

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

**SECONDARY EDUCATION CERTIFICATE LEVEL**

**MAY 2015 SESSION**

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SUBJECT: **Design and Technology**  
 PAPER NUMBER: IIA  
 DATE: 24<sup>th</sup> April 2015  
 TIME: 4:00 p.m. to 6:00 p.m.

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

**Useful Information:**

**Non-programmable calculators are allowed**

**Resistor colour code chart**

| Colour | Band 1 | Band 2 | Band 3<br>(No. Of 0s) | Band 4<br>(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 = $\pm 10\%$   |

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**DESIGN PROCESS**

**Question 1**

a. List TWO points you would expect to find in a Design Brief.

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**2 marks**

b. Data can be collected through primary and secondary research. Describe the advantages of using the following sources of information.

Interviews and questionnaires:

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Internet:

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**4 marks**

c. i. State the importance of a specification list when designing a product.

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**1 mark**

ii. Identify ONE common issue that these Specifications are concerned with:

- keep wastage to a minimum
- recycled material should be used

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**1 mark**

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iii. Give FOUR factors that one expects to find in the specification list other than the ones mentioned in Question 1 c ii.

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**2 marks**

**Question 2**

a. You are asked to design a torch for toddlers to keep by their bedside. The torch has to light up when the child holds it in his/her hand and an alarm goes on for the parents to know that the child woke up. Sketch TWO ideas of the torch’s case adding notes to explain your designs and identify all the features of the torch. The torch has to be aesthetically appealing for these young children.

|        |  |
|--------|--|
| IDEA 1 |  |
|--------|--|

IDEA 2



**7 marks**

b. How should the artefact you designed be tested after it is produced?

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**1 mark**

c. Why is a sample product created before it goes to the production line?

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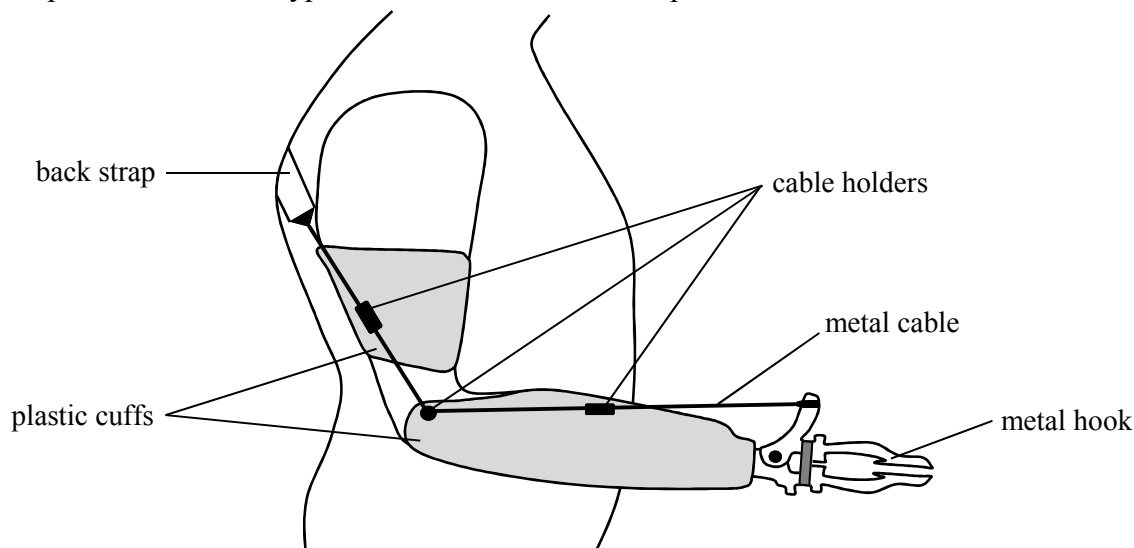
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**2 marks**

**RESISTANT MATERIALS**

**Question 3**

Figure A shows a body-powered artificial arm which allows the wearer to hold and release an item. It is made up of two different types of materials: metals and plastics.



**Figure A: Body-powered artificial arm**

- a. The materials used for the artificial arm have to be durable and strong. Define each of the TWO material properties.

|            |  |
|------------|--|
| DURABILITY |  |
| STRENGTH   |  |

**2 marks**

- b. Give ONE other property which the materials of the artificial arm need to have.

\_\_\_\_\_ **1 mark**

- c. The plastic cuffs are to be casted from a mould based on the specific measurements of the body of the wearer. Briefly describe how the plastic cuffs can be formed.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ **2 marks**

d. The plastic cuffs are polished to obtain a high-quality finish. Briefly describe how this finishing process is achieved, assuming that the surface has been already given the required shape.

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**2 marks**

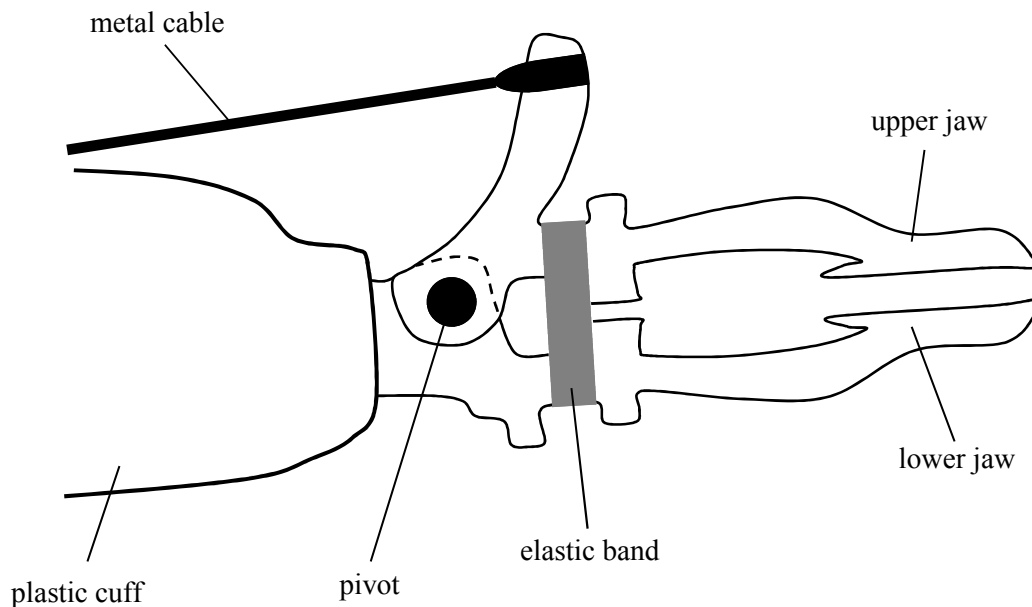
e. The hook is made from metal. Complete the table below by suggesting TWO suitable metals for the hook. Add the class of each metal.

