Index No:_____ SEC33/2A.16m

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

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2016 SESSION

SUBJECT:	**Design and Technology**
PAPER NUMBER:	IIA
DATE:	22nd April 2016
TIME:	4:00 p.m. to 6:05 p.m.

Answer ALL 10 questions. Each question carries 10 marks.

Useful Information:

Non-programmable calculators are allowed

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%

DESIGN PROCESS

Question 1

A company specialising in electrical appliances wants to expand its range of electric kettles by seeking for an innovative eco-friendly design through a competition aimed at D & T students.

a. Write a Design Brief for the making of this electric kettle.

_____

_____

2 marks

b. In the space provided sketch TWO ideas for the Design Brief. Add colours, annotations, dimensions and other information which you feel is adequate and important at this stage.

IDEA 1

IDEA 2

7 marks

c. Choose ONE of the two ideas which you think can be developed further. Tick the box of the idea you have chosen.

Idea 1 ☐ Idea 2 ☐

Give TWO valid reasons for your choice.

Reason 1: _____

_____

Reason 2: _____

_____

1 mark

Question 2

a. Explain the term 'Specifications' in the Design Process.

_____

_____

1 mark

b. Identify the criteria used to choose the most suitable material for the design you chose in question 1c.

_____

1 mark

c. Determine the environmental issues that should be considered when working with materials.

_____

1 mark

d. State what the designer has to take into consideration when choosing the material to produce the kettle's handle.

_____

1 mark

e. Testing and evaluation are very important steps in designing. Name TWO suitable persons you would propose to evaluate your product.

_____

2 marks

f. State which personal protective equipment (PPE) you should use while doing the following actions:

i. Cutting plastic: _____

ii. Soldering: _____

2 marks

g. Mention TWO different tests that can be applied to the electric kettle in order to be declared safe for use.

_____

_____

2 marks

RESISTANT MATERIALS

Question 3

Figure A shows one of the processes used to form plastic objects. The process consists of a plastic filament which is extruded on a moving bed to form a three-dimensional object. The process is called fused-deposition modelling and is one of the methods used to achieve 3D printing.

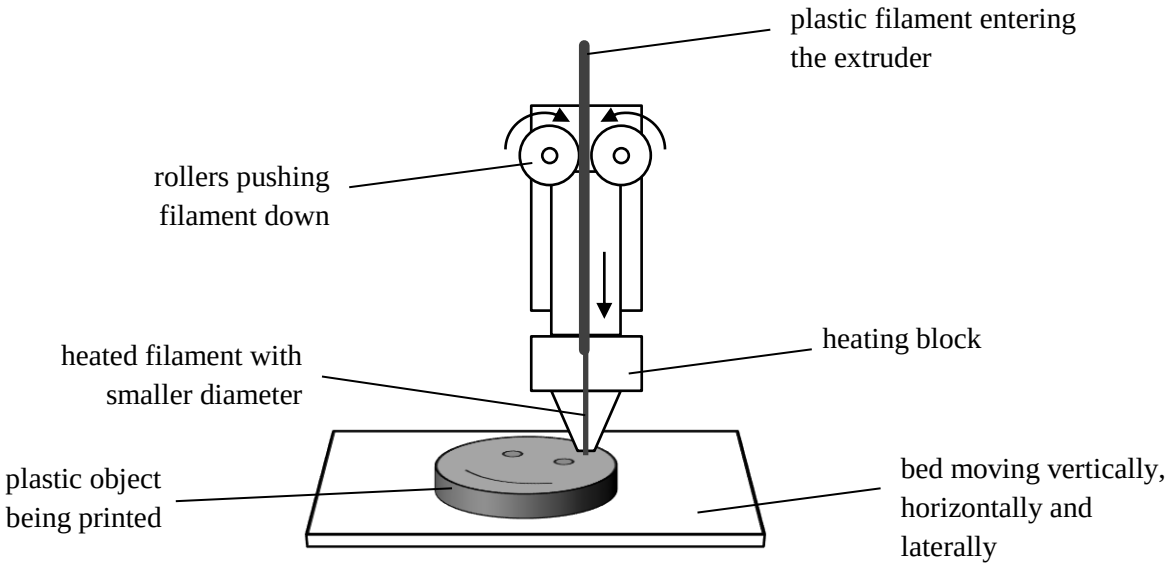


Figure A: Fused-deposition modelling

a. Carefully read the annotations found on Figure A.

i. Briefly describe what is meant by extrusion in general plastics manufacturing.

_____

_____

2 marks

ii. Suggest which class of plastics can be used for the process shown in Figure A. Give ONE reason for your answer.

_____

_____

1 mark

b. Discuss the effects of petroleum-based plastics on the environment.

_____

_____

2 marks

c. Fused-deposition modelling (FDM) is a process which can be used during computer-integrated manufacturing.

i. Explain what is meant by computer-integrated manufacturing.

_____

_____

1 mark

ii. Mention another method used by a designer to model prototypes.

_____

1 mark

d. '3D' is not only used in printing but also in drawings.

i. Show the difference between 2D and 3D drawings by sketching a try-square in both techniques. Clearly identify the 2D and 3D sketches.

2 marks

ii. Name ONE drawing technique classified under each of the following:

2D : _____

3D : _____

1 mark

Question 4

A number of donation boxes were designed for a charity foundation working with stray dogs. These donation boxes have the shape of a dog which moves its jaw when money is donated. Figure B shows the internal mechanism which controls the movement of the dog's jaw. The input force is generated by a d.c. motor.

