



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2022

Marking Scheme

Applied Technology

Common Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

Instructions

Answer all questions.

Write your answers in blue or black pen. You may use pencil for sketches only.

Write your answers in the spaces provided in this booklet. There is space for extra work at the end of the booklet. Label any such extra work clearly with the question number and part.

Note to marking scheme.

Total marks for a question; shown in the format: **33**

Total marks on a page; shown in the format: **12**

Marks for question/part; shown in the format: **1**

Acknowledgements

Graphic Q1(a) (i) page 3. <https://www.wellerhire.co.uk/wp-content/uploads/2015/10/Garden-Hand-Tools-Tool-Hire.jpg>

Graphic Q1(a) (ii) page 3. <https://www.kepuchina.cn/ldyy/theme/agriculture/01/>

Graphic Q1(a) (iii) page 3. <https://www.pinterest.cl/pin/616500636480179672/>

Graphic Q2(a) (i) page 7. <https://www.facebook.com/AnimalsInPredicaments/photos/a.677382572401256/1910949759044525/>

Graphic Q2(c) (i) page 9. <https://3dandprint.eu/en/3d-printers/3d-printer-easythreed-nano/>

Graphic Q2(h) (i) page 14. https://en.wikipedia.org/wiki/History_of_monorail#/media/File:Palmer-monorail.png

Graphic Q2(h) (iv) page 14. <https://www.micro.ai/resources/case-studies/ai-enabled-defect-detection-solutions-in-manufacturing>

Graphic Q3(a) (i) page 15. <https://powertime.co.za/online/wp-content/uploads/2019/05/solar-air-conditioning.png>

Graphic Q3(a) (ii) page 15. http://www.renewable.com/images/System%20Parts/Panels/100_0054.jpg

Graphic Q3(a) (iii) page 15. <https://oddtymall.com/includes/content/this-shade-hat-has-a-solar-panel-that-powers-a-fan-to-keep-your-noggin-cool-0.jpg>

Question 1 33

- (a) (i) Gardening tools are often made from materials such as aluminium, hardwood, thermosetting plastic, and metal alloys.

Use a tic (✓) to show if each of the following statements is true **or** false.



12

Statement	True	False
Aluminium is a non-ferrous metal	✓	
Hardwood trees are usually evergreen		✓
A thermosetting plastic will soften when heated		✓
An alloy is made from more than one metal	✓	

1

1

1

1

- (ii) Greenhouses use a range of automated systems.
Outline **two** automated systems which could be used in a greenhouse.

1. /2.
Automatic watering, automatic feeding (nutrients),
Temperature control (open / close vents), etc
Humidity control (vents), pH levels, CO ₂ levels, Light levels



2

2

- (iii) An image of a pepper-picking robot is shown. Identify **two** problems which the robot must overcome in order to pick the peppers successfully.



1. Correctly identify ripe peppers, not to damage peppers,
Correctly position snips / cutter to cut pepper from plant
Identify when collection basket is full, etc
2. Catch cut fruit & send to basket,
Remain on track between plants.

2

2

- (b) A student's design for a working model of a motorised gardening cart is shown.

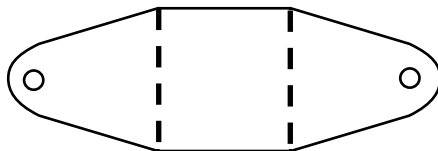
- (i) Name a suitable plastic from which to vacuum form the tub.

Plastic: HIPS, PC, PMMA, Foamex, etc.

- (ii) Part of the castor wheel bracket is shown. Name a suitable material from which to manufacture the bracket **and** draw the development of this part.