| SUITABLE METALS | CLASSIFICATION |
|-----------------|----------------|
|                 |                |
|                 |                |

**3 marks**

**Question 4**

Figure B shows a close-up of the gripping hook mechanism of the artificial hand. The mechanism functions when the wearer moves the amputated arm.



**Figure B: Hook mechanism**

a. i. By drawing an arrow on Figure B, mark out the INPUT force exerted when the hook needs to be opened

**1 mark**

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ii. Describe the type of motion that the upper jaw performs when the hook is opened and closed.

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**1 mark**

iii. Detect ONE mechanism present in the artificial arm.

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**1 mark**

b. i. Through sketches, explain how to mark out and drill a hole in the lower jaw so as to fit the pivot. In your diagrams, clearly state the names of all the tools used.



**4 marks**

ii. Identify ONE risk which can occur during the procedure of drilling and state a precaution which should be taken to prevent that risk.

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**1 mark**

c. Certain artificial limbs make use of motors to control the input of the hook rather than using body movement. However the output of the motor is too fast for the mechanism to operate well. Suggest a suitable mechanical solution for this problem.

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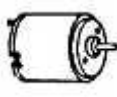
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**2 marks**

**ELECTRONICS**

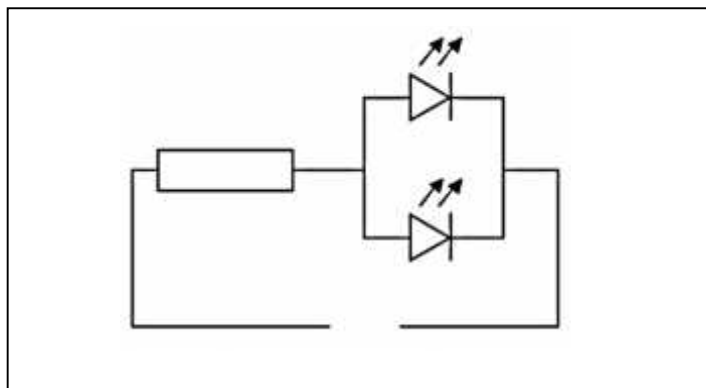
**Question 5**

a. In the space provided name and draw the symbol of the components shown.

| Component   | Name | Symbol |
|---|------|--------|
|  |      |        |
|  |      |        |

**2 marks**

b. A student has drawn the schematic diagram shown in Figure C.



**Figure C**

i. Describe what a schematic diagram is.

**1 mark**

ii. Complete the circuit in Figure C by drawing the missing battery in such a way that the LEDs light up.

**1 mark**

iii. In which arrangement are the 2 LEDs wired?

**1 mark**



iv. Before soldering, the circuit was built on a breadboard. List TWO advantages of using a breadboard.

1 mark

v. Construct the circuit shown in Figure C on the given breadboard shown in Figure D. Identify clearly the positive and negative leads.

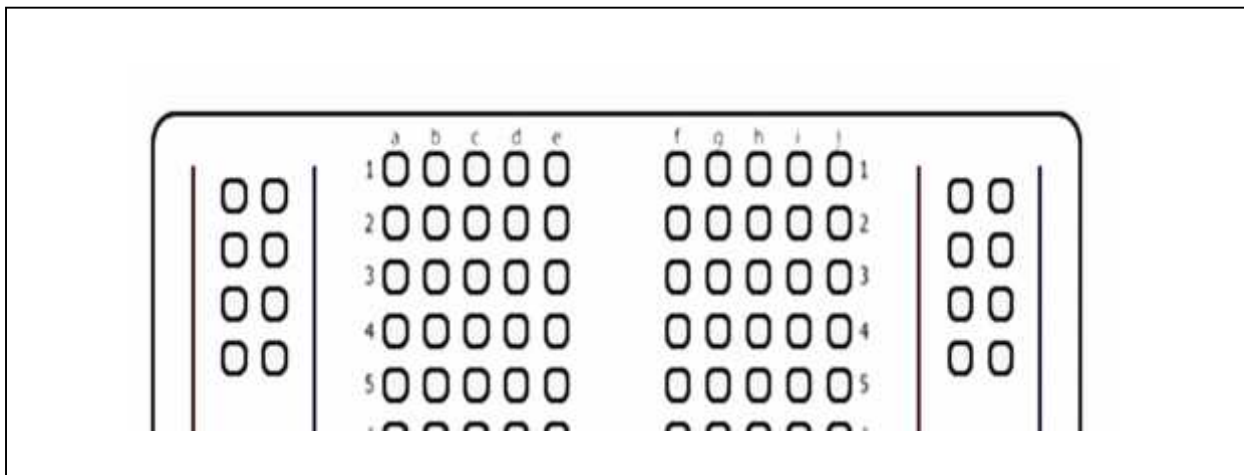


Figure D

4 marks

Question 6

a. An electrolytic capacitor is shown in the table below. Complete the table by writing the TWO physical properties that help you identify the negative lead of this capacitor.

|   |                     |  |
|---|---------------------|--|
|  | Physical property 1 |  |
|   | Physical property 2 |  |

1 mark

b. i. State the value of a resistor with the following coloured bands.

|                                 |  |
|---------------------------------|--|
| <u>Orange – Orange - Yellow</u> |  |
|---------------------------------|--|

1 mark

ii. Label the colour bands on the 1KΩ resistor shown in Figure E.