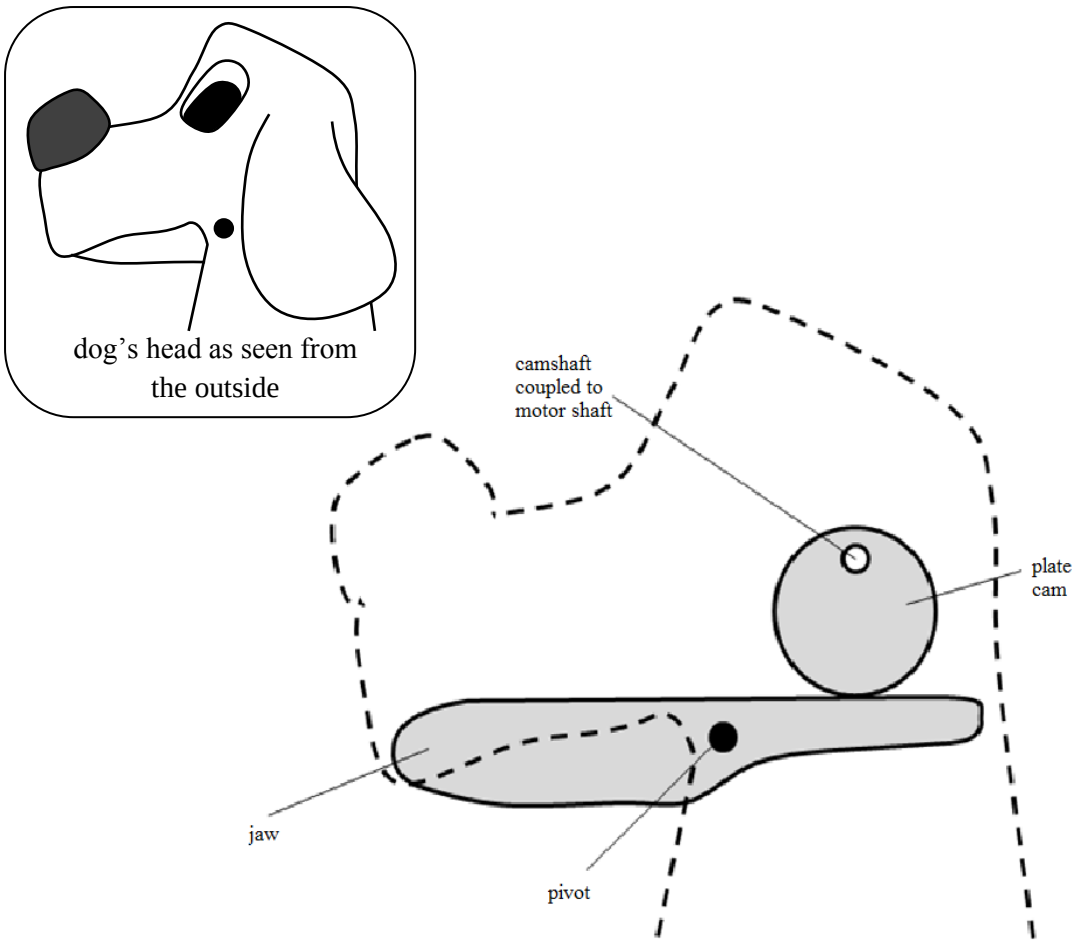


Figure B: Internal mechanism of the dog's lower jaw

a. Name another mechanism shown in Figure B apart from cams.

1 mark

b. On Figure B, add arrows to show the movement of the INPUT and OUTPUT mechanisms. Label the arrows you draw.

2 marks

c. Find ONE reason why the jaw of the dog has an irregular form with one side thicker and longer than the other.

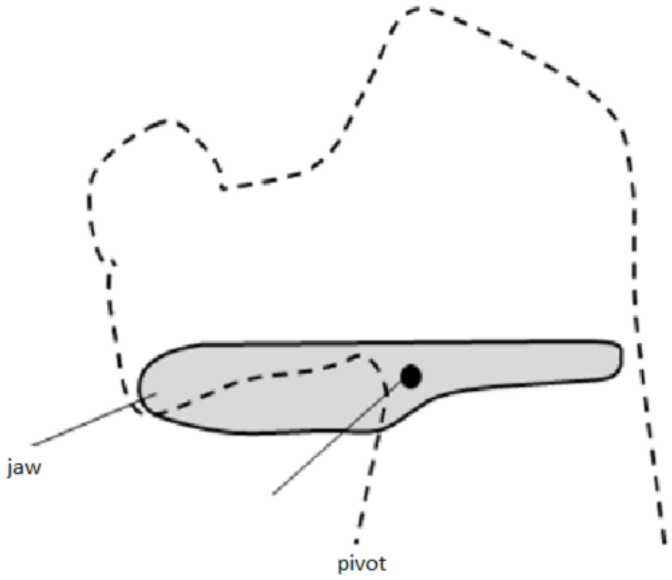
2 marks

d. i. Give the name of the plate cam profile shown in Figure B.

_____

1 mark

ii. On the diagram below, design a new plate cam which makes the jaw open and close three times in one revolution of the cam shaft, considering the space available inside the dog's head. Label your design.



4 marks

ELECTRONICS

Question 5

a. Fill in Table 1 by naming and drawing the schematic symbol of the components shown.

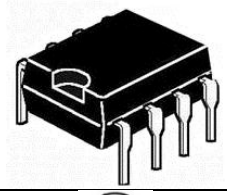
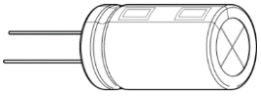
Component	Name	Symbol
		
		
		

Table 1

3 marks

b. Give TWO purposes of a component data sheet.

