

Candidate Name _____

Class

Candidate
Number

--	--

WESTWOOD SECONDARY SCHOOL

PRELIMINARY EXAMINATION



Secondary Four Express/ Five Normal Academic
DESIGN AND TECHNOLOGY

7059
August 2024
2 hour

INSTRUCTIONS TO CANDIDATES

Write your name, index number and class in the spaces at the top of this page and on all separate answer paper used.

Candidates answer on the Question Paper.

No Additional Materials are required.

Answer **all** questions on the Question Paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question.

All dimensions are in millimeters unless otherwise stated.

FOR EXAMINER'S USE		
Question	MARK	TOTAL
1		26
2		18
3		18
4		18
TOTAL MARKS		80

This question paper consists of 15 printed pages.

Setter : Ahmad Luqman

[Turn over

- 1 Figure 1.1 shows a barbeque pit at a park. The nearest light is far away, making the area around the barbeque pit quite dim at night. This causes inconvenience for users who are unable to see if their food is fully cooked. A portable lamp placed on the table beside the barbeque pit would help address this issue.

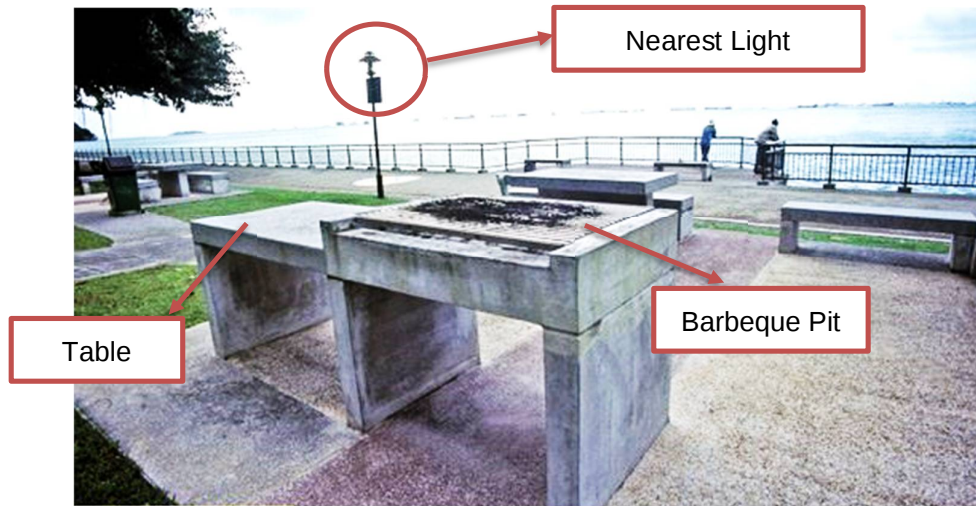


Fig. 1.1

- (a) Write a suitable design brief for the situation identified above.

.....

..... [2]

- (b) Describe how the designer can conduct research through observation to better understand this identified need.

.....

.....

..... [3]

- (c) Sustainability is a crucial consideration for designers when creating a product. Explain briefly why this is important.

.....

..... [2]

- (d) Write a suitable design specification related to "Materials" for designing the portable lamp for the identified situation.

.....

..... [2]

- (e) Sketch a design of the portable lamp to be used on the barbeque-pit table. A faded outline of the barbeque pit table is included for proportion. Your design must include:
- Light from the portable lamp that can illuminate the entire area of the barbeque pit.
 - A portability feature for the lamp.
 - An interesting and aesthetically pleasing shape for the lamp.

You may use additional sketches to communicate your design and include annotations if necessary.