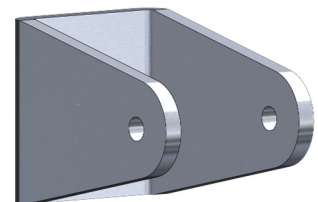
Suitable material: Named metal or plastic

Development of part



Outline, holes, bend lines

3 x 1 mk

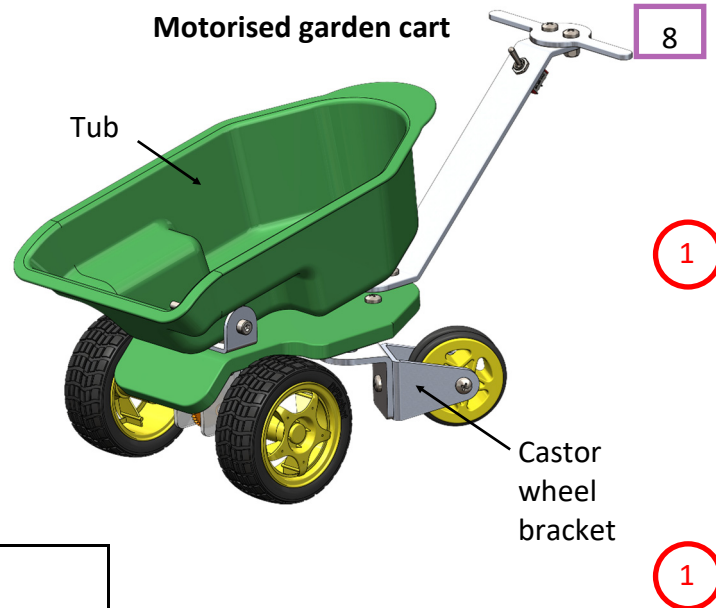
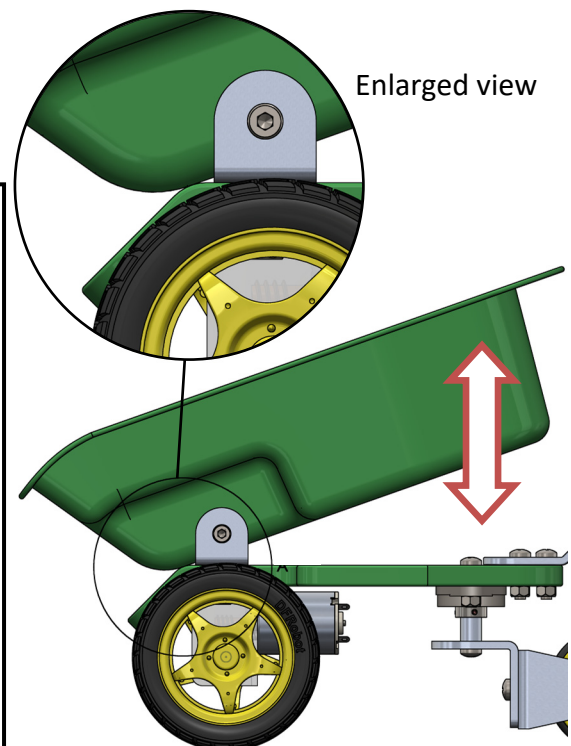


Castor bracket part

- (c) When using the cart, it was found that the tub could not tilt enough to allow the contents to fall out. In the space below, sketch a design change to correct this fault.

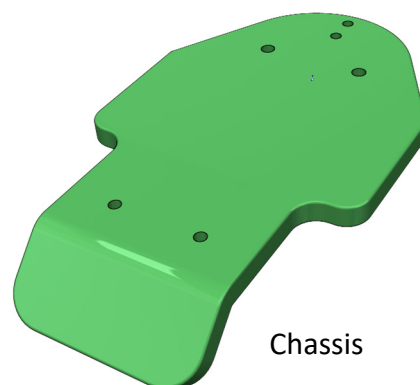
Effectiveness of design change 3/2/1

- Raise tub on bracket,
- Raise bracket,
- Alter shape of tub,
- Alter shape of base.



