DIRECTORATE FOR QUALITY AND STANDARDS IN EDUCATION
Department for Curriculum Management and eLearning
Educational Assessment Unit
Annual Examinations for Secondary Schools 2013

FORM 5 **DESIGN & TECHNOLOGY** **TIME: 1h 45min**

Name: _____ Form: _____ Set: _____

---------- **Note to student:** ----------

You are required to answer all questions.

Useful Formulae:

Gear Ratio = Speed of Input : Speed of Output

$V_t = V_1 + V_2 + \ldots$ $P = I \times V$

FOR TEACHERS' USE ONLY DISTRIBUTION OF MARKS

	Areas corrected					Marks for Written Exam	Marks for Design Folio	TOTAL	**FINAL MARK**
	D	**RM**	**E**	**T**	**F**				
Max. Marks	20	20	20	20	20	100	100	200	**%**
Student's mark									

Enter student's mark obtained in every area of study in the above table.
D for Design, **RM** for Resistant Materials, **E** for Electronics, **T** for Textiles and **F** for Food

SECTION A: **DESIGN**

IMPORTANT: FIRST READ THE FOLLOWING SITUATION CAREFULLY.

SITUATION

Your local council intends to organise a day dedicated to your village. During this day the council wishes to provide various items to the vendors and participants. You are asked to take part in the design of ONE product from the following list:

- TEXTILES BANNERS TO BE HUNG AT VARIOUS PLACES AROUND THE VILLAGE.
- A TRADITIONAL LOCAL DISH WITH A TWIST TO BE SOLD FROM STALLS.
- RESISTANT MATERIAL MEMENTOS TO BE DISTRIBUTED DURING THIS DAY.
- AN ELECTRONIC LIGHTENING DISPLAY THEMED WITH THE VILLAGE COAT OF ARMS TO BE PLACED IN THE VILLAGE MAIN SQUARE.

Underline your choice before answering questions 1 to 7.

1. According to your choice, write a design brief and underline TWO keywords.

_____

_____

_____

_____

2 marks + (½ mark × 2) = 3 marks

2. Name the most suitable method of production for making the product you intend to design. Give ONE reason for your answer.

METHOD OF PRODUCTION:	
REASON:	

1 mark × 2 = 2 marks

3. In the space provided list TWO research items you would expect the designer to find information about.

_____

_____

1 mark × 2 = 2 marks

4. Give THREE design specifications that you would consider important for your product.

_____

_____

_____

1 mark × 3 = 3 marks

5. Sketch ONE idea for your chosen product. Add notes and enhance your sketches with colour.

6 marks

6. After choosing the most suitable idea, what is the next step in the Design Process?

_____

1 mark

7. The last stage of the design process is Testing and Evaluation. Mention THREE questions that you may ask during this stage.

_____

_____

_____

1 mark × 3 = 3 marks

SECTION B: **RESISTANT MATERIALS**

A company is considering environmental issues for designing a new garden cultivator. **Fig** shows the present design of the cultivator which uses fossil fuel to operate a small engine, w **Figure B** shows the new proposed design which uses solar energy to operate a powerful d.c. motor.