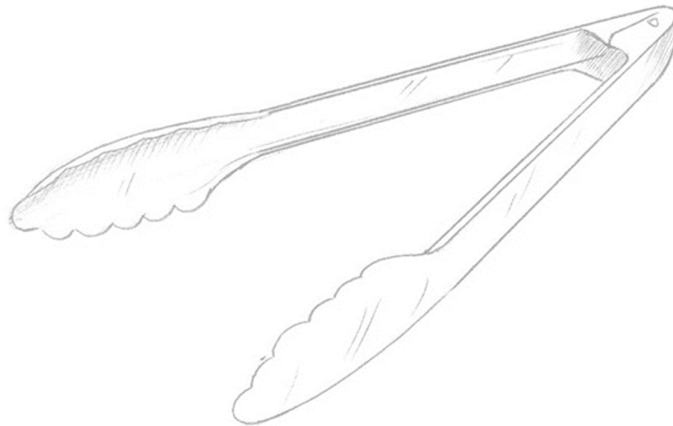
- (f) Fig 1.2 below shows a pair of tongs being used to handle food while barbequing. The user's hand can become very hot from the fire's heat over time, potentially leading to burns. Additionally, the slippery surface of the metal tongs makes holding and handling them difficult and uncomfortable.



Fig. 1.2

Sketch an idea to show how the tongs can be improved to protect the user's hand from burns caused by the heat of the barbeque pit. You may use the faded diagram of the tongs below to assist with your sketch.

You may include additional sketches to communicate your design and add annotations if necessary.



- (g) Explain how anthropometric data is used in designing your idea in question 1f). Include clear sketches to support your explanation.

[3]

- (h) Ergonomics is an important consideration in product design. Briefly explain what 'Ergonomics' means.

.....

.....

[2]

- (i) Explain **one** effective method for meaningfully evaluating a product prototype of a design.

.....

.....

[2]

- 2 Figure 2.1 shows a wardrobe used for storing or hanging clothing at home.



Fig. 2.1

- (a) Identify the type of man-made structure that the outer body of this wooden wardrobe, shown in Figure 2.1, is associated with.

..... [1]

- (b) Name and briefly explain **two** structural functions of this wooden wardrobe.

1

.....

2

..... [4]

- (c) Figure 2.2 shows a shelf inside the wooden wardrobe with clothing placed on top of it.



Fig. 2.2

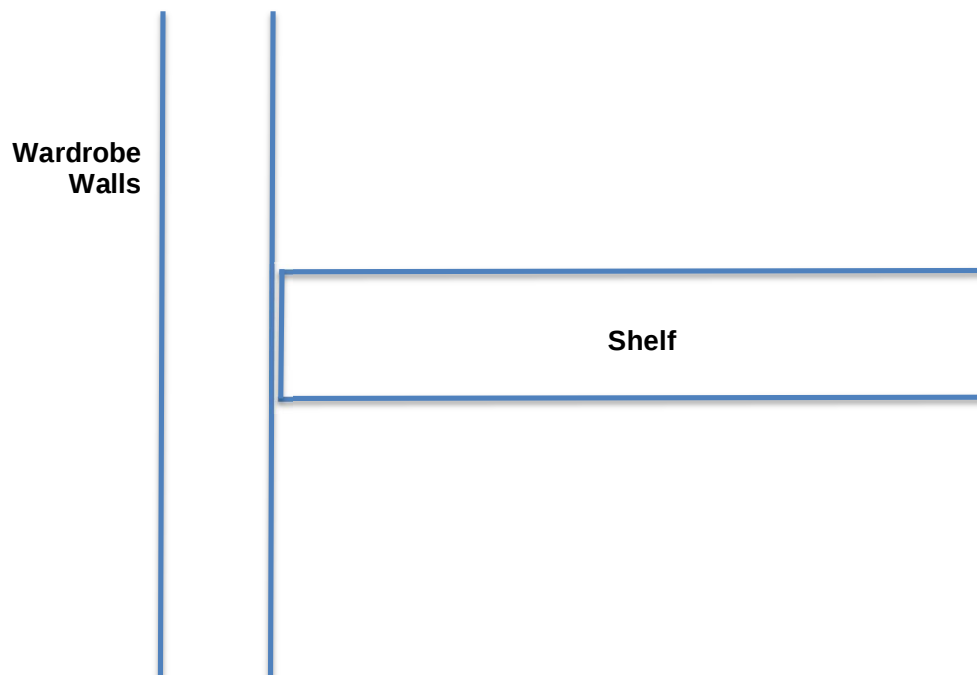
- (i) Identify the type of force acting on the shelf.
 [1]
- (ii) Identify the type of beam that is experiencing the same type of force as the shelf shown in Figure 2.2.
 [1]
- (iii) Draw the schematic diagram of the shelf experiencing the force, in the space below. You are to indicate the direction of the force clearly.
 [3]
- (iv) Laminating is a method used to reinforce the shelf, making it more rigid to resist the force(s) as shown in Fig 2.2. Explain what "laminating" (in structural terms) is.
 [2]

