

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

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2013 SESSION

SUBJECT: **Design and Technology**
 PAPER NUMBER: IIA
 DATE: 23rd May 2013
 TIME: 9:00 a.m. to 11:00 a.m.

Answer ALL 10 questions. Each question carries 10 marks.

Useful Information:

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 = ±5%
				Silver = ±10%

Equations

$$R_t = R_1 + R_2 + R_3$$

$$V = IR$$

$$\frac{1}{R_t} = \frac{1}{R_1 + R_2 + R_3}$$

DESIGN

Question 1 and **Question 2** are based on the single situation given below.

Industry is already getting ready for the Christmas season. One company wants to focus on a particular market. Teenagers like to be able to buy small gifts for their friends and the company wants to focus on this by producing a novel range of products. As it is teenagers (11 to 19 years of age) that they want to attract, the gifts must be cheap to buy but there must also be ample choice.

The company has asked you to design one gift. You are able to work in any one of four areas (resistant materials OR electronics OR food OR textiles). As the designer you must choose the area you will work in to produce the gift.

Question 1

- a. Write a design brief to be able to start the design of the gift. The brief must, in this instance, show the area you are going to work in.

2 marks

- b. According to the design brief, describe the main research you would carry out.

4 marks

A large, empty rectangular box with a thin black border, occupying most of the page. It is intended for the student to write their answer to the question.

7 marks

b. One idea will be chosen for developing and making. State which idea should be developed and made.

Idea Number	
-------------	--

Your finished product should be tested. Suggest suitable tests for your product.

3 marks

Please turn the page.

RESISTANT MATERIALS**Question 3**

The grand piano is made from several different materials. Figure 1 shows some of the elements which form part of such pianos.

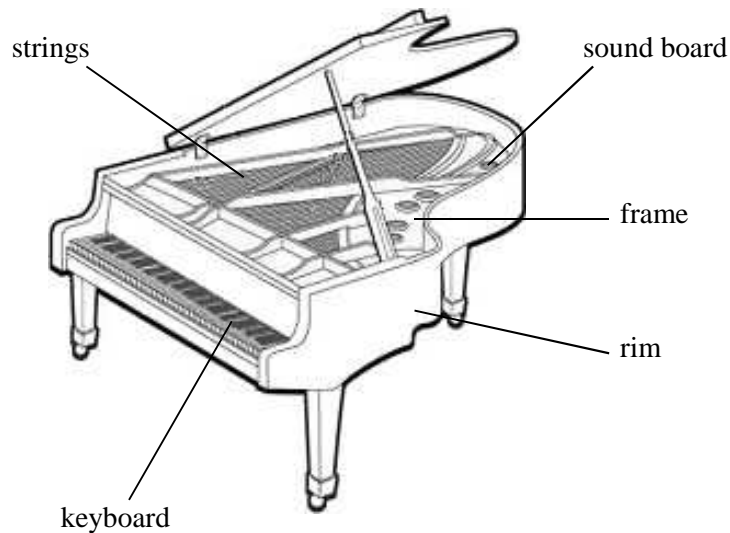


Figure 1: Grand piano main parts

- a. Certain modern keyboards are sometimes covered with plastic. Mention TWO properties which such plastic should have.

1 mark

- b. The strings are made from high-carbon steel wires fixed to the frame. Some of the wires have different diameters to produce different musical notes.

- i. Identify a tool that can be used to measure the diameter of the wire.

1 mark

- ii. Suggest ONE other method by which the same wires can produce other musical notes.

1 mark

- c. The sound board has the function of amplifying the sound resulting from the vibration of the strings. Sound boards are usually made from spruce, which is a softwood. Define the term softwood and write down TWO other examples.

DEFINITION		
EXAMPLES		

2 marks

- d. The frame is made from cast iron. Figure 2 shows a cross-section of the three parts which need to be joined together. Sketch and name a method by which to join the frame to the soundboard and bottom of the inner rim which are both made from wood.

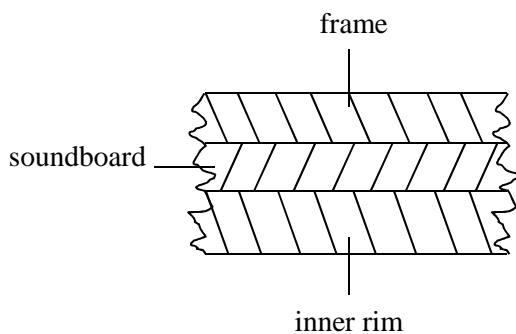


Figure 2: Cross-section of joining parts

SKETCH:

NAME:

2 marks

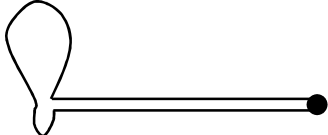
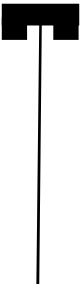
- e. The rim is made from laminated hardwood
- i. By means of labelled diagrams, explain what lamination is.

2 marks

- ii. State the main advantage of using laminated hardwood instead of solid timber for making the rim of the piano.

1 mark

b. Complete the table below by adding arrows to show the direction of movement of the hammer and damper when the key is pressed and released. Also name the type of motion occurring at each part.