2 marks

c. Name the TWO physical properties of the electronic component shown in Figure C that indicate pin one.

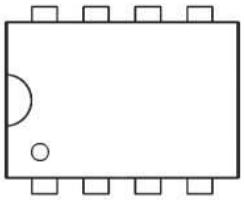


Figure C

Physical property 1	
Physical property 2	

1 mark

d. Describe the purpose of the metal body of power transistors as show in Figure D.

Figure D

1 mark

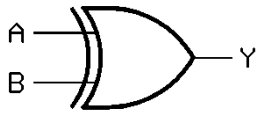
e. State ONE reason why transistors are ideal for circuits triggered by touch sensitive switches.

1 mark

f. State ONE advantage of a darlington pair transistor over common transistors.

1 mark

g. Complete the truth table below for the XOR gate, by stating the combinations for input A and B when the output is on.



XOR

A	B	OUTPUT Y
		1
		1

1 mark

Question 6

A student wants to build the circuit shown below in Figure E.

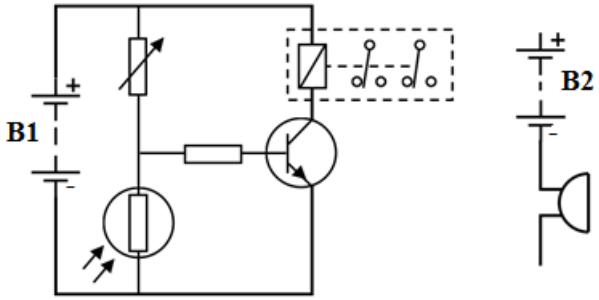


Figure E

a. Describe TWO functions of the circuit shown in Figure E.

2 marks

b. On Figure E, wire the battery B2 and buzzer to the relay such that the buzzer will sound when the relay is energised.

1 mark

c. When using a relay switch it is important to wire a clamping diode. Give a reason for this statement.

1 mark

d. Draw appropriately the protective diode on Figure E.

1 mark

e. Figure F shows an incomplete PCB layout of the schematic circuit shown in Figure E from the component side. The diode has not been included. Complete the PCB shown in Figure F by drawing the missing tracks.

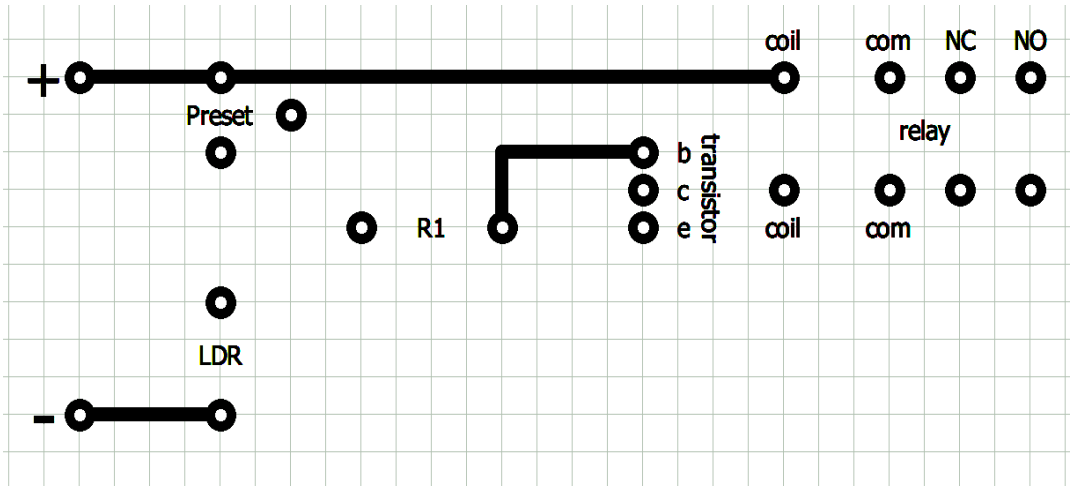


Figure F

3 marks

f. Describe the meanings of the terms "NO" and "NC" as used in relay contacts.

Abbreviation	Name	Description
NO		
NC		

2 marks

FOOD

Question 7

a. Name the THREE ways heat is transferred during cooking.

_____

1 mark

b. Suggest TWO different ways of cooking food using:

i. moist method –_____

ii. dry method – _____

2 marks

c. Paul is told to eliminate fat from his diet. Suggest ONE way he can cook his vegetables and describe the method you suggested.

Method: _____

Description: _____

_____

3 marks

d. List FOUR pre-manufacturing checks that should be carried out before any food is produced.

_____

_____

_____

_____

2 marks

e. Identify TWO potential hazards in food production and give an example of each hazard mentioned.

_____

_____

2 marks

Question 8

a. Jane is vegetarian; explain what a vegetarian is.

_____

_____

2 marks

b. There are different types of vegetarians; name and explain TWO types.

_____

_____

_____

_____

2 marks

c. A bakery wants to produce an innovative snack aimed at teenagers. Two important nutrients suitable for this target group are proteins and calcium.

i. State the function of these two nutrients.

- protein _____

- calcium _____

1 mark

ii Name the three nutrients which provide energy and state their caloric value.

Nutrients	**Kcal/gram**

3 marks

iii. The following are the main ingredients that will be used for the casing and its filling of the snack. Modify the recipe so that it will be suitable for a person following a strict vegetarian diet.

