _____

Advantage: _____

Disadvantage: _____

_____ (2)

c. Describe briefly **ONE** process required in the making of your idea and **ONE** safety precaution that should be taken during this process.

Process: _____

Precaution: _____ (2)

This question continues on next page.

2a. IDEA 1

2a. IDEA 2

(Total: 10 marks)

RESISTANT MATERIALS

Question 3

Figure A shows a possible design for the mechanism of an extendable wooden table. The surface is made of **THREE** main parts, one of which is hinged underneath and therefore hidden if the table is in normal mode. When the left and right table halves slide away from each other, the folding centre can be opened and flipped in place.

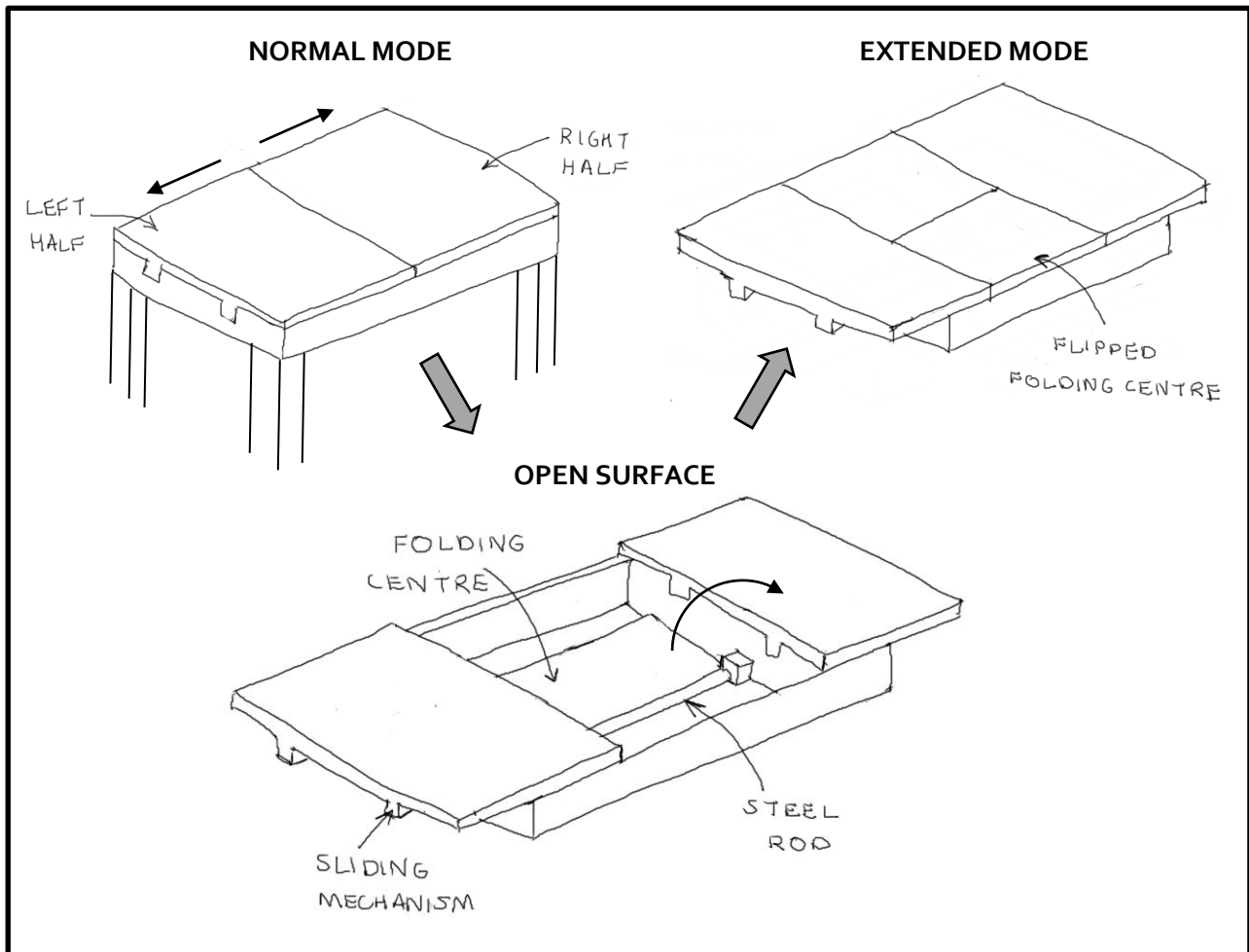


Figure A: Extendable table surface mechanism

- a. Determine the type of motion occurring when:
- i. the table halves slide away from each other;

- ii. the folding centre is opened and flipped in place.

(2)

b. Figure B shows a 3D view of the folding centre mechanism. The folding centre will rotate about the steel rod and fold from the hinges to double in size.

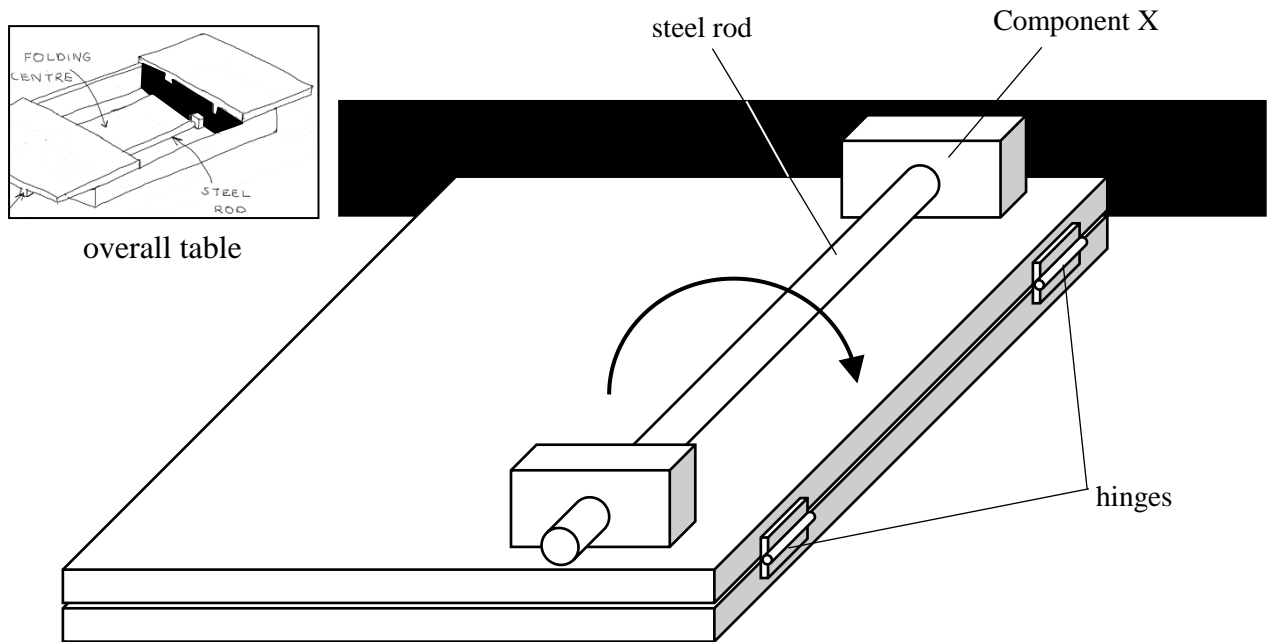


Figure B: Folding centre

i. Tick whether the following statements are **true** or **false** and give a reason for your answer in Table 1.