PART	DIAGRAM	TYPE OF MOTION
Hammer		
Damper		

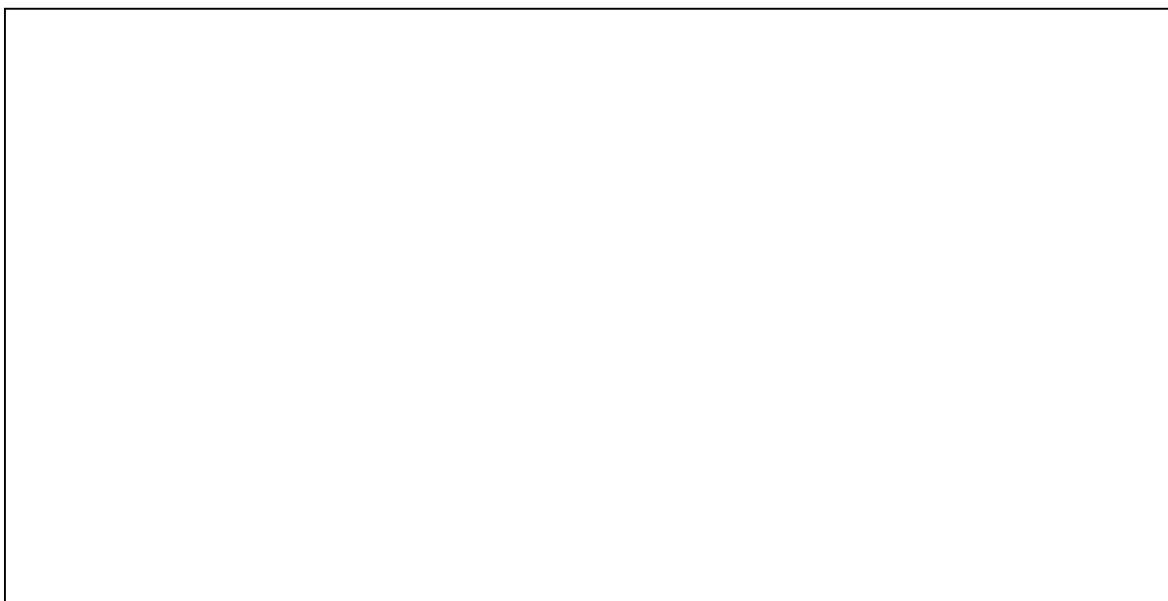
2 marks

c. Give the function of the following parts in the piano mechanism.

- i. Fixed slider: _____
- ii. Damper: _____

2 marks

d. The mechanism shown in Figure 3 needs to undergo a long performance test. Therefore another mechanism is needed in order to create an automatic input on the piano key. The testing device shall work with a motor. In the space provided below, sketch the output mechanism of this testing device.



3 marks

ELECTRONICS

Question 5

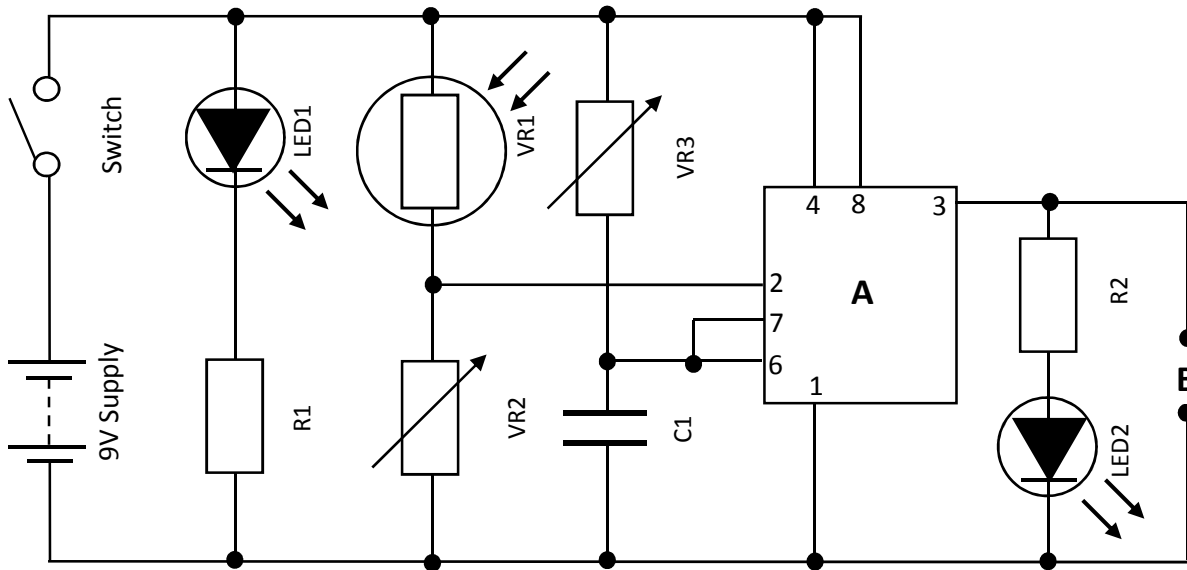


Figure 4

a. The circuit diagram for an intruder alarm is shown in Figure 4.

i. State the function of a monostable circuit as shown in Figure 4.

1 mark

ii. State the name of the IC shown as component A.

1 mark

iii. State the purpose of pin 3 of the IC.

1 mark

b. In space B a sound device for the alarm should be inserted. Write the name of a sound device and draw its symbol in the space below.

NAME	SYMBOL

1 mark

c. State the purpose of resistor R1.

1 mark

d. i. Calculate the value for resistor R1 when a current of 20mA flows through LED1 in Figure 4. The voltage for LED1 is 2V and the voltage for the circuit's supply is 9V. Show all working in the space provided below.

2 marks

ii. Explain the purpose of VR2 and VR3 variable resistors in the circuit.

2 marks

iii. The circuit triggers when darkness falls on the LDR. If this sensory circuit needs to function vice versa, that is it triggers when light falls on the LDR, what modifications should be made to the circuit?