Casing	**Filling**
• Flour • Butter • Water/ milk • Pinch of salt	• Ground beef • bacon • Carrots • Peas • Onion

Select ingredient	**Substitute**

2 marks

TEXTILES

Question 9

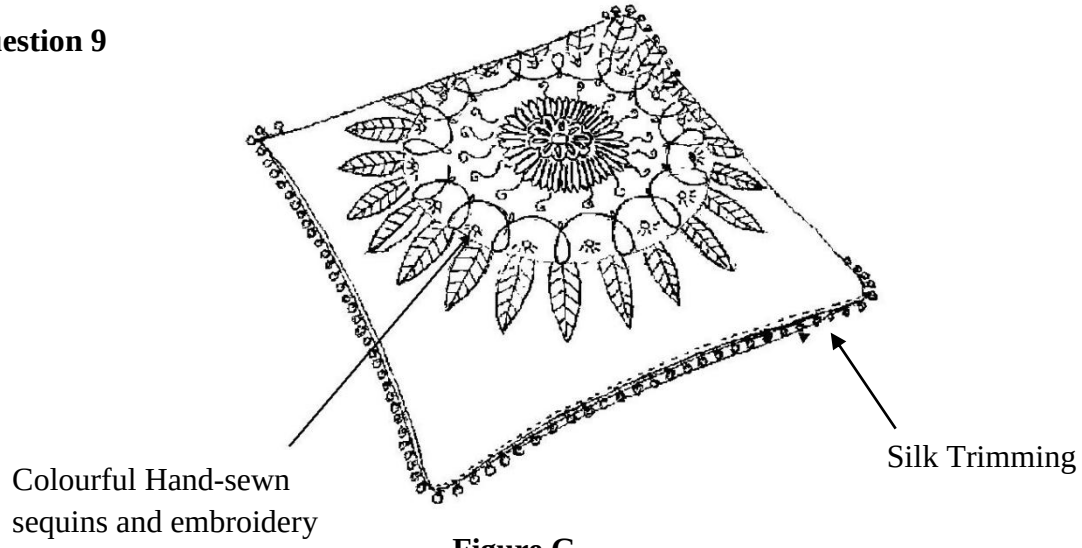


Figure G

Figure G shows a non-removable cover cushion which is made from 100% wool fabric.

a. Name TWO properties of wool that can make it suitable for the decorative cushion cover. Give ONE reason for each property.

Properties	**Reason**

3 marks

b. Name TWO disadvantages which can make wool a less suitable fibre for the cushion cover. Provide ONE reason for each disadvantage.

Disadvantages	**Reason**

3 marks

c. i. Explain why hand sewn sequins are unsuitable for the non-removable cover.

_____

_____

2 marks

ii. Suggest another method of decoration other than embroidery to solve the issues mentioned in your answer.

_____

2 marks

Question 10

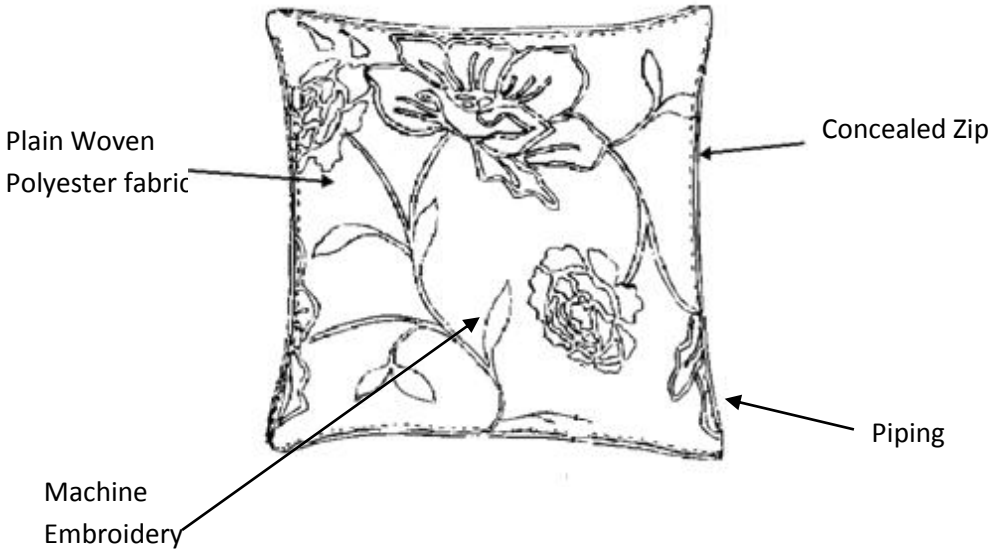


Figure H

Figure H shows a removable cushion cover which is made from polyester fabric.

a. The cushion shown in Figure G is made from wool and the cushion cover shown in Figure H is made from polyester fabric. Explain, in terms of fibre origin, the difference between both materials.

_____

_____

_____

2 marks

b. In both designs, one of the Specifications was that the cushion cover must be attractive for users. State how this Specification was addressed in the cushions' designs shown in Figure G and Figure H.

Figure G	
Figure H	

2 marks

c. In Figure H a concealed zip was used to keep the cushion in place.

i. Give TWO reasons why this fastener is more effective than other fasteners.

_____

_____

1 mark

ii. Name TWO other fasteners which are similarly effective for this cushion.

_____

1 mark

d. i.. Suggest ONE reason why piping was used on the edge of the cushion cover**.**

Reason: _____

1 mark

ii. By means of a sketch show how piping was attached.

2 mark

e. Textile manufacturers need to consider the impact their products have on the environment. List TWO considerations that can be taken to minimise pollution in the manufacture of the cushions.