Table 1

STATEMENT	TRUE	FALSE	REASON
Figure B is drawn in isometric.			
The mechanism shown in Figure B has two pivots.			

(3)

ii. The hinges could be made of brass. Describe the composition of this alloy and give **ONE** reason why it would be suitable to use in this mechanism in Table 2.

Table 2

COMPOSITION	
REASON	

(2)

This question continues on next page.

- iii. By using sketches, explain how wooden component X can be joined to the folding part without damaging the surface of the table. Annotate your sketches.

(3)

(Total: 10 marks)

Question 4

- a. Consider the **TWO** scenarios given in Table 3. Complete the table by suggesting the most suitable wood which could be used for the surface of the extendable table. Give a reason for each of your choice of wood.

Table 3

SCENARIO A:	The design will be used to manufacture low-cost, do-it-yourself tables which will be assembled and painted by the customers.
Name of wood:	
Reason for choice:	
SCENARIO B:	The design will be used to produce one-off furniture for high-end customers.
Name of wood:	
Reason for choice:	

(3)

- b. Tick the correct column in Table 4, to determine the class of the two woods mentioned in part (a).

Table 4

	CLASS OF WOOD		
	Hardwood	Softwood	Manufactured Boards
SCENARIO A			
SCENARIO B			

(1)

- c. A chisel, as shown in Figure C, is a tool which can be used in the process of making such a table. The steel blade of such a tool needs to be hardened and tempered.

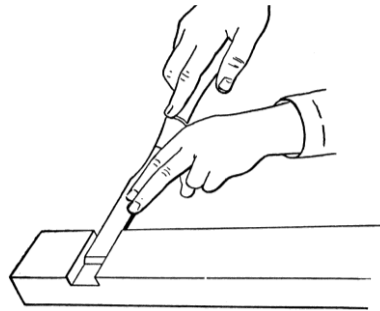


Figure C

- i. State **ONE** reason why such a blade needs to be:

hardened; _____

tempered. _____ (2)

- ii. Explain how the hardening process is achieved on such a steel blade.

 _____ (2)

- d. The current design of the sliding mechanism as shown in Figure D has a potential of failing because it can easily trip out of its channel. Complete the table by redesigning the cross-section of the channel to avoid tripping.

CURRENT CROSS-SECTION	PROPOSED CROSS-SECTION
<p>Figure D</p>	<p>_____</p>

(2)

(Total: 10 marks)

ELECTRONICS

Question 5

Some home-owners are using electronic systems which control everyday tasks in their homes to make their lives easier. An electronic system is used to open and close automatically an awning as shown in Figure E. Figure F shows a simple prototype circuit schematic of the awning control system.

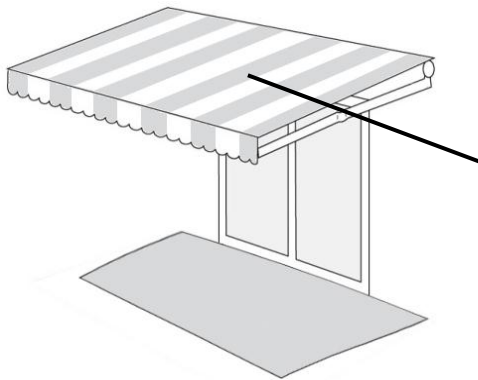


Figure E

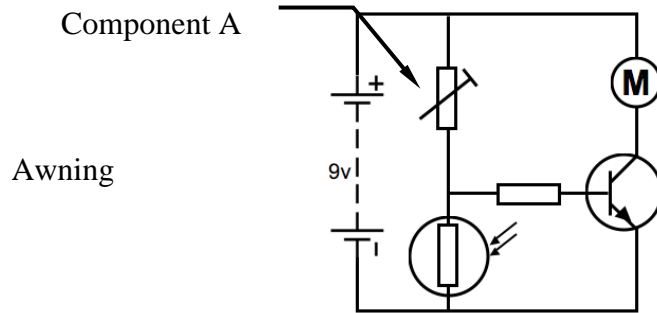


Figure F

- a. Name the component in Figure F labelled as 'Component A': _____ (1)
- b. Complete the circuit, shown in the schematic in Figure F, on the strip-board layout diagram in Figure G.

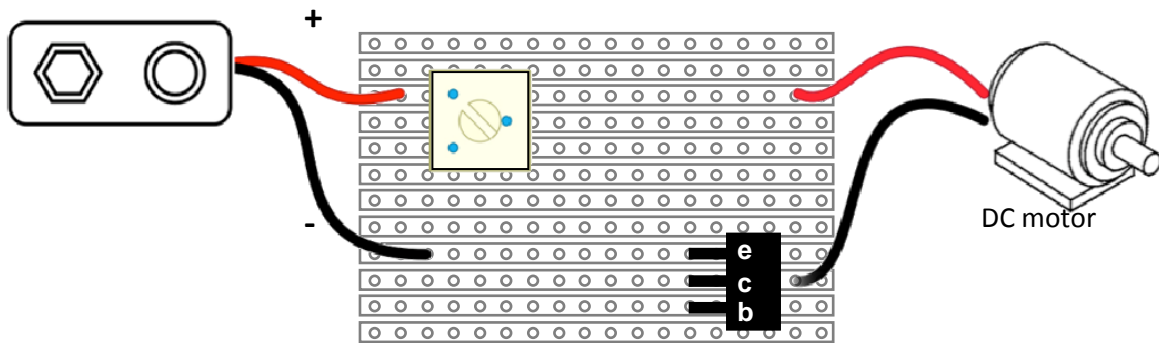


Figure G

(3)

- c. Suggest a component instead of the LDR that could be used to sense when the awning should open:

Component: _____

Give a reason for your choice:

_____ (2)

- d. A micro switch is being used to stop the motor when the awning is fully open. The switch will be triggered when part of the frame presses the micro switch.

On the given image below (Figure H) sketch how the switch, battery and the motor circuit could be connected together to achieve the desired function explained above.