1 mark

Question 6

a. i. Complete the following:

The term PCB stands for:_____ . The circuit diagram is printed on a transparency and used as a mask. The mask is placed together with the board in a light box and exposed to _____ light for 2-3 minutes, The board is then placed into a tank filled with _____ to remove the photo-resist film. The board is washed with water and then placed in a _____ bath to remove unwanted copper leaving the tracks only.

1 mark

ii. State the reason why a Vero board has to be cleaned before soldering.

1 mark

b. Figure 5 shows a piece of equipment with a component in place.

i. State the name of the piece of equipment and its function.

1 mark

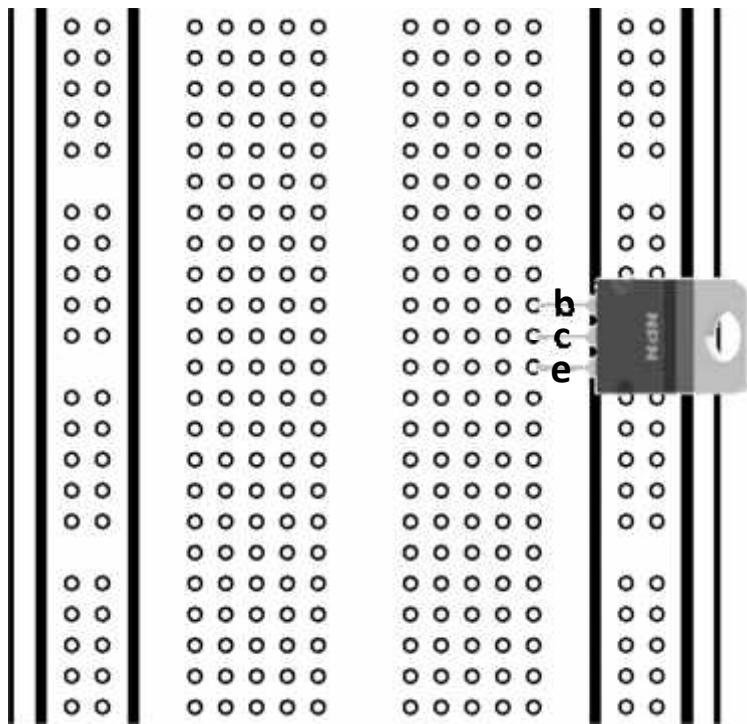


Figure 5

ii. On Figure 5 above construct the circuit given in Figure 6. One component has been drawn for you. Clearly label the supply and the components.

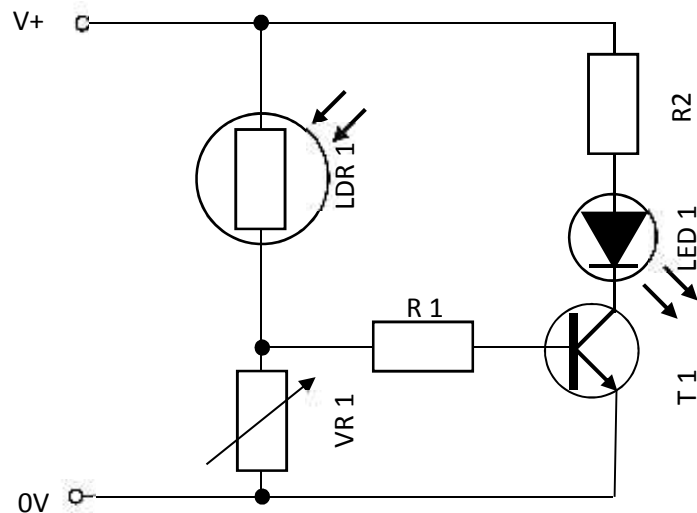


Figure 6

3 marks

c. Figure 7 shows a logic circuit.

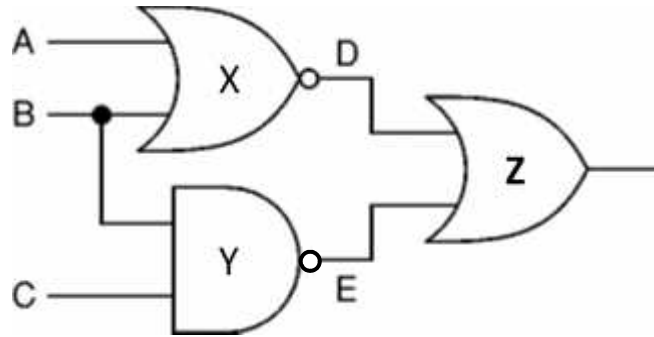


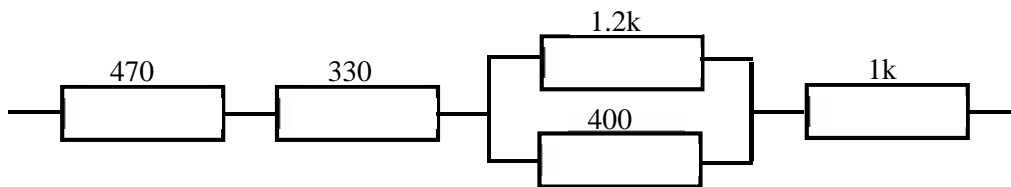
Figure 7

State the names of these logic gates in the table below.

LOGIC GATE	NAME
X	
Y	
Z	

2 marks

d. Find out the total resistance for the circuit below. Show your working in the space provided.



2 marks

FOOD

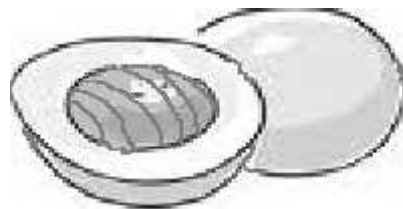
Question 7

During the year there are several instances where people get together to celebrate all kinds of occasions. A catering company sees this as an opportunity for developing finger food for such events. The food prepared should be in line with the dietary guidelines.

a. List TWO dietary guidelines and give ONE example of how each can be achieved.