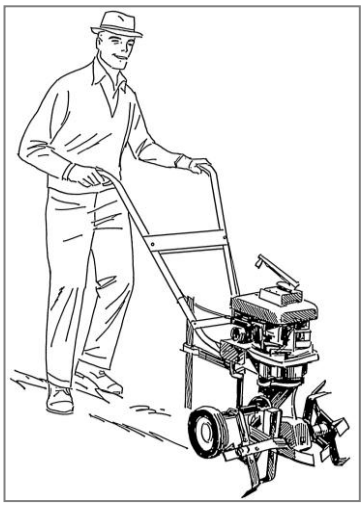


Figure A: Present cultivator

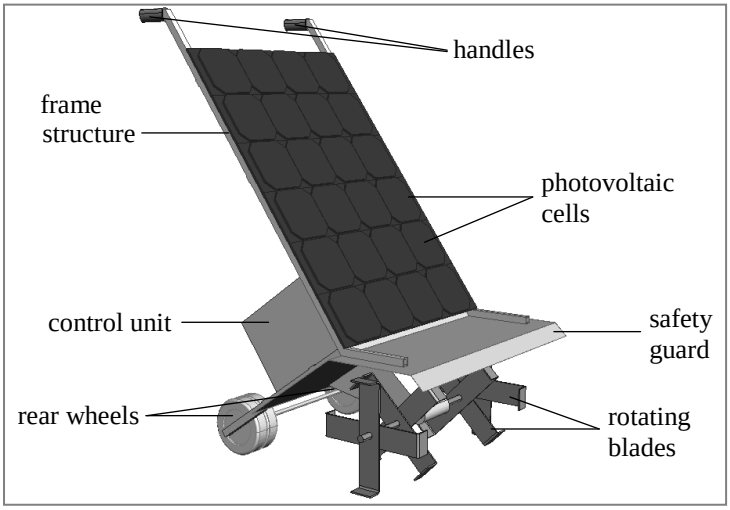


Figure B: New proposed cultivator

8. The new cultivator needs to have a lighter weight than the current design because of the additional weight of the solar panels. However, parts must maintain their strength and resist to outdoor conditions. Choose the most suitable material for each of the following parts by underlining the correct answer from the brackets.

a. cultivator's hollow frame structure: (white deal / aluminium alloy / oak / cast iron)

b. casing for control unit: (high-density polythene / heat-treated steel / plywood / MDF)

c. safety guard sheet: (acrylic / plywood / aluminium alloy / cast iron)

d. rotating blades: (cast iron / oak / heat-treated steel / acrylic)

1 mark × 4 = 4 marks

9. The structure is made from a square hollow section, whereas the safety guard is made of sheet material. Explain, through labelled sketches, how the guard can be joined to the frame structure. Remember that the joint has to withstand vibrations.

3 marks

10. The output force and motion of the motor is transferred to the shaft of the blades [illegible] of gears and pulleys as shown in **Figure C**.

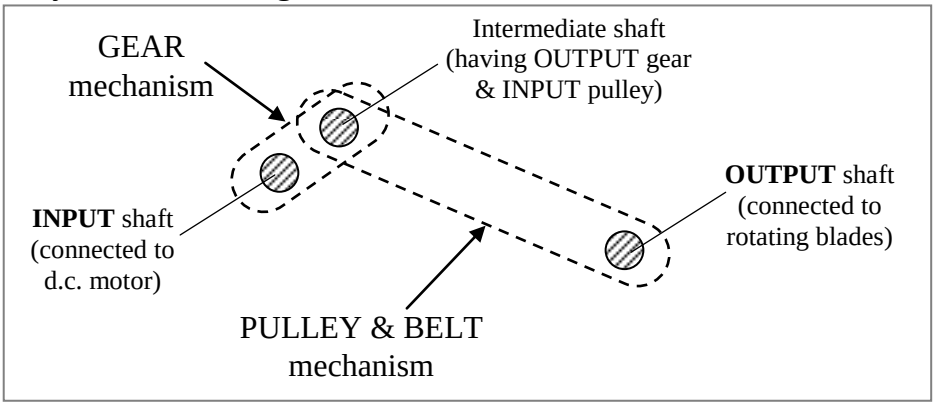


Figure C: Cultivator's mechanism

a. The gear mechanism consists of two meshing gears which reduce the speed of the motor. The shaft of the motor rotates at 300 r.p.m., but the blades of the cultivator are needed to rotate at 60 r.p.m. Assuming that there is no change in speed from the pulley and belt mechanism, find the gear ratio of the meshing gears.

3 marks

b. If the input gear has 20 teeth, calculate the number of teeth of the output gear.

2 marks

c. Explain the effect that this gear mechanism has on rotational force.

_____

1 mark

d. In the space below, draw a labelled diagram of the pulley and belt mechanism, assuming no change in speed and direction of motion.

2 marks

e. Give ONE reason why the pulley and belt mechanism was introduced in the tra… system even if it has no effect on the speed.