- (v) Member A in Fig. 2.2 is subjected to the same type of force experienced by the shelf. Since it is a solid round rod, it is not effective in resisting the force.

Draw a suitable structural member to replace Member A in the space below, clearly showing its cross-sectional view.

[2]

- (vi) Fig. 2.3 shows one side of the shelf attached to the wardrobe walls using adhesive. **Name** and **sketch** a reinforcement that will better support the shelf to hold heavier loads.



[4]

- 3 (a) Fig. 3.1 shows a wheelbarrow for gardening use.

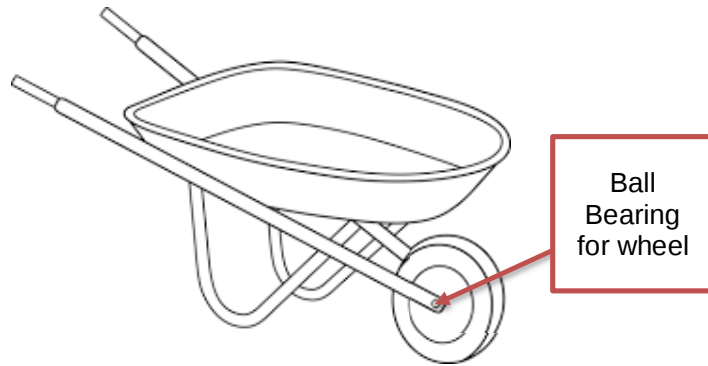


Fig. 3.1

- (i) Identify the class of lever to which a wheelbarrow belongs.

..... [1]

- (ii) Draw the schematic diagram of the lever system for the wheelbarrow with a load. Clearly indicate the **effort**, **load**, and **fulcrum** in the diagram.

[3]

- (iii) Explain why it is important to use a ball bearing for the wheel in Fig.3.1.

.....
 [2]

(b) Fig. 3.2 below shows a common bicycle.

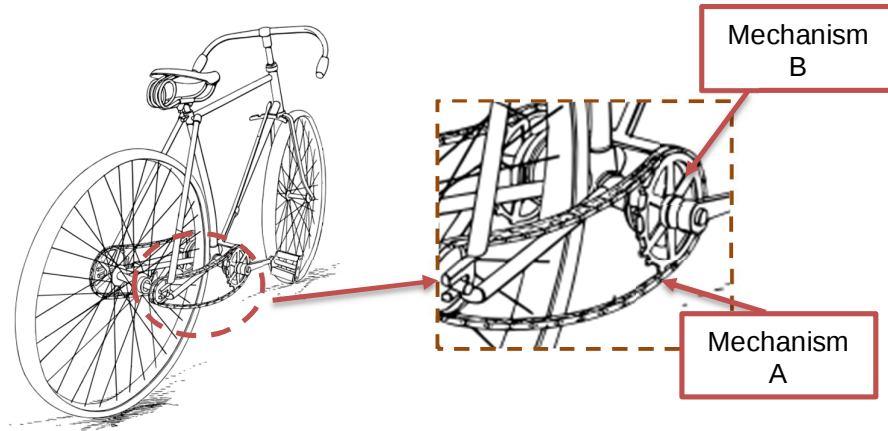


Fig. 3.2

(i) Identify the **two** mechanisms labeled Mechanism A and Mechanism B in Fig. 3.2.

