Index No:_____ SEC33/2A.14m

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

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2014 SESSION

SUBJECT:	**Design and Technology**
PAPER NUMBER:	IIA
DATE:	28th April 2014
TIME:	4:00 p.m. to 6:00 p.m.

Answer ALL 10 questions. Each question carries 10 marks.

Useful Information:

Calculators are allowed

Equations

$$R_t = R_1 + R_2 + R_3$$

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

$$P = IV$$

DESIGN

Question 1 and **Question 2** are based on the four situations given below. Choose ONE situation and indicate *your choice by ticking* [✓] the appropriate box.

Situation 1- Textiles

☐ Remote controls end up on coffee tables, sofas, nearby furniture or on the floor. This frequently results in having to look for a specific remote control in more than one place, which is annoying. With the help of textiles try to resolve such a situation.

Situation 2 – Resistant Materials

☐ Preserved food is frequently packed in glass jars with sealed lids. Opening such jars can be very difficult especially for the elderly. Solve this problem by designing a tool.

Situation 3 – Electronics

☐ Nowadays, the number of people living in blocks of apartments has increased. Checking the letter box can sometimes be seen as a burden because of the fact that apartments are high above street level. With the help of electronics, an automated system can be created to indicate whether there is post in the letterbox.

Situation 4 – Food

☐ An adventure shop is asking for your help in order to create a meal suitable for hikers. The meal has to be high in energy in order to help the individual in this activity.

Question 1

a. Write a Design Brief for the problem presented in the situation you have chosen.

_____

_____

_____

2 marks

b. Analyse your Design Brief carefully and identify TWO keywords.

_____

_____

1 mark

c. Mention TWO different sources from where research for your project can be collected.

_____

_____

1 mark

d. Explain what information you would research for your project.

_____

_____

1 mark

e. Write ONE specification for each of the following.

i. The main function of the product.

_____

ii. The main materials which are likely to be used.

_____

iii. Type of production to be used.

_____

iv. Environmental issues that have to be considered.

_____

4 marks

f. State the main purpose of the specifications list.

_____

_____

_____

1 mark

Question 2

a. In the space below sketch and number some possible solutions for the Design Brief you wrote in **Question 1a**. Take into consideration the main features you want to include. Detail your sketches with notes and dimensions.

8 marks

b. Explain how you would choose an idea in order to develop it further.

_____

_____

_____

_____

_____

2 marks

Please turn the page.

RESISTANT MATERIALS

Question 3

Figure A explains a particular manufacturing process used to make certain standard forms of metals and plastics.

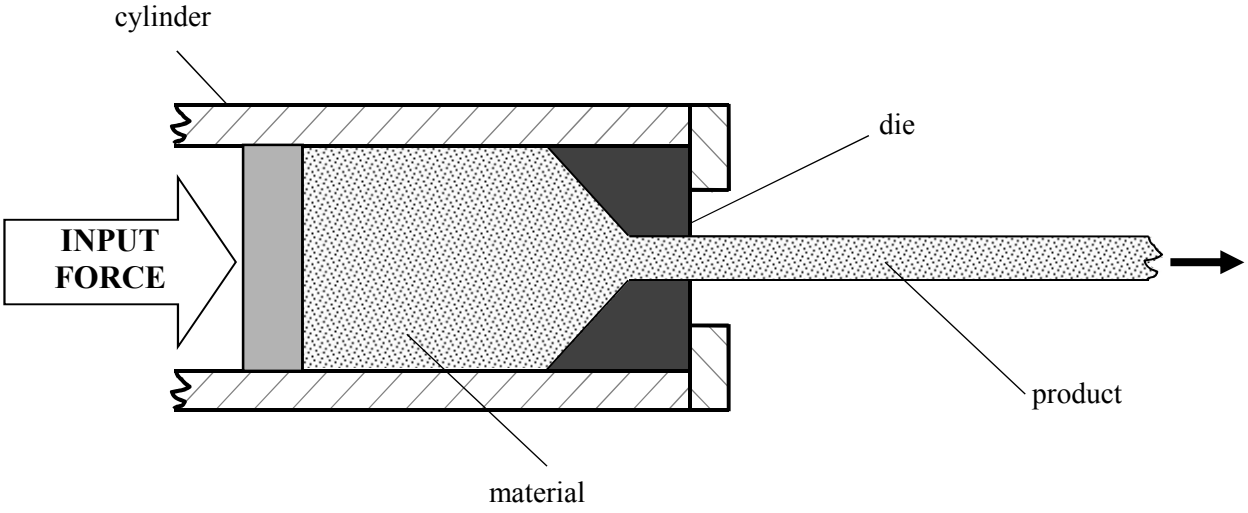


Figure A: A manufacturing process

a. Give the name of the manufacturing process shown in Figure A.

_____

1 mark

b. Fill in the blanks to explain how this process works.

A material inside a cylinder is forced through a die to produce a _____ profile of particular _____-section. Examples of objects manufactured by this process include: _____ and _____.

2 marks

c. Give ONE explanation for each of the following statements.

i. The process shown in Figure A can be applied on malleable metals.

_____

ii. Thermoplastics can be manufactured by the process shown in Figure A more than once.

_____

2 marks

d. In Table 1 use 3D graphical representation to draw TWO different standard forms of metal or plastic which can be produced by the process shown in Figure A. Name EACH standard form.

SKETCH		
NAME		

Table 1

2 marks

e. i. Identify the type of motion that the input force exerts on the material as drawn in Figure A.

_____

1 mark

ii. In the space provided, draw a mechanical system that can produce the input force for the manufacturing process shown in Figure A to work. Use labelled sketches in your answer.