_____

_____

2 marks

11. Consider these manufacturing processes:

■ casting ■ injection moulding ■ bending ■ facing ■ extrusion

Using the above list, suggest the manufacturing process which the following parts went through:

a. the square hollow section of the frame structure: _____

b. the handles : _____

c. the safety guard: _____

1 mark × 3 = 3 marks

SECTION C: **ELECTRONICS**

12. **Figure D** shows a group of photovoltaic cells used to form the required solar panel to power the cultivator's motor.

a. Give TWO advantages of using solar cells over other methods used to power up electronic devices.

_____

_____

_____

_____

½ mark × 2 = 1 mark

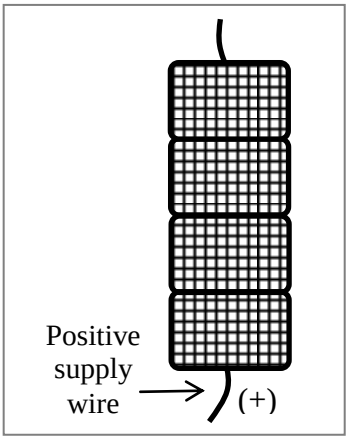


Figure D: Photovoltaic cells

b. Complete the table below by indicating whether these statements are TRUE or FALSE.

	Statement	**TRUE/FALSE**
i.	Solar cells are cheaper to buy compared to primary batteries.	
ii.	The output from a solar cell is d.c.	
iii.	Solar cells convert heat energy to electrical energy.	

1 mark × 3 = 3 marks

13. **Figure E** shows the six groups of photovoltaic cells forming the solar panel used to power a cultivator's motor together with its unconnected circuit.

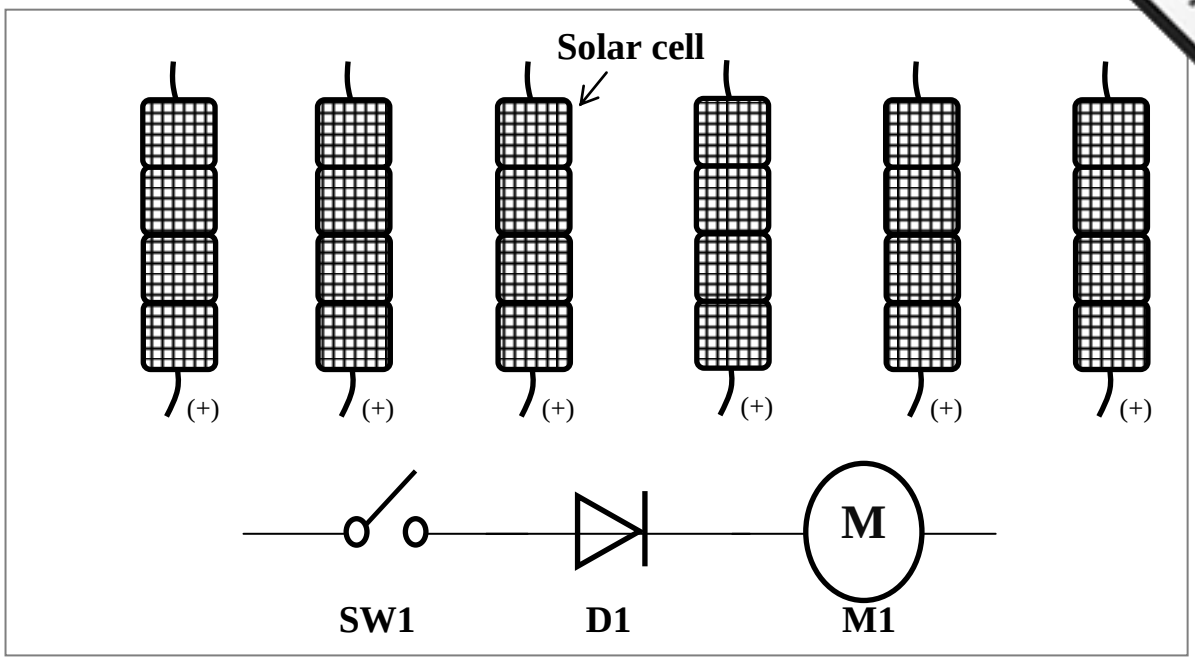


Figure E: Cultivator's motor circuit

a. On **Figure E** show how to connect:

i. the six groups of solar cells in series

ii. the cells connected in series with SW1, D1 and M1 to complete a closed circuit.