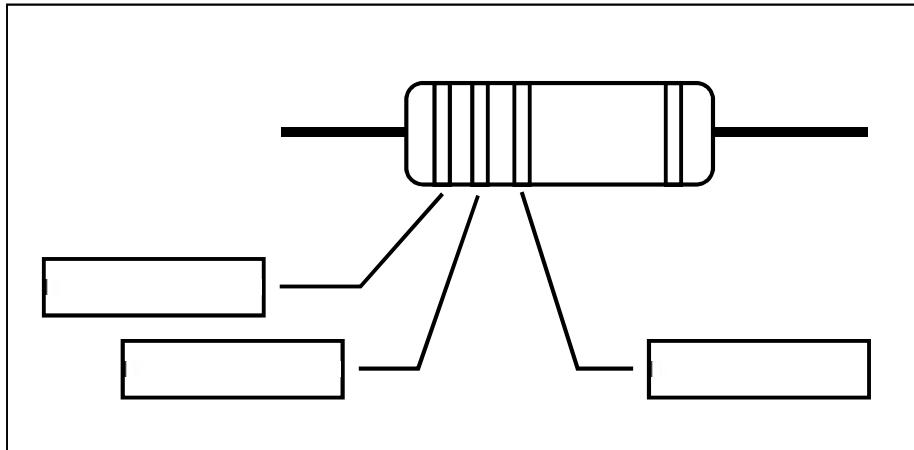


Figure E

1 mark

c. Name ONE safety precaution you must take when soldering to avoid inhaling fumes.

1 mark

d. Complete the truth table below for an XOR gate.

| XOR |   |        |
|-----|---|--------|
| A   | B | Output |
| 0   | 0 |        |
| 0   | 1 |        |
| 1   | 0 |        |
| 1   | 1 |        |

2 marks

e. A company that specialises in bicycle safety equipment is designing a new device with continuous flashing LEDs using the NE555.

Suggest an adequate reason why an NE555 is used in this circuit.

1 mark

f. The circuit in Figure F shows only one LED connected to the output lead of the NE555. On Figure F, draw a second LED that will light alternately to LED 1 (when LED1 is off LED 2 is on, and when LED 1 is on LED 2 is off)

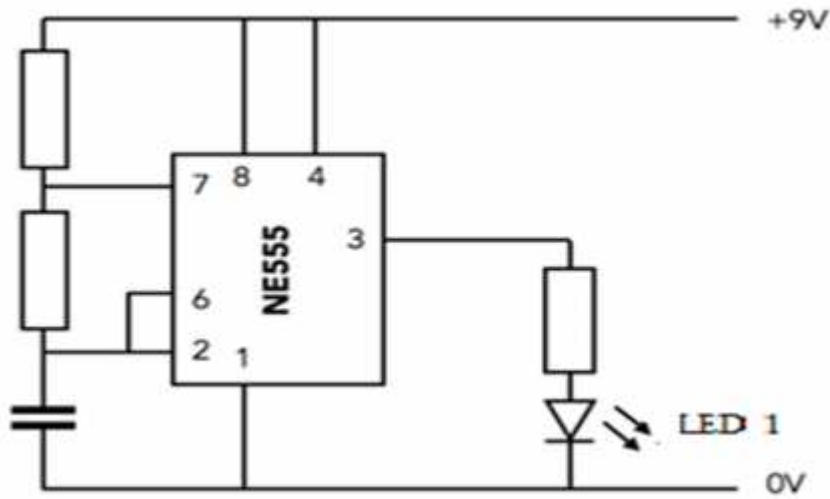


Figure F

3 marks

**FOOD**

**Question 7**

a. Give TWO reasons why food packaging is necessary.

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2 marks

b. Briefly explain what the following types of packaging are:

|                                |  |
|--------------------------------|--|
| <b>Biodegradable packaging</b> |  |
|                                |  |
| <b>Recyclable packaging</b>    |  |
|                                |  |

2 marks

c. Explain the difference between ‘best before’ and ‘use by’ dates.

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**2 marks**

d. The following table shows the nutritional information of a cereal bar. Calculate the amount of energy in calories of the cereal bar. All working must be shown.

|                                       |            |
|---------------------------------------|------------|
| <b>Cereal Bar</b>                     |            |
| <b>Nutrition value per bar of 45g</b> |            |
| <b>Protein</b>                        | <b>10g</b> |
| <b>Carbohydrate</b>                   | <b>25g</b> |
| <b>Fat</b>                            | <b>6g</b>  |

**2 marks**

e. The name and date of the product must be printed on food packaging according to EU law. Mention FOUR other items of information that must be listed according to EU standards.

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**2 marks**

**Question 8**

a. Complete the following sentences about temperature control.

- i. The temperature of a freezer should not be above \_\_\_\_\_ .
- ii. The temperature of the refrigerator should be between \_\_\_\_\_ and \_\_\_\_\_ .
- iii. Water boils at \_\_\_\_\_ .
- iv. Bacteria multiply rapidly between \_\_\_\_\_ and \_\_\_\_\_ .

**3 marks**

b. What are the functions of the following ingredients?

| <b>Ingredients</b> | <b>Functions</b> |
|--------------------|------------------|
| Yeast              |                  |
| Egg                |                  |

**2 marks**

c. List TWO conditions microorganisms need in order to multiply.

**1 mark**

d. Identify the methods of preservation described in the table below.

| <b>Description</b>  | <b>Preservation Method</b> |
|---|----------------------------|
| The atmosphere inside the packaging maintains the colour and delays spoilage. Gases to control this have been put inside the packaging. |                            |
| Storing food in a bottle, can or plastic where the oxygen has been removed.   |                            |
| Heating to 72°C for 15 seconds and then cooling rapidly to 4°C to kill harmful micro-organisms.   |                            |
| This process involves passing rays from a radioactive or electron beam source through the food.   |                            |

**4 marks**

**TEXTILES**

**Question 9**

Figure G shows a sketch of an evening dress.



**Figure G**

- a. Suggest a natural fibre or fabric to produce the evening dress shown in Figure G and explain in detail why this material is suitable to produce such items.

