

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

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2012 SESSION

SUBJECT: **Design and Technology**
 PAPER NUMBER: IIA
 DATE: 18th May 2012
 TIME: 4:00 p.m. to 6:00 p.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

$$R_t = R_1 + R_2 + R_3$$

$$T = RC$$

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

$$V=IR$$

$$V_{out} = \left(\frac{R_2}{R_1+R_2} \right) V_{supply}$$

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DESIGN PROGRESS

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

A mother of a 10 year old child is planning for the child's 11th birthday. She knows she wants to invite at least 20 children of similar age (between 10 and 13 years) to a party. She wants to be able to give the children who attend the party a small gift as a thank you. For this reason she has turned to a company that is able to produce small gifts.

The company has asked you to design the 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

Having chosen the area (resistant materials OR electronics OR food OR textiles) you will work in, you must start your design.

- a) Write a design brief to be able to start the design of the gift. The design brief should identify the area you are working in.

2 marks

- b) According to the area you are working in, describe the main research you would carry out.

4 marks

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c) According to the area you are working in. Determine the main specification you must work to. Specifications provide the guide you need to keep the design focused on the brief and the situation.

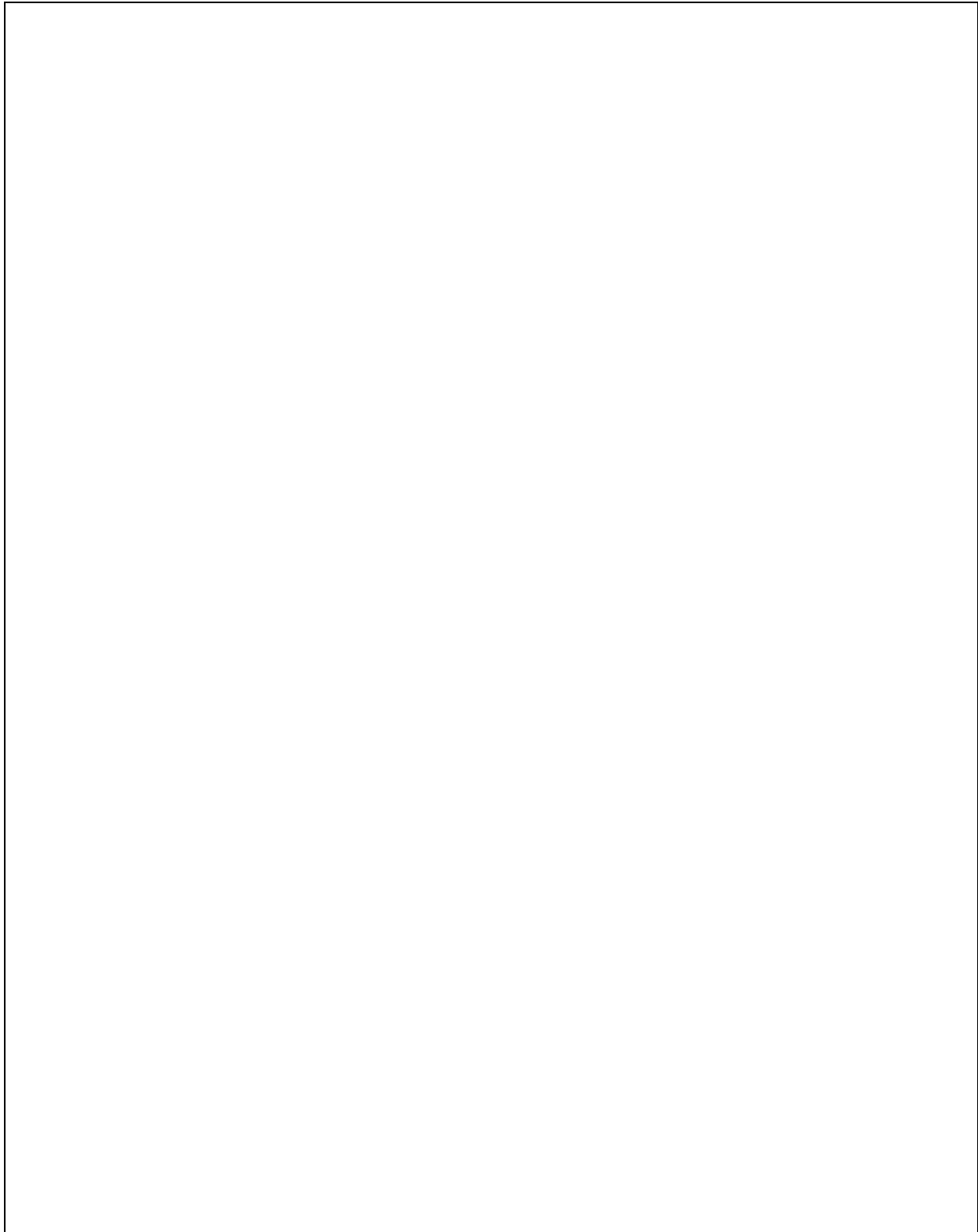
4 marks

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Question 2

- a) Considering the answers given in **Question 1** you must now produce some ideas that may produce the small gift required by the mother. Use the space provided to sketch **MORE THAN ONE** idea. You must clarify your sketches with notes and dimensions.



7 marks

DO NOT WRITE ABOVE THIS LINE

- b) Evaluate your design proposals to be able to choose the one idea you would develop and make. You must use your specifications given in **Question 1 c)** to aid the evaluation and choice.

3 marks

RESISTANT MATERIALS

Question 3

Figure 1 depicts the set-up of the apparatus used for electric arc welding. This joining process works by melting material through an electric arc created between the electrode and the work piece.

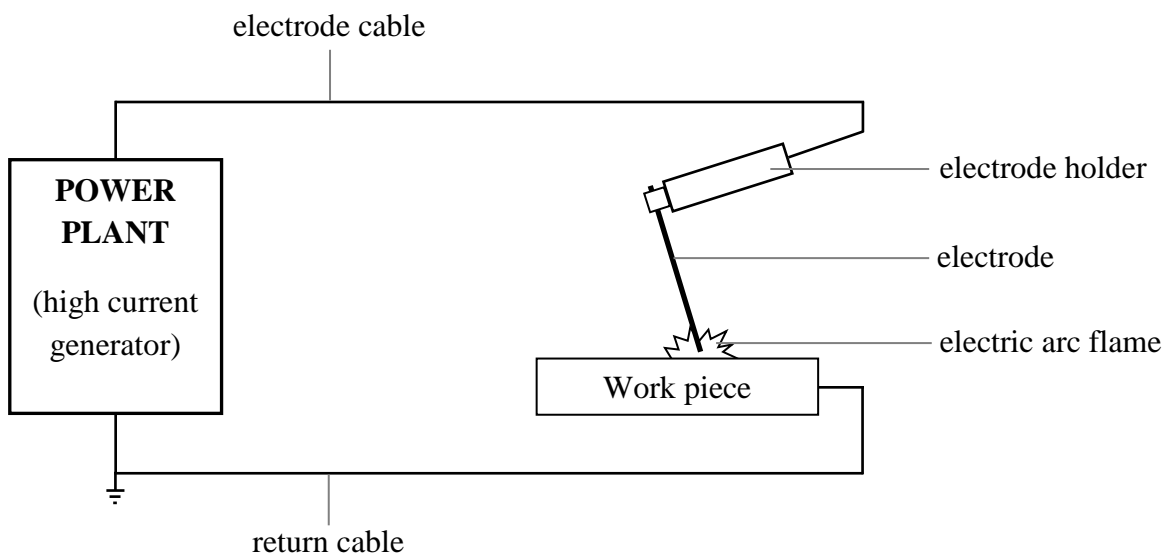


Figure 1: Set-up for electric arc welding

- a) Colourless safety glasses are not suitable to wear when performing this process. Give a reason for this statement and suggest a solution.