2 marks

Question 4

Figure B shows a pull-along toy train for a toddler. The toy includes several wagons which can be joined by the child. The driver wagon is different from the rest of the wagons.

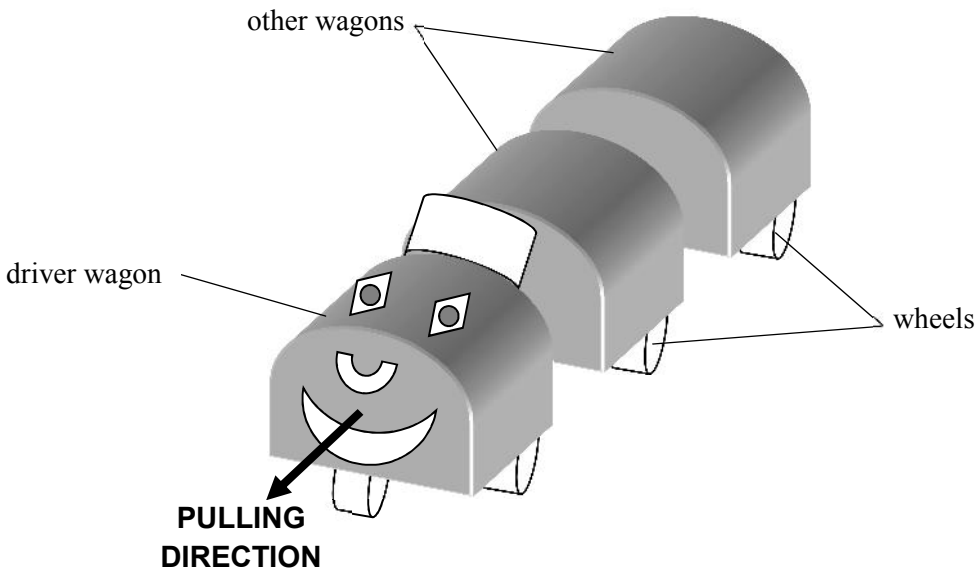


Figure B: Pull-along toy train

a. i. Name a suitable material for the toy shown in Figure B. Mention ONE suitable surface finish which can be applied on this material for this toy and state ONE reason for your choice.

Suitable material	
Surface finish	
Reason for surface finish	

2 marks

ii. Briefly explain how this surface finish is applied onto the material.

_____

_____

2 mark

b. The driver wagon has three wheels, one on a front axle and two at a back axle all made from the same material. By using labelled sketches and considering the material you chose in Question 4a, explain how ONE of these wheels can be joined to the axle.

2 marks

c. The remaining wagons have only one axle with two eccentric wheels as shown in Figure C.

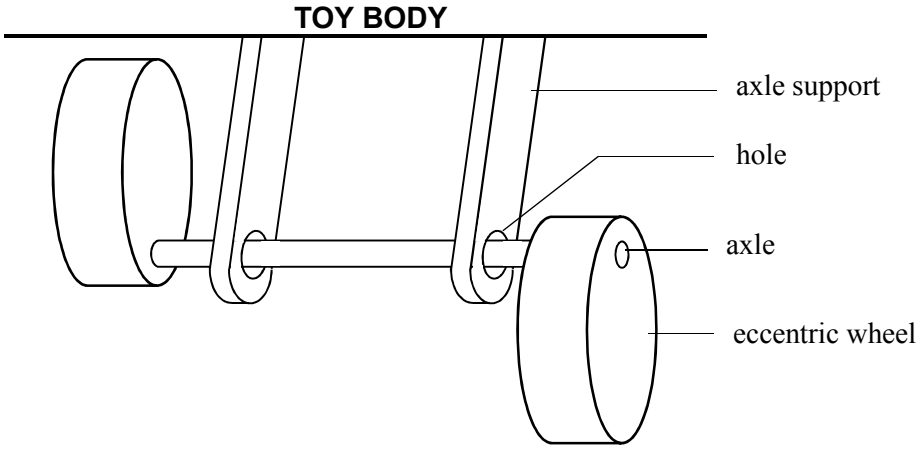


Figure C: Axle with two eccentric wheels

i. On Figure C, draw an arrow to show the direction of movement of the input. Label this arrow as INPUT. Also draw an arrow to show the direction of movement of the wheels. Label this arrow as OUTPUT.

1 mark

ii. Suggest a reason why the driver wagon was designed with two axles instead of one axle like the other wagons.

_____

1 mark

d. i. Describe the effect that the eccentric wheels have on the movement of the whole wagon.

_____

ii. Indicate a method how this effect can be reduced but not eliminated.

_____

2 marks

ELECTRONICS

Question 5

a. A circuit diagram for a fire alarm is shown in Figure D. When the LDR is covered by the smoke the alarm will turn ON via a logic gate.