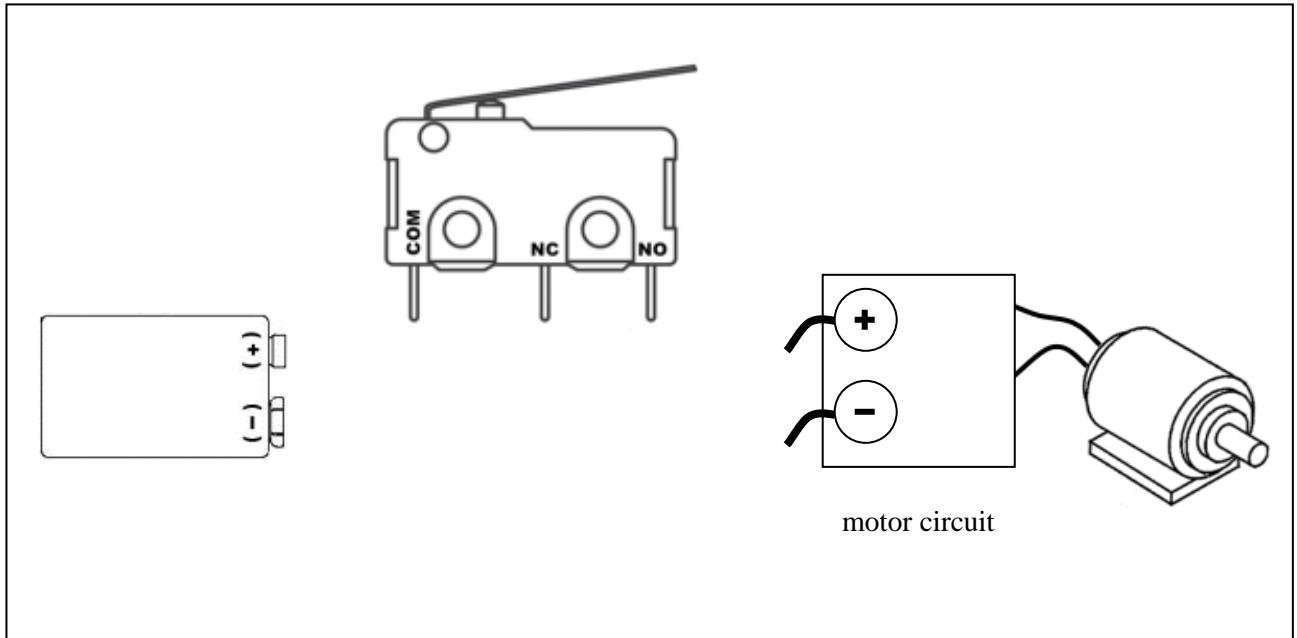


Figure H (2)

- e. A standby LED output was added to this system. The standby indicator LED lights when the light sensing circuit is 'off', and the micro switch is 'on'. Complete the truth table for this particular system.

INPUT (light sensing circuit)	Micro switch	LED OUTPUT
0	0	
0	1	
1	0	
1	1	

(2)
(Total: 10 marks)

Please turn the page.

Question 6

For safety reasons, an indicator lamp placed next to the awning, in Question 5 will alert bystanders that the awning is being operated. It was decided to control the lamp using the circuit shown in Figure I.

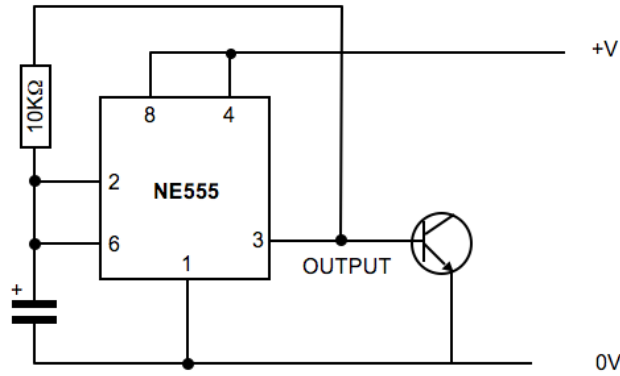


Figure I

- a. Describe the term astable.
_____ (1)
- b. Complete the circuit on Figure I by drawing the missing lamp in the appropriate space.
_____ (1)
- c. Name **ONE** of the components that changes the flashing rate of the lamp.
_____ (1)
- d. What do the numbers around an IC symbol represent?
_____ (1)
- e. Describe the function of the transistor used in the circuit shown in Figure I.
_____ (1)
- f. List the colour for each band of the 10 KΩ resistor shown in Figure I.

Band 1	Band 2	Band 3	Tolerance band
			Gold

(1)

g. Suggest how the circuit system shown in Figure I can be modified to trigger a 20 Watt AC light bulb. Point out which component needs to be removed, and which component should replace it.

Component to be removed: _____

Component to be installed: _____ (2)

h. A 20 W, 240 V light bulb will be used to warn bystanders that the awning is being operated. Calculate the current drawn by the bulb. Show your working.

Answer: _____

(1)

i. On the axis below in Figure J, sketch one cycle of an AC wave.

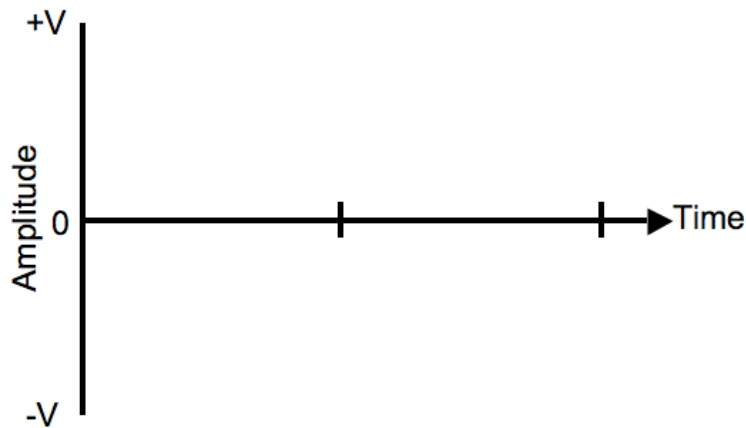


Figure J

(1)

(Total: 10 marks)

Please turn the page.

FOOD

Question 7

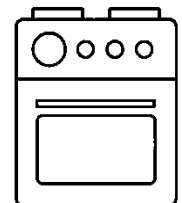
a. In Table 5, shown below, list down the **FOUR** dietary guidelines in order to follow a balanced diet and suggest **ONE** change in eating habits to follow each dietary guideline.

Table 5

Dietary Guidelines	Suggestions
i. _____ _____ (0.5)	i. _____ _____ _____ (1)
ii. _____ _____ (0.5)	ii. _____ _____ _____ (1)
iii. _____ _____ (0.5)	iii. _____ _____ _____ (1)
iv. _____ _____ (0.5)	iv. _____ _____ _____ (1)

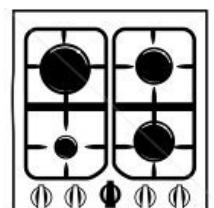
b. List down **ONE** hazard of using an oven to bake a pie.

_____ (1)



c. List down **ONE** hazard when using a hob to fry an omelette.

_____ (1)



d. List **ONE** advantage and **ONE** disadvantage of using a microwave to heat a frozen pizza.


i. Advantage: _____ (1)

ii. Disadvantage: _____ (1)

(Total: 10 marks)

Question 8

a. Fill in the blank spaces to complete the procedure of making yoghurt:

<p>Step 1: Prepare myself (wear apron and cap, remove jewellery, wash hands, etc.)</p> <p>Step 2: Prepare all ingredients and equipment in an organized manner.</p> <p>Step 3: _____ flask and caps with boiling water.</p> <p>Step 4: Heat the milk to _____ °C.</p> <p>Step 5: Add one spoonful of _____ to 250ml fresh milk.</p> <p>Step 6: Pour the milk in the flask, close flask, shake and leave for three hours at _____.</p> <p>Step 7: Leave overnight in a refrigerator.</p>	
--	--

(2)

b. Describe the importance of these steps in the making of yoghurt:

i. Step 3: _____

ii. Step 4: _____ (2)

c. Suggest **ONE** healthy way to add flavour to the yoghurt.

_____ (1)

This question continues on next page.

d. Which cooking method is used to heat the milk in the yoghurt procedure?

_____ (1)

e. Which is the best preservation method to keep the yoghurt safe for a number of days?

_____ (1)

f. Explain the term biotechnology.

_____ (2)

g. Mention **TWO** biotechnology products, apart from the yoghurt.