_____

_____

1 mark

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Grey	8	8	-	
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				Gold = ±5%
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DESIGN PROCESS

Question 1

A company specialising in electrical appliances wants to expand its range of electric kettles by seeking for an innovative eco-friendly design through a competition aimed at D & T students.

a. Write a Design Brief for the making of this electric kettle.

_____

_____

2 marks

b. In the space provided sketch TWO ideas for the Design Brief. Add colours, annotations, dimensions and other information which you feel is adequate and important at this stage.

IDEA 1

IDEA 2

7 marks

c. Choose ONE of the two ideas which you think can be developed further. Tick the box of the idea you have chosen.

Idea 1 ☐ Idea 2 ☐

Give TWO valid reasons for your choice.

Reason 1: _____

_____

Reason 2: _____

_____

1 mark

Question 2

a. Explain the term 'Specifications' in the Design Process.

_____

_____

1 mark

b. Identify the criteria used to choose the most suitable material for the design you chose in question 1c.

_____

1 mark

c. Determine the environmental issues that should be considered when working with materials.

_____

1 mark

d. State what the designer has to take into consideration when choosing the material to produce the kettle's handle.

_____

1 mark

e. Testing and evaluation are very important steps in designing. Name TWO suitable persons you would propose to evaluate your product.

_____

2 marks

f. State which personal protective equipment (PPE) you should use while doing the following actions:

i. Cutting plastic: _____

ii. Soldering: _____

2 marks

g. Mention TWO different tests that can be applied to the electric kettle in order to be declared safe for use.

_____

_____

2 marks

RESISTANT MATERIALS

Question 3

Figure A shows one of the processes used to form plastic objects. The process consists of a plastic filament which is extruded on a moving bed to form a three-dimensional object. The process is called fused-deposition modelling and is one of the methods used to achieve 3D printing.

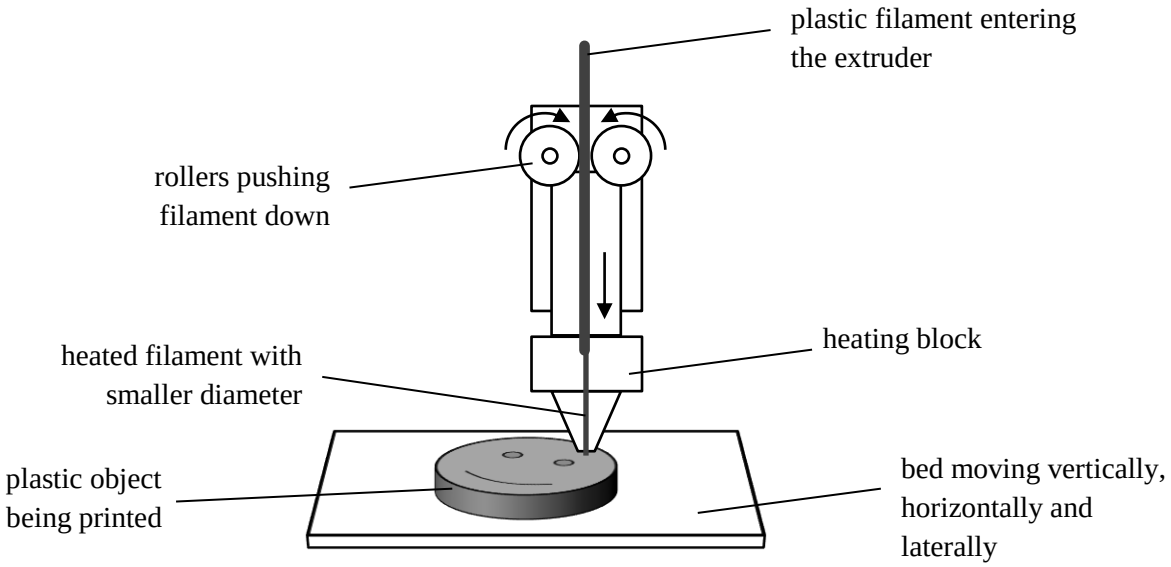


Figure A: Fused-deposition modelling

a. Carefully read the annotations found on Figure A.

i. **W**hat is meant by extrusion in the general plastic manufacturing?

_____

_____

1 mark

ii. Mention another type of manufacturing process used to form plastic parts.

_____

1 mark

iii. Give a reason why only thermoplastics can be shaped using the process shown in Figure A.

_____

_____

1 mark

b. Mention TWO effects of producing petroleum-based plastics on the environment.

_____

_____

2 marks

c. 3D designs are created on a computer in a process called CIM. Explain briefly ONE way in which you could create a 3D model of your Design and Technology project.

_____

_____

2 marks

d. 3D is not only used in printing but also in drawings.

i. In the space provided draw a try-square in 3D, using a standard drawing technique.

2 marks

ii. Name a standard 3D drawing technique.

_____

1 mark

Question 4

A number of donation boxes were designed for a charity foundation working with stray dogs. These donation boxes have the shape of a dog which moves its jaw when money is donated. Figure B shows the internal mechanism which controls the movement of the dog's jaw. The input force is generated by a d.c. motor.