1 mark

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b) Give **ONE** advantage and **ONE** disadvantage of using electric arc welding.

ADVANTAGE	
DISADVANTAGE	

2 marks

c) List **TWO** properties which both the electrode and the work piece should have for this process to function.

2 marks

d) Study carefully **Figure 2**.

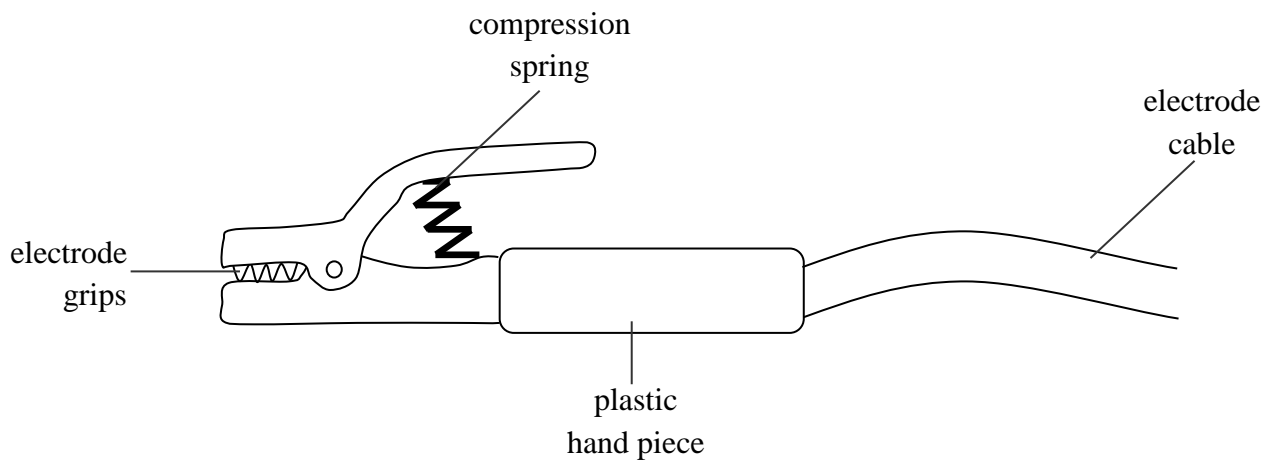


Figure 2: Detailed electrode holder

i) Name the most suitable material for the electrode grips.

1 mark

ii) State the class of plastic that would be most suitable for the hand piece. Sustain your statement.

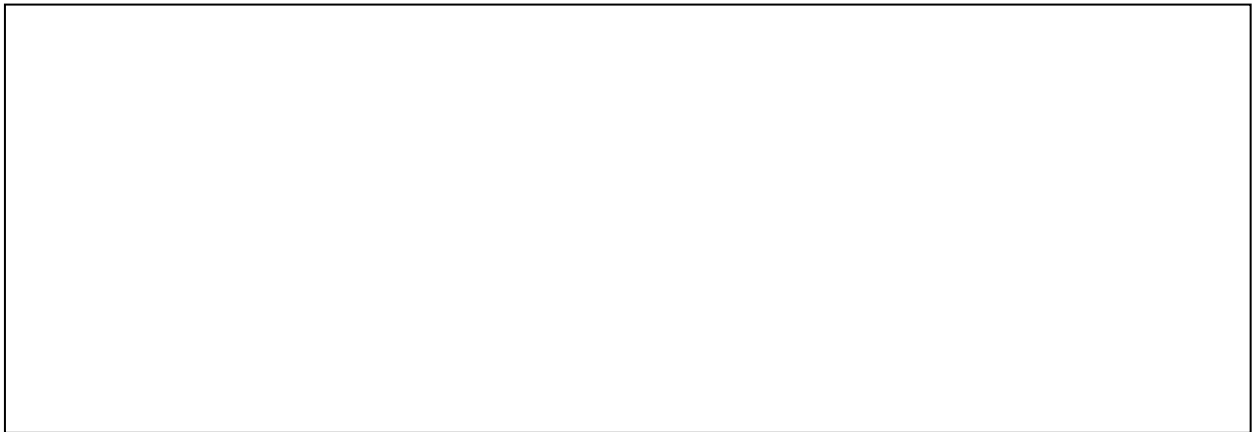
1 mark

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- iii) The compression spring is made from tempered alloy steel. What do you understand with the term 'tempered alloy steel'?

1 mark

- e) Two 0.5mm thick mild steel sheets are to be fixed together by other joining methods. Suggest, through labelled sketches, **ONE** other possible joining method.



2 marks

Question 4

Figure 3 shows a schematic diagram of a lift which works by using both a pneumatic system and levers.

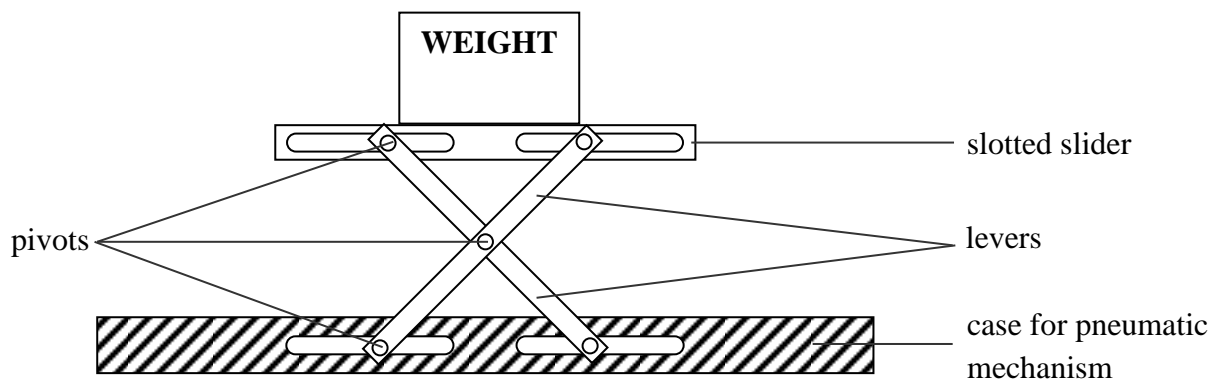


Figure 3: Pneumatic lift

- a) Give the name of the type of levers which are used for the lift shown in **Figure 3**.

1 mark

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b) Use arrows to label the direction of movement of the **INPUT** and **OUTPUT** of the lever mechanism in **Figure 3** when the lift is going up.

1 mark

c) Describe what a pneumatic system is.