_____ (1)

(Total: 10 marks)

TEXTILES

Question 9


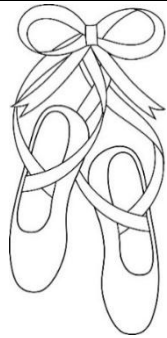
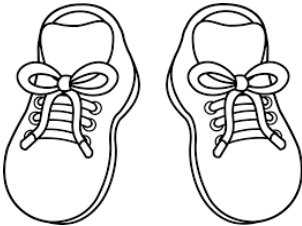

a. Explain through sketches and annotations how to produce a plain seam.



(2)

- b. Complete Table 6 with the following information. Some answers were given. Do **not** repeat your answers.
- i. The name of the component used for each method of fastening (fastener name).
 - ii. **ONE** advantage and **ONE** disadvantage in relation to the wearer.

Table 6: Shoes and their fasteners

	Shoes for Children aged 0 - 5 years	
	Fastener name:	
	Advantage:	<i>Adjustable and secure</i>
	Disadvantage:	
	Ballerina Shoes for wearers 5 – 10 years	
	Fastener name:	
	Advantage:	
	Disadvantage:	<i>Sometimes gets undone on its own</i>
	Shoes for Children aged 10 - 15 years	
	Fastener name:	
	Advantage:	
	Disadvantage:	<i>May cause fall if undone</i>
	Shoes for elderly wearers aged 65 + years	
	Fastener name:	
	Advantage:	<i>Easy to be done and undone but firm</i>
	Disadvantage:	

(6)

This question continues on next page.

c. Name and sketch **TWO** methods used to finish a fabric edge. Sketch each method in the space provided.



Finish method: _____ (1)

Finish method: _____ (1)

(Total: 10 marks)

Question 10

Figure K shows a sweater made from 100% wool fibre and its close-up view.

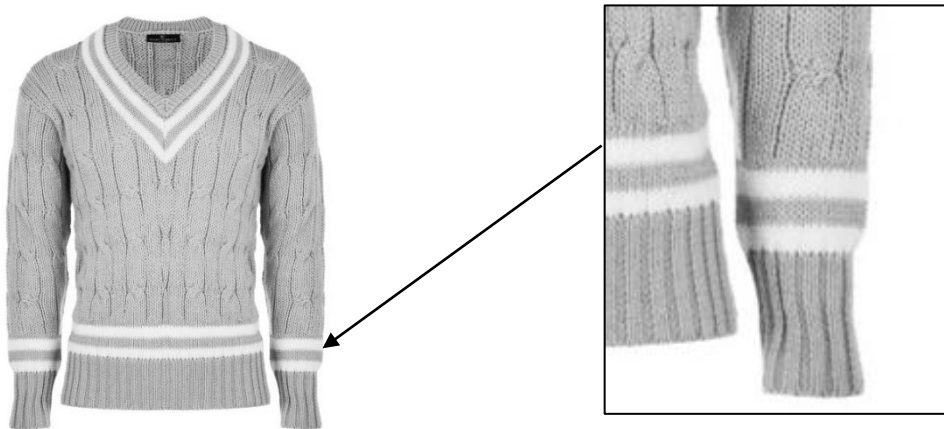


Figure K

a. The sweater is made from 100% wool fibre. Give **TWO** disadvantages of using wool for this sweater

i. _____ (1)

ii. _____ (1)

b. Name **TWO** synthetic fibres which could be used instead of wool for this sweater:

_____ (2)

c. Mention and sketch the method of fabric construction for the sweater.

Method of construction:



(1)

d. The woollen sweater was chosen to be used as part of a scouts' troop uniform. List and explain **TWO** properties that the material should have.

i. Property: _____

Explanation: _____

ii. Property: _____

Explanation: _____ (3)

e. Being a scout uniform, badges and logos/emblems need to be added to the sweater.

i. Mention a suitable method of adding the badge to the sweater.

_____ (0.5)

ii. Suggest another method of adding permanently a logo/emblem to the sweater.

_____ (0.5)

f. These notes are written on the care label of the sweater.

Machine wash on wool cycle

Hand wash only

Discuss why these are being recommended.

_____ (1)

(Total: 10 marks)

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SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2017 SESSION

SUBJECT: **Design and Technology**
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 TIME: 4:00 p.m. to 6:05 p.m.

Instructions and Information

Answer **ALL** ten questions. Each question carries 10 marks.

Non-programmable calculators are allowed

Formula:

$$P=IV$$

Resistor colour code chart:

Colour	Band 1	Band 2	Band 3 (No. of 0s)	Band 4 (Tolerance)
Black	0	0	None	
Brown	1	1	0	
Red	2	2	00	
Orange	3	3	000	
Yellow	4	4	0000	
Green	5	5	00000	
Blue	6	6	000000	
Violet	7	7	-	
Grey	8	8	-	
White	9	9	-	
				Gold = $\pm 5\%$
				Silver = $\pm 10\%$

DESIGN PROCESS

Situation: A new science centre called ‘Discovery Centre’ is seeking a technology-related souvenir that shall be sold in its gift shop. The scientific theme suggested for this design shall be ‘Mechanisms are Fun’.



The Discovery Centre Logo is given here for reference:

Question 1

- a. Write a Design Brief for the design and make of this souvenir with reference to the above situation.

(2)

- b. In order to carry out some research, mention **TWO** primary sources that could be used to learn more about the design of the souvenir. Explain why these sources are useful.

i. Source: _____

Explanation: _____

ii. Source: _____

Explanation: _____ (3)

- c. Complete the following Specifications by defining them further in order to guide your design.

i. The souvenir shall be suitable for a target visitor of ages between _____.

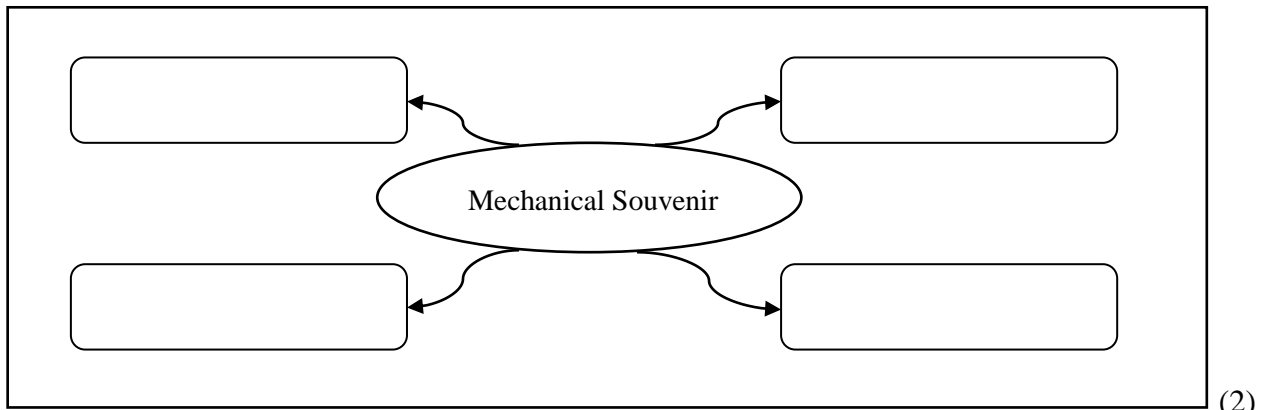
ii. The _____ to manufacture should not exceed €2, while the _____ -
_____ should be not more than €4.

iii. The maximum _____ for the item should be L20 cm × W10 cm × H10 cm.

iv. The item must have at least two moving _____ and be safe to use.

v. The item needs to be attractive and show the Discovery Centre logo. (3)

d. In order to explore the product further, complete the following (web) diagram with any **FOUR** main aspects you should consider in your design:



(2)
(Total: 10 marks)

Question 2. This question refers to the Situation in Question 1.