2 marks

b. Stuffed eggs are popular finger food. The main nutrient in this finger food is protein.



i. Outline the main function of protein. _____

ii. Identify TWO sources of non-animal protein. _____

iii. State ONE advantage of these alternative proteins. _____

iv. Give ONE deficiency caused by lack of protein. _____

4 marks

c. Suggest a healthy filling and a finishing technique for stuffed eggs.

2 marks

d. Recommend ONE healthy cooking method for each of the following finger food and give a description of the method of cooking suggested.

FOOD	COOKING METHODS	DESCRIPTION
Meat balls		
Pastry stuffed with dates (imqaret)		

2 marks

Question 8

Before developing finger food products, the company carried out market research. They found that yeast-based finger foods are always a popular selection for different occasions.

a. Why do food companies carry out market research?

1 mark

b. What method is used for finger food production for such get-togethers? Give a reason for your answer.

2 marks

c. What is yeast?

1 mark

d. State how the temperature of water affects the yeast if the water is:

i. cold - _____

ii. hot - _____

2 marks

e. Explain ONE function of the following ingredients in a yeast product.

INGREDIENTS	FUNCTION
Yeast	
Sugar	
Flour	

3 marks

iii. Continue the following sentence.

Yeast ferments the sugars in the mixture and produces _____ and _____ . This is trapped inside tiny bubbles and causes the dough to _____ .

1 mark

TEXTILES

Question 9



Figure 8

Figure 8 shows a covered plain cushion produced by ‘Flower Power Textiles’ which can be produced both from natural and manufactured fabrics.

- a. Complete the table below by giving TWO examples of a natural and manufactured material. Give TWO examples of a different product made from each.

	NAME OF FABRIC	PRODUCT
NATURAL		
MANUFACTURED		

4 marks

- b. The process used to produce that pattern on the cushion cover shown in Figure 8 is called Tie and Dye. Mention FOUR other different finishing processes to enhance the appearance of the cushion.

- i. _____
- ii. _____
- iii. _____
- iv. _____

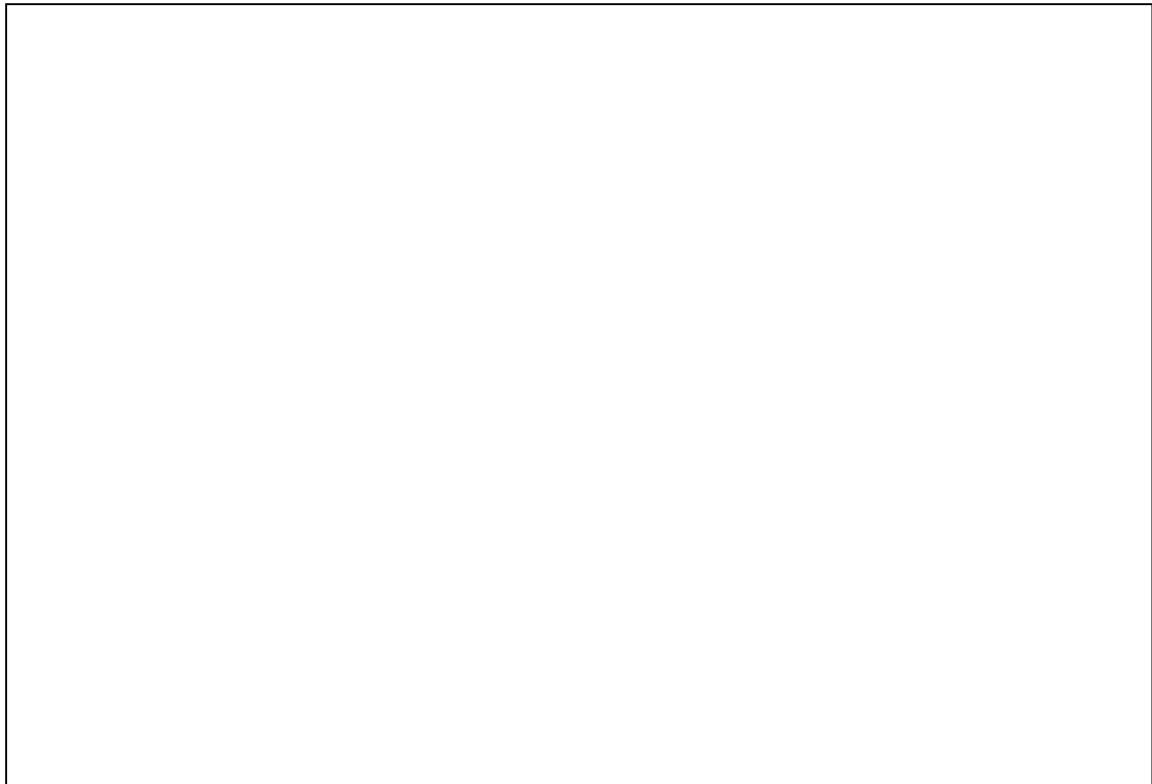
2 marks

- c. Complete the sentence below by naming the most fitting natural fabric for the process of tie and dye to be a success, and give the reason for your answer.

The cushion should be produced from _____ because it is a very _____ material.

1 mark

- d. Explain how the tritik process is applied to a piece of fabric. Enhance your answer with diagrams.



3 marks

Question 10



Figure 9

a. Name the machine shown in Figure 9 and explain its purpose.

Name of the machine: _____

Purpose: _____

1 mark

b. Mention TWO techniques that can be used to finish an edge while making the cushion cover.