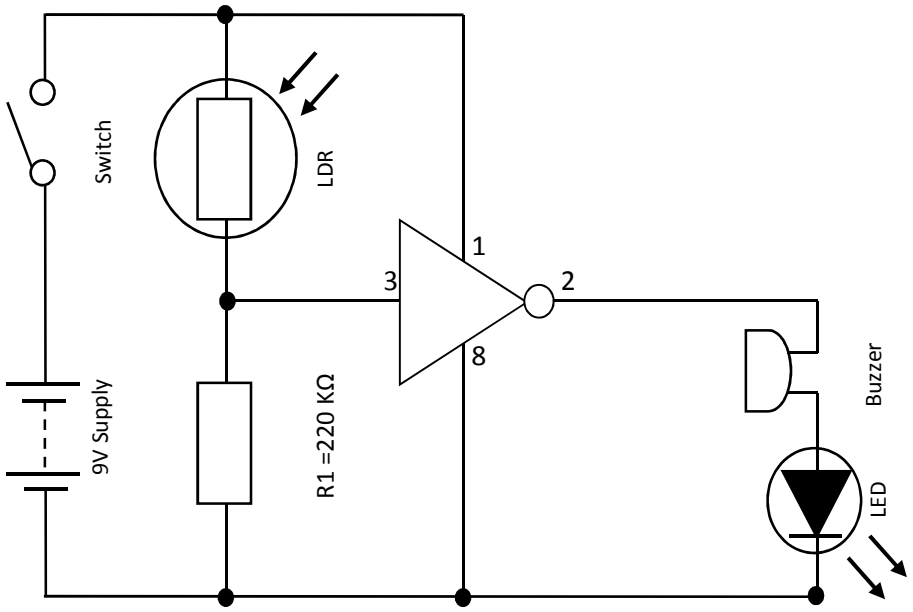


Figure D

i. State the name of the logic gate shown in Figure D.

_____

1 mark

ii. Give the purpose of each connection of the logic gate in Table 2.

Connection Number	Purpose
Connection 1	
Connection 2	
Connection 3	
Connection 8	

Table 2

1 mark

iii. In the space below draw the truth table for the logic gate used in Figure D.

1 mark

iv. State the purpose of the LED in Figure D.

_____

1 mark

v. The LED's positive and negative terminals have specific names. Label them in Figure E.

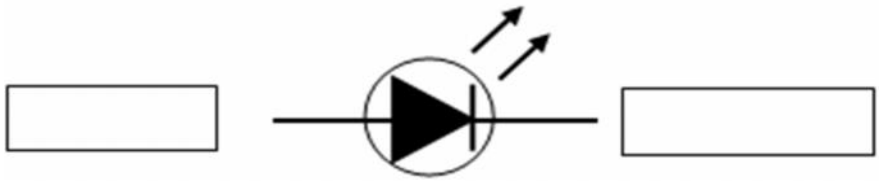


Figure E

1 mark

b. If the circuit needs to be modified to be activated by a rise in the room temperature, the LDR should be replaced with another component. In Table 3 state the name of this component and draw its symbol.

Name	Symbol

Table 3

1 mark

c. In Table 4 state which component should replace one of the components to obtain control over the sensitivity of the circuit in Figure D.

.

New Component	Removed component

Table 4

1 mark

d. The logic gate does not give enough current for the output to function well. Complete the circuit in Figure F below by adding a darlington pair and any other components required in the circuit to increase the current at the output.

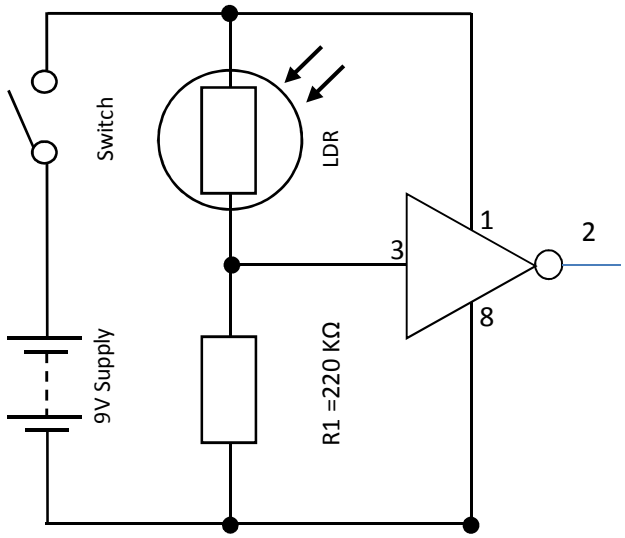


Figure F

3 marks

Question 6

a. Power sources can either be AC or DC.

i. Complete Table 5 with their full names and ONE source example for each.

	Full Name	**Example**
AC		
DC		

Table 5

1 mark

ii. In the space below sketch the graph produced by an AC supply.

1 mark

b. Figure G shows an electromechanical device. Name the device and its main use.

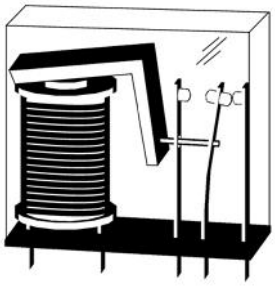


Figure G

_____

1 mark

c. Figure H shows a 555 timer IC set up in DIL package.

i. Identify the IC pin numbers. Write the numbers on the diagram below.

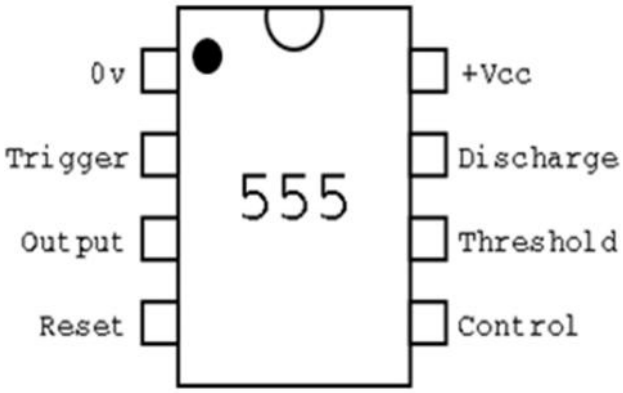


Figure H

1 mark

ii. In Table 6 state what the terms IC and DIL stand for.

IC	
DIL	

Table 6

1 mark

d. Table 7 has a list of appliances with their technical specifications. Find out the missing information.