- a. In the space provided on pages 4 and 5, sketch **TWO** ideas for the Design Brief. Add colours, annotations, dimensions, and other information which describes the features of this design. (6)
- b. Identify which idea you want to choose from part (a) and discuss **ONE** advantage and **ONE** disadvantage this offers.

Chosen Idea: _____

Advantage: _____

Disadvantage: _____
_____ (2)

c. Describe briefly **ONE** process required in the making of your idea and **ONE** safety precaution that should be taken during this process.

Process: _____

Precaution: _____ (2)

This question continues on next page.

2a. IDEA 1

2a. IDEA 2

(Total: 10 marks)

RESISTANT MATERIALS

Question 3

Figure A shows a possible design for the mechanism of an extendable wooden table. The surface is made of **THREE** main parts, one of which is hinged underneath and therefore hidden if the table is in normal mode. When the left and right table halves slide away from each other, the folding centre can be opened and flipped in place.

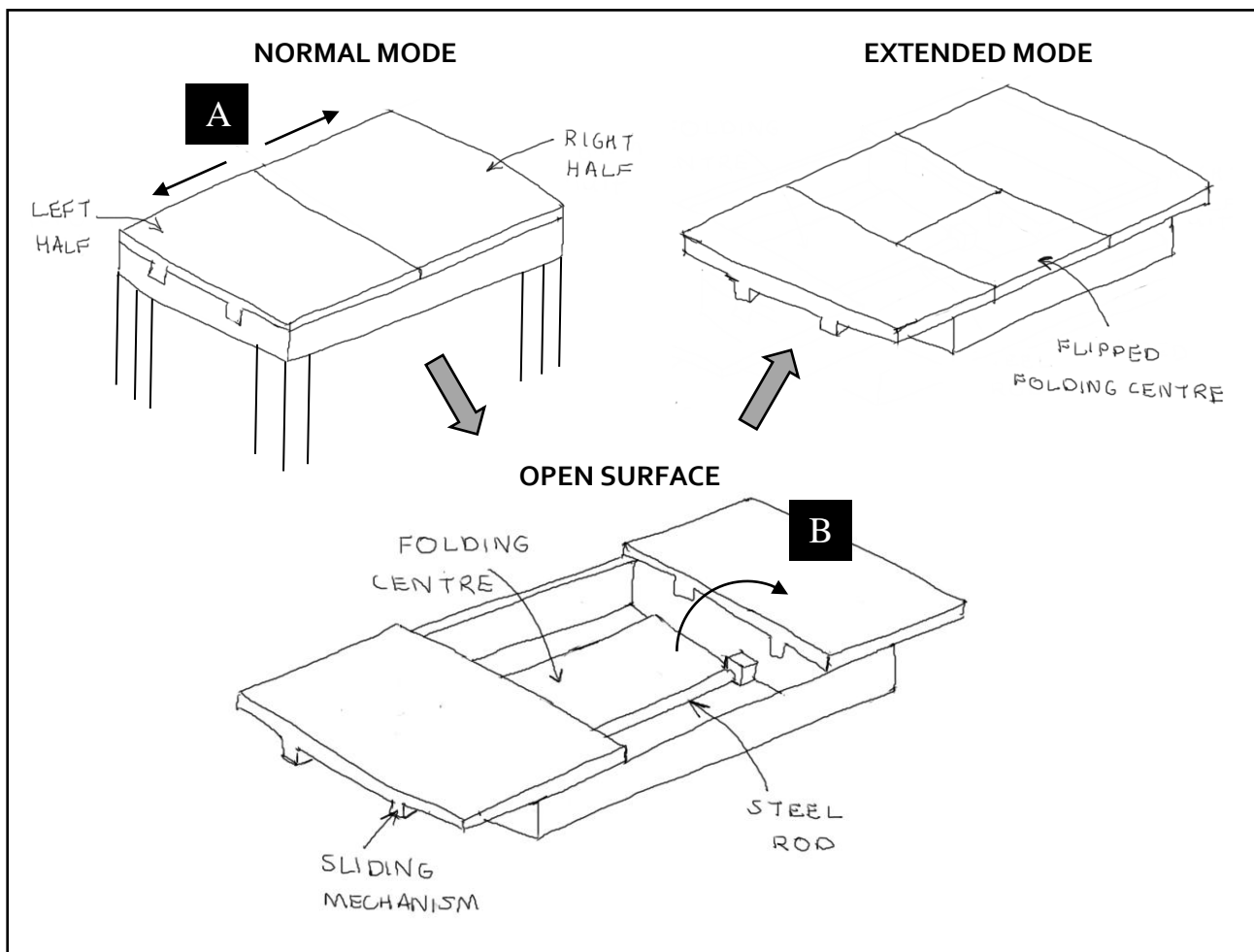


Figure A: Extendable table surface mechanism

a. Determine the type of motion shown at:

- i. arrow A; _____
- ii. arrow B. _____ (2)

b. Figure B shows a 3D view of the folding centre mechanism. The folding centre will rotate about the steel rod and fold from the hinges to double in size.