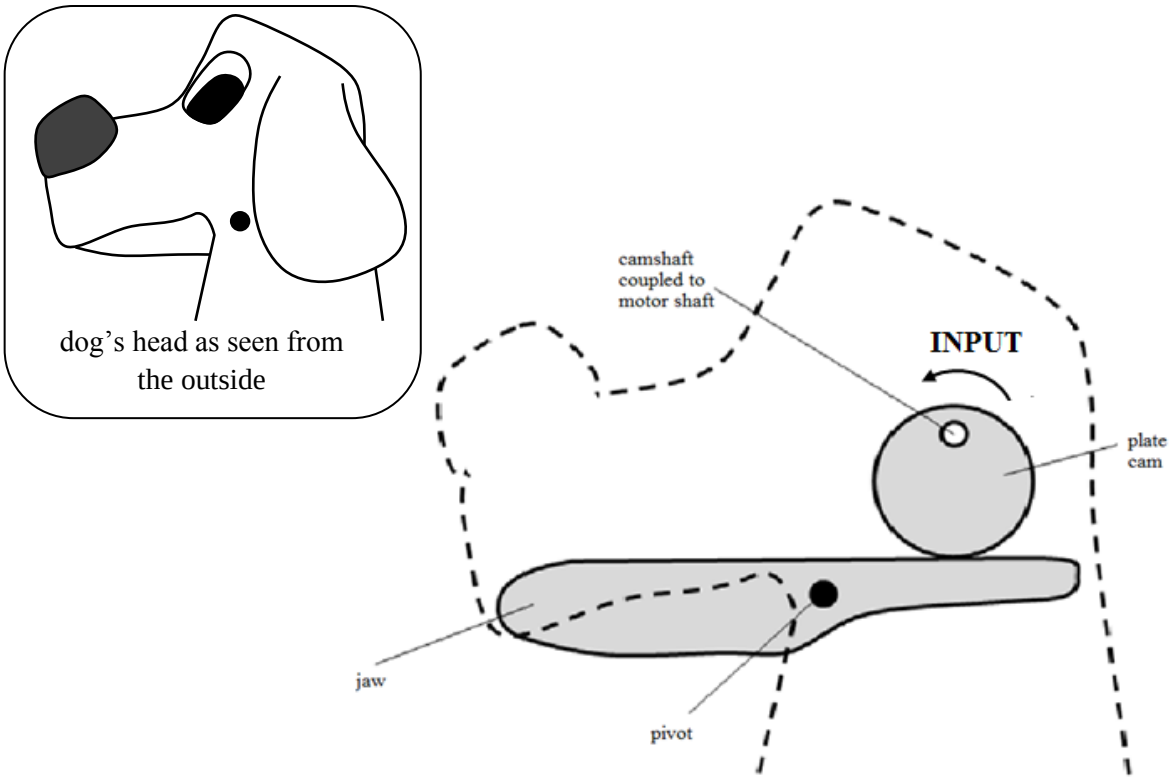


Figure B: Internal mechanism of the dog's lower jaw

a. Name another mechanism shown in Figure B apart from cams.

_____

1 mark

b. On Figure B, add arrows to show the direction of movement of the OUTPUT.

1 mark

c. Decide whether the following statements are TRUE or FALSE. Give ONE reason for each answer.

STATEMENT	TRUE/ FALSE	REASON
The mechanism shown in Figure B will function in the same way if the cam rotates clockwise.		
The mechanism will still function if the camshaft is moved to the centre of the cam profile.		

3 marks

d. i. Give the name of the plate cam profile shown in Figure B.

_____

1 mark

ii. On Figure C below, design a new plate cam which makes the jaw open and close twice in one revolution. Consider the space available inside the dog's head. The camshaft has been drawn for you.

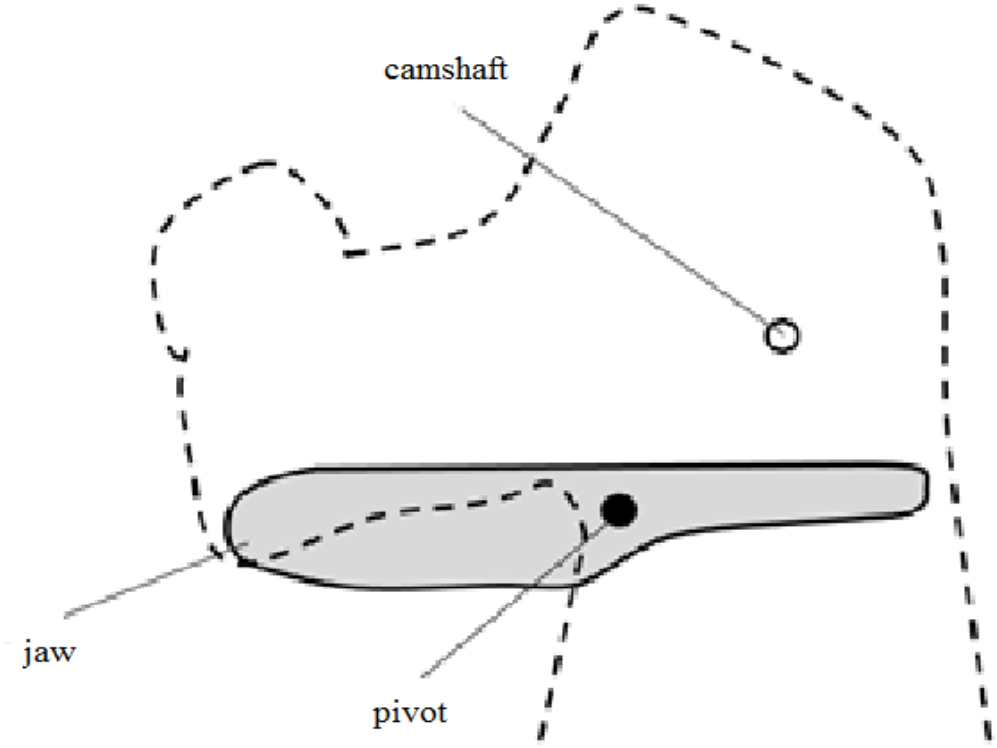


Figure C: New mehanism

4 marks

ELECTRONICS

Question 5

a. Fill in Table 1 by naming the components shown.

