Annual Examinations for Secondary Schools 2014

FORM 1 DESIGN AND TECHNOLOGY TIME: 2 hrs

Name: _____________________________________ Class: ______________

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

Note to student: You are required to answer all questions

Useful Formulae:

\[ R = \frac{V}{l} \quad V_t = V_1 + V_2 + \ldots \]

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

FOR TEACHERS’ USE ONLY

<table>
<thead>
<tr>
<th>Marks for Written Exam.</th>
<th>Marks for Design Folio</th>
<th>Marks for Making Skills</th>
<th>TOTAL</th>
<th>FINAL MARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Marks</td>
<td>100</td>
<td>50</td>
<td>50</td>
<td>200</td>
</tr>
<tr>
<td>Student’s mark</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---------------------------------------------------------------------
1. Use the following terms to fill in the steps of the design process shown in Figure A. *One has been done for you.*

- Development
- Making
- Research
- Planning
- Design brief
- Initial Ideas
- Specifications

![Diagram of Design Process]

Figure A: Design Process

$\frac{1}{2} \text{ mark } \times 10 = 5 \text{ marks}$

2. Read the following statement.

A film about human-like robots will be shot in Malta. The production company needs a particular head mask to be worn by the main actor of the film. The head mask will be the face of the main robot character of the film and should attract attention by the use of internal lighting and/or sound.

Which stage of the design process best describes this statement?

______________________________

1 mark

The following is a possible design brief for the statement above. Read it carefully to answer Questions 3 to 5.

**Design and make a robot head mask with internal lighting and/or sound to be used by the main actor of a film.**
3. Write down THREE keywords from this design brief.

____________________          ____________________          ____________________  

1 mark × 3 = 3 marks

4. To prepare your specifications list you need to do research. State THREE sources from where you can gather information.

____________________          ____________________          ____________________  

1 mark × 3 = 3 marks

5. a. Figure B shows an idea for the resistant material part of the robot head mask. In the space provided, sketch another idea for resistant material part of the human-like robot mask.

![Figure B: Design idea for a human-like robot mask](image)

**Figure B: Design idea for a human-like robot mask**

4 marks
b. Figure C shows an idea for the electronic system of the lighting for the robot head mask. In the space provided, sketch another idea for electronic system of the lighting for the robot head mask.

![Diagram of electronic system](image)

**Figure C: Design idea for the electronic system for the lighting of the human-like robot mask**

4 marks

6. The bent metal wire antennas of the robot mask shown in Figure B are to be made from 2mm diameter mild steel, which is ferrous.


_________________________________________________________________________

_________________________________________________________________________

1 mark

b. Suggest a quick test by which you can check whether a metal is ferrous or not.

_________________________________________________________________________

1 mark
c. The round-nose pliers circled below can be used when shaping the metal wire. Circle another TWO tools which can be used when shaping the metal wire.

\[ \frac{1}{2} \text{ mark } \times 2 = 1 \text{ mark } \]

d. Fill in the table below by writing the name of the tools you have circled in question 6c and state their use for the shaping of the metal wire. *The first one has been done for you.*

<table>
<thead>
<tr>
<th>NAME OF TOOL</th>
<th>USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round-nose pliers</td>
<td>Holding and bending the wire</td>
</tr>
</tbody>
</table>

5 marks

7. It was suggested to use the different metals to construct the mouth of the mask shown in Figure B so as to have a colourful effect. Consider the following list of metals when answering question 7a to 7d:

- copper  
- lead  
- gold  
- aluminium

a. State ONE factor which these metals have in common.

_________________________________________________________  

1 mark

b. In the boxes provided, write down the metal from the list above which is commonly used to produce each of the following items:

i. electrical wiring  
ii. diamond ring  
iii. window frame  
iv. Strip board  
v. X-ray protection equipment  
vi. food dish

\[ \frac{1}{2} \text{ mark } \times 6 = 3 \text{ marks } \]
c. Complete the table below by matching the above metals with their correct colour description.

<table>
<thead>
<tr>
<th>COLOUR DESCRIPTION</th>
<th>NAME OF METAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>bluish white</td>
<td></td>
</tr>
<tr>
<td>silvery white</td>
<td></td>
</tr>
<tr>
<td>reddish brown</td>
<td></td>
</tr>
<tr>
<td>bright yellow</td>
<td></td>
</tr>
</tbody>
</table>

1 mark × 4 = 4 marks

d. Two of the above metals were chosen for the mouth of the mask: copper and aluminium. Complete the following sentences by ticking the correct phrase from the tables with (√).

i. One reason for choosing copper and aluminium was because:

- they are lighter in weight. ✅
- they are heavier in weight.
- they have no density.

ii. Gold was not chosen because:

- it is a poor electric conductor. ✅
- it is very expensive.
- it is ferrous.

iii. Lead was not chosen because:

- it is toxic.
- it is very hard.
- it is ferrous. ✅

1 mark × 3 = 3 marks

8. The outer plastic casing of the mask shown in Figure B is to be made of polystyrene sheet. The central part of the mask is bent to shape from a flat sheet as shown in Figure D by heating.