1 mark

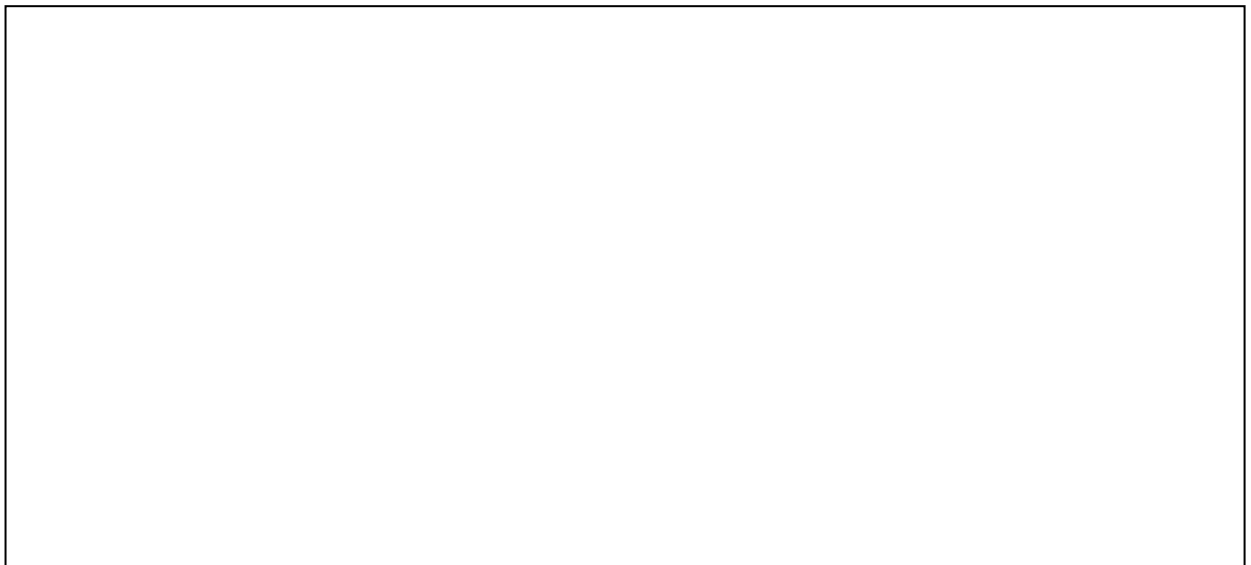
d) Explain how the lift can be modified in order to reach higher positions.

2 marks

e) Explain how the lift can be modified to bear more weight.

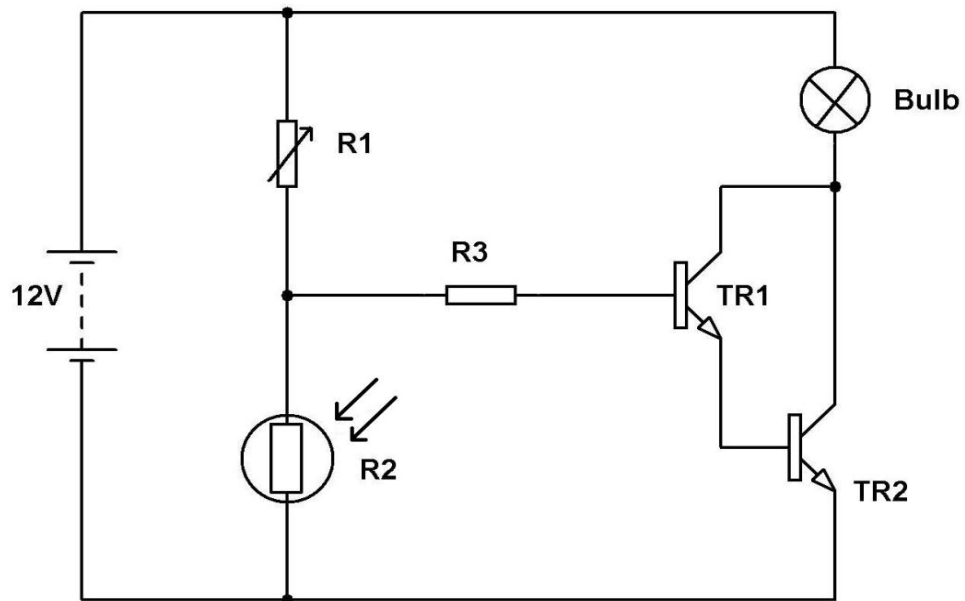
2 marks

f) In the space provided, design a pneumatic system that drives the lift by making use of the least number of components. Label your diagram.



3 marks

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ELECTRONICS**Question 5****Figure 4**

a) Name component R1 and its function in **Figure 4**.

2 marks

b) Name component R2 in **Figure 4**.

1 mark

c) How does the resistance of R2 change when the light is projected on it becomes brighter?

1 mark

d) Components TR1 and TR2 are two transistors that are connected in a way to act as one. What is this connection called?

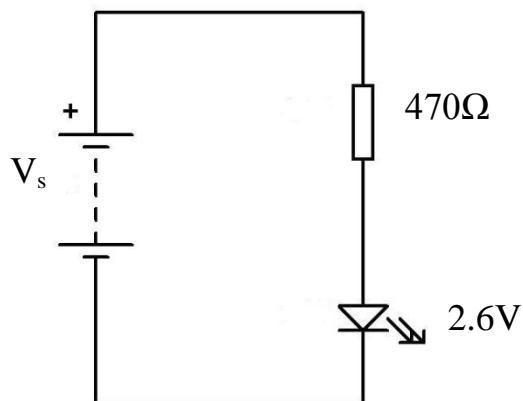
1 mark

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- e) Taking into consideration **Figure 4** assume R_1 is set to $10\text{K}\Omega$ and R_2 is set to 100Ω should the bulb be ON or OFF? Show all your working in the space below.

3 marks

- f) In the space provided calculate the Supply Voltage value V_s of **Figure 5** where a current of 20mA flows through the LED. Show your working.

**Figure 5****2 marks**

Question 6

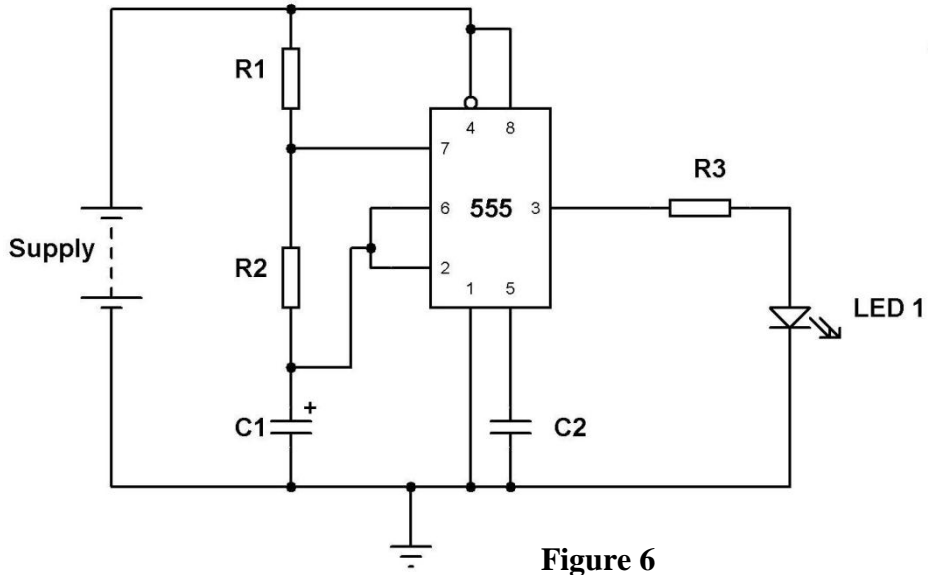
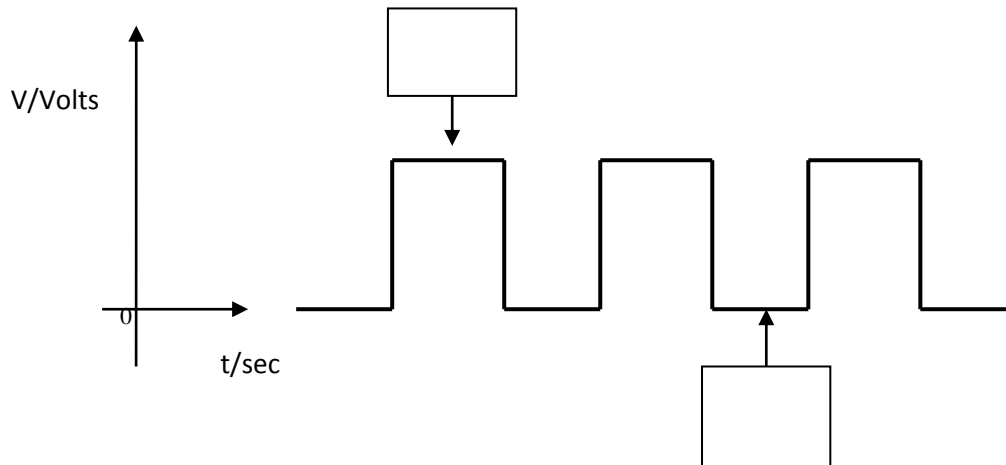