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**3 mark**

- b. What are the disadvantages of using the mentioned material for this occasional item?

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**2 marks**

- c. Name TWO synthetic fibres or fabrics which could be used for occasional garments such as this evening dress.

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**2 marks**

d. Manufacturers use different types of production methods to make dresses. Name TWO types of production systems and explain ONE of them.

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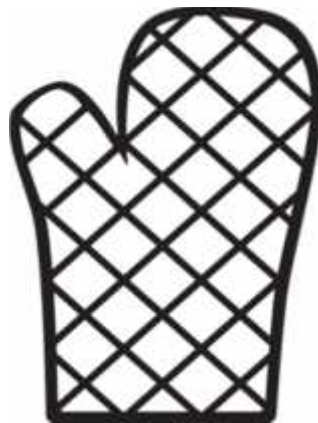
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3 marks

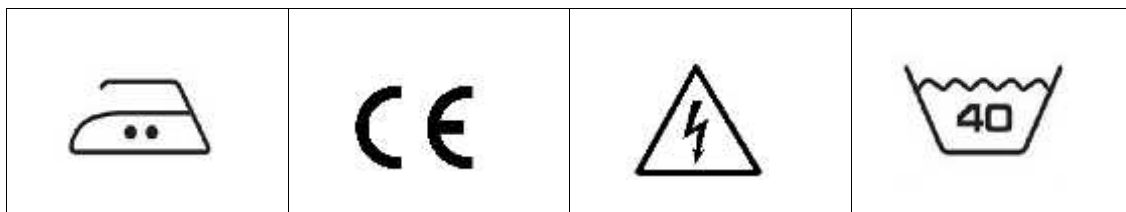
**Question 10**

Figure H shows an oven glove.



**Figure H**

a. Circle the TWO symbols that could be found on the care label of such a glove.



1 mark

b. What type of material can be used to produce the gloves? Give TWO properties of the material you suggested.

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2 marks

- c. Sketch a pattern to produce the single oven glove shown in Figure I. In your sketch include the number of pieces that have to be cut. Include approximate dimensions.



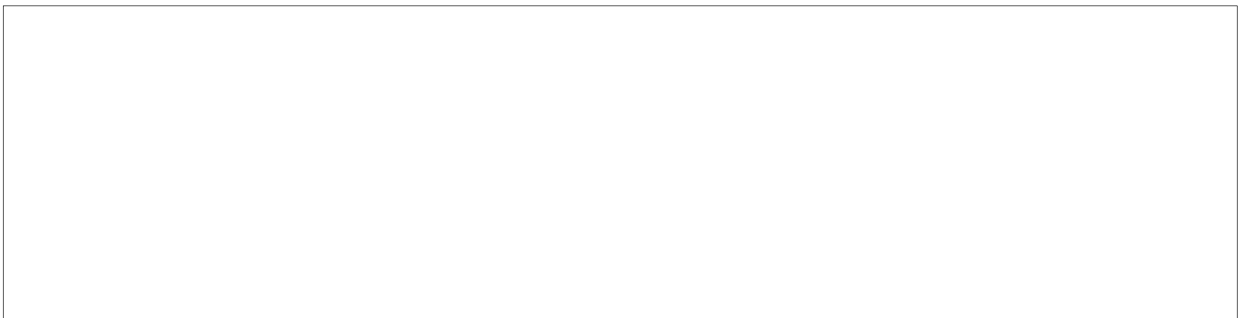
**3 marks**

- d. What structural component can be sewn between the materials of the glove so that the user will not burn his hands?



**1 mark**

- e. Sketch a diagram to show how the structural component mentioned in Question 10d is sewn. Label your diagram.



**3 marks**



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UNIVERSITY OF MALTA, MSIDA

**SECONDARY EDUCATION CERTIFICATE LEVEL**

**MAY 2015 SESSION**

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SUBJECT: **Design and Technology**  
 PAPER NUMBER: IIB  
 DATE: 24<sup>th</sup> April 2015  
 TIME: 4:00 p.m. to 6:00 p.m.

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

**Useful Information:**

**Non-programmable calculators are allowed**

**Resistor colour code chart**

| Colour | Band 1 | Band 2 | Band 3<br>(No. Of 0s) | Band 4<br>(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 = ±5%            |
|        |        |        |                       | Silver = ±10%         |

**Equations**

**Gear ratio =  $\frac{\text{input speed}}{\text{output speed}}$**

**DESIGN PROCESS**

**Question 1**

a. List TWO points you would expect to find in the Design Brief.

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**2 marks**

b. Data can be collected through primary and secondary research. Describe the advantages of using the following sources of information.

Interviews and questionnaires:

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Internet:

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---

---

**4 marks**

c. i. State the importance of a specification list when designing a product.

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---

---

**1 mark**

ii. Identify ONE common issue that these Specifications are concerned with:

- keep wastage to a minimum
- recycled material should be used

---

**1 mark**

---

iii. Give FOUR factors that one expects to find in the specification list other than the ones mentioned in Question 1 c ii.

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**2 marks**

**Question 2**

a. You are asked to design a torch for toddlers to keep by their bedside. The torch has to light up when the child holds it in his/her hand and an alarm goes on for the parents to know that the child woke up. Sketch TWO ideas of the torches case adding notes to explain your designs and identify all the features of the torch. The torch has to be aesthetically appealing for these young children.

|        |  |
|--------|--|
| IDEA 1 |  |
|--------|--|

IDEA 2



**7 marks**

b. How should the artefact you designed be tested after it is produced?

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**1 mark**

c. Why is a sample product created before it goes to the production line?