1 mark

c. Sometimes the cushion cover needs to be washed and placed in again. Mention TWO ways how the cushion cover could be kept in place.

2 marks

d. Textiles products come with various labels. Which is the most important label that textile product such as the cushion cover should carry.

1 mark

Please turn the page.

e. Draw the label that is going to be on the cushion if the listed information needs to be delivered to the user.

- Product from 'Flower Power Textiles Ltd.'
- It is made 100% from the material mentioned in 9c
- Do not bleach warning sign
- Wash with 40 °C water
- Iron with low temperature
- It is Made in China



5 marks

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SECONDARY EDUCATION CERTIFICATE LEVEL

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Violet	7	7	-	
Grey	8	8	-	
White	9	9	-	
				Gold = $\pm 5\%$
				Silver = $\pm 10\%$

Equations

$$R_t = R_1 + R_2 + R_3$$

$$\frac{1}{R_t} = \frac{1}{R_1 + R_2 + R_3}$$

$$R = \frac{V_S - V_{LED}}{I}$$

DESIGN

Question 1 and **Question 2** are based on the single situation given below.

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Question 1

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2 marks

- b. According to the design brief, describe the main research you would carry out.

4 marks

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7 marks

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Idea Number	
-------------	--

Your finished product should be tested. Suggest suitable tests for your product.

3 marks

Please turn the page.

RESISTANT MATERIALS**Question 3**

The grand piano is made from several different materials. Figure 1 shows some of the parts which form such pianos.

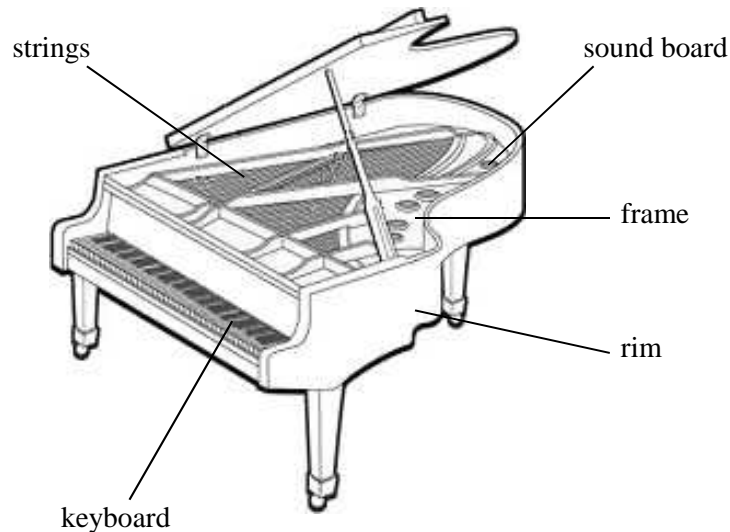


Figure 1: Grand piano main parts

- a. Certain modern keyboards are covered with plastic. Mention ONE property which such plastic should have.

1 mark

- b. The strings are made from high-carbon steel wires fixed to the frame. Some of the wires have different diameters to produce different musical notes.

- i. Underline ONE tool from the list below that can be used to measure the diameter of the wire.

Vernier callipers steel rule micrometer screw gauge

measuring tape outside callipers

1 mark

- ii. Suggest ONE other method by which the same wires can produce other musical notes.

1 mark

c. The sound board has the function of amplifying the sound resulting from the vibration of the strings.

i. High-quality sound boards are made from spruce, which is a softwood. Define the term softwood and write down ONE other example.

DEFINITION	
EXAMPLE	

2 marks

ii. Low-quality sound boards are made from plywood. In the space provided, sketch and label this material.

2 marks

d. The frame is made from cast iron. Name a method by which to join the frame to the soundboard and bottom of the piano which are both made from wood.

1 mark

e. Fill in the blanks to complete the paragraph.

The rim is made from laminated hardwood. Lamination is the joining of different _____ of material to form a sheet. The main advantage of using laminated hardwood over solid material is that laminated sheets are _____.

2 marks

Question 4

Figure 2 is a simplified diagram of the mechanism which produces the sound on a grand piano. When the key is pressed down, the hammer hits the metal string which vibrates and generates a sound.