1 mark × 2 = 2 marks

b. If the output of each group of solar cells is 6V, calculate the total voltage for all the cells connected in series.

1 mark

c. Calculate the total power generated by the six groups of solar cells connected in series. Assume total current through all six group of cells connected in series is 50mA.

1 mark

d. Component D1 shown in **Figure E** is used to control the flow of current in one direction, hence controlling the motor to turn in only one direction.

i. Name component D1. _____ **1 mark**

ii. In the space provided below, draw the physical appearance of D1 a... ANODE and CATHODE.

1 mark

e. The company producing the electronic circuit for the cultivator, decided to design the circuit on a PCB. What does PCB refer to?

_____

1 mark

14.

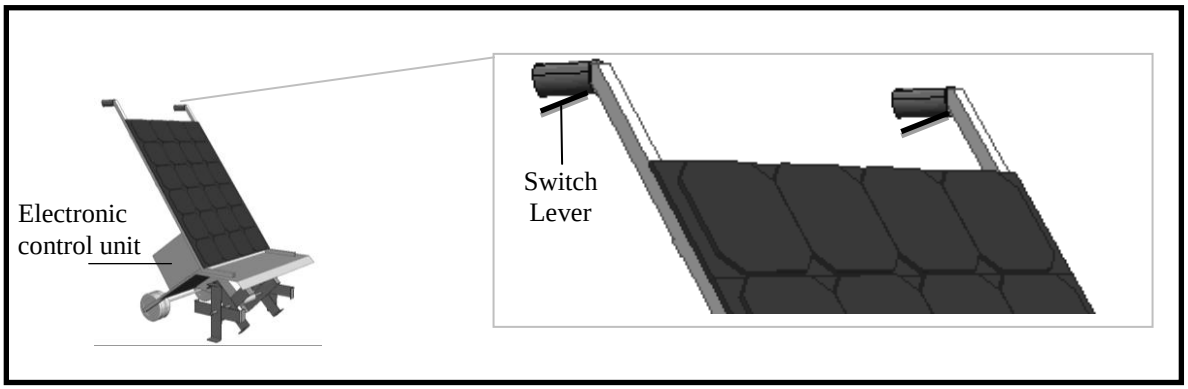


Figure F: Cultivator's handles

Figure F shows the handles of the cultivator from which the user controls its movement. The designers attached a lever to each handle to satisfy the following safety specification:

The cultivator's motor must only rotate when BOTH switch levers are simultaneously pressed, while if only one lever is released the motor will automatically turn off.

During research the designers found two types of switches: a latched type switch and a non-latched type switch.

a. Which of the two types of switches better meets the specification above? Give ONE reason for you answer.
TYPE OF SWITCH: _____

REASON: _____

_____

1 mark × 2 = 2 marks

b. SPST lever type micro switches were a possible solution to be used for this design. What does SPST refer to? _____

1 mark

c. In the space provided below explain how a digital multimeter (DMM) is used to test the function of an SPST switch. **Use diagrams to explain your answer.**

1 mark

15. **Figure G** shows the block diagram for the electronic design used for the cultivator's control system.

