FORM 4       DESIGN & TECHNOLOGY       TIME: 2 hours

Name: _____________________________________                                Class: _______________

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--- Note to student: ---
You are required to answer all questions

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<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>T</td>
<td>F</td>
</tr>
<tr>
<td>Max. Marks</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Student’s mark</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

FOR TEACHERS' USE ONLY

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

D for Design, RM for Resistant Materials, E for Electronics, T for Textiles technology and F for Food technology
A toy manufacturer has noticed that the sales of pull along toys (a toy which can be pulled/pushed along) for children aged between 2 and 3 years old are declining. The manufacturer wants to sell the product around the globe.

1. Write down a design brief for the given situation and on your design brief underline TWO keywords.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

1 mark + (½ × 2) = 2 marks

2. Research is an important part of a design process. In the space provided mention THREE aspects you would research for to design a pull along toy.

■________________________________________________________________________
■________________________________________________________________________
■________________________________________________________________________

1 mark × 3 = 3 marks

3. Write THREE design specifications that you would consider essential for an appropriate pull along toy required by the manufacturer.

■________________________________________________________________________
■________________________________________________________________________
■________________________________________________________________________

1 mark × 3 = 3 marks
4. In the space provided below sketch ONE idea you would present to the manufacturer for producing a pull along toy. *In your answer add notes, dimensions, labelling, and colouring.*

6 marks

5. Explain briefly how you could evaluate the initial ideas in order to find out the best idea for your project.

__________________________________________________________________________________

__________________________________________________________________________________

__________________________________________________________________________________

1 mark

6. Which is the most suitable method used for making your product and state why?

- Method of production: ____________________________________________________________

- Reason why: _________________________________________________________________

1 mark \* 2 = 2 marks
7. Explain 3 types of testing that should be applied to the model (prototype) before it is manufactured.

- ________________________________

- ________________________________

- ________________________________

1 mark × 3 = 3 marks
8. A student needed a mechanism with three variable rotational speeds for a project. The student came up with a combination of six pulleys set-up on two shafts. Figure A explains how this mechanism functions.

![Figure A](image)

**Figure A**

a. State the direction of rotation of the OUTPUT shaft. ________________________________
   1 mark

b. Underline the correct words in the following sentences:

   i. When the belt is engaged on pulley A and pulley B the output speed is ( less than / equal to / greater to ) the input speed.

   ii. When the belt is engaged on pulley B and pulley C, the output speed is ( less than / equal to / greater to ) the input speed.

   \[
   \frac{1}{2} \text{ mark } \times 2 = 1 \text{ mark}
   \]
c. The student wanted to obtain an increase in speed from the input to the output shaft when pulley E and pulley F are engaged. Complete the diagram on Figure B by drawing and labelling pulley F and adding the belt.

![Figure B](image_url)

**Figure B**  
2 marks

d. Describe the relationship between the speed and force in a pulley and belt mechanism.

__________________________________________________________________________  
2 marks

9. MDF was used to make a model of the pulley system.

a. Define what MDF stands for: _______________________________________________  
1 mark

b. Give TWO reasons for this choice of material:

- ________________________________________________  

- ________________________________________________  
1 mark × 2 = 2 marks

c. Here is a list of tools that the student could have used when producing the model of pulleys.

- chisel  
- pillar drill and twist drill  
- Vernier callipers  
- a pair of compasses  
- coping saw

Using the above list, state the most suitable tool for each of the following processes:

i. marking the outside diameter of the pulley________________________________________  

ii. cutting the outside diameter of the pulleys _______________________________________  

iii. making the centre holes on the pulleys _________________________________________  

iv. checking the dimension of the outside diameter of the pulleys ____________________  

_________________________________________________  
½ mark × 4 = 2 mark
10. Both input and output shafts were made from a wooden dowel and each pulley was distanced 2mm away from the other on the same shaft.

a. Name the most suitable adhesive for joining the pulleys to the shaft. _______________ 1 mark

b. In the space below, illustrate ONE method how to keep the 2mm distance between each pulley on the shaft.


2 marks

11. A cam was connected on the output shaft of the pulley system shown in Figure A in order to obtain a change in motion.

a. What type of motion is obtained at the output of a cam? _____________________ 1 mark

b. Give the names of the following cam profiles.

Cam A     Cam B                                   Cam C
___________________             ______ _____________      ___________________

1 mark × 3 = 3 marks

c. Which of the above cams will not work in the system that the student designed? Give ONE reason for your answer.

■ CAM: __________
■ REASON: ___________________________________________ _________________

1 mark × 2 = 2 marks
12. Figure C shows a block diagram of an electronic circuit used in a project.

a. On Figure C, properly show in the INPUT, PROCESS, and OUTPUT stages of the circuit.  