(d) Describe with the aid of sketches any **two** of the following manufacturing processes required to manufacture the chassis of the cart from acrylic.

- Drilling the holes
- Cutting out the overall shape
- Rounding the corners
- Bending the material.



Process 1: _____

Suitable sketch 1 mk

Any valid process 1 mk

- Preparation,
- Safety precautions,
- Process steps,
- Finish.

Process 2: _____

Suitable sketch 1 mk

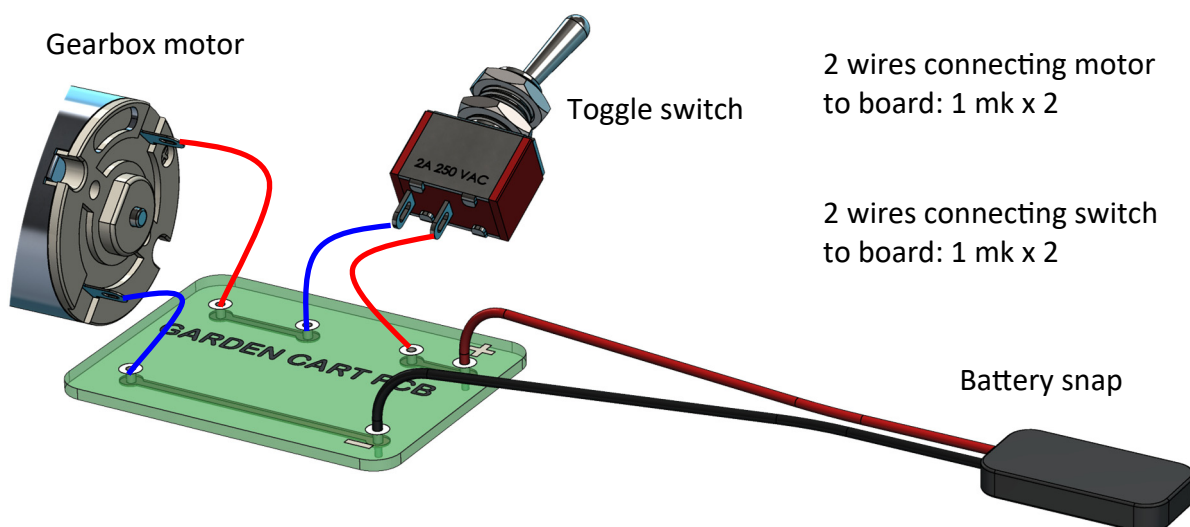
Any valid process 1 mk

- Preparation,
- Safety precautions,
- Process steps,
- Finish.

2

2

(e) Four wires are required to complete the circuit below which controls the motor. Draw in the **four** required wire connections.



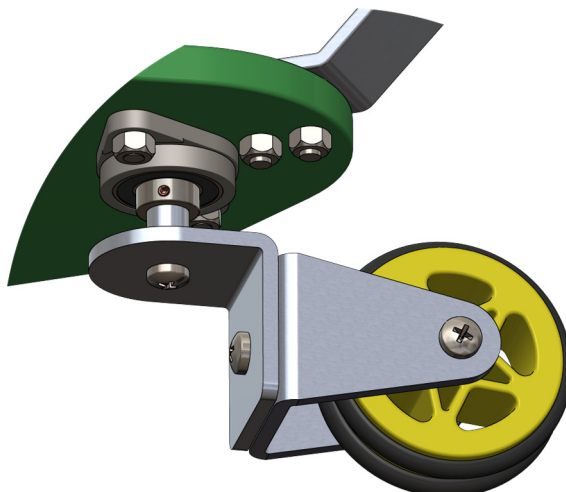
1

1

1

1

- (f) A view from underneath the castor wheel assembly is shown.