Figure 6

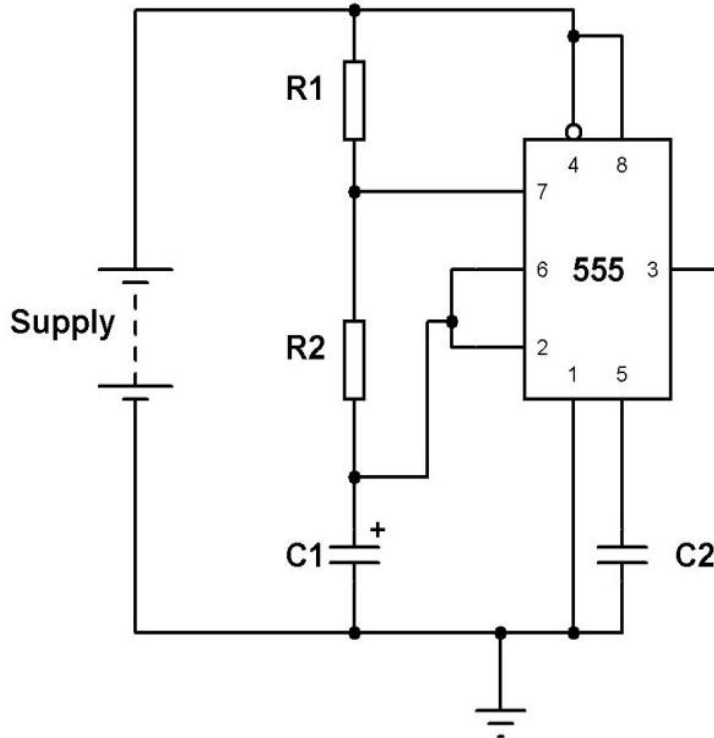
- a) The circuit of **Figure 6** provides an astable operation. Identify the ON and OFF time duty cycle for the graph below. Write **ON** and **OFF** in the spaces provided.



1 mark

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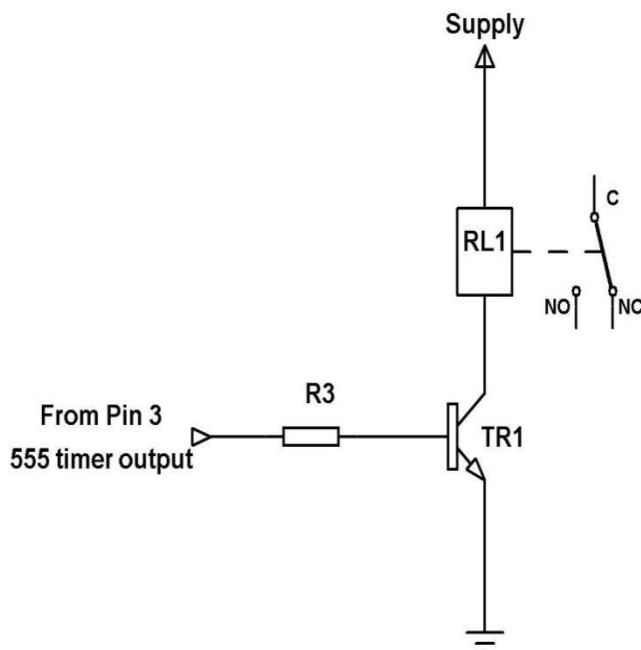
- b) In the circuit shown in **Figure 6** LED 1 lights up only during the ON period. Complete the circuit diagram shown in **Figure 7** to demonstrate what should be done so that LED 1 lights only during the OFF period.



2 marks

Figure 7

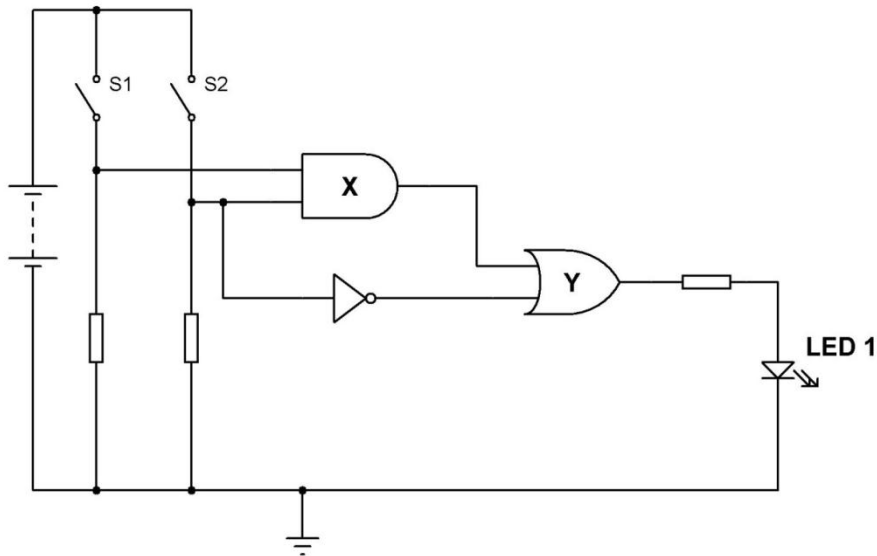
- c) The LED was removed and the output of the 555 timer was connected to a single pole relay RL1 as shown in **Figure 8**. The single pole relay has to switch on a bulb during the ON time period and a buzzer during the OFF time period. Complete the following circuit to show the necessary modifications.



2 marks

Figure 8

DO NOT WRITE ABOVE THIS LINE

d) **Figure 9** is a series of logic circuits.**Figure 9**

i) Name logic gate X _____

ii) Name logic gate Y _____

iii) Complete the following truth tables

Truth table for Logic Gate X		
Inputs		Output
0	0	
1	0	
0	1	
1	1	

Truth table for Logic Gate Y		
Inputs		Output
0	0	
1	0	
0	1	
1	1	

3 marksiv) In which combination should the switches be in order to switch **OFF** LED1? Mark with an X the correct order in the following table.

Switch S1	Switch S2	Answer
OPEN	OPEN	
OPEN	CLOSED	
CLOSED	OPEN	
CLOSED	CLOSED	

2 marks

DO NOT WRITE ABOVE THIS LINE

FOOD**Question 7**

a) State what the following symbols represent?

**3 marks**

b) For each of the problems listed in the table below suggest how they can be prevented.