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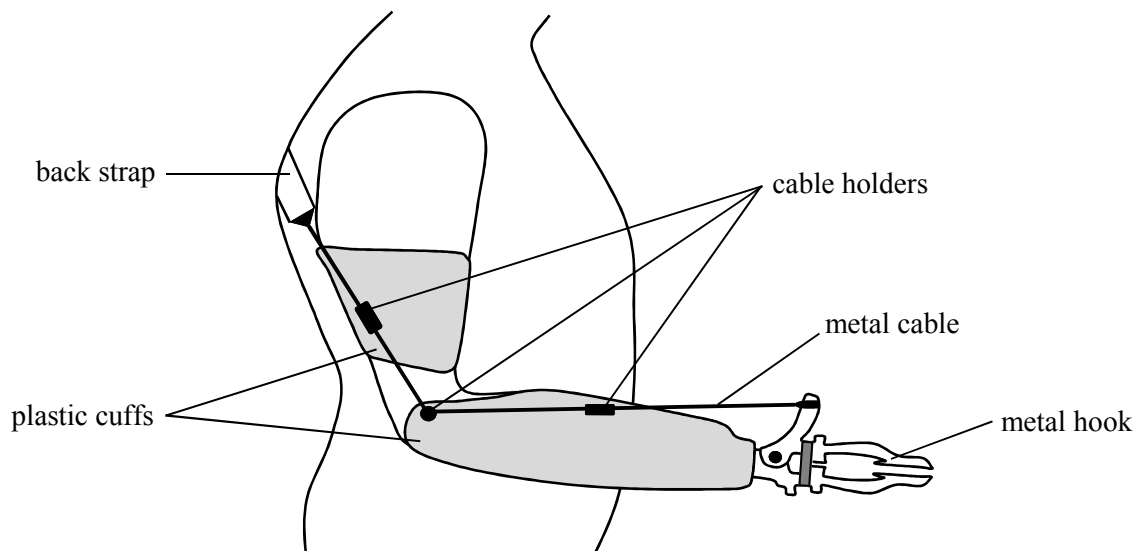
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**2 marks**

**RESISTANT MATERIALS**

**Question 3**

**Figure A** shows a body-powered artificial arm which allows the wearer to hold and release an item. It is made up of two different types of materials: metals and plastics.



**Figure A: Body-powered artificial arm**

- a. The materials used for the artificial arm have to be durable and strong. Define each of the TWO material properties.

|            |  |
|------------|--|
| DURABILITY |  |
| STRENGTH   |  |

**2 marks**

- b. The plastic cuffs are to be casted from a mould based on the specific measurements of the body of the wearer.

- i. Briefly explain how a thermoplastic can be casted.

---



---

**2 marks**

- ii. Which tool is used to accurately measure the thickness of the plastic used to produce the cuffs?

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**1 mark**

c. The plastic cuffs are polished to obtain a high-quality finish. Insert numbers next to the steps below to explain the procedure for polishing the cuffs in the correct sequence.

| No | Finishing Process   |
|----|---|
|    | Buff with clean buffer.   |
|    | Clean surface from large particles.                                 |
|    | Apply polishing chemicals with a rotating buffer.                   |
|    | Apply burnishing cream repeatedly using finer grades as instructed. |

2 marks

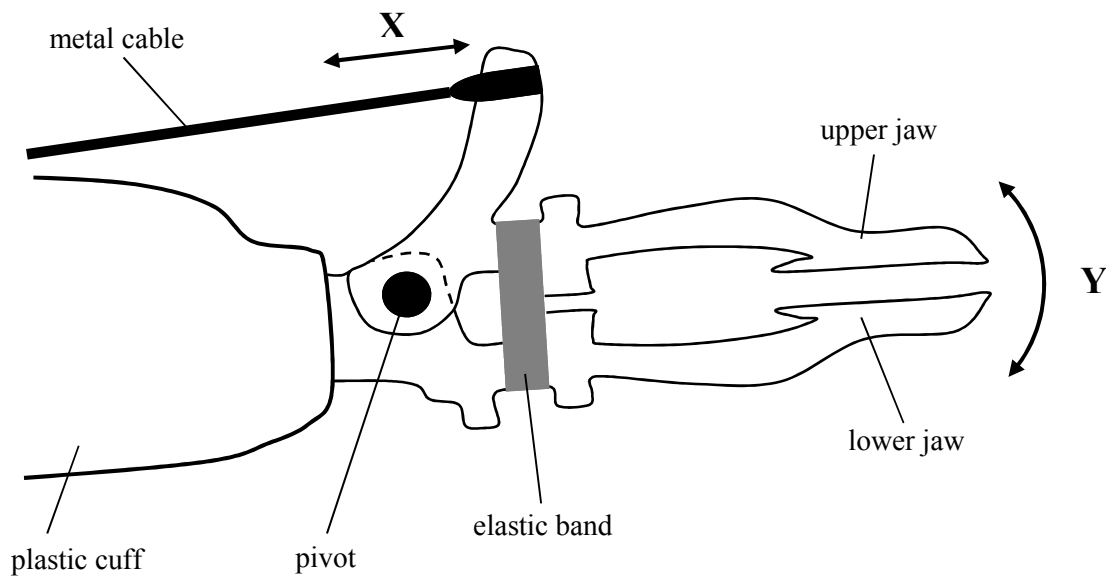
d. Fill in the table below by suggesting TWO suitable metals for the hook. State whether the metals you suggested are ferrous or non-ferrous by ticking (✓) under the correct column.

| SUITABLE METALS | FERROUS | NON-FERROUS |
|-----------------|---------|-------------|
|                 |         |             |
|                 |         |             |

3 marks

**Question 4**

Figure B shows a close-up of the gripping hook mechanism of the artificial hand. The mechanism functions when the wearer moves the amputated arm.