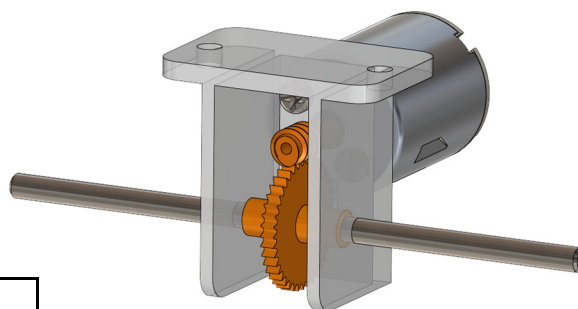


- (i) Explain why a castor wheel is necessary for this design of cart.

Easy to steer, makes it possible to steer, swivel, rotate, turn,

1

- (ii) Name the mechanism shown, which is used to drive the garden cart and give a reason for its selection.



1

Name: Worm (& wheel)

Reason: Compact size, Speed reduction, No slippage, high torque, motion thro' 90degrees

2

Question 2 57

- (a) Elevated monorail transport systems are common in modern cities.



- (i) Suggest **two** reasons why these transport systems are elevated.

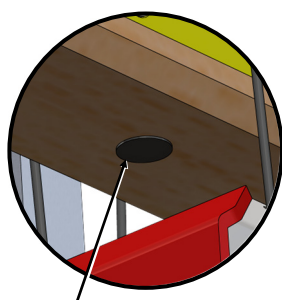
Reason 1: Avoid traffic / faster / More efficient than road based systems	
Quicker, etc.	
	2
Reason 2: Easier to build / does not interfere with road based traffic	
	2

- (ii) Outline **two** ways in which public transport systems, like monorails, help reduce environmental pollution.

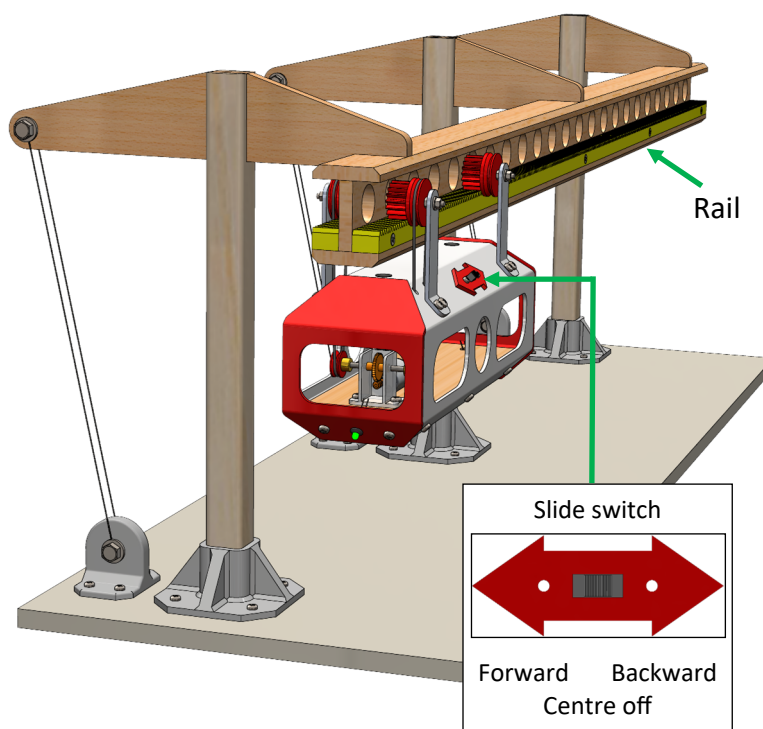
1. Less energy lost / less fumes produced by monorail compared with road based traffic.	
Power to monorail could use 'clean' electricity in place of 'polluting' fossil fuels	
Carry large numbers of passengers quickly (minimum delay)	2
2.	
	2

- (b) A working model of an electrically operated, suspended monorail transport system is shown.

The system is powered by an on-board electric motor and includes magnetically operated limit switches at the end of each rail.