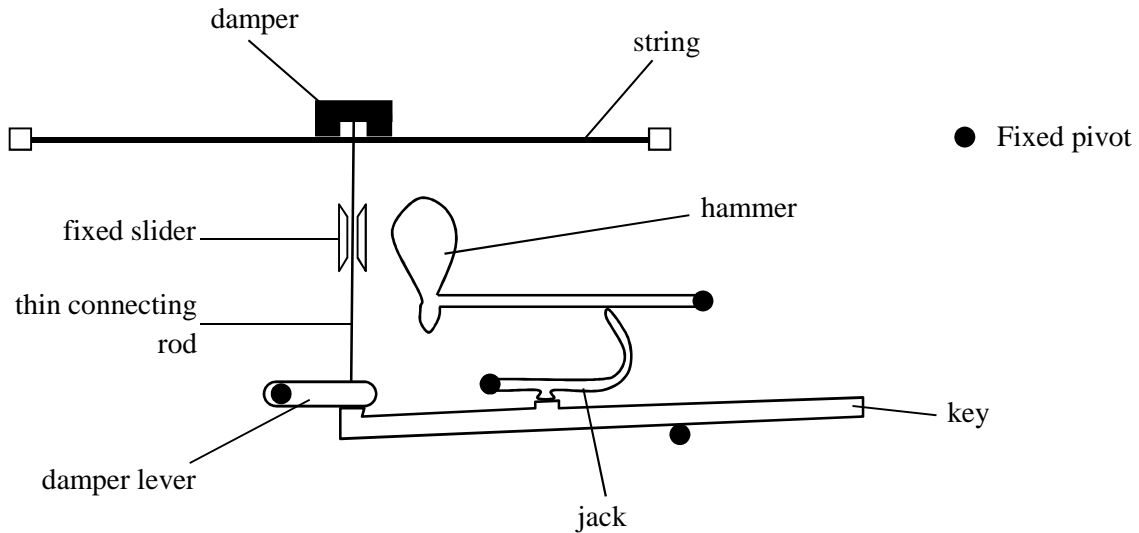
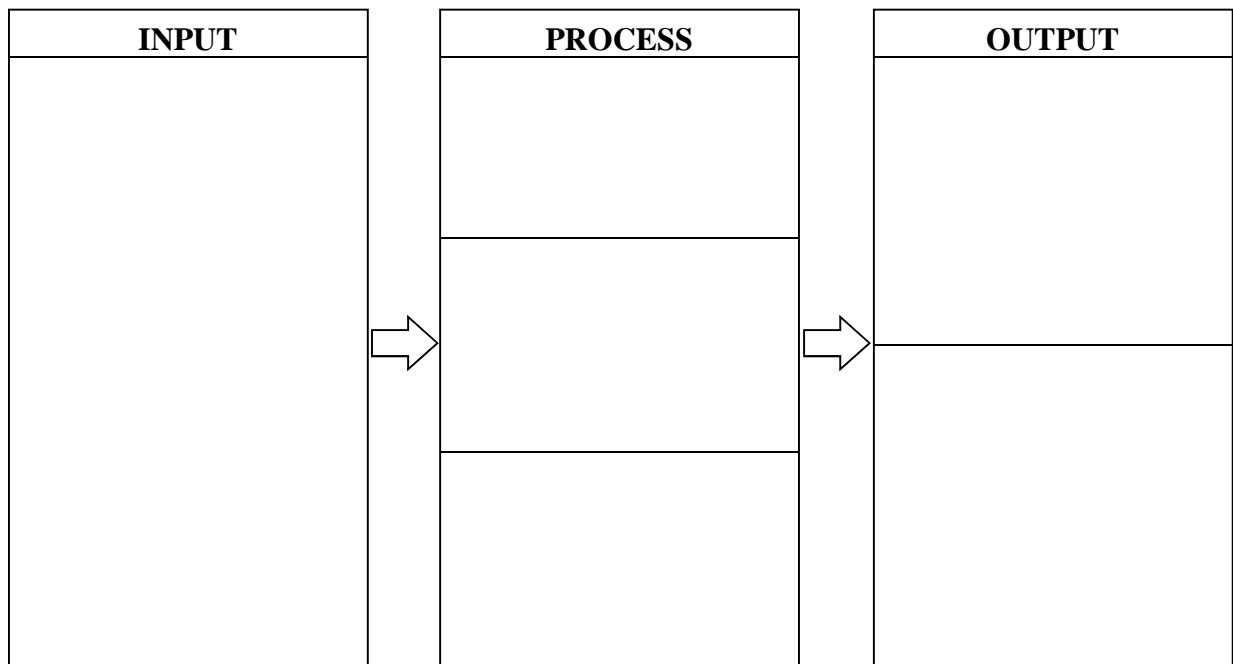


Figure 2: Simplified piano mechanism

a. Put the following SIX statements in the correct section of the block diagram to define how the mechanical system presented in Figure 2 works.

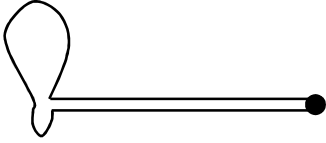
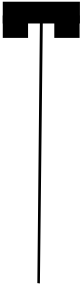
Hammer lever rotates.
 Damper lever and jack rotate.
 Damper moves up.

Key is pressed.
 Hammer strikes the string.
 Key lever rotates.



3 marks

b. Complete the table below by adding arrows to show the direction of movement of the hammer and damper when the key is pressed and released.

PART	DIAGRAM
Hammer	
Damper	

2 marks

c. Give the function of the following parts in the piano mechanism.

i. Fixed slider: _____

ii. Damper: _____

2 marks

d. The mechanism shown in Figure 2 needs to be tested. Therefore, another mechanism is needed in order to create an automatic input on the piano key. The testing device shall make use of **cams** to copy the action at the input of the piano mechanism. In the space provided below, sketch and name the most suitable cam profile for this situation.