Problem	Preventing the problem
a hair in the salad	
a fly in the soup pot	

2 marks

c) What is the use of the food probe when:

i) cooking _____

ii) reheating food _____

2 marks

d) Describe how you would apply finishing techniques to enhance the appearance of the following foods.

• Pie – _____

• Biscuits – _____

• Cake – _____

3 marks

DO NOT WRITE ABOVE THIS LINE

Question 8

a) You are to develop a yeast product. Identify **ONE** other material (NOT YEAST) you would investigate and give an example of the material chosen.

2 marks

b) Today we find different types of bread on the market. Give **TWO** reasons why these varieties have become accepted.

2 marks

c) For what reason is wholemeal bread a healthy option? State **ONE** of its benefits.

Reason	Benefit

2 marks

d) Why is Sensory Analysis important in the food industry?

2 marks

e) The following points are taken from the WHO disease fact chart:

- High blood pressure affects 600 million people per year worldwide.
- 12 million people die per year of heart attack and stroke.

What type of modifications should you do to recipes to make them suitable for people suffering from:

i) High blood pressure _____

ii) Coronary heart disease _____

2 marks

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TEXTILES**Question 9**

a) In the production of a wide variety of textile items different shaping methods are used.

Name **FOUR** types of shaping methods and suggest **ONE** textile product where each method is most suitable. No textile product can be used more than **ONCE**.

Shaping Methods	Textile product

4 marks

b) A variety of assembly line systems are used in the mass production of textile items.

i) What is the use of ticketing?

ii) Mention **ONE** stage in production when accuracy is considered necessary.

iii) Besides ticketing and accuracy, what other factor needs to be considered in the mass production of textile items?

3 marks

c) Fabric laying depends upon the way a fabric is constructed, printed, or finished. Give **THREE** examples of fabrics when one-way laying is recommended.

i) _____

ii) _____

iii) _____

3 marks

DO NOT WRITE ABOVE THIS LINE

Question 10

a) Complete the following statements by filling in the empty spaces using appropriate words in each case.

i) Fabrics are tested for _____ and _____ .

ii) Twill _____ produces a _____ surface effect on fabric.





iii) Two methods of manufacturing involved in the production of textile products are _____ and _____ .

6 marks

b) Quality control aims at meeting a list of standards that produce a high quality textile product. List **TWO** characteristics that make a good quality textile product.

2 marks

c) What instruction does each of the following care symbols give you?

CARE SYMBOL	INSTRUCTION
	
	
	
	

2 marks

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Question 1

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- a) Write a design brief to be able to start the design of the gift. The design brief should identify the area you are working in.

2 marks

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4 marks

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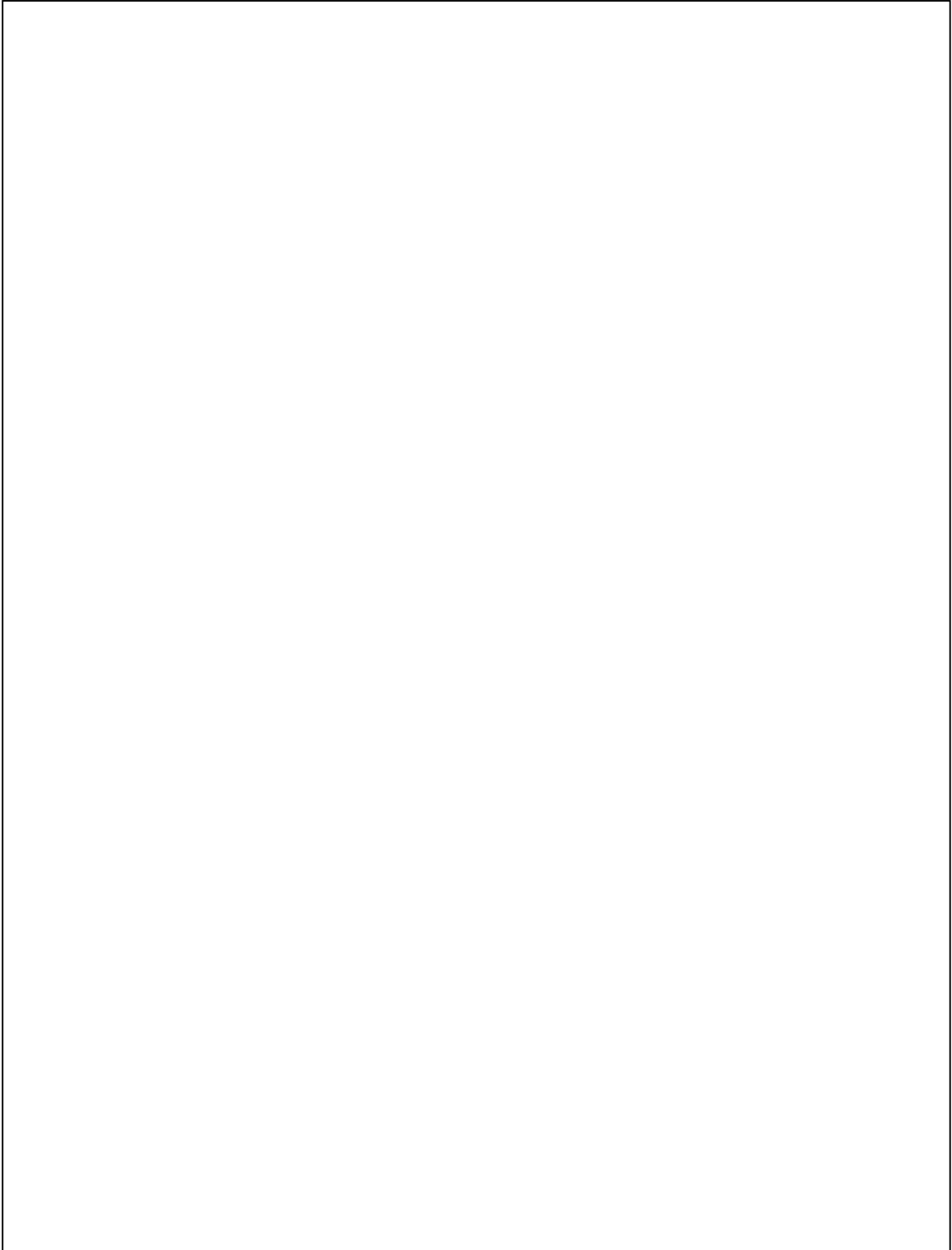
4 marks

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7 marks

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3 marks**RESISTANT MATERIALS****Question 3**

Figure 1 depicts the set-up of the apparatus used for electric arc welding. This joining process works by melting material through an electric arc created between the electrode and the work piece.