Limit switch on underside of rail at **each** end

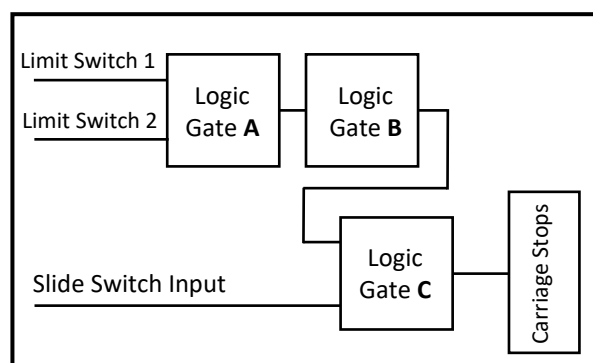


The control system for the monorail uses the digital logic system below.

- Slide switch (forward or backward) = logic level 1
- Slide switch in centre position = logic level 0
- Limit switch open = logic level 0
- Limit switch closed = logic level 1.

- (i) Name the logic gates **A**, **B**, and **C** required to make the carriage stop at each end.

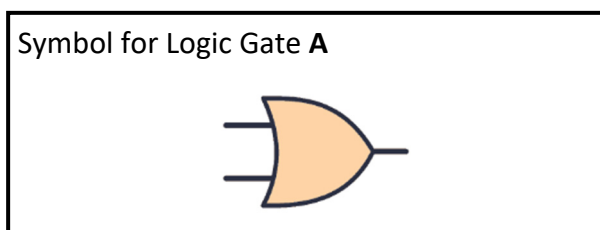
Logic Gate A	OR
Logic Gate B	NOT
Logic Gate C	AND



Control System

1
1
1

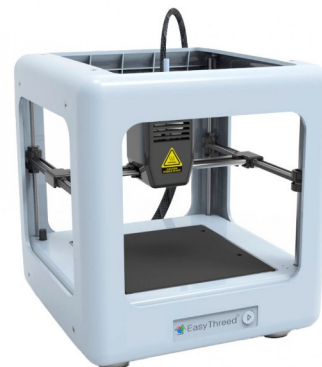
- (ii) Draw the symbol for Logic Gate **A** and complete the Truth Table for this gate.



Input 1	Input 2	Output
1	1	1
1	0	1
0	1	1
0	0	0

1
1
1
1

(c) The image shows a 3D printer.



(i) Give **one** advantage and **one** disadvantage of using a 3D printer in the Applied Technology classroom.

Advantage: possible to make a unique / complex /original parts (for projects) ,
parts can be produced at low cost, less waste, rapid prototyping, etc.

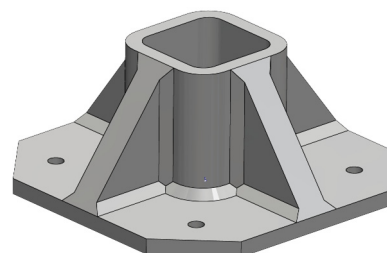
2

Disadvantage: slow, can be expensive, Size of parts produced limited
Automated process (few skills needed)
x

2

(ii) The wooden columns supporting the rail sit into plastic shoes which have been 3D printed.

Explain why 3D printing is a suitable technology to use in the manufacture of this part.



3D Printed column shoe

Possible to manufacture this complex shapes (in 3D) in the workshop at low cost.
Exact copies can be made, quicker by this method,

2

(iii) 3D printing is a form of **Additive Manufacturing**. Explain the meaning of this term.