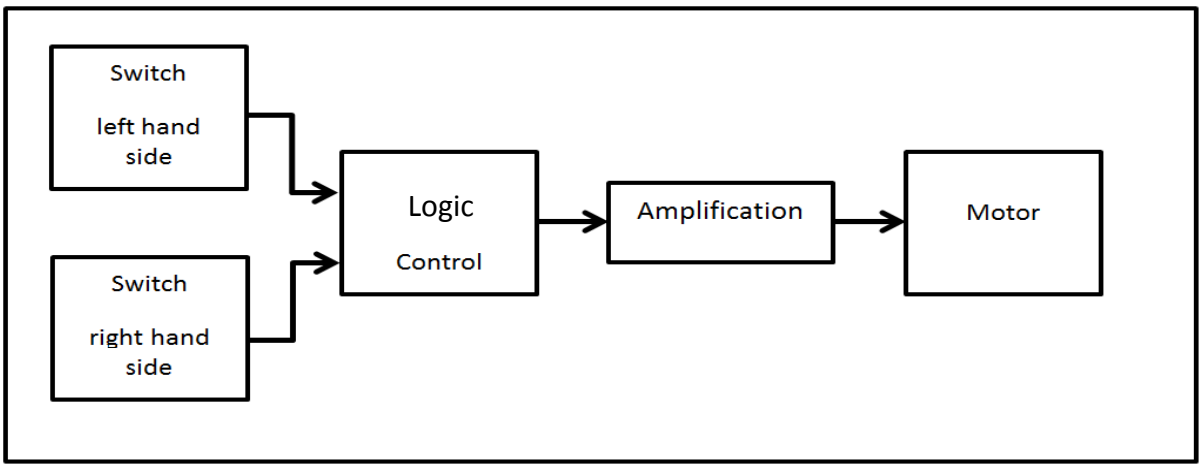


Figure G: Cultivator's control system

a. On the block diagram of **Figure G**, draw lines and label the INPUT, PROCESS and OUTPUT sections. **1 mark**

b. i. Name the logic gate needed to satisfy the safety specification stated in question **14**.

_____ **1 mark**

ii. In the box provided on **Figure H**, draw the symbol of this logic gate. **1 mark**

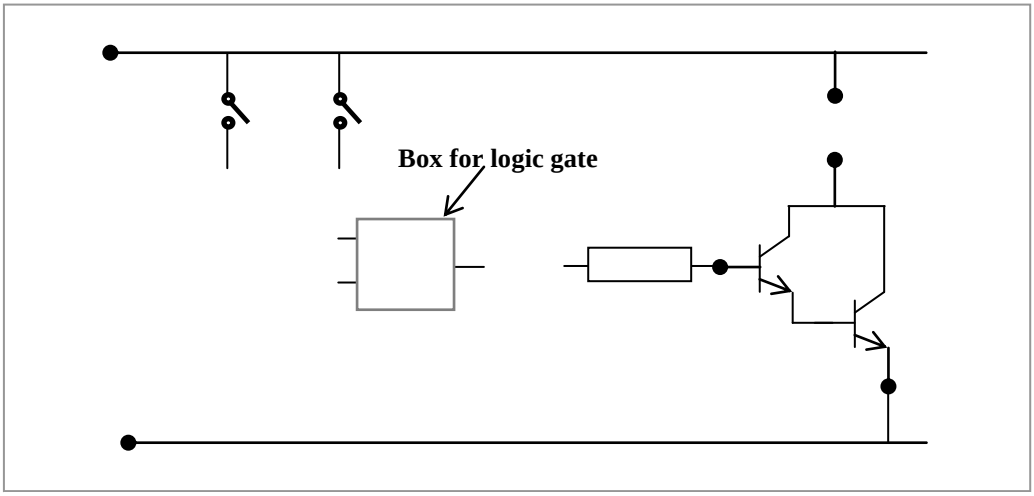


Figure H: Cultivator's electronic circuit

c. Complete the electronic circuit design on **Figure H** to show how:
   i. the two switches are connected to the logic gate
   ii. the logic gate is connected to the Darlington amplifier circuit
   iii. the motor is connected to the Darlington amplifier circuit **½ mark × 4 = 2 ma**

SECTION E: **TEXTILES**

16. Note that questions in this area are related to the same garden cultivator mentioned in previous areas.

a. Give TWO reasons why fabrics are commonly used to produce a cover for a garden cultivator.

_____

_____

1 mark x 2 = 2 marks

b. State TWO main properties that the chosen fabric should have to satisfy the purpose of the cover.

