FORM 3 (1st Yr)  DESIGN & TECHNOLOGY  TIME: 2 hours

Name: _____________________________________  Class: ____________

---------------------------------------------------------------------

------------------------------------ Note to student: ------------------------------------

You are required to answer all questions.

Useful Formulae:

\[ V_{OUT} = \frac{R_2}{R_1 + R_2} \times V_{IN} \]

---------------------------------------------------------------------

FOR TEACHERS' USE ONLY

DISTRIBUTION OF MARKS

<table>
<thead>
<tr>
<th>Areas corrected</th>
<th>Marks for Written Exam.</th>
<th>Marks for Design Folio</th>
<th>TOTAL</th>
<th>FINAL MARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>RM</td>
<td>E</td>
<td>F</td>
<td>T</td>
</tr>
</tbody>
</table>

Enter student’s mark obtained in every area of study in the above table.

D for Design, RM for Resistant Materials, E for Electronics, F for Food and T for Textiles
SECTION A: Design Process

1. Apart from the front cover and contents list, give more page titles or headings related to the design process that should be included in the design folio.

i. __________________________

ii. __________________________

iii. __________________________

iv. __________________________

v. __________________________

vi. __________________________

vii. __________________________

viii. __________________________

ix. __________________________

tax. __________________________

½ mark × 10 = 5 marks

Read the situation carefully. Questions 2 to 6 refer to it.

The Association for Athletes is going to celebrate its 50th anniversary by organising a run, a walk, and a cycle for its members. Each participant is invited to give a contribution of €5 and will be given a souvenir at the finish line. The association has asked you to design this souvenir to be distributed to the athletes on the day. The souvenir should be produced from either textiles or resistant materials.

Choose the area you want to work in by ticking the desired box:

□ Textiles

□ Resistant Materials

2. a. Write a design brief for the given situation.

____________________________________________

____________________________________________

____________________________________________

____________________________________________

____________________________________________

2 marks

b. Find ONE keyword from your design brief.

____________________________________________

1 mark

3. For your design ideas to be satisfactory, you first need to do research. You therefore decided to conduct some product analysis related to the above situation.

a. Name TWO products that you would choose to analyse.

____________________________________________

____________________________________________

½ mark × 2 = 1 mark
b. Write down THREE questions you would ask about the product you are analysing.

* _______________________________________________________________________
* _______________________________________________________________________
* _______________________________________________________________________

1 mark \( \times 3 = 3 \) marks

4. Sketch ONE initial idea that will satisfy the design brief you wrote in Question 2. Remember that in order to communicate your ideas to others it is important that your sketches are clear and give an indication of size, material, colour, finishing and any purposeful decorations.

5. The Association for Athletes needs 2000 souvenirs. State the method of production you would use to produce the souvenirs. Give ONE reason for your answer.

<table>
<thead>
<tr>
<th>METHOD OF PRODUCTION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>REASON:</td>
</tr>
</tbody>
</table>

3 marks
A scientist was doing some experiments on mixing liquid chemicals and wanted to find out which of three mixtures heated up first by the chemical reaction. The mixing was done inside beakers which had a temperature sensor inside. These experiments involved a certain level of risk so an appropriate cubicle was designed as shown in Figure A.

**Figure A: Experiment cubicle**

6. The cubicle was made of plastic.
   a. Plastic is a thermal insulator. Define the term thermal insulator.

   _______________________________________________________
   1 mark

   b. Name TWO particular resistant materials which are thermal insulators.

   ___________________________ ___________________________
   1 mark x 2 = 2 marks

   c. Give another reason why plastic was used for the cubicle.

   _______________________________________________________
   1 mark

7. The sides and back are made from one whole plastic sheet with two perpendicular bends.

   a. Sketch the flat shape which was cut out from the plastic sheet to form the sides and back. Show the bending lines in your drawing.

   _______________________________________________________
   2 marks
b. i. Name the equipment which is used to bend plastic at an angle.

_____________________________________________________________________

1 mark

two marks

ii. Briefly explain how plastic is bent on this equipment.

_____________________________________________________________________

_____________________________________________________________________

8. The top opening flap is joined to the back by appropriate hinges which are bolted to the plastic and secured with nuts.

a. Label the bolt head, thread, nut and material on the diagram below.

[Diagram of bolt and nut]

½ mark × 4 = 2 marks

b. Holes need to be drilled in order to insert the bolts. State ONE safety precaution that should be observed when drilling holes in plastic.

_____________________________________________________________________

1 mark

c. The bolts and nuts used for these hinges were made of a ferrous alloy. Give a definition and a different example for each of following terms:

<table>
<thead>
<tr>
<th>TERM</th>
<th>DEFINITION</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferrous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alloy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 mark × 4 = 4 marks
d. Suggest a permanent joining method which is suitable to secure the hinges in place.