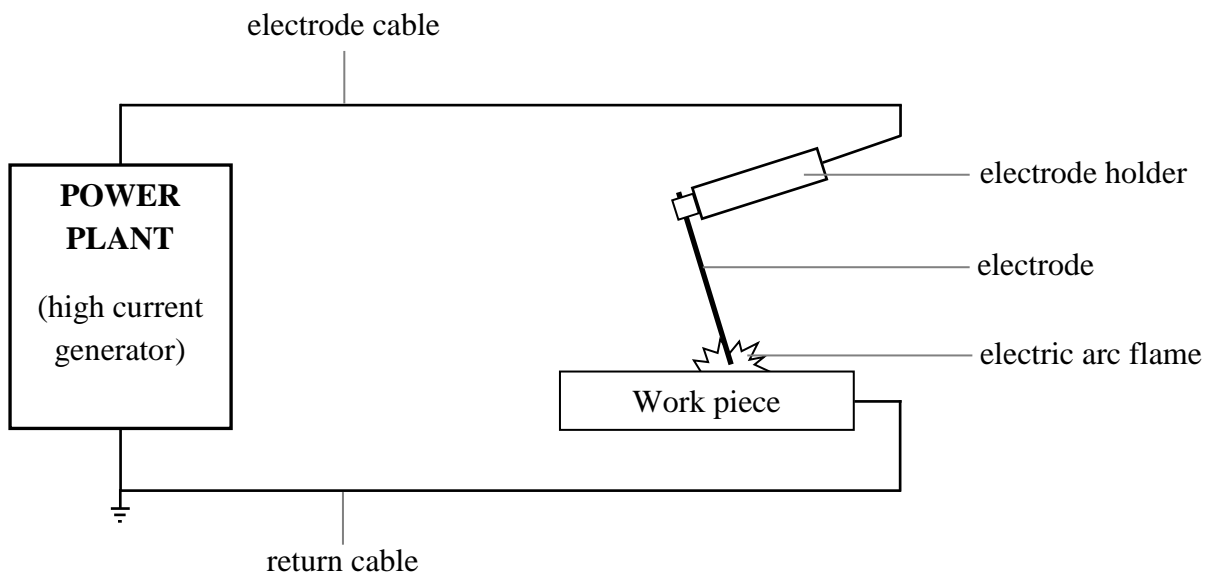


Figure 1: Set-up for electric arc welding

- a) Give a safety precaution that should be observed when performing electric arc welding.

1 mark

DO NOT WRITE ABOVE THIS LINE

b) Give **ONE** advantage and **ONE** disadvantage of using electric arc welding.

ADVANTAGE	
DISADVANTAGE	

2 marks

c) Both the work piece and electrode should be electric conductors and fusible at high temperature. Explain why both parts should have these properties.

2 marks

d) Study carefully **Figure 2**

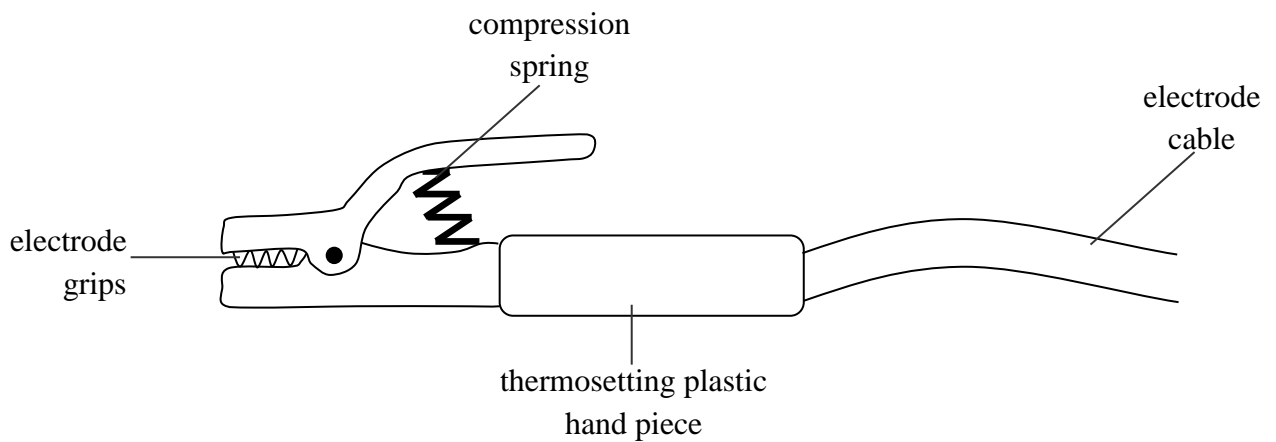


Figure 2: Detailed electrode holder

i) On **Figure 2**, circle the part which needs to be made from metal with **NO** insulating cover.

1 mark

ii) Name a suitable material for the electrode grips.

2 marks

iii) Give **ONE** reason why the hand piece was made from thermosetting plastic.

1 mark

DO NOT WRITE ABOVE THIS LINE

- e) Mention **ONE** joining method which is suitable to join two pieces of 0.5 mm sheet mild steel.

1 mark

Question 4

Figure 3 shows a schematic diagram of a lift which works by using both a pneumatic system and levers.

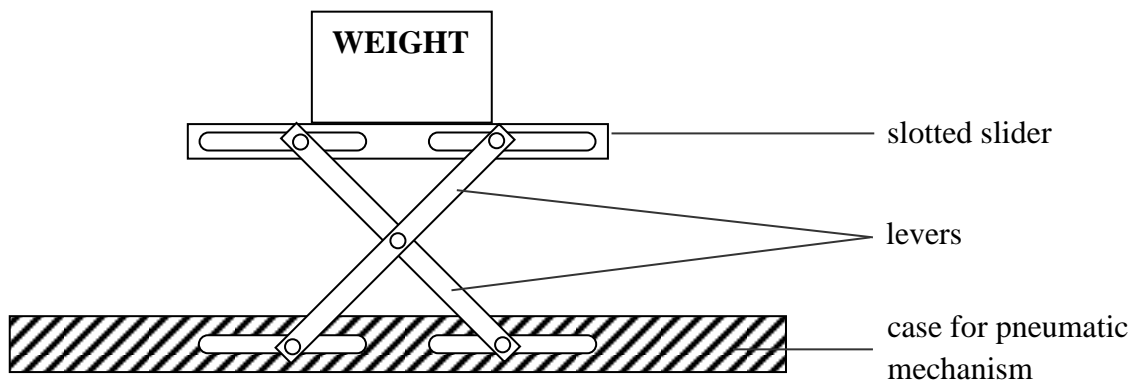


Figure 3: Pneumatic Lift

- a) The lift makes use of two first class levers. On **Figure 3** label the **PIVOT** of the lever mechanism. Using arrows also label the direction of the **EFFORT** and **LOAD** when the lift rises.

3 marks

- b) Draw **ONE** object which works by means of second class levers. On your diagram also label the effort, pivot and load.



3 marks

DO NOT WRITE ABOVE THIS LINE

c) Describe what a pneumatic system is.

1 mark

d) **Figure 4** shows a schematic diagram of the pneumatic system which makes the lift move.

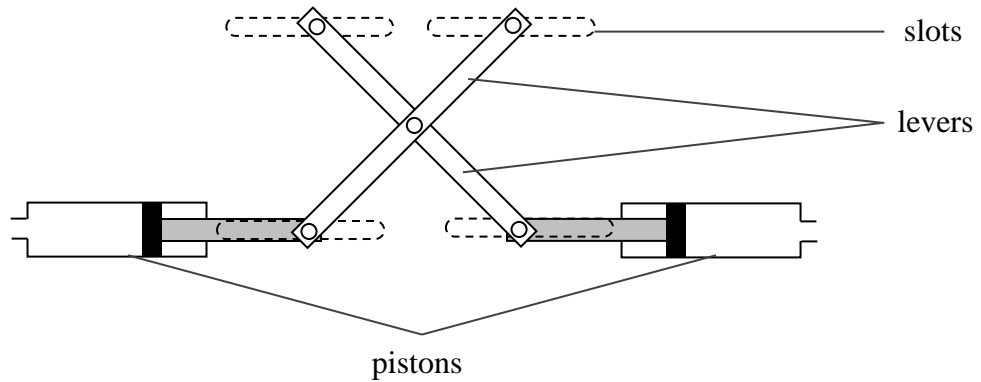


Figure 4: Pneumatic system driving the lift

i) On **Figure 4** add **TWO** arrows to show the direction of the inputs of the pneumatic system for the lift to go up.