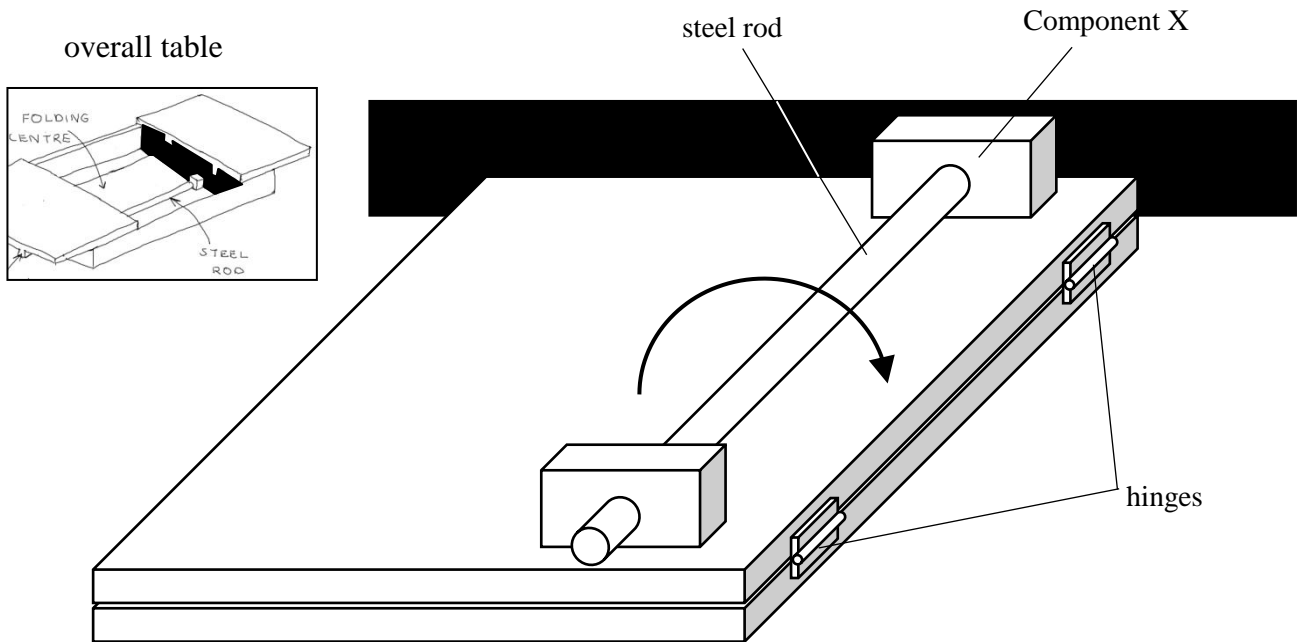


Figure B: Folding centre

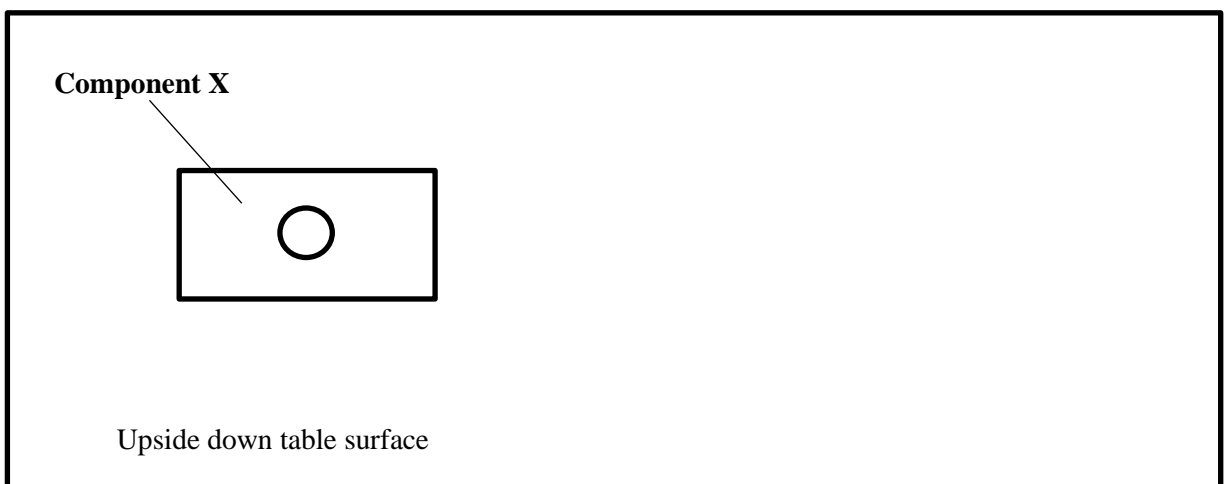
i. Name the 3D drawing technique used in Figure B.

_____ (1)

ii. On the mechanism shown in Figure B, circle **TWO** different pivots.

(2)

iii. By using sketches, explain how wooden Component X can be joined to the folding part without damaging the surface of the table. An initial drawing has been done for you. (3)



iv. The hinges could be made of brass which is an alloy. Explain briefly what is a metal alloy.

_____ (2)

(Total: 10 marks)

Question 4

- a. Consider the **TWO** scenarios given in Table 1. Complete the table by suggesting the most suitable wood which could be used for the surface of the extendable table.

Table 1

	SCENARIO	NAME OF WOOD
i	The design will be used to manufacture low-cost, do-it-yourself tables which will be assembled and painted by the customers.	
ii	The design will be used to produce one-off furniture for high-end customers.	

(2)

- b. Tick the correct column in Table 2, to determine the class of the two woods mentioned in question 3a.

Table 2

	CLASS OF WOOD		
	Hardwood (including Hardwood veneered Boards)	Softwood	Manufactured Boards
SCENARIO i			
SCENARIO ii			

(2)

- c. Certain tools which can be used in the process of making such a table need to be heat-treated.

- i. Define the following terms:

hardening; _____

annealing. _____ (2)

- ii. Explain why certain parts of these tools need to be heat-treated.

 _____ (2)

d. The current design of the cross-section of the sliding surface mechanism as shown in Figure C was changed to the one shown in Figure D.

CURRENT CROSS-SECTION

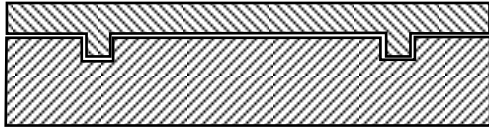


Figure C

NEW CROSS-SECTION



Figure D

Suggest **ONE** reason why such a change was made.

(2)

(Total: 10 marks)

ELECTRONICS

Question 5

Some home-owners are using electronic systems which control everyday tasks in their homes to make their lives easier.

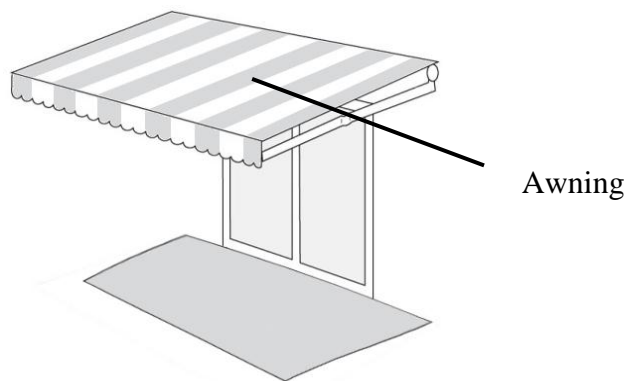


Figure E

This question continues on next page.

An electronic system is used to open and close automatically an awning as shown in Figure E. Figure F shows a simple prototype circuit schematic of the awning control system.

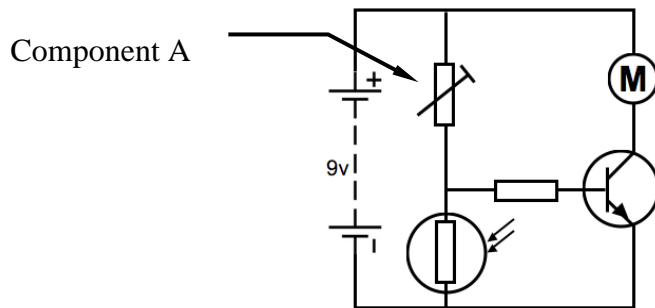


Figure F

- a. Name the component in Figure F, labelled as 'Component A': _____ (1)
- b. Complete the circuit, shown in the schematic in Figure F, on the strip-board layout diagram in Figure G.

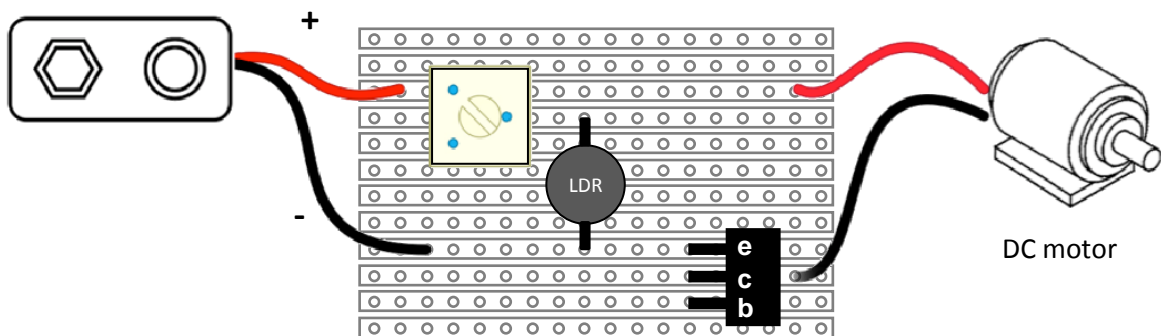


Figure G

(3)

- c. The circuit shown in Figure G uses an LDR as a sensor. What does the LDR sense?