Mechanism A

Mechanism B [2]

(ii) State the motion conversion of the bicycle when in motion.

..... to [2]

(iii) Mechanism A and B will be replaced by a pulley and belt system, as shown in Fig. 3.3 below. Explain why this type of belt is not suitable for use on a bicycle.

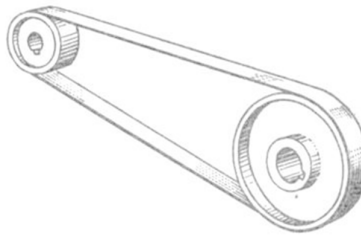


Fig. 3.3

.....
 [2]

(iv) Name and sketch a type of belt that will be most suitable for a bicycle's pulley and belt system in the space below. The belt should **NOT** be made of metal.

[2]

- (c) Fig. 3.4 below shows a small toy truck that will move forward slowly. The movement will be powered by a small DC motor driving the back wheel using simple spur gears.

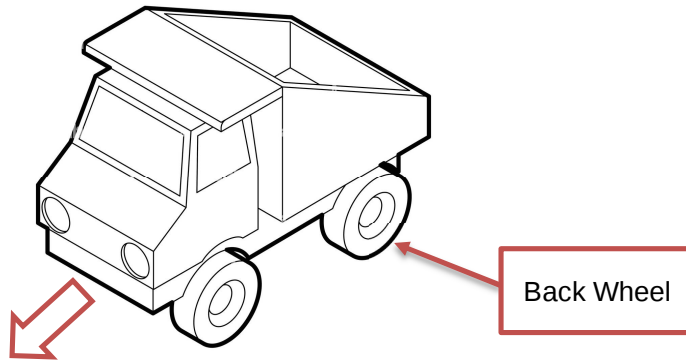


Fig. 3.4

- (i) Sketch the schematic diagram of the gearing system suitable for the slow movement described in the space below. Clearly indicate the gear attached to the back wheel.

[3]

- (ii) Briefly explain how the gearing system you sketched above achieves the required slow movement for the toy truck.

..... [1]

- 4 A designer wants to create an automated fan that detects if the area around the baby's bed becomes too warm. When this happens, the fan (powered by a DC motor) will automatically turn on to cool the baby. The fan will be powered by rechargeable batteries and will include a power on/off switch. The user will also be able to adjust the sensitivity of the sensing circuit. The fan will be placed in the location shown in Fig. 4.1.

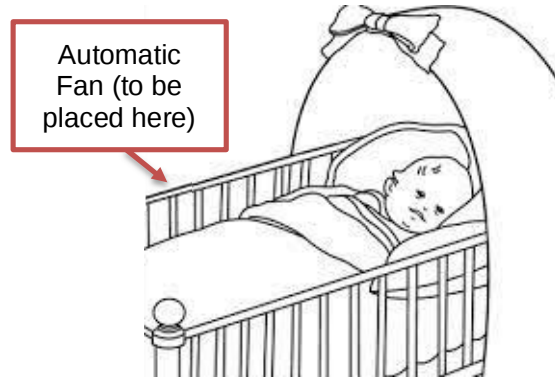


Fig. 4.1

- (a) Design a sensing circuit for the automated fan that meets the specified requirements. Clearly label all the components used in the circuit.

(b) The sensing circuit in Fig 4.1 is an example of an electronic control system.

(i) State whether this sensing circuit is an open or closed loop control system.

..... [1]

(ii) Draw the block diagram flowchart of the control system mentioned in question 4bi), in the space below.

[2]

(c) Explain why the designer prefers to use rechargeable batteries instead of single-use batteries for the automated fan.

.....

.....

[2]

- (d) Fig. 4.2 shows a circuit component that can be used to display the number of minutes the automated fan has been switched on.