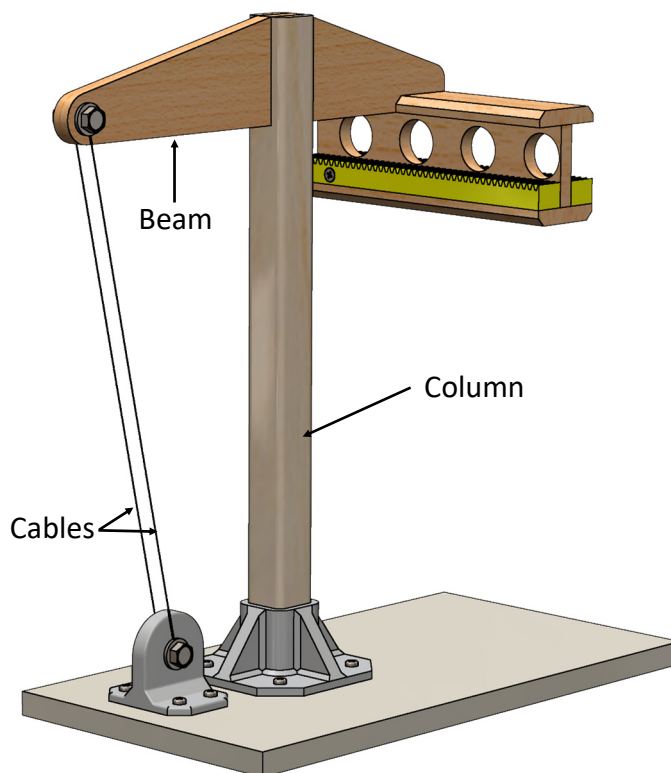
Layers (strands) of (hot) plastic are laid down on top of (added to) a previous layer (strand)
of plastic to build up the required shape, with minimum waste.

1

(d) An image of the main components of the monorail supporting structure is shown.

(i) Name the primary force acting in **each** of the components named below.

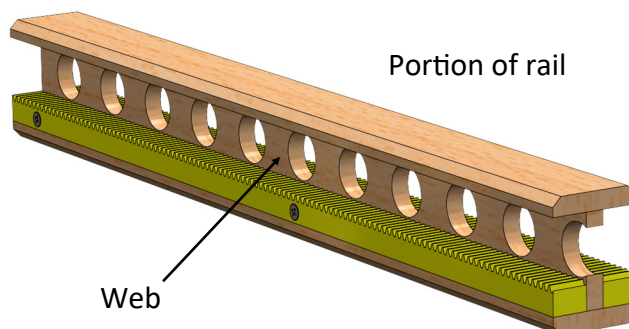
Component	Force
Beam	Bending
Column	Compression
Cables	Tension



1
1
1

(ii) A portion of the wooden rail on which the carriage is suspended is shown. The web of this rail has a series of holes drilled through it.

Give a reason for including these holes in the design of the rail.



Reason for holes: Reduce weight of rail, reduce material, reduce cost of beam,
Improve strength to weight ratio, reduce sagging, etc.

1

- (e) A detail view of the mechanism used to move the carriage along the overhead rail is shown.

(i) Name this mechanism.

Name: Rack & Pinion

- (ii) Part A has 18 teeth and the distance between the teeth on Part B is 5 mm.
Calculate the distance travelled for one full revolution of Part A.