Appliance	Power (W)	Current (A)	Voltage (V)	Working Space
Vacuum Cleaner	2300		230	
Laptop	27.6	2.3		

Table 7

2 marks

e. Find out the total resistance for the circuit in Figure I. Show your working in the space provided.

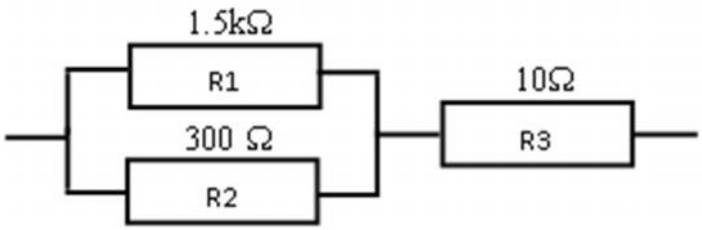


Figure I

2 marks

f. A 316Ω resistor is not found on the market. Select the nearest preferred resistor value to use.

_____

1 mark

FOOD

Question 7

A food company wants to produce a new range of packed vegetable pasta products.

The following are the ingredients of a vegetable pasta recipe.

500g white spaghetti	freshly ground black pepper
Olive oil	120ml double cream
2 cloves garlic	sea salt
400g spinach	150 mascarpone cheese
Parmesan cheese, freshly grated	

a. Propose modifications that can be made to the pasta recipe to:

i. Improve the nutritional content.

_____

ii. Alter flavour.

_____

iii. Alter presentation of the finished product.

_____

3 marks

b. Suggest what can be added or substituted in the vegetable pasta to add more fibre to the product.

_____

_____

1 mark

c. Indicate for which this diet vegetable pasta is suitable. Give a reason for your answer.

Diet	
Reason	

2 marks

d. Insert the number of each nutrient to its corresponding function in Table 8.

	Nutrient		**Function**
1	Carbohydrates		For growth and repair of body tissues.
2	Non-starch polysaccharide (NSP)		Maintain health and prevent diseases.
3	Starch		For strong bones and teeth.
4	Protein		It helps to prevent many bowel disorders.
5	Fats		It provides the body with energy.
6	Vitamins		It adds bulk to the diet.
7	Minerals - Calcium		It helps in the formation of red blood cells.
8	Mineral - Iron		It insulates the body against cold.

Table 8

4 marks

Question 8

a. i. Define what food spoilage is.

_____

_____

1 mark

ii. State what causes food spoilage.

_____

_____

1 mark

b. i. Indicate what HACCP stands for.

_____

_____

2 marks

ii. List and explain TWO main steps of the HACCP system.

_____

_____

_____

_____

_____

4 marks

c. The Food Safety Regulations aim to ensure that food products are produced safely and that they are of good quality. List TWO requirements covered by these food safety regulations.

_____

_____

_____

_____

_____

2 marks

TEXTILES

Question 9

A teacher had the idea to give students a project on how they can recycle old clothes. Students suggested several ideas on how to convert old clothes into new products. Figure J shows some final products made by students.

Figure J – Shopping bags from recycled fabric.

a. Name FOUR other products (not shown in Figure J) that could be produced from recycled textiles.

_____

_____

2 marks

b. Name and sketch the TWO ideal seams that should be used to create the shopping baskets mentioned in Figure J. Label your sketches to be more clear.

1. _____ **2.** _____

5 marks

c. Mention TWO different types of fasteners that could be used to secure items in the bag.

2 marks

d. Suggest a textile material that the student should use between the fabric and the lining of the bags to add shape.

1 mark

Question 10

A pattern is a template that is used to make a product. Each pattern carries symbols for pattern markings.

a. Complete Table 9 by filling the missing information.

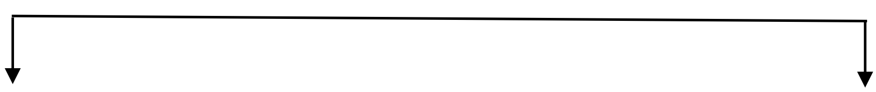
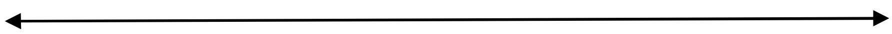
Meaning	**Symbol**	
Cutting line		
Notch / Balance Mark	Single notch	Double notch
		
		
Dart		

Table 9

6 marks

b. Name TWO tools that are mainly used when marking out fabric.

_____

1 mark

c. In the space below sketch and label a pattern for ONE of the bags shown in Figure J.

3 marks

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SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2014 SESSION

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DATE:	28rd April 2014
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Answer ALL 10 questions. Each question carries 10 marks.

Useful Information:

Calculators are allowed

Equations

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

$$P = IV$$

DESIGN

Question 1 and **Question 2** are based on the four situations given below. Choose ONE situation and indicate *your choice by ticking* [✓] the appropriate box.

Situation 1- Textiles

☐ Remote controls end up on coffee tables, sofas, nearby furniture or on the floor. This frequently results in having to look for a specific remote control in more than one place, which is annoying. With the help of textiles try to resolve such a situation.

Situation 2 – Resistant Materials

☐ Preserved food is frequently packed in glass jars with sealed lids. Opening such jars can be very difficult especially for the elderly. Solve this problem by designing a tool.

Situation 3 – Electronics

☐ Nowadays, the number of people living in blocks of apartments has increased. Checking the letter box can sometimes be seen as a burden because of the fact that apartments are high above street level. With the help of electronics, an automated system can be created to indicate whether there is post in the letterbox.