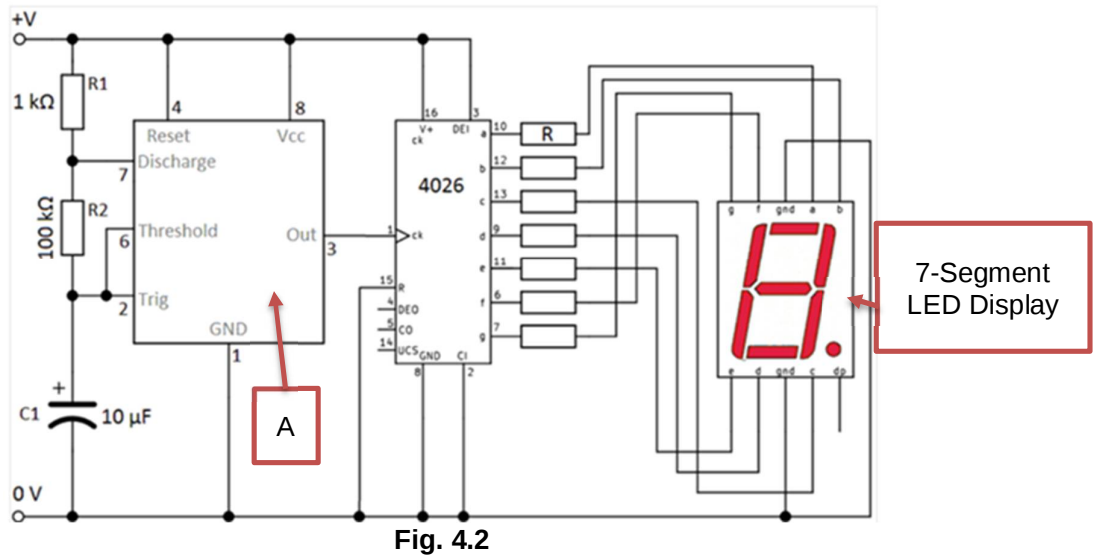


Fig. 4.2

- (i) Identify the component labeled as IC Chip A in Fig. 4.2.

IC Chip A [1]

- (ii) Explain the function of the 4026 IC chip in the circuit in Fig. 4.2.

.....
 [2]

(e) The designer plans to create a small clip-on lamp for use at the baby bed using the following electronic components:

- A 9V rechargeable battery
- A slide switch
- Three super-bright white LEDs, each with a 3V voltage rating for optimal brightness
- Electrical wires

Design the lamp by drawing the electronic components in an appropriate lamp casing. Also, clearly illustrate how the three LEDs are connected to ensure they shine at optimal brightness. You may use the template in **Fig. 4.3** and space in this page to communicate your design.

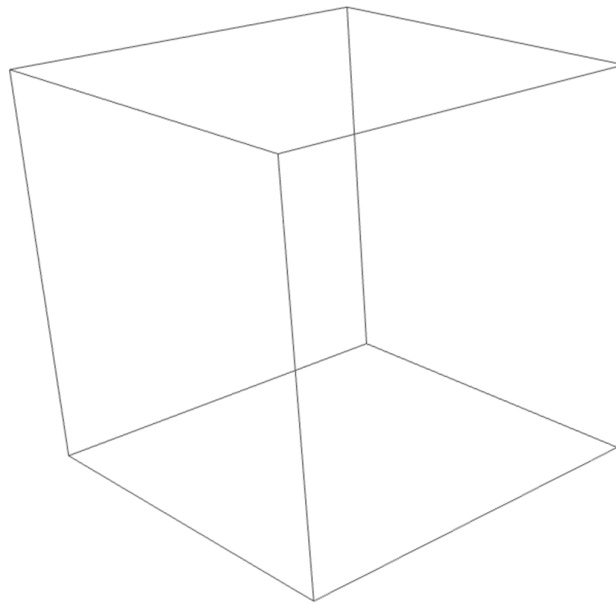


Fig. 4.3

END OF PAPER

[4]