Calculation: $18 \times 5 \text{ mm} = 90 \text{ mm}$

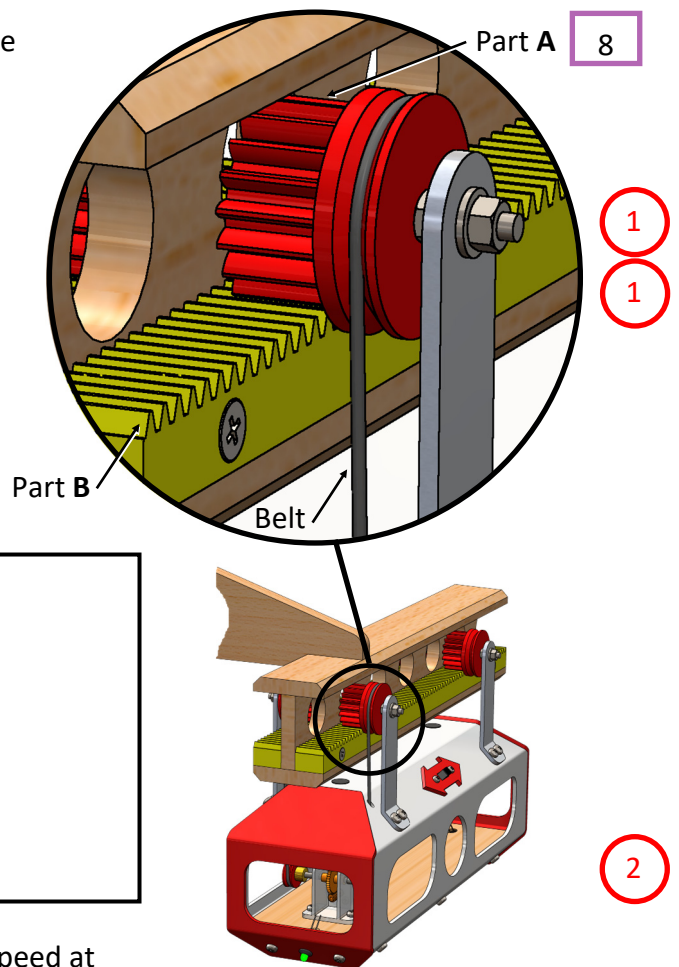
- (iii) If Part A rotates at 10 RPM, calculate the speed at which the carriage moves in millimetres per minute.

Calculation: $10 \times 90 \text{ mm} = 900 \text{ mm/min}$
 $(10 \times 18 \times 5 = 900 \text{ mm/min})$

- (iv) A belt drive is used to transfer motion from the gearbox to the upper mechanism.
Give **one** advantage of using a belt drive instead of a chain and sprocket in this situation.

Advantage: Lower cost / easy to replace / no lubrication / less weight / less noise

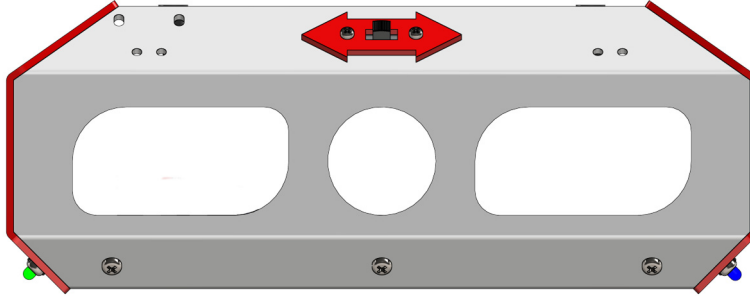
Allow for slippage



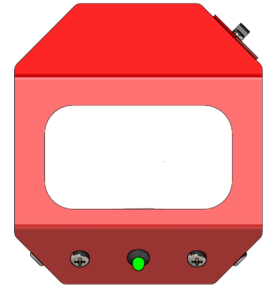
(f) The Elevation and End View of the carriage are shown.

3

In the space below, sketch an alternative design for the carriage.



Elevation



End View

Alternative Design: 3/2/1 mk

3

9

- (g) Two LEDs are used in the control circuit to indicate that the carriage is in motion.

- (i) What do the letters **LED** stand for?

L LIGHT	E EMITTING	D DIODE
---------	------------	---------



1

1

1

- (ii) What name is given to the longer leg of an LED?

Name: Anode (Positive leg)

1

- (iii) It is best practice when soldering wires to LEDs to use heat shrink sleeve.
Explain why this should be done.

Prevent short circuit (legs of LED touching / leg touching metal body of carriage), tidy up cable



Heat Shrink Sleeve

1

- (iv) When cutting out the wooden beams, the student had a choice between beam 1 or beam 2. State which beam is strongest and explain why.

Strongest beam: Beam 1