Situation 4 – Food

☐ An adventure shop is asking for your help in order to create a meal suitable for hikers. The meal has to be high in energy in order to help the individual in this activity.

Question 1

a. Write a Design Brief for the problem presented in the situation you have chosen.

_____

_____

_____

2 marks

b. Analyse your Design Brief carefully and identify TWO keywords.

_____

_____

1 mark

c. Mention TWO different sources from where research for your project can be collected.

_____

_____

1 mark

d. Explain what information you would research for your project.

_____

_____

1 mark

e. Write ONE specification for each of the following.

i. The main function of the product.

_____

ii. The main materials which are likely to be used.

_____

iii. Type of production to be used.

_____

iv. Environmental issues that have to be considered.

_____

4 marks

f. State the main purpose of the specifications list.

_____

_____

_____

1 mark

Question 2

a. In the space below sketch and number some possible solutions for the Design Brief you wrote in **Question 1a**. Take into consideration the main features you want to include. Detail your sketches with notes and dimensions.

8 marks

b. Explain how you would choose an idea in order to develop it further.

2 marks

RESISTANT MATERIALS

Question 3

Figure A explains the process of extrusion which is used to make certain standard forms of metals and plastics.

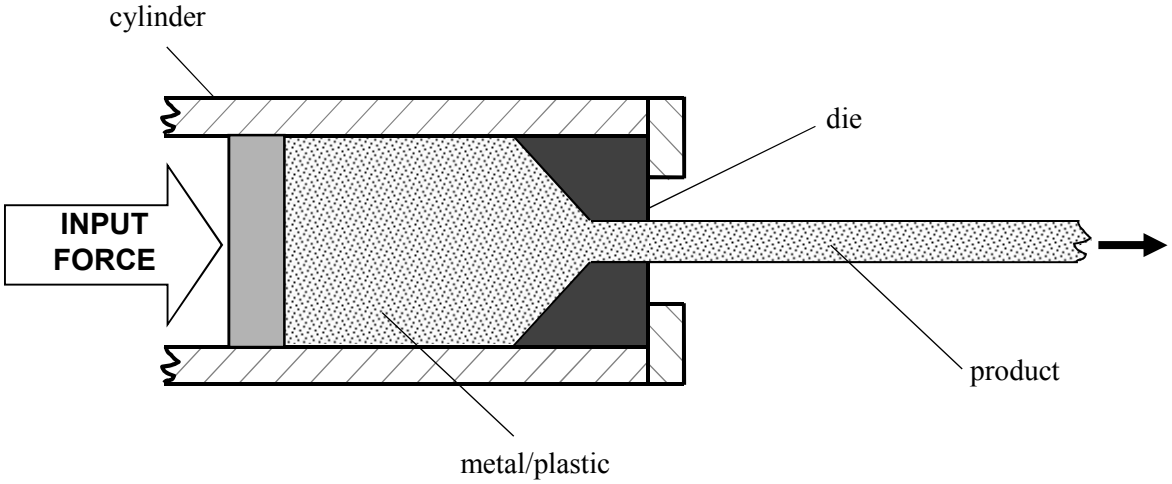


Figure A: Extrusion process

a. Use the following words to fill in the blanks.

▪ **hot** ▪ **cross-section** ▪ **continuous** ▪ **cold**

During extrusion, a material is forced through a die of particular _____ to produce a _____ profile. The material being pressed can be either _____ or _____.

2 marks

b. i. Malleable metals can be extruded. Give the meaning of malleability.

_____

1 mark

ii. Thermoplastics can be extruded more than once. Define thermoplastics.

_____

1 mark

c. Complete Table 1. The first row is given as the example.

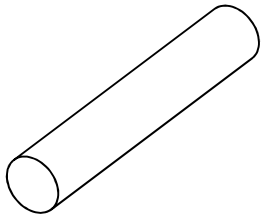
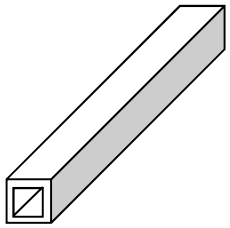
STANDARD FORMS OF METALS & PLASTICS		CAN BE FORMED BY EXTRUSION?	
SKETCH	**NAME**	**YES**	**NO**
	round bar	✓	
	sheet		
			

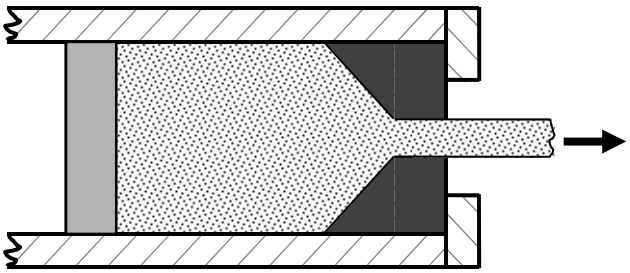
Table 1

3 marks

d. i. Identify the type of motion of the input force as shown in Figure A.

1 mark

ii. In the space provided, add a mechanical system that can produce the input force for the extrusion process shown in Figure A to work. Use labelled sketches in your answer.



2 marks

QUESTION 4

Figure B shows a pull-along toy train for a toddler. The toy includes several wagons which can be joined by the child. The driver wagon is different from the rest of the wagons.