_________________________________________________________________________

1 mark

9. Screws were used to join the base and upper part of the cubicle. Assuming that the base control unit has the form of a simple box, complete the diagram below to show how the two parts were joined.

SECTION C: Electronics

10. Figure B shows the power source circuit used for the experiment cubicle described in the previous section. Tick the correct column to state whether the following sentences are TRUE or FALSE.

<table>
<thead>
<tr>
<th></th>
<th>TRUE</th>
<th>FALSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. <strong>Figure B</strong> shows 4 batteries connected in series.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. <strong>Figure B</strong> shows 2 batteries connected in parallel.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. AA, AAA, C, D, and PP3 all refer to different types of batteries.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Primary type batteries are batteries that can be used more than once.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Secondary type batteries are more environment-friendly than primary type batteries.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. An ammeter is used to measure the total voltage supplied by the circuit in <strong>Figure B</strong>.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

½ mark × 6 = 3 marks
11. **Figure C** shows the idea for the electronic system of the same experiment cubicle.

![Figure C Diagram]

**a.** What do we call the diagram shown in **Figure C**?

______________________________

1 mark

**b.** SPST switches were used for both the main switch and safety switch. In the space provided, add another SPST switch to show how the two switches are connected in series.

![Diagram](Diagram.png)

1 mark

**c.** A latched type switch was used for the main switch and a non-latched type switch was used for the safety switch. Tick the correct ending for the following sentences.

i. A latched type switch was used for the main switch because:

- ☐ it automatically turns ON.
- ☐ once it is pressed it remains in the required state until it is pressed again.
- ☐ it does not reduce any current from the circuit.

ii. A non-latched switch was used for the safety switch because:

- ☐ it does not offer resistance in the circuit.
- ☐ once it is pressed it stays OFF until it is pressed again.
- ☐ it needs to be continuously pressed to keep the required state.

1 mark × 2 = 2 marks
12. Figure D shows a potential divider circuit used for the temperature sensor found in the electronic system of the experiment cubicle. Table 1 shows part of the data sheet for Component A.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>35°C</td>
<td>9000 KΩ</td>
</tr>
<tr>
<td>30°C</td>
<td>4500 KΩ</td>
</tr>
<tr>
<td>25°C</td>
<td>3000 KΩ</td>
</tr>
<tr>
<td>29°C</td>
<td>100 KΩ</td>
</tr>
<tr>
<td>15°C</td>
<td>700 Ω</td>
</tr>
<tr>
<td>10°C</td>
<td>50Ω</td>
</tr>
</tbody>
</table>

**Table 1**

a. Name Component A labelled in Figure D.  

___________________  

1 mark

b. Underline the correct phrase to complete the following statements.

i. Vout:
   - never changes its voltage even though the temperature changes.
   - increases when temperature rises.
   - is always half the supply voltage.

ii. The reason for the above answer is because:
   - the resistance of Component A increases when temperature rises.
   - the resistance of Component A increases when temperature goes down.
   - Component A is a fixed resistor.

1 mark × 2 = 2 marks

c. Refer to Table 1 to calculate Vout when the temperature is 35°C.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>35°C</td>
<td>9000 KΩ</td>
</tr>
<tr>
<td>30°C</td>
<td>4500 KΩ</td>
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<tr>
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<td>3000 KΩ</td>
</tr>
<tr>
<td>29°C</td>
<td>100 KΩ</td>
</tr>
<tr>
<td>15°C</td>
<td>700 Ω</td>
</tr>
<tr>
<td>10°C</td>
<td>50Ω</td>
</tr>
</tbody>
</table>

**Figure D**

D. i. Place the potential divider shown in Figure D on the strip board in Figure E. Start from the positive end of the mains power supply which is already connected.  

1 mark

ii. By drawing a line, show how to connect the negative end of the mains power supply to the potential divider you have just drawn on Figure E.  

1 mark

iii. On Figure E, draw lines to show how the digital multimeter (DMM) should be connected to measure Vout on the strip board.  

1 mark
13. **Figure F** shows the incomplete electronic circuit used for the temperature sensor.

   a. On **Figure F** show how the potential divider circuit shown in **Figure D** is to be connected to turn the transistor on.  
      1 mark

   b. On **Figure F** show how an LED is to be connected so that it lights when the transistor is turned ON. Note that the LED needs 2.1V; 30mA.  
      1 mark

14. The transistor was replaced by a Darlington pair transistor so as to light a light bulb instead of the LED.

   a. Connect the TWO transistors shown in **Figure G** to form a Darlington pair transistor.  
      1 mark

   b. On **Figure G** label the collector, base and emitter of TR1.  
      1 mark

   c. Complete the sentences below by underlining the correct answer from the brackets.

      i. A Darlington pair transistor is used to (amplify / store / decrease) the current.

      ii. The transistors used for the Darlington pair in **Figure G** were (PNP / NPN / NNP) type.