1 mark

ii) In the space provided redesign the system shown in **Figure 4** so as to use fewer components.

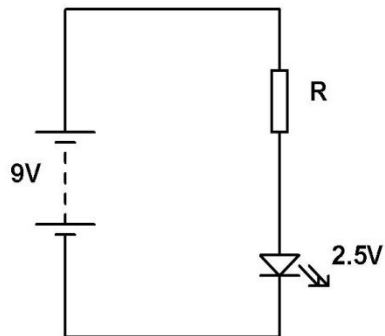
2 marks

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ELECTRONICS**Question 5**

a) Draw the symbols for the following switches:

Switch Name	Symbol
Single Pole Double Throw (SPDT)	
Push to make	

2 marksb) Considering **Figure 5** calculate the voltage across the resistor R. Show all the necessary working in the space provided.**Figure 5****2 marks**

DO NOT WRITE ABOVE THIS LINE

- c) Calculate the total resistance in **Figure 6**. Show all the necessary working in the space provided.

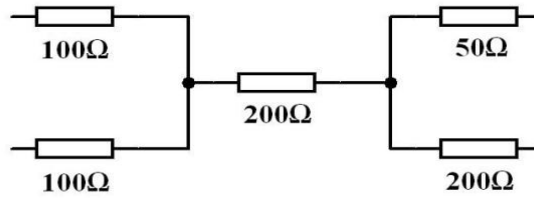


Figure 6

2 marks

- d) A student needs a timing circuit for a project. **Figure 7** below shows the electronic circuit involved for timing using a resistor and a capacitor connected in series.

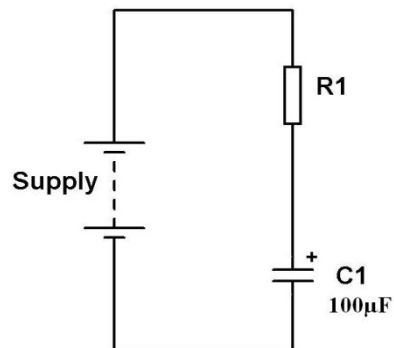


Figure 7

- i) If C1 has a value of $100\mu\text{F}$, calculate the value of R1 to produce a time period of 1 (one) second.

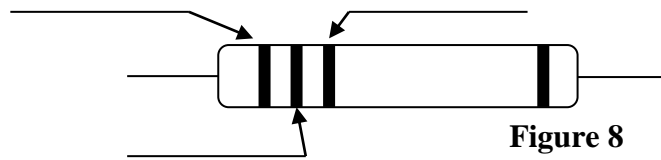
2 marks

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ii) What happens to the time if the value of the capacitor C in **Figure 7** is doubled?

1 mark

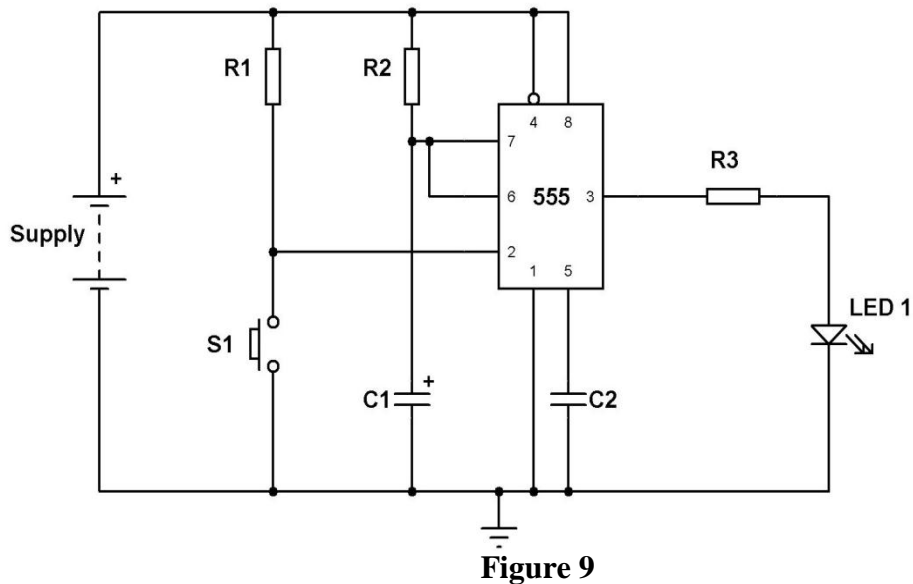
iii) In **Figure 8** insert the colour codes on the arrows for a 47KΩ resistor.



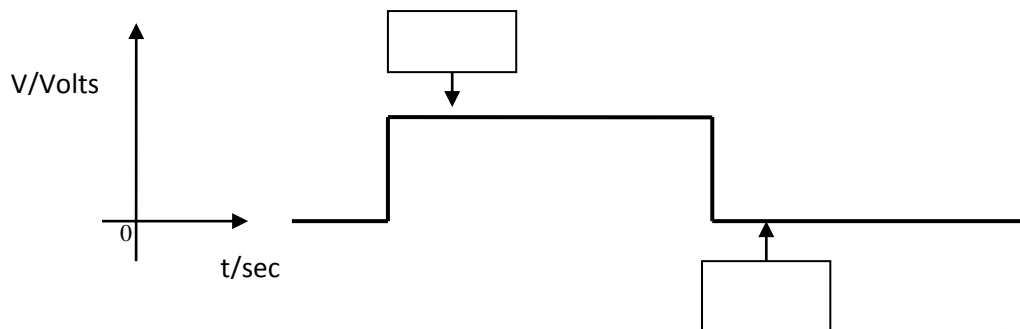
1 mark

Question 6

a) This question is about 555 timers, transistors and logic gates.



i) **Figure 9** provides a MONOSTABLE operation. Identify the ON and OFF time duty cycle for this graph below. Write **ON** and **OFF** in the spaces provided.



1 mark

DO NOT WRITE ABOVE THIS LINE

ii) Describe the term MONOSTABLE

1 mark

iii) In the circuit of **Figure 9**, LED 1 lights up only during the ON period. Complete the circuit diagram shown in **Figure 10** to demonstrate what should be done so that LED 1 lights only during the OFF period.