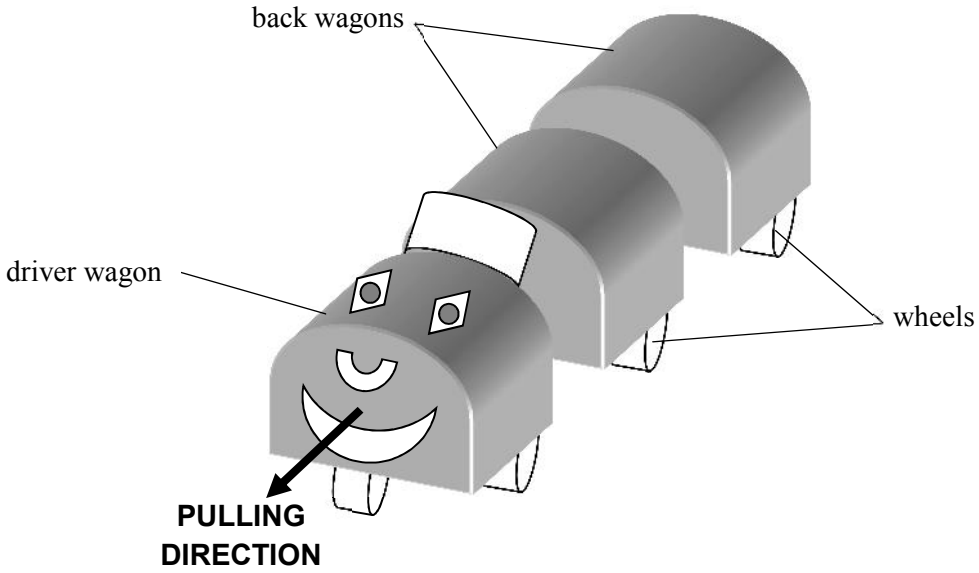


Figure B: Pull-along toy train

a. i. Name a suitable material for the toy shown in Figure B.

_____

ii. Mention ONE suitable surface finish which can be applied on this material.

_____

2 marks

b. The back wagons have one axle with two eccentric wheels as shown in Figure C, all made from the same material.

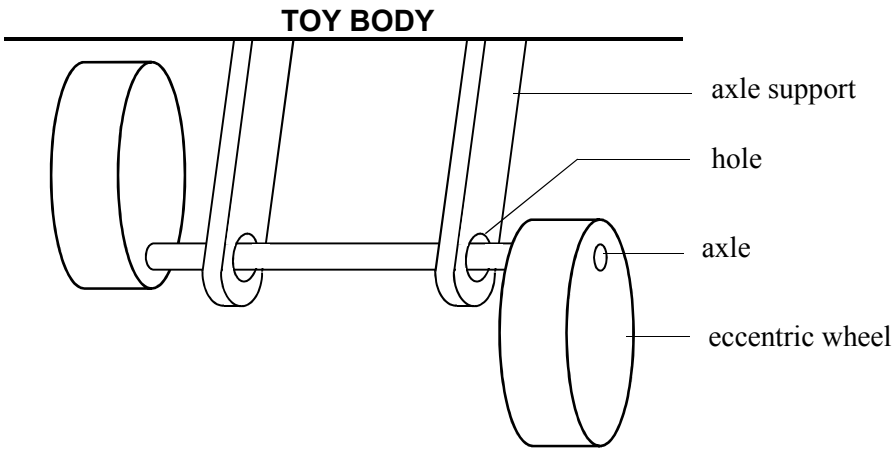


Figure C: Axle with two eccentric wheels

i. On Figure C, draw an arrow to show the direction of movement of the input. Label this arrow as INPUT.

1 mark

ii. On Figure C, draw an arrow to show the direction of movement of the wheels. Label this arrow as OUTPUT.

1 mark

iii. By using labelled sketches and considering the material you chose in Question 4a, explain how ONE of the eccentric wheels can be joined to the axle.

2 marks

iv. Mention the TWO tools which are used to cut out the hole in the axle support.

_____

1 mark

c. i. Describe the effect that the eccentric wheels have on the movement of the whole wagon.

_____

1 mark

ii. Suggest a method how this effect can be reduced but not eliminated.

_____

_____

2 marks

ELECTRONICS

Question 5

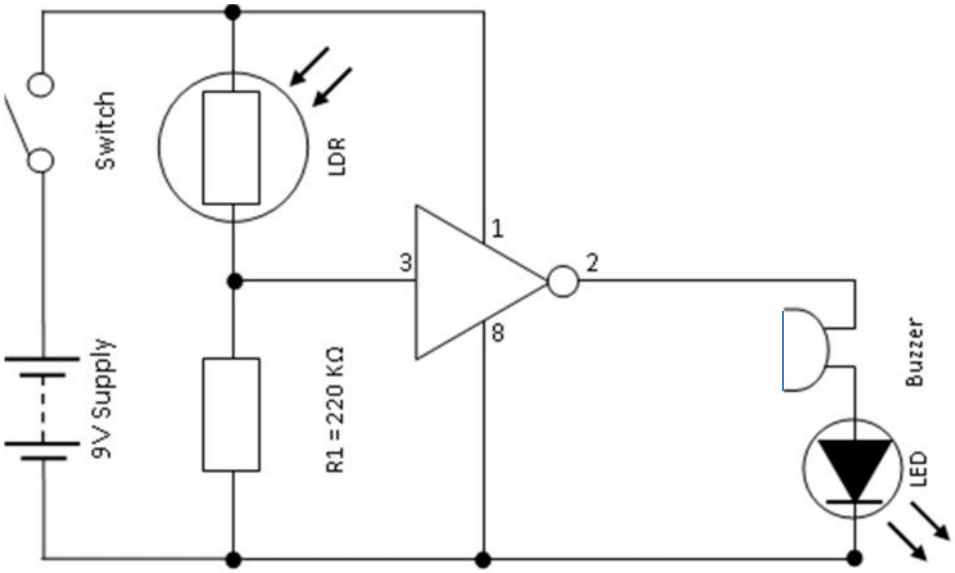


Figure D

a. A circuit diagram for a fire alarm is shown in Figure D. When the LDR is covered by the smoke the alarm will turn ON via a logic gate.

i. State the name of the logic gate shown in Figure D

_____

1 mark

ii. State the purpose of each connection of the logic gate in the Table below:

Connection 2		Connection 3	

Table 2

1 mark

iii. In Table 3 complete the truth table for the logic gate used in Figure D.