   ![Figure C](image)

   **Figure C**

b. Draw the symbol used for an OR gate and label its inputs A, B and its output Z.

   ![OR gate symbol](image)

   2 marks

c. Complete the truth table for an OR gate.

<table>
<thead>
<tr>
<th>INPUTS</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

   \( \frac{1}{2} \text{ mark } \times 4 = 2 \text{ marks} \)

d. Logic gates are built within an IC. What does IC mean?

   ___________________________________________

   1 mark
13. Figure D shows a possible layout to develop the design idea in question 1. When the shaft shown in Figure D rotates, either clockwise or anticlockwise, an LED lights.

[a.] What type of batteries did the student use for the project shown in Figure D?

[1 mark]

[b.] If each battery has a voltage of 3V and the student needs to have 6V, show how the two batteries are to be connected using electronic symbols only.

[2 marks]

[c.] Figure E shows the INPUT circuit diagram of the project. Complete the circuit by designing the PROCESS and OUTPUT stages. Label all components used and show the necessary calculation.

Datasheet information for: LED: 2.3V, 0.025amps
OR gate output voltage: +5V

[5 marks]
14. Instead of using an LED for the OUTPUT stage, a design and technology student designed the circuit shown in Figure F to have a beeping type sound for the OUTPUT.

![Circuit Diagram](image)

**Figure F**

a. On Figure F, label the non-electrolytic capacitor. 

1 mark

b. Use the ✓ symbol and mark the correct answer only.

- ☐ Figure F shows an electronic circuit diagram.
- ☐ Figure F shows a block diagram.
- ☐ Figure F shows a veroboard layout.

1 mark

c. The three components involved to control the timing in Figure F are R1, VR1 and C1. If the total resistance of R1 and VR1 is 100KΩ and C1 is 1000µF, calculate the charging time. \( \text{(time} = \text{Resistance} \times \text{Capacitance}) \).

\[
\text{charging time} = 100 \times 1000 = 100,000 \text{ seconds}
\]

2 marks
15. Put the following food items into the appropriate categories.

<table>
<thead>
<tr>
<th>RAW FOOD</th>
<th>PRIMARY FOOD</th>
<th>SECONDARY FOOD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Pasteurised milk
- Yoghurt
- Milk
- Tomato sauce
- Tomato juice
- Tomatoes

½ mark × 6 = 3 marks

16. Give ONE example of each working property of food given below. An example is given.

a. Thickening: adding flour to sauce.

b. Coating: _________________________________

c. Aerating: _________________________________

1 mark × 2 = 2 marks

17. A food outlet wants to offer savoury, healthy wraps. Suggest ONE filling for the wraps and give a reason for your choice.

a. Filling: _________________________________

b. Reason: _________________________________

1 mark × 2 = 2 marks

18. Fill in the table below by putting the SIX vitamins under the correct heading.

<table>
<thead>
<tr>
<th>WATER SOLUBLE VITAMINS</th>
<th>FAT SOLUBLE VITAMINS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
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<td></td>
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</tbody>
</table>

½ mark × 6 = 3 marks
19. State the healthiest cooking method used for the following foods and give ONE reason for each method.

<table>
<thead>
<tr>
<th>FOOD</th>
<th>METHOD</th>
<th>REASON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef burgers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 mark × 4 = 4 marks

20. Fill in the star diagram below showing the sensory specifications for peach yoghurt.

21. a. Which ingredient helps the bread rise?

_______________________________________________ _______________________

1 mark

b. What is the purpose of resting the bread dough before baking it?

_______________________________________________ _______________________

1 mark
SECTION E: Textiles

22. Bathroom towels are often made from 100% cotton towelling. Give TWO reasons why this fabric is suitable for the making of bathroom towels.

■ _____________________________________________________________
■ _____________________________________________________________

1 mark × 2 = 2 marks

23. Identify the following basic construction methods usually used in the manufacture of fabrics.

a. ________________________  
   b. ________________________  

1 mark × 2 = 2 marks

24. Give THREE reasons why the information found on a label of a textile product is useful to the consumer.

■ _____________________________________________________________
■ _____________________________________________________________
■ _____________________________________________________________
■ _____________________________________________________________

2 marks × 3 = 6 marks
25. Give THREE reasons why manufacturers now use Elastane fibres to produce swim wear.

- ________________________________________________________________
- ________________________________________________________________
- ________________________________________________________________

2 marks × 3 = 6 marks

26. List FOUR factors to look for when choosing a pair of cutting shears suitable for cutting fabrics.

- ________________________________________________________________
- ________________________________________________________________
- ________________________________________________________________
- ________________________________________________________________

1 mark × 4 = 4 marks