      $\frac{1}{2} \text{ mark} \times 2 = 1 \text{ mark}$
15. Underline the correct answer from the brackets for each of the following statements.


b. Chicken is a good source of ( fibre / calcium / iron ).

c. ( Carbohydrates / Fats / Minerals ) do not give us energy.

d. The danger zone for high risk food is between ( 0°C and 5°C / 5°C and 63°C / 63°C and 132°C ).

e. The food product has its quality guaranteed until the ( best before / use by / manufactured on ) date.

1 mark × 5 = 5 marks

16. Use the nutritional information of the four sandwich fillings below to answer the questions.

<table>
<thead>
<tr>
<th>100g provides:</th>
<th>Energy: kcal</th>
<th>Protein: g</th>
<th>Carbohydrate: g</th>
<th>Fat: g</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: grilled chicken</td>
<td>187</td>
<td>5</td>
<td>25</td>
<td>7</td>
</tr>
<tr>
<td>B: tuna</td>
<td>176</td>
<td>8</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>C: egg and cheese</td>
<td>233</td>
<td>11</td>
<td>18</td>
<td>13</td>
</tr>
<tr>
<td>D: ham and cheese</td>
<td>241</td>
<td>14</td>
<td>23</td>
<td>11</td>
</tr>
</tbody>
</table>

a. Which of the above filling:
   i. has the most fat? __________
   ii. has the most carbohydrates? __________
   iii. is suitable for someone who works as a clerk in an office? __________
   iv. is most suitable for a person who is training to be a body builder? __________

1 mark × 4 = 4 marks

b. Which TWO sandwiches provide us with the same amount of carbohydrates? __________

1 mark

17. A shopping centre will be opening shortly and one of its outlets will be a snack bar where shoppers will relax over a refreshing yoghurt drink and a snack.

a. The bar will be selling pastry products which make use of short crust pastries.
   i. Fill in the blank.
      In short crust pastry, there should be 200g of flour for every ______g of fat.

1 mark

ii. Half of the flour in the recipe was substituted by whole meal flour, which contains more fibre. List TWO functions of fibre in the body.

   ▪ __________________________________________________________________________
   ▪ __________________________________________________________________________

1 mark × 2 = 2 marks

iii. At what temperature should the oven be set for baking the pastry?

   _________________________________

1 mark
b. The bar will be serving yoghurt smoothies.

i. List THREE important steps that should be considered in yoghurt making.

▪ ________________________________________________________________
▪ ________________________________________________________________
▪ ________________________________________________________________ 1 mark × 3 = 3 marks

ii. Fill in the blanks with the following words.
▪ texture  ▪ lactic acid  ▪ biotechnological
▪ ferment  ▪ microorganisms  ▪ calcium

Yoghurt is a traditional ___________________ product. It is produced by _________________. The bacteria ________________ the sugar in the milk and produces _________________. This gives the yoghurt its ________________ and sour taste. Yoghurt is a healthy product rich in ________________ and protein. ½ mark × 6 = 3 marks

SECTION E: Textiles

18. Knitted fabrics are widely used in today’s clothing market.

a. Give TWO reasons why manufacturers use synthetic knitted fabrics to produce swimwear.

▪ ________________________________________________________________
▪ ________________________________________________________________ 1 mark × 2 = 2 marks

b. Give TWO advantages of using cotton knitted fabrics.

▪ ________________________________________________________________
▪ ________________________________________________________________ 1 mark × 2 = 2 marks

19. When using equipment, it is important to be safe.

a. State TWO safety checks you would carry out before using a sewing machine.

▪ ________________________________________________________________
▪ ________________________________________________________________ 1 mark × 2 = 2 marks
b. State TWO precautions you should observe when using dyes.

* ____________________________________________________________
* ____________________________________________________________

1 mark × 2 = 2 marks

20. Textiles products manufacturers include after-care labels in their products.

a. Fill in the table below by giving the meaning of each symbol.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Symbol 1]</td>
<td>![Meaning 1]</td>
</tr>
<tr>
<td>![Symbol 2]</td>
<td>![Meaning 2]</td>
</tr>
<tr>
<td>![Symbol 3]</td>
<td>![Meaning 3]</td>
</tr>
<tr>
<td>![Symbol 4]</td>
<td>![Meaning 4]</td>
</tr>
</tbody>
</table>

1 mark × 4 = 4 marks

b. Why are symbols used on these labels instead of written instructions?

________________________________________________________________________

2 marks

21. Name the type of seam shown in the diagram below.

NAME OF SEAM: _______________________________________________________

2 marks

22. Identify the TWO edge finishes shown in the diagrams below.

_____________________________________________________________________

1 mark × 2 = 2 marks

23. The steam iron is a tool commonly found in a Textiles Lab. List TWO uses of the steam iron.

* ____________________________________________________________
* ____________________________________________________________

1 mark × 2 = 2 marks