Input	Output

Table 3

1 mark

iv. Label the positive and negative terminals of the LED in Figure E .

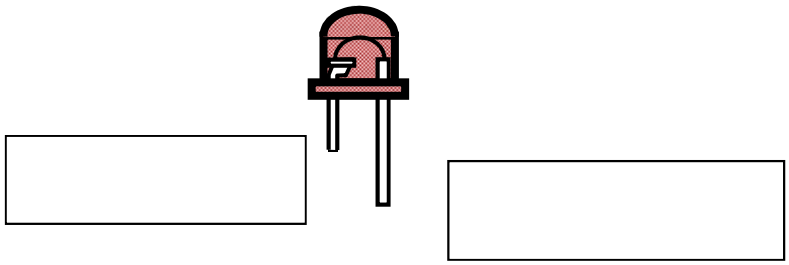


Figure E

1 mark

v. State the purpose of the LED shown in Figure D.

_____

1 mark

b. State what affects the resistance if the LDR will be replaced with a thermistor.

_____

1 mark

c. The fixed 220KΩ resistor was replaced by a variable resistor. State why this change was made.

_____

1 mark

d. In Table 4 identify the input and output components in the circuit in Figure D.

Input	**Output**

Table 4

3 marks

Question 6

a. There are two different supplies for electronic circuits. These are mainly AC and DC.

i. Complete Table 5 with ONE source examples of each.

	Full Name	**Example**
AC	Alternating Current	
DC	Direct Current	

Table 5 **1 mark**

ii. On the diagram below draw the wave form produced by an AC supply.

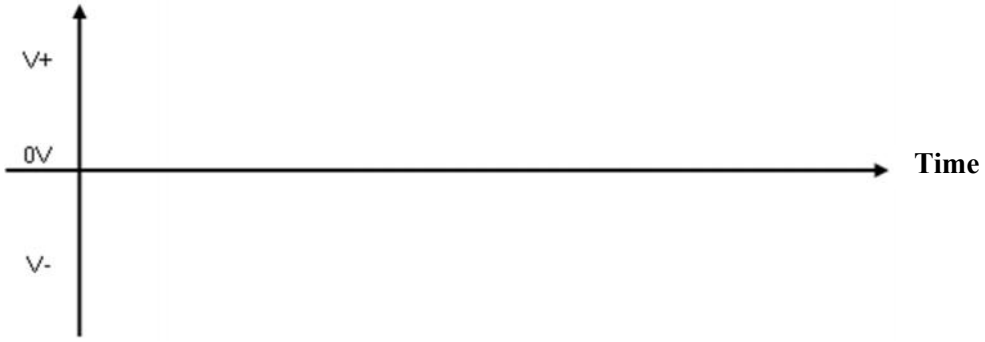


Figure F

1 mark

b. Figure G shows an electromechanical device used as an interface between a DC and an AC circuit. Name the device.

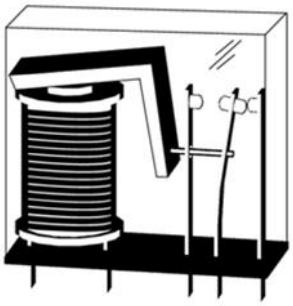


Figure G

1 mark

c. Figure H shows a 555 timer IC.

i. Identify the pin numbers of the IC on Figure H.

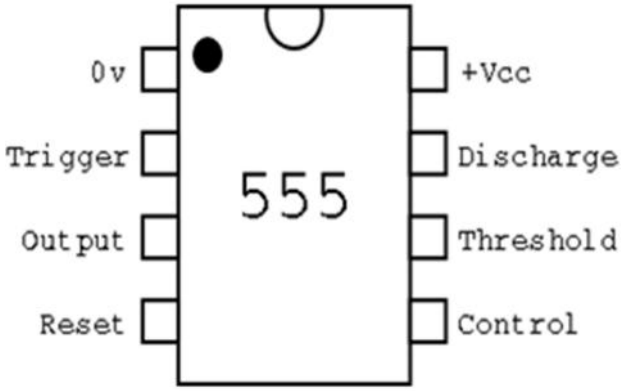


Figure H

1 mark

ii. State what the term IC stands for.

_____

1 mark

d. In Table 6 complete the data for a vacuum cleaner.

Appliance	Power (W)	Current (A)	Voltage (V)	Working Area
Vacuum Cleaner	2300W		230 V	

Table 6

2 marks

e. i. Find out the total resistance for the circuit in Figure I. Show your working in the space provided.

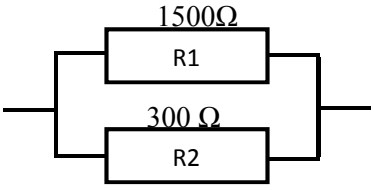


Figure I

2 marks

ii. A 316Ω resistor is not found on the market. Tick [✓] against the nearest preferred resistor value to use in Table 7.

300 Ω	
330 Ω	

Table 7

1 mark

FOOD

Question 7

a. Fill in the blanks with the appropriate nutrient. Use the following words only once.