_____ (1)

- d. It was decided to operate the awning when the temperature rises above a pre-determined temperature. Name the sensor ideal for this situation.

_____ (1)

- e. A micro switch is being used to stop the motor when the awning is fully open. The switch will be triggered when part of the frame presses the micro switch.

On the given image below, Figure H, sketch how the micro switch, battery and the motor circuit could be connected together to achieve the desired function explained above (motor goes off when triggered).

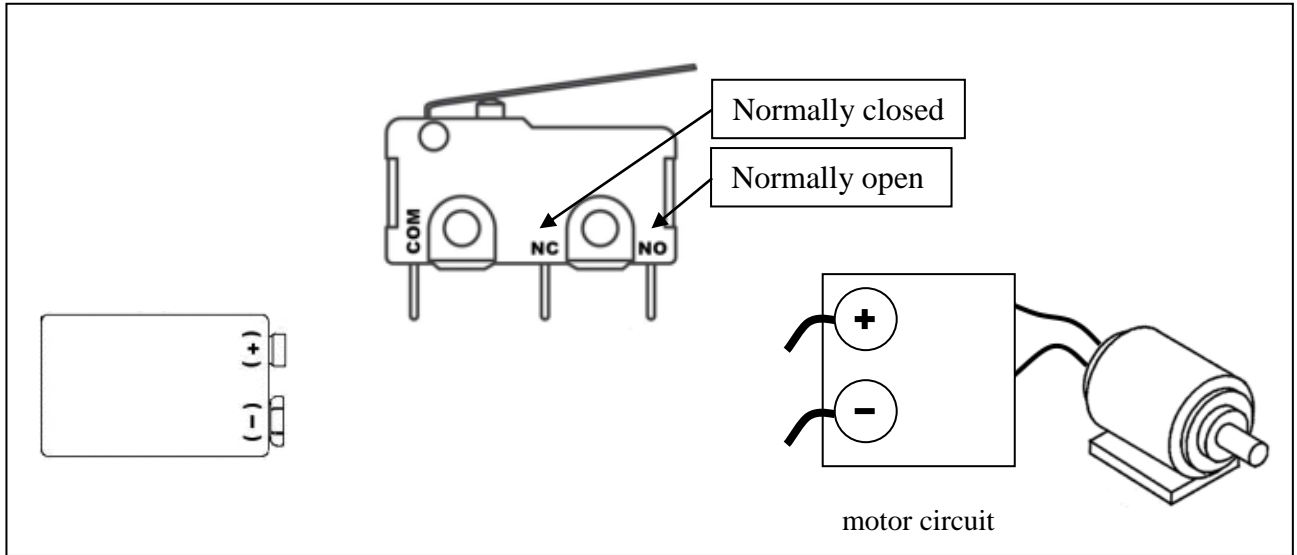


Figure H

(2)

- f. The system was designed to operate the awning only when the LDR is ‘on’, and until the micro switch is ‘on’. Complete the truth table for the AND gate used in this system.

LDR INPUT (sensor)	Micro switch	OUTPUT (Awning motor)
0	0	
0	1	
1	0	
1	1	

(2)

(Total: 10 marks)

Please turn the page.

Question 6

For safety reasons, a flashing indicator lamp placed next to the awning will alert bystanders that the awning is being operated. It was decided to control the flashing lamp using the circuit shown in Figure I.

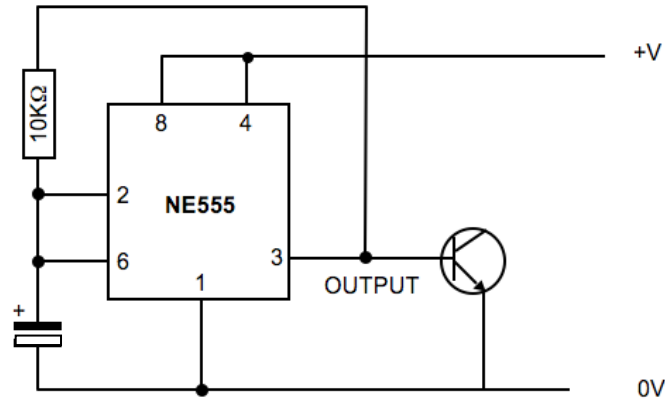


Figure I

a. Select, by ticking the appropriate box, the mode in which the NE555 should be wired.

- Astable Monostable (1)

b. Complete the circuit on Figure I by connecting the missing lamp between the positive lead and the transistor's collector. (1)

c. Describe what happens when the value of the capacitor is changed.

(1)

d. Label the pins of the NE555 IC shown in Figure J.

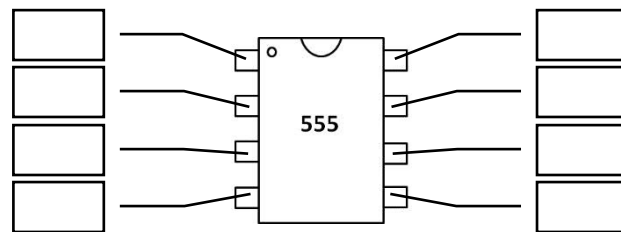


Figure J (1)

e. Give a reason why a transistor is used to light the lamp rather than connecting the lamp directly to the output of the IC.

(1)

f. List the colour for each band of a 10,000Ω resistor.

Band 1	Band 2	Band 3	Tolerance band
			Gold

(1)

g. Some electronic circuits use a DC supply. On the axis below shown in Figure K, draw the signal representing a constant DC supply.

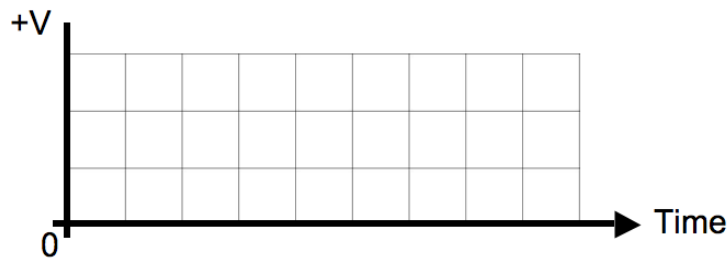


Figure K

(1)

h. Which component should be used to connect the DC circuit in Figure I to a more powerful AC light bulb?

(2)

i. The light bulb draws 0.15 A of current when powered by 240 V AC supply. Calculate the power of the bulb.

Answer: _____ (1)

(Total: 10 marks)

Please turn the page.

FOOD

Question 7

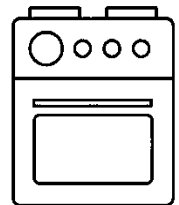
a. In Table 3, shown below, list down the **TWO** dietary guidelines in order to follow a balanced diet AND suggest **ONE** change in eating habits to follow each dietary guideline.

Table 3

Dietary Guidelines	Suggestions
i. _____ _____ (1)	i. _____ _____ _____ (1)
ii. _____ _____ (1)	ii. _____ _____ _____ (1)

b. Give **TWO** examples of food products which should be prepared in an oven.

- i. _____ (1)
- ii. _____ (1)

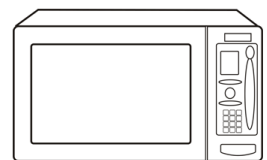


c. List down **TWO** health and safety precautions to be followed when using an oven.