**Figure B: Hook mechanism**

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a. i. Describe the type of motion shown by:

Arrow X: \_\_\_\_\_

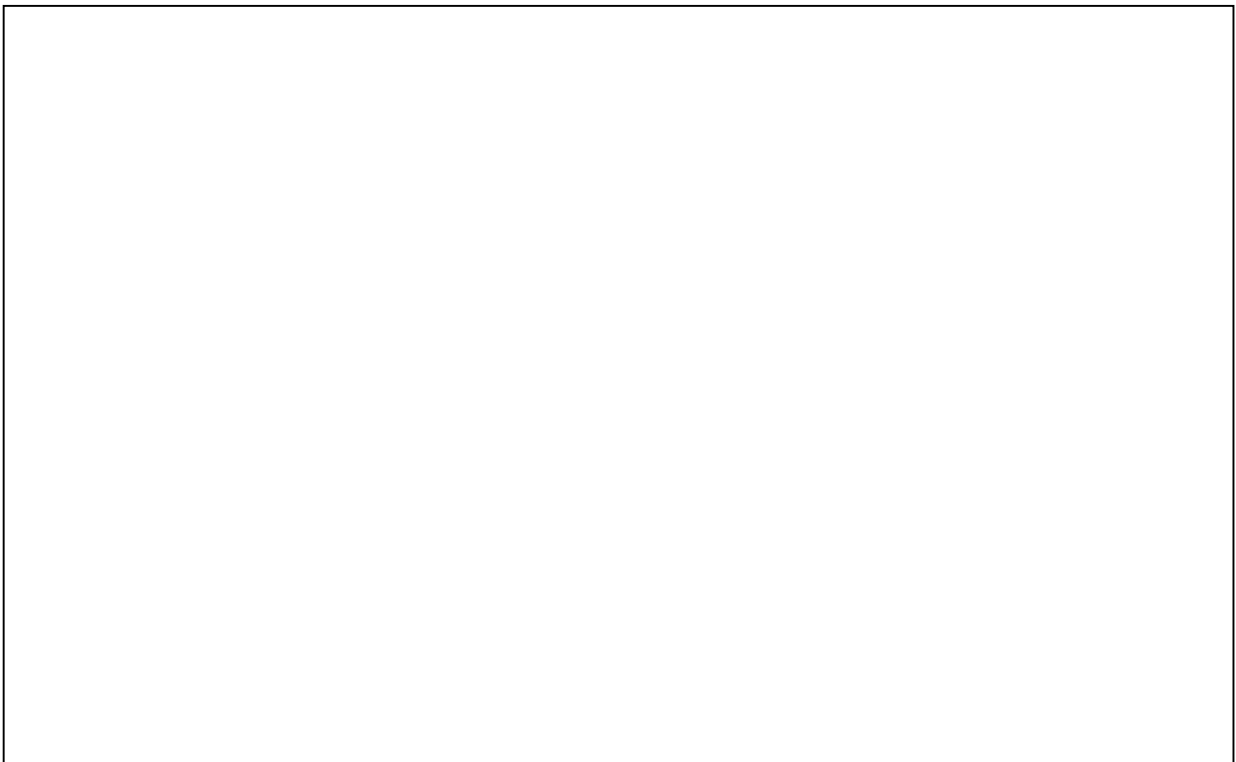
Arrow Y: \_\_\_\_\_

**2 marks**

ii. On Figure B, label arrows X and Y to show which one is the INPUT and which one is the OUTPUT.

**1 mark**

b. i. Through sketches, explain how to mark out the centre for the hole in the lower jaw so as to fit the pivot. In your diagrams, clearly state the names of the tools used.



**3 marks**

ii. State TWO safety precautions which should be taken when drilling the hole for the pivot.

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**2 marks**

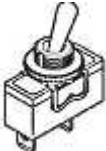


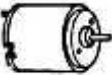
c. Certain artificial arms make use of a motor to control the input of the hook rather than using body movement. The speed of the motor is 1500r.p.m. However a speed of 300r.p.m is required. Find the gear ratio needed to reduce the speed of the motor.

**2 marks**

**ELECTRONICS**

**Question 5**

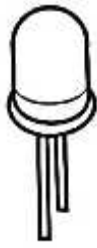
a. Fill in the table by naming the components shown.

| Component   | Name |
|---|------|
|  |      |
|  |      |
|  |      |
|  |      |

**2 marks**

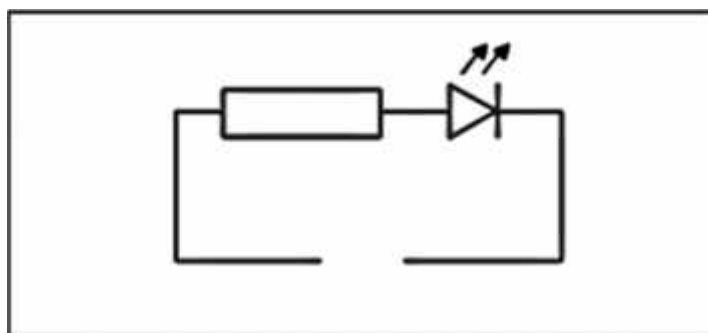


b. An LED is shown in the table below. Explain, by writing in the space provided, the TWO physical properties that help you identify the negative lead of this LED.

|   |                     |  |
|---|---------------------|--|
|  | Physical property 1 |  |
|   | Physical property 2 |  |

**1 mark**

c. A student has drawn the schematic diagram shown in Figure C.



**Figure C**

i. Describe what a schematic diagram is.

**1 mark**

ii. Complete the circuit in Figure C by drawing the missing battery in such a way that the LED lights up.

**1 mark**

iii. In which setup is the resistor and LED wired?

**1 mark**

iv. Before soldering, the circuit was built on a breadboard. List TWO advantages of using such a board.

**1 mark**

- v. Construct the circuit shown in Figure C on the breadboard shown in Figure D. Identify clearly the positive and negative leads.