_____

_____

1 mark x 2 = 2 marks

17. Give TWO reasons why it may be necessary to neaten the edge of a seam allowance in the cover.

_____

_____

2 marks x 2 = 4 marks

18. Explain TWO points that must be considered when cutting pattern pieces from fabric to manufacture the cover.

_____

_____

2 marks x 2 = 4 marks

19. Fastenings on a product are important for the application and proper use of a cover.
a. Name TWO types of fasteners which may be used on the cover.

_____

_____

2 marks x 2 = 4 marks

b. Give ONE advantage for your choice.

_____

2 marks

c. In the space provided draw an annotated diagram of the fastener used on the co

2 marks

SECTION D: **FOOD**

20. You are doing voluntary work in the kitchen of an elderly people's home. People over the age of 65 are at a higher risk of food poisoning. Special care should be taken when preparing meals and snacks for this group of people.

a. State THREE precautions you would take to lower or eliminate this risk.

_____

_____

_____

1 mark x 3 = 3 marks

b. What is meant by high risk food?

_____

1 mark

c. Where should high risk food be stored?

_____

½ mark

d. At what temperature should high risk food be stored?

_____

½ mark

e. Mention TWO things that bacteria need to reproduce.

_____ _____

1 mark x 2 = 2 marks

21. As most of the residents in this home have different health conditions some recipes have to be modified and ingredients are replaced by alternative healthy ones.

a. Suggest healthier alternatives you would use instead of:

Salt :_____

Mayonnaise :_____

Sugar : _____

Cream : _____

1 mark x 4 = 4 marks

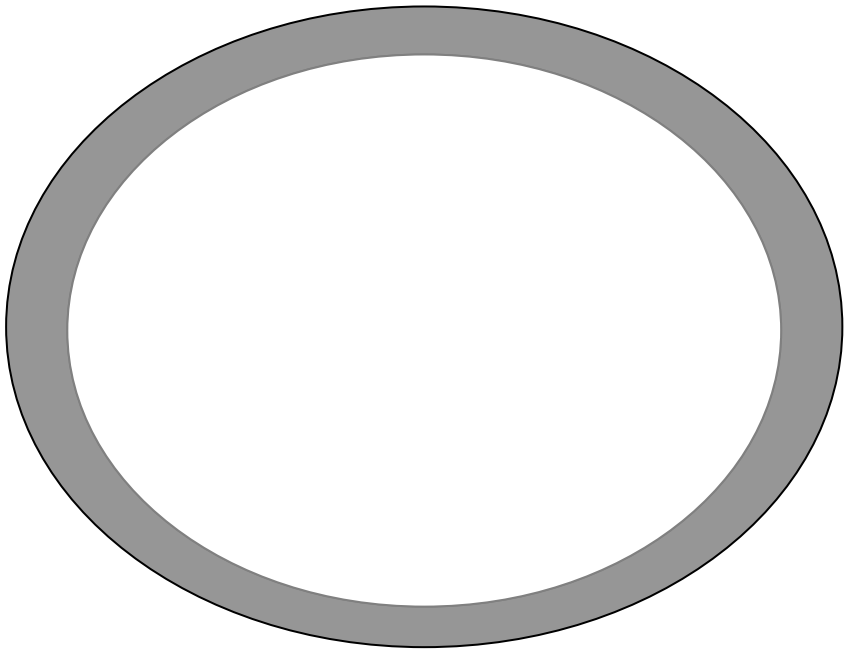
b. Which method of cooking would you use to prepare the following food. Give a reason why this method was chosen.

Food	Method of cooking	Reason
Vegetables		
Beef burgers		

1 mark x 4 = 4 marks

c. As people get older they may find difficulties in coping with certain food but eating well helps them to maintain a positive outlook and reduce the risk of diseases.

i. In the diagram below draw and name food items you would prepare for people in this age group indicating the main nutrients in the chosen food.



Plate

4 marks

ii. Use TWO sensory descriptors to describe the characteristics of the chosen food.

_____ _____

½ mark x 2 = 1 mark