3 marks

ELECTRONICS

Question 5

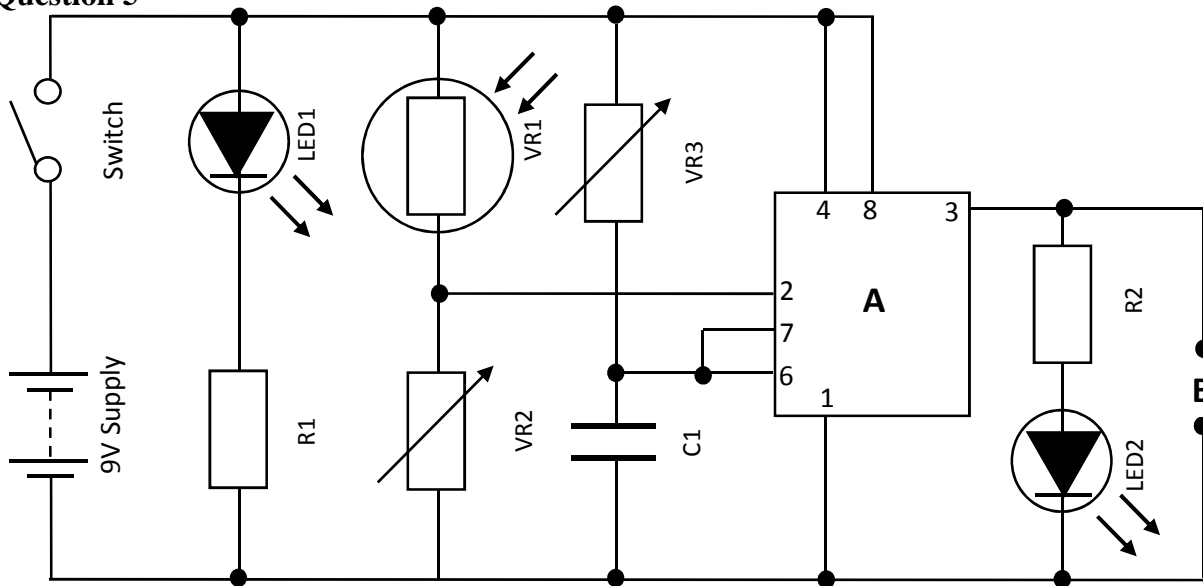


Figure 3

a. Figure 3 shows the schematic diagram for an intruder alarm.

i. Component A is a 555 timer. Give two modes in which the timer can be used.

1 mark

ii. State the name of component C1.

1 mark

iii. What does the term LED stand for and what is the function of LED1 in the circuit?

2 marks

b. In space B a sound device for the alarm should be inserted. A buzzer is a suitable sound device for the circuit. Draw its symbol in the space below.



2 marks

c. State the purpose of resistors R1 and R2 in the circuit.

1 mark

d. i. Calculate the value for resistor R1 when a current of 20mA flows through LED1 in Figure 3. The voltage for LED1 is 2V and the voltage for the circuit's supply is 9V. Show all working in the space provided below.

2 marks

ii. Name a switch that can be used for the circuit in Figure 3.

iii. A Veroboard is used to build a circuit permanently. Name ONE other board the circuit can be permanently built on.

1 mark





Please turn the page.

Question 6

a. i. A Veroboard has to be cleaned before soldering. State the reason why.

1 mark

ii. Complete the following table:

TOOL				
NAME				

2 marks

b. Figure 4 shows a piece of equipment.

i. State the name of the piece of equipment and its function.

1 mark

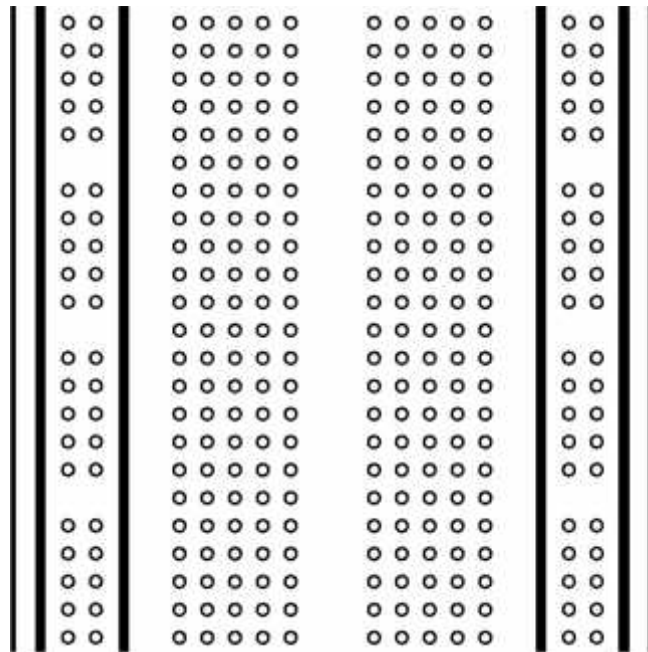


Figure 4

ii. On Figure 4 construct the circuit given below in Figure 5. Clearly label the supply and components.

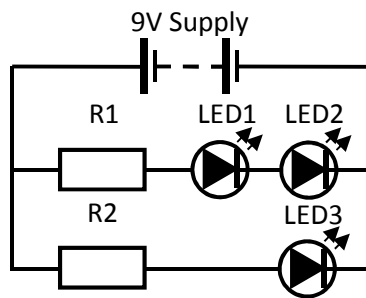


Figure 5

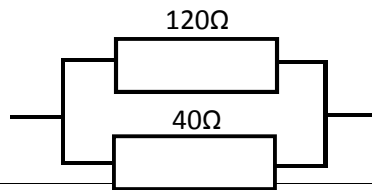
3 marks

c. Fill in the table below with the appropriate colour codes for the resistors values:

RESISTOR VALUE	FIRST BAND	SECOND BAND	THIRD BAND
47			
1.5k			

1 mark

- d. Find out the total resistance for the circuit below. Show your working in the space provided.



2 marks

FOOD

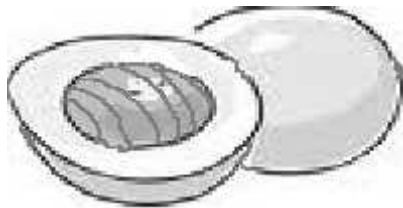
Question 7

During the year there are several instances where people get together to celebrate all kinds of occasions. A catering company sees this as an opportunity for developing finger food for such events. The food prepared should be in line with the dietary guidelines.

a. List the FOUR dietary guidelines.

2 marks

b. Stuffed eggs are popular finger food. The main nutrient in this finger food is protein.



i. Outline the main function of protein. _____

ii. Identify one other good source of this nutrient. _____

iii. Give ONE deficiency caused by lack of protein. _____

3 marks

c. Suggest a healthy filling for stuffed eggs.

3 marks

d. Recommend ONE healthy cooking method for each of the following finger food.