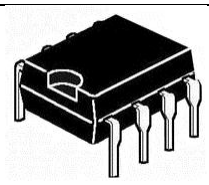
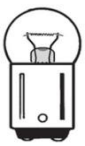
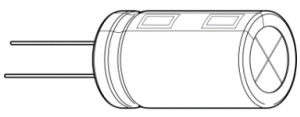
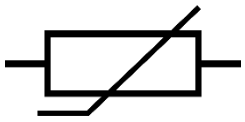
Component				
Name				

Table 1

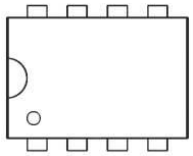
4 marks

b. List ONE important feature of a component you would expect to find in the data sheet.

Component _____ Feature _____

1 mark

c. Describe the purpose for the notch and spot on the component shown below.



_____

1 mark

d. It is very common to attach heat sinks to power transistors. Describe the purpose of the heat sink when attached to a power transistor as show in figure D.

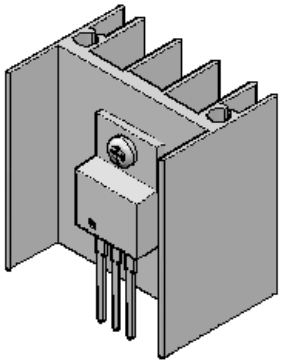


Figure D

_____

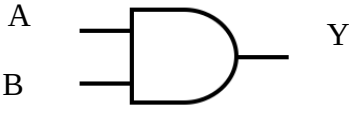
1 mark

e. State ONE use of a transistor.

_____

1 mark

f. Complete the truth table below for the AND gate, by stating the combinations for input A and B when the output is on and another combination when the output is off.



AND

A	B	OUTPUT Y
		1
		0

2 marks

Question 6

A student wants to build the circuit shown below in Figure E.

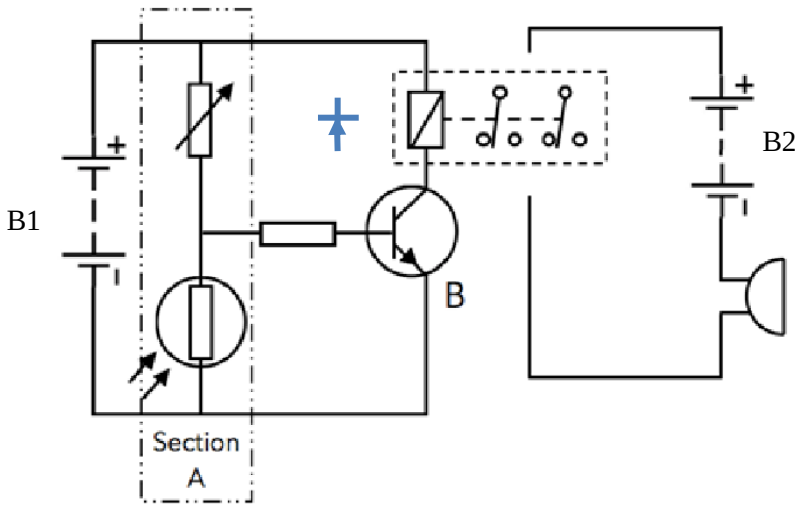


Figure E

a. Describe the function of Section A in the circuit shown in Figure E.

_____

_____

1 mark

b. Describe the functions of component B in the circuit shown in Figure E.

_____

1 mark

c. On Figure E, connect battery B2 and buzzer to the relay's switches, such that the buzzer will sound when the relay is energised.

1 mark

d. When using a relay switch it is important to wire a clamping diode in reverse bias over the relay's coil. Give a reason for this statement.

_____

1 mark

e. Connect the clamping diode on Figure E

1 mark

Figure F shows an incomplete PCB layout of the schematic circuit shown in Figure E, from the component side. The Diode has not been included.

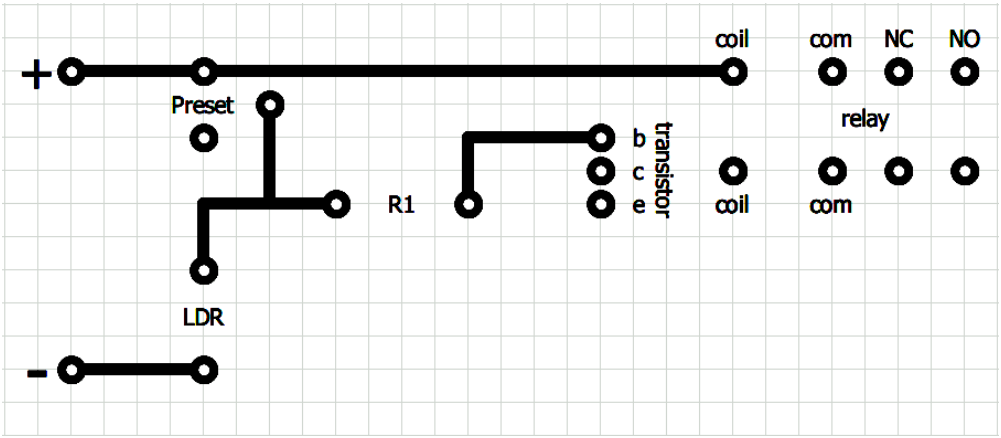


Figure F

f. Complete the PCB shown in Figure F by correctly drawing the tracks that connect:

i. The collector's pad to the relay's coil.

ii. The emitter pad to the LDR.