- i. _____ (1)
- ii. _____ (1)

d. List **TWO** advantages of using a microwave.

- i. _____ (1)
- ii. _____ (1)



(Total: 10 marks)

Question 8

a. Mention **TWO** biotechnology products apart from yoghurt.


_____ (1)

_____ (1)

b. Fill in the blank spaces to complete the procedure of making yoghurt using some of the following words.

Live yoghurt, sterilise, water, 40°C- 45°C, room temperature, -15°C

- Prepare myself (wear apron and cap, remove jewellery, wash hands, etc.)
- Prepare all ingredients and equipment in an organized manner.
- _____ flask and caps with boiling water. (1)
- Heat the milk to _____. (1)
- Add one spoonful of _____ to 250ml fresh milk. (1)
- Pour the milk in the flask, close flask, shake and leave for three hours at _____. (1)
- Leave overnight in a refrigerator.



c. Suggest **ONE** healthy way to add flavour to the yoghurt.

_____ (1)

This question continues on next page.

d. Tick the correct answer.

i. Which cooking method is used to heat the milk in the yoghurt procedure?

Boiling Baking Frying (1)

ii. Which is the best preservation method to keep the yoghurt safe for a number of days?

Vacuum packing Refrigerating Pasteurisation (1)

iii. Which heat treatment is used to kill harmful bacteria in milk at 63 °C?

Sterilisation Ultra Heat Treatment Pasteurisation (1)

(Total: 10 marks)

TEXTILES

Question 9



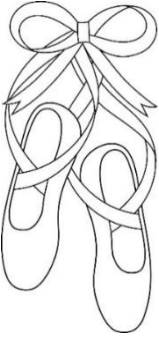
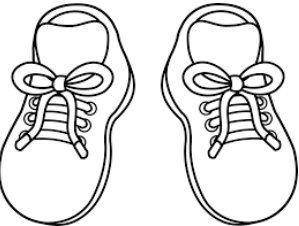
a. Explain through sketches and annotations how to produce a plain seam.

(2)

b. Complete Table 4 with the following information.

- i. The name of the component used for each method of fastening (fastener name).
- ii. **ONE** advantage in relation to the fastener.

Table 4: Shoes and their fasteners

	Shoes for children aged 0 - 5 years	
	Fastener name:	Advantage:
	Shoes for children aged 0 - 5 years	
	Fastener name:	Advantage:
	Ballerina shoes for children aged 0 - 5 years	
	Fastener name:	Advantage:
	Shoes for children aged 0 - 5 years	
	Fastener name:	Advantage:

(6)

This question continues on next page.

c. Name and sketch **TWO** methods used to finish a fabric edge. Sketch each method in the space provided.



Finish method: _____ (1)

Finish method: _____ (1)

(Total: 10 marks)

Question 10

Figure L shows a sweater made from 100% wool fibre and its close-up view.

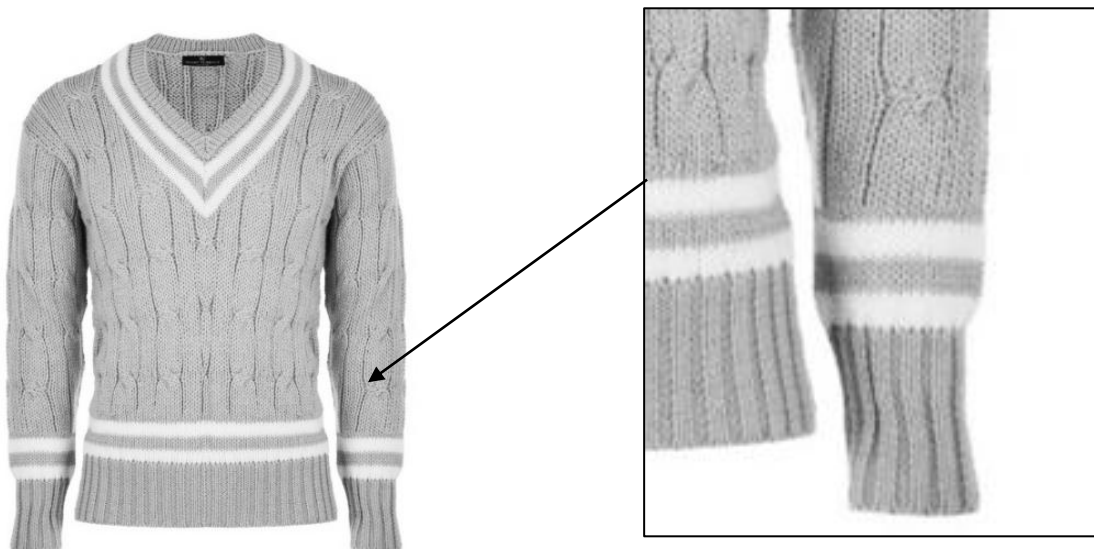
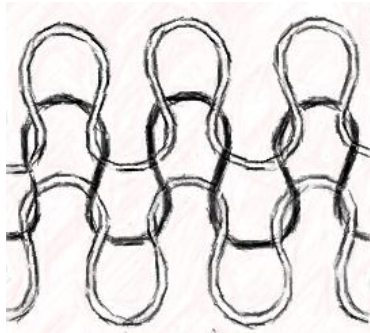
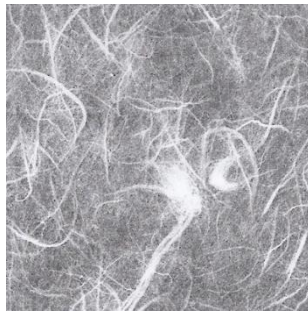


Figure L

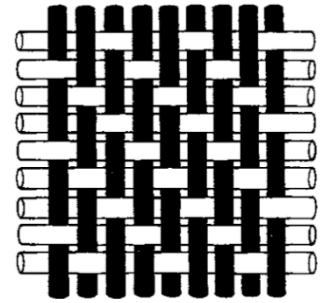
a. Circle the method of fabric construction used for the sweater in Figure L.



Knitted



Bonded



Twill weave

(1)

b. Name **ONE** synthetic fibre which could be used instead of wool for this sweater:

(1)

c. The sweater is going to be used as part of a scouts' troop uniform. List and explain **ONE** property that the material should have.

Property: _____

(1)

Explanation: _____

(1)

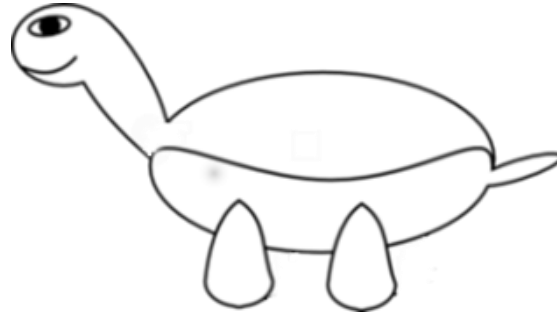
d. Describe briefly **TWO** methods to permanently add a logo/emblem to the sweater.

(1)

(1)

This question continues on next page.

e. A banner will be produced featuring the troop emblem.



Troop Emblem

In the space below use notes and sketches to explain how to produce this emblem on a banner using applique. You do not need to show the full banner.

Marks will be awarded for showing a suitable method which includes how this emblem is constructed.

(4)

(Total: 10 marks)