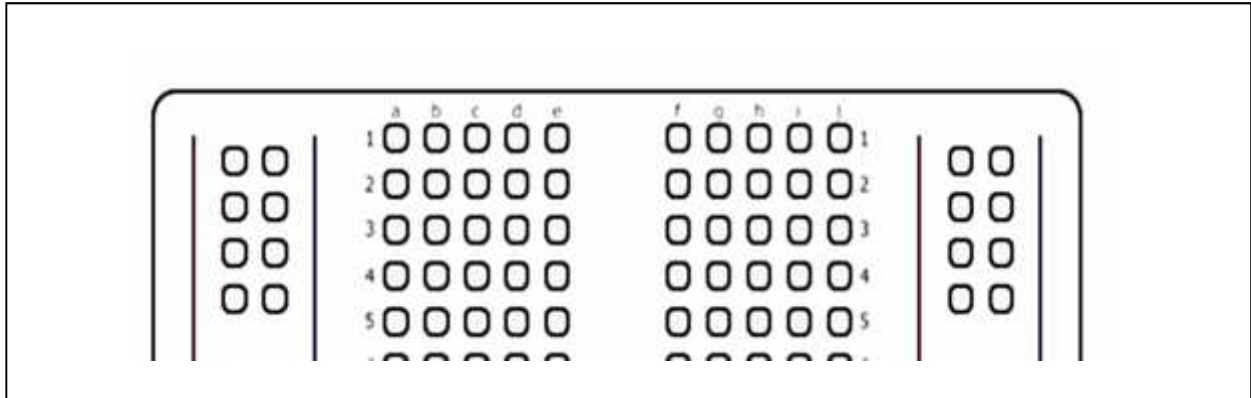


Figure D

3 marks

**Question 6**

- a. Give the value of a resistor with the following coloured bands.

|                          |  |
|--------------------------|--|
| Orange – Orange - Yellow |  |
|--------------------------|--|

1 mark

- b. Label the colour bands on the 500Ω resistor shown in **Figure E**.

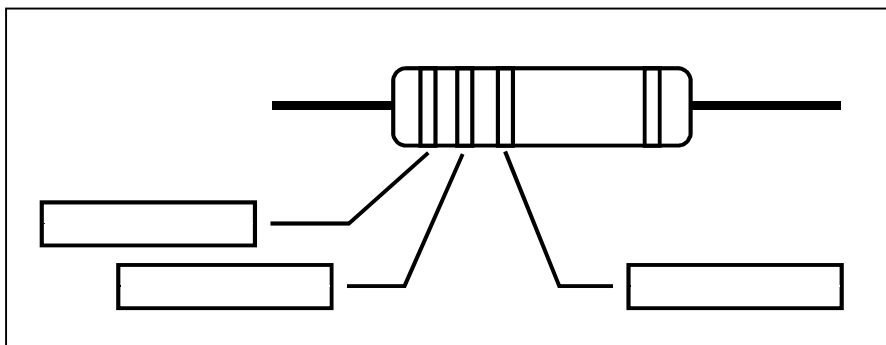


Figure E

1 mark

- c. Name TWO safety precaution you must take while soldering.

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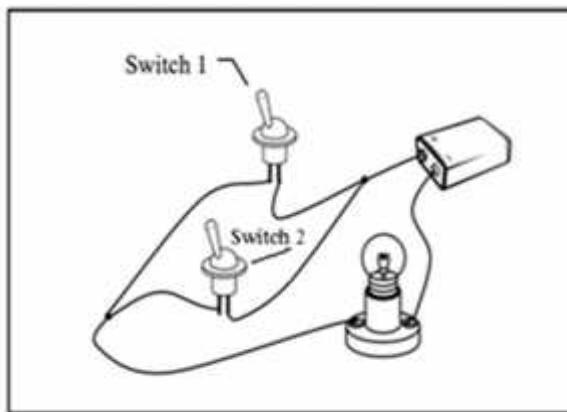
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2 marks

d. List TWO reasons why a mass-produced circuit is built on a PCB.

2 marks

e. The circuit in Figure F shows a bulb, two switches and a battery wired together. The table below shows all the different switch combinations. Complete the table by writing whether the bulb will be ON or OFF for every combination.



| Switch 1 | Switch 2 | Bulb |
|----------|----------|------|
| OFF      | OFF      |      |
| OFF      | ON       |      |
| ON       | OFF      |      |
| ON       | ON       |      |

Figure F

2 marks

f. Draw a circle around the pre-set resistor in the circuit shown in Figure G.

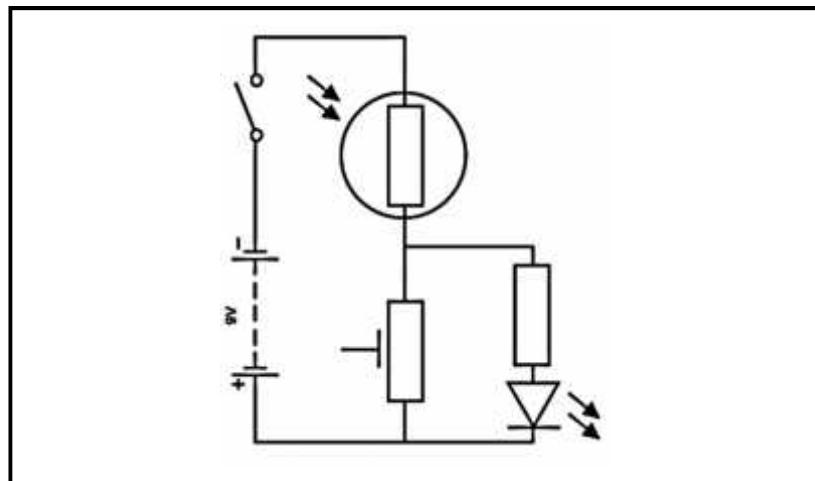


Figure G

1 mark

g. What is the function of the sensor in Figure G?

1 mark

**FOOD****Question 7**

a. Name the unit used to measure energy.

**1 mark**

b. List the THREE nutrients that provide energy and state their value.

| Nutrients | Energy Value |
|-----------|--------------|
|           |              |
|           |              |
|           |              |

**3 marks**

c. List the water soluble and fat soluble vitamins.

| Water Soluble | Fat Soluble |
|---------------|-------------|
|               |             |

**3 marks**

d. Name the disease caused by a lack of iron in the diet.

**1 mark**

e. Describe the effects of boiling vegetables on water soluble vitamins.

**1 mark**

f. Give ONE cooking method which is healthier than boiling vegetables.

**1 mark**





**Question 8**

a. State ONE suitable material for packaging to be used for each of these take-away foods. Give TWO reasons for each of your choice. (Use a reason only once).

| Food              |     | Pizza | Sweet and sour pork with rice |
|-------------------|-----|-------|-------------------------------|
| Packaging         |     |       |                               |
| Reason for choice | i.  |       |                               |
|                   | ii. |       |                               |

**3 marks**

b. What is the meaning of the following symbols that are usually found on food labels?

|  |  |   |  |
|--|--|---|--|
|  |  |  |  |
|  |  |   |  |

**2 marks**

c. Explain the importance of 'best before' and 'use by' date.