FOOD	COOKING METHODS
Meat balls	
Pastry stuffed with dates (imqaret)	

2 marks

Question 8

Before developing finger food products the company carried out a market research and found out that yeast products are always a popular selection finger food for different occasions.

a. What is yeast?

1 mark

b. Name FOUR factors that affect the growth of yeast.

2 marks

c. Explain ONE function of the following ingredients in a yeast product.

INGREDIENTS	FUNCTION
Yeast	
Sugar	
Flour	

3 marks

d. Name TWO other products that are produced by a fermentation process.

2 marks

e. Chopping boards are used in the preparation of finger foods.



i. State the colour code used for:

bread – _____ vegetables – _____

1 mark

ii. Why do we need different colour coded chopping boards?

1 mark

TEXTILES

Question 9

a. Underline the most suitable material for each of the products shown below.

Oven Glove	Swimming shorts	Winter coat
		
Cotton / Linen	Nylon / Silk	Viscose / Wool

Table 1

3 marks

b. Fibres are classified as natural and manufactured.

i. Put all the above mentioned materials under the right column.

NATURAL	MANUFACTURED

3 marks

ii. Name FOUR sources of natural fibres.

2 marks

iii. State the main source of regenerated cellulose fibres.

1 mark

iv. Explain why manufactured fibres are often mixed with natural fibres when making fabrics.

1 mark

Question 10

The materials you have chosen for the products shown in Table 1 must have various properties.

a. Mention ONE property for each material chosen.

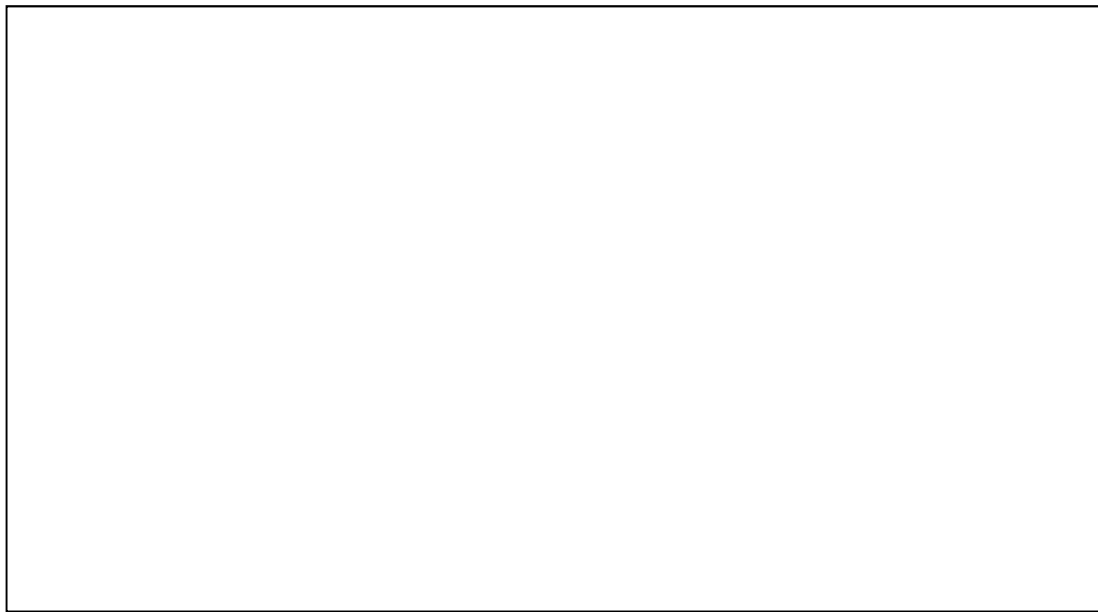
i. Oven Glove: _____

ii. Swimming shorts: _____

iii. Winter Coat: _____

3 marks

b. Describe how you would test a material for abrasion resistance to itself. Enhance your answer with sketches.

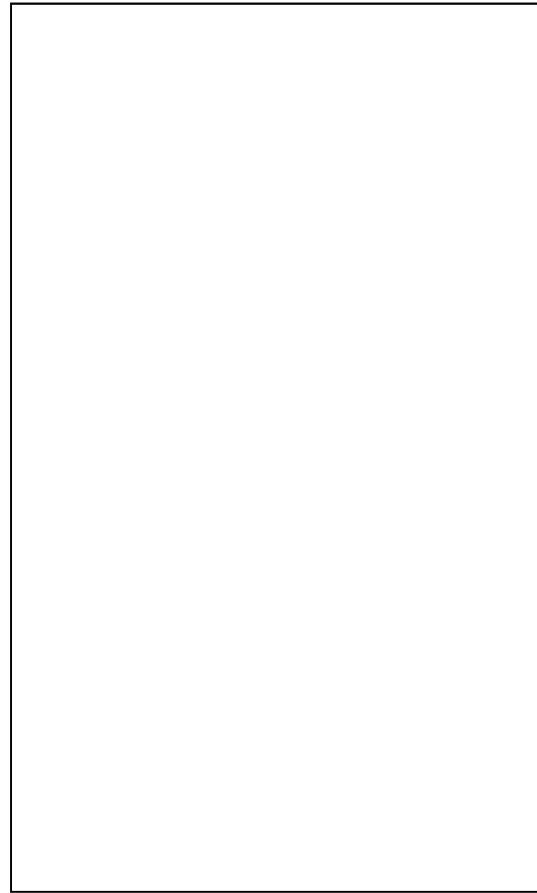


4 marks

- c. Figure 6 shows the information found on the care label found on the swimming shorts. In the space provided draw the care label by inserting the phrases and symbols required.

50% Cotton
50% Polyester
Machine wash in warm water
Tumble Dry
No Bleach
Made in U.S.A.

Figure 6



3 marks

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