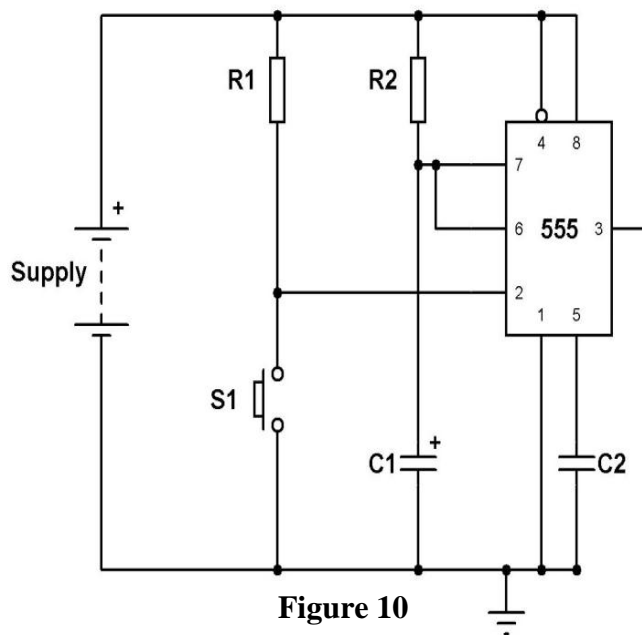


Figure 10

2 marks

b) The questions below refer to **Figure 11**

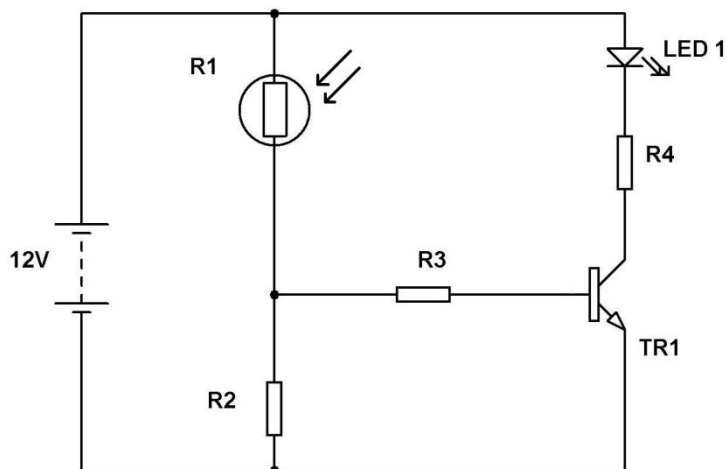


Figure 11

i) Name component R1 _____

1 mark

DO NOT WRITE ABOVE THIS LINE

- ii) When the circuit of **Figure 11** was tested, it was noted that LED 1 was turning ON during day time. Suggest what needs to be done so that LED 1 will turn ON only at night time.

1 mark

- iii) What is the function of the resistor R3 in the circuit of **Figure 11**?

1 mark

- c) Look at **Figure 12** and then answer the questions.

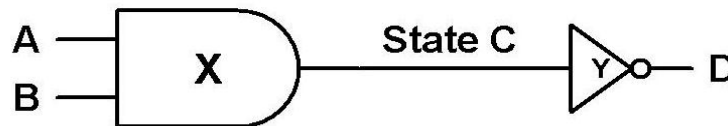


Figure 12

- i) Name logic gate X _____

- ii) Name logic gate Y _____

1 mark

- iii) Complete the following truth table.

Input A	Input B	State C	Output D
0	0		
0	1		
1	0		
1	1		

2 marks

DO NOT WRITE ABOVE THIS LINE

FOOD**Question 7**

- a) Name **TWO** food items that can be bought from a school canteen serving healthy lunches.
Give reasons for your answers.

Food	Reason

4 marks

- b. Give **ONE** safety precaution for each of the following:

- i) To prevent electric shock;

- ii) To prevent burns and scalds.

2 marks

- c. Give **TWO** advantages for each of the following materials used in food packaging.

Material	Advantages
Plastic	i.
	ii.
Paper	i.
	ii.

4 marks

DO NOT WRITE ABOVE THIS LINE

Question 8

a) State whether the following statements are **TRUE** or **FALSE**.

- i) Vitamins B and C are fat-soluble vitamins. _____
- ii) All bacteria are harmful. _____
- iii) The danger zone for food is between 5⁰C and 63⁰C. _____
- iv) The INPUT in a system is the finished, packed product. _____
- v) One of the recommended dietary guidelines is to eat more fibre. _____
- vi) Yoghurt and canned fish contain calcium. _____

3 marks

b) Complete the sentences using the words given below.

- **HACCP** ▪ **biological hazard** ▪ **cross-contamination**

- i) _____ is the transfer of micro-organisms from one food to another.
- ii) _____ is used during food processing to control food safety and quality issues.
- iii) _____ is the presence of bacteria such as salmonella in a food product.

3 marks

c) Different foods require different storage places and temperatures to keep fresh and avoid spoilage. Suggest proper storage for the following food items.

- i) Raw beef chops and steaks _____
- ii) Root vegetables such as potatoes, onions, etc. _____
- iii) Fresh vegetables _____

3 marks

d) You are to develop a new desert for children aged between 9 and 11. Identify **ONE** type of investigation you will carry out.

1 mark

DO NOT WRITE ABOVE THIS LINE

TEXTILES**Question 9**

a) Complete these sentences below by selecting the correct word from this list:

- creases
- appliqué
- silkworm
- overlock

i) If the source of wool is sheep, _____ is the source of silk.

ii) One disadvantage of rayon is that it _____.

iii) An _____ is used to decorate various textile items.

iv) One method of finishing seam edges is _____.

2 marks

b) Answer the following questions.

i) Does velvet have a smooth or rough surface?

ii) Which of these fabric constructions have more elasticity: woven or knitted?

iii) Which one of these two fabrics is considered most absorbent: linen or nylon?

iv) Which one of these fabrics does not frail: linen, felt or cotton?

2 marks

c) Fill in the table provided. From the list given below, match **TWO** fabric properties for the textile products in **COLUMN A**. You can use any property only **ONCE**.

- | | | |
|--------------|------------|-------------------|
| • breathable | • elastic | • warm |
| • colourful | • soft | • windproof |
| • durable | • stretchy | • water-resistant |
| • easy-care | • strong | • flame-resistant |

DO NOT WRITE ABOVE THIS LINE

Column A	TWO fabric properties
Cycling jackets	
Children's jumpers	
Seat belts	
Fire protective clothing	

4 marks

- d) Draw the symbols you would expect to find on a care label that recommends cool iron and dry clean.

Cool iron	Dry clean

2 marks**Question 10**

- a) You have been asked to produce a skirt using checked linen fabric.
i) Name **ONE** important factor you would keep in mind during the laying and cutting processes.

- ii) Which appropriate method would you use to finish the edges of seams?

- iii) What type of pressing method would you recommend for the finished product?

- iv) State whether it is true or false when one says that linen fabric tends to shrink when washed.

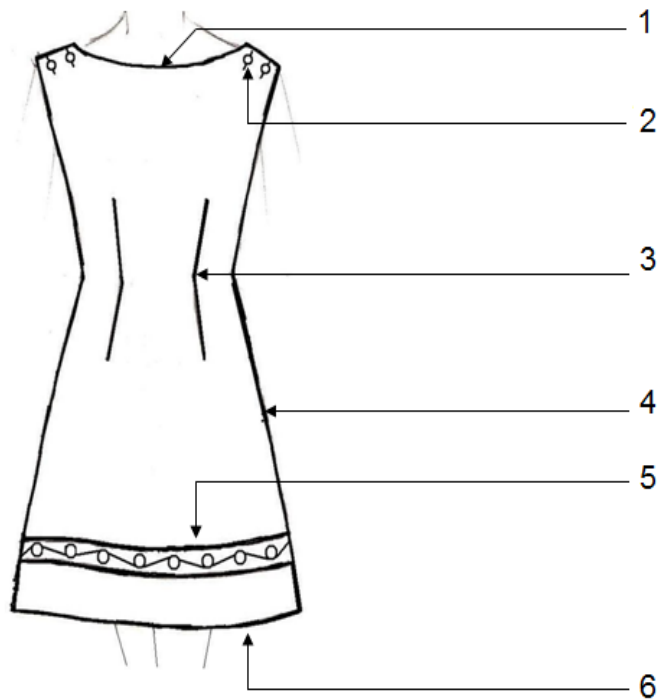
DO NOT WRITE ABOVE THIS LINE

4 marks

b) The following are various methods involved in the production of garments:

- adding shapes
- finishing edges
- joining seams
- adding decorative component
- adding structural component

Label the **SIX** arrows in **Figure 13** by applying these methods appropriately. Any method can be used more than once.

**Figure 13****6 marks**