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**2 marks**

d. List THREE items of information apart from the 'date', that must be included on the food packaging/label according to EU standards.

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**3 marks**

**TEXTILES****Question 9**

Figure H shows a sketch of a dress designed to be worn for a special occasion.



**Figure H**

a. Name a natural fabric to produce the evening dress shown in Figure H.

**1 mark**

b. Tick (✓) FOUR properties that make this fabric suitable to produce such an item.

- |   |   |
|---|---|
| <input type="checkbox"/> elastic                | <input type="checkbox"/> comfortable next to skin |
| <input type="checkbox"/> natural sheen/lustrous | <input type="checkbox"/> flammable                |
| <input type="checkbox"/> lightweight            | <input type="checkbox"/> drapes well              |

**2 marks**

c. Explain why the type of material used for fine dresses is often dry cleaned.

**2 marks**

d. Suggest TWO decorative components that could be added to an evening dress to make it more attractive.

**2 marks**

e. Which type of production method is used to make the following garments?

Tailor made evening dress - \_\_\_\_\_

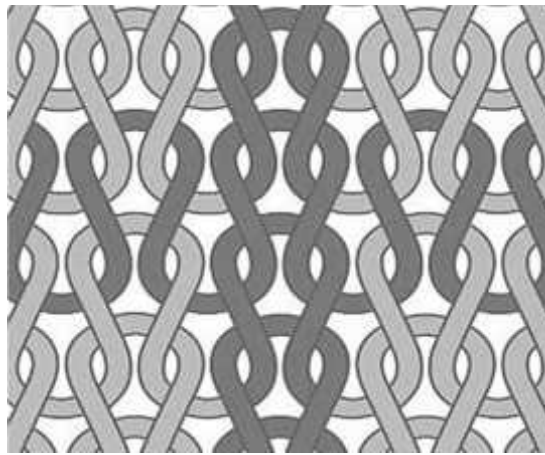
Denim jeans - \_\_\_\_\_

School uniforms - \_\_\_\_\_

**3 marks**

**Question 10**

a. Figure I shows a close up view of a fabric.



**Figure I**

i. Name the type of weave shown in Figure I.

\_\_\_\_\_ **1 mark**

ii. Suggest a fabric made from natural fibre having this type of weave.

\_\_\_\_\_ **1 mark**

iii. Give TWO properties of the fabric you mentioned in Question 10a ii.

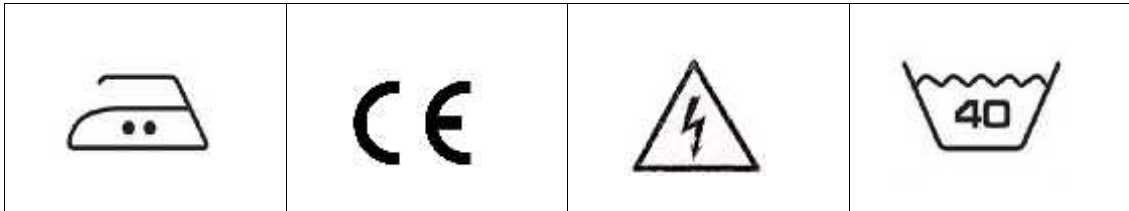
\_\_\_\_\_  
\_\_\_\_\_ **2 marks**

b. Figure J shows an oven glove.



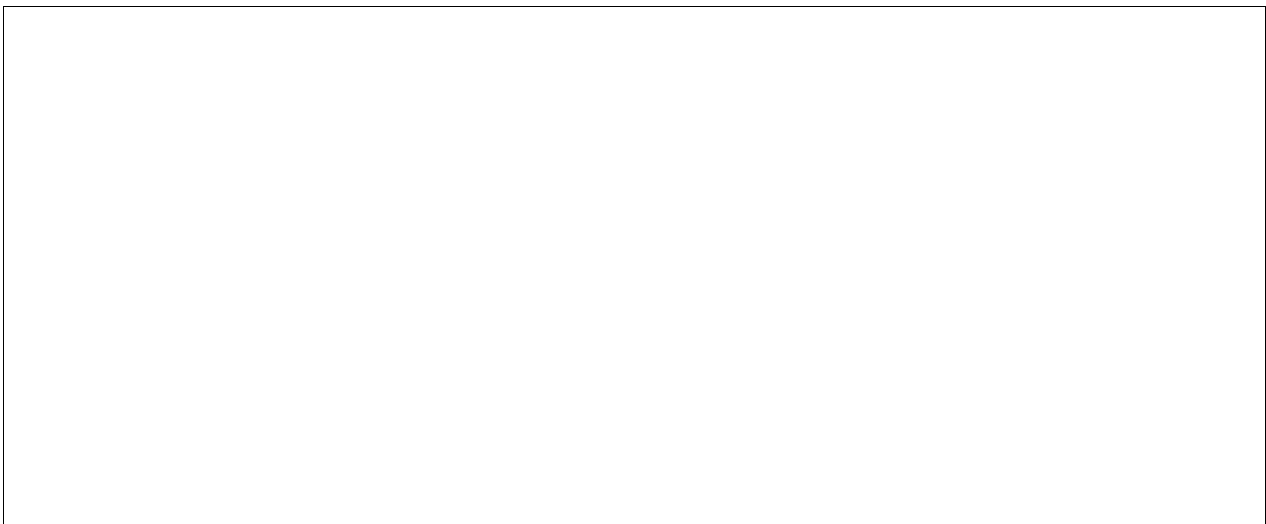
Figure J

i. Circle the TWO symbols that could be found on the care label of the glove shown in Figure J.



2 marks

ii. Sketch a pattern to produce a single oven glove shown in the Figure J. In your sketch include the number of pieces that have to be cut.



3 marks

iii. Name ONE structural component that can be sewn between the materials of the oven glove to protect your hands from getting burnt.

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1mark