Figure D: Shaping the plastic sheet
a. Give ONE reason why polystyrene can be shaped by heating.

_________________________________________________________________________

1 mark

b. The polystyrene sheet is 240mm wide. The resulting shape should have an outside diameter of 200mm and a height of 220mm.

i. On the bent sheet shown on Figure D, neatly mark these THREE dimensions.

1 mark \times 3 = 3 marks

ii. Explain how you would calculate the total length of sheet needed to make the required shape.

_________________________________________________________________________

_________________________________________________________________________

2 marks

c. On Figure D, shade the area of the flat sheet that should be heated in order to perform the shown bend.

1 mark

d. Give the name of ONE tool which can be used to heat the plastic. Also give TWO safety precautions which should be observed when using this tool.

<table>
<thead>
<tr>
<th>NAME OF TOOL:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAFETY PRECAUTIONS:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

3 marks

e. In the box provided, draw the mould onto which the sheet should be shaped.

2 marks
9. Wood is a possible material from which to make the mould for bending the plastic sheet. Consider the following types of wood:

- red deal
- chipboard
- parana pine
- beech
- MDF
- plywood

a. Divide the above wood according to the following two categories:

<table>
<thead>
<tr>
<th>NATURAL WOOD</th>
<th>MANUFACTURED BOARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>-------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------------</td>
</tr>
</tbody>
</table>

½ mark × 6 = 3 marks

b. Figure E shows a plank of a natural wood. Finish the drawing to show how natural wood looks like. Then label the LINE OF GRAIN and the END GRAIN.

Figure E: A plank of wood

3 marks

c. The plank is not large enough to make the mould for bending the plastic, so you have to join one plank on top of the other to obtain the required size. By means of sketches, explain how you would join the two planks together. Also name the type of joining method used.

SKETCH:

NAME OF JOINING METHOD:

3 marks
The robot head mask shown in Figure B needs a light source for the wobbling eyes and a buzzer to generate sound. Flashing light effects will also be introduced around the mouth of the mask as shown in Figure F.

![Figure F: Electronics for the robot mask](image)

10. Figure G shows TWO different light sources. However, white LEDs shall be used as light sources for the eyes of the robot mask.

   a. On Figure G draw a circle round the LED.  
      1 mark

   b. Label the Anode and Cathode of the LED.  
      1 mark

   c. In the space provided below, draw the symbol for an LED.  
      2 marks

![Figure G](image)

11. Figure H shows TWO different sources of electrical energy. The system of the robot mask requires AAA-type secondary batteries as a source of electrical energy for the LEDs.

   a. On Figure H draw a circle around the AAA-type battery.  
      1 mark

   b. Give the meaning of secondary type batteries.  
      2 marks

![Figure H](image)
c. Use electronic symbols to show how to connect FOUR batteries in series.


2 marks

d. Calculate the total voltage for the FOUR batteries connected in series.


3 marks

12. Figure I shows the electronic circuit used to generate the mask sound.

a. What type of switch is used in Figure I?


1 mark

b. The switch in Figure I is a non-latched type switch. What does a non-latched switch means?


2 marks

c. The buzzer shown in Figure I needs 6V and 0.022A to function properly. Calculate the value of the resistor needed for the circuit in Figure I.


4 marks

d. Figure J shows an incomplete circuit layout for the buzzer circuit shown in Figure I. Complete the circuit layout by placing the components shown below into their proper position.


4 marks

e. Mention ONE safety rule that must be observed during soldering of electronic components.


1 mark
f. The following tools and materials were used to make the circuit shown in Figure J.

- Soldering iron
- Solder
- Side cutter
- Wire stripper
- Soldering iron stand

Use these tools and materials to label the pictures shown below. The first one is done for you.

13. Figure K shows an equipment used in the development of the electronic circuit used for the robot mask.

   a. Mention why do we use breadboard.

   ______________________________________________________________________
   ______________________________________________________________________

   2 marks

b. Figure L shows the block diagram used for the flashing LEDs circuit used for the robot mask.

   i. In the space below write the:

   INPUT COMPONENT/S ______________________________________________________
   PROCESS COMPONENT/S __________________________________________________
   OUTPUT COMPONENT/S ____________________________________________________
ii. What does SPDT refer to?

iii. Why is there no need to connect a resistor with flashing LEDs when connected with 9V batteries?

iv. In the space provided below draw the electronic circuit for the block diagram shown in Figure L.
| Design & Technology | Levels 5 – 8  
| Student’s Paper  
| Page 10 - Question 11d  
| Question should read: Calculate the total voltage for the FOUR AAA batteries connected in series. |