3 marks

g. Describe the terms "normally open" and "normally closed" used on switches.

Normally open	
Normally closed	

2 marks

FOOD

Question 7

a. Name TWO ways in which heat is transferred.

_____

2 mark

b. Suggest TWO different ways of cooking food using:

i. moist method _____

ii. dry method _____

2 marks

c. Paul is told to eliminate fat from his diet.

i. Tick the best method he should use to cook his vegetables.

Roasting ☐ Steaming ☐ Frying ☐

ii. Give a reason for your choice.

_____

_____

2 marks

e. Give TWO different reasons that affect the way people choose to cook their food.

Reason 1_____

Reason 2_____

2 marks

f. Give FOUR hygiene and safety precautions that must be taken before preparing food.

_____

_____

_____

_____

2 marks

Question 8

a. Jane is vegetarian; explain what is meant by this term.

_____

_____

2 marks

b. Lacto-ovo-vegetarians are one type of vegetarians. What type of food do lacto-ovo-vegetarians accept as part of their diet which other strict vegetarians do not.

_____

_____

1 mark

c. A bakery wants to produce an innovative snack aimed at teenagers. Two important nutrients suitable for this target group are proteins and calcium.

i. State the function of these two nutrients.

- protein _____
- calcium _____

2 marks

ii. Give TWO example of protein food.

_____

1 mark

iii. Most of protein food is considered as high risk food. Explain what you understand by high risk food.

_____

_____

1 mark

iv. High risk food should not be left in the danger zone. What is the temperature of the danger zone?

_____

1 mark

d. Harmful bacteria is present on some raw food.

i. State ONE way in which this bacteria can be transferred on cooked food.

_____

ii. Identify ONE way this bacteria can be destroyed.

_____

2 marks

TEXTILES

Question 9

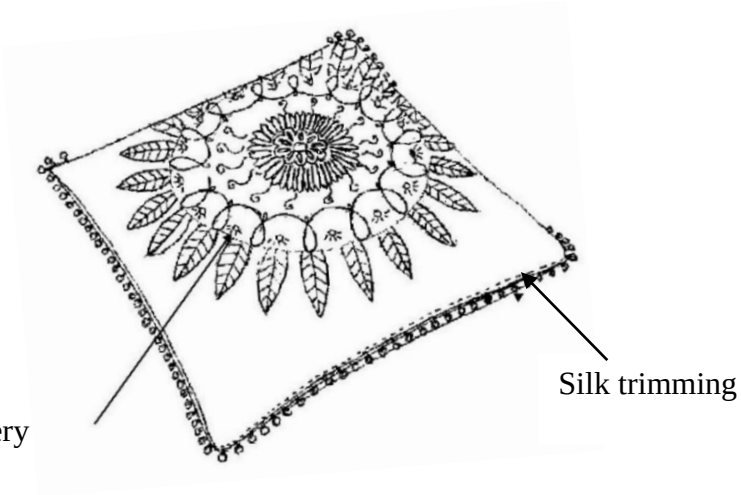


Figure G

Figure G shows a non-removable cushion cover which is made from 100% wool fabric. This material has its advantages and disadvantages.

a. Name TWO properties of wool that makes it suitable for the decorative cushion cover and give ONE reason for each property.

Properties	**Reason**

3 marks

b. Silk trimming was used to decorate the edge of the cushion. Mention another TWO decorative components that could be used for the edge.

_____

2 marks

c. i. Securely hand-sewn sequins were used to decorate the non-removable cover. Give TWO reasons why this method of decoration is unsuitable for the non-removable cover.

_____

_____

2 marks

ii. Name other methods of decoration that could be used to produce the cushion cover.

_____

1 mark

d. i. CAD can be used to design the cushion. What does CAD stand for?

_____

1 mark

ii. Give ONE advantage of CAD in the textile industry.

_____

1 mark

Question 10

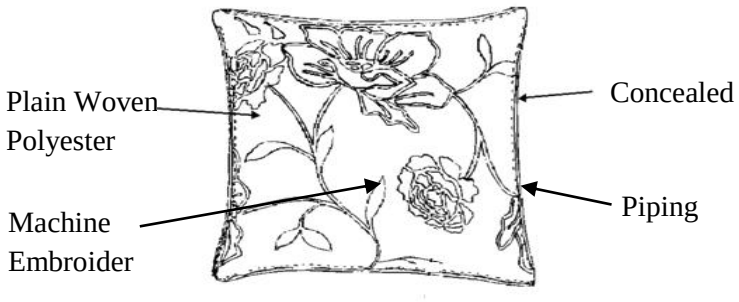


Figure H

Figure H shows a removable cushion cover which is made from Polyester Fabric.

a. Complete the table below:

Fibre	**Origin**	**Source**
Wool		
Polyester Fabric		

2 marks

b. Explain why both cushion covers are attractive to users.

_____

_____

2 marks

c. The following are stages involved in making the cushion but these are not in the correct order. Number the steps in a correct sequence.

	Join the front and back of the material together.
	Neat all edges of both pieces with an overlock machine.
	Prepare the fabric and cut it according to the size you decide.
	Pin the piping on the right side of the material and attach zip.
	Attach the sequins on the front piece of the material.

5 marks

d. Name TWO ways how textile materials can be recycled.

_____

1 mark

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