■ Carbohydrates ■ Protein ■ Fat ■ Vitamins ■ Calcium ■ Iron

1. _____ is needed for growth and repair of body tissues.
2. _____ maintain our health and prevent diseases.
3. _____ helps in the formation of red blood cells.
4. _____ supply the body with energy.
5. _____ is essential for the formation of bones and teeth.
6. _____ insulates the body against cold.

3 marks

b. The following is a basic recipe for Spaghetti Bolognese.

500g spaghetti	1 onion
100g streaky bacon	2 cloves of garlic
500 g beef mince	2 sprigs of fresh rosemary
500 g tomatoes	olive oil
Parmesan cheese	

i. A food company wants to produce a new range of packed pasta meals. Suggest modifications that can be made to the basic pasta recipe to make it healthier.

_____

_____

1 mark

ii. Underline TWO of the following ingredients that the company can use as alternative protein in the pasta meals.

■ pork mince ■ soya mince ■ chicken mince ■ corn beef ■ mushrooms

1 mark

iii. Give TWO reasons why this company wants to use alternative protein.

_____

_____

2 marks

c. The food production system consists of three elements. In Table 8 below insert the following under the correct headings.

- vacuumed packed pasta ■ baking pasta ■ pasta ■ tomatoes ■ onions
- mixing sauce ingredients

INPUT	PROCESS	OUTPUT

Table 8

3 marks

Question 8

Food safety rules and regulations give instructions about food hygiene standards.

a. Give THREE personal hygiene rules that food handlers must follow to observe the regulations.

_____

_____

_____

3 marks

b. John had food poisoning from the chicken sandwich he prepared; state TWO precautions he should have taken to avoid food poisoning.

_____

_____

2 marks

c. Name the THREE microorganisms that spoil food.

_____

2 marks

d. Indicate what the letters HACCP stand for.

_____

_____

3 marks

TEXTILES

Question 9

A teacher had the idea to give students a project on how they can recycle old clothes. Students suggested several ideas on how to convert old clothes into new products. Figure J shows some final products made by students.

Figure J – Shopping bags from recycled fabric.

a. Name FOUR other products (not shown in Figure J) that could be produced from recycled textiles.

_____

_____

2 marks

b. Methods of recycling textiles include using old clothes to produce something smaller or joining many pieces together to produce larger products. State another method used to recycle or re-use textiles.

_____

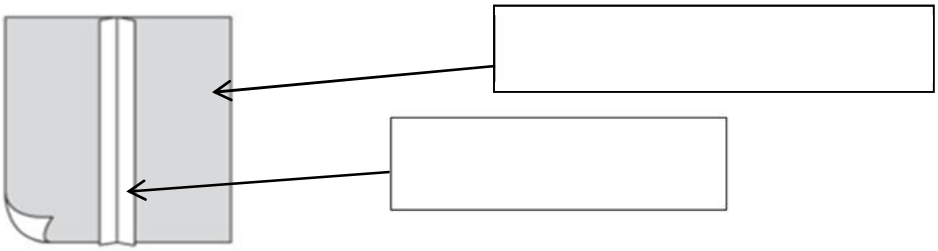
1 mark

c. Mention TWO different types of fasteners that could be used to secure items in the bags shown in Figure J.

_____

2 marks

d. Figure K is a diagram of a seam that could be used when joining the bags shown in Figure J. Label the diagram and give the name of the seam shown.



Name of seam:_____

Figure K

2 marks

e. Table 9 shows different methods of adding shape to your products.

i. Match the pictures with the correct names by inserting the number in the empty column.

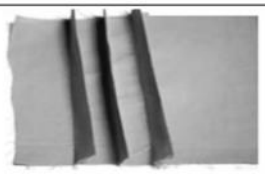
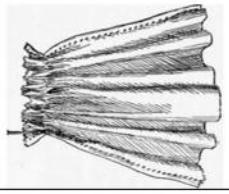
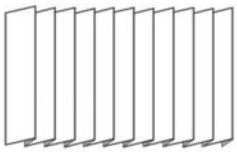
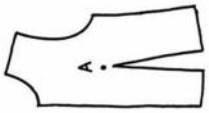
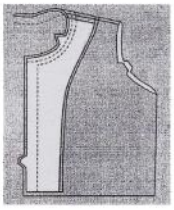
	Pictures		**Names**
1			Darts
2			Interfacing
3			Gathering
4			Tucks
5			Pleats

Table 9

ii. State ONE method listed in Table 9 that the student can use between the fabric and the lining of the bags to add shape.

_____

3 marks

Question 10

A pattern is a template that is used to make a product. Each pattern carries symbols of pattern markings.

a. Table 10 shows a list of symbols and their meanings. Match the symbols with the correct meaning by inserting the number in the column next to the symbol.

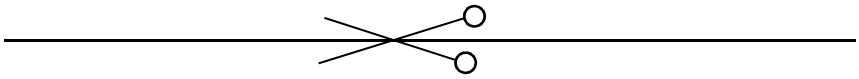
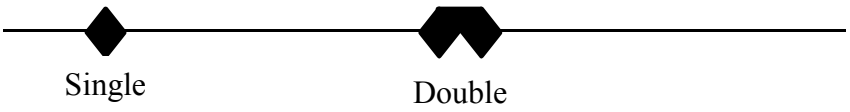
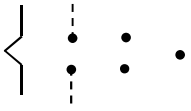
Meaning		**Symbol**	
1	Dart		
2	Straight grain line		
3	Place on fold		
4	Cutting line		
5	Sewing Line		
6	Notch / Balance Mark		

Table 10

6 marks

b. Name TWO tools that are mainly used when drawing the pattern on fabric.

_____

1 mark

c. In the space below sketch a pattern for one of the bags mentioned in Figure J.

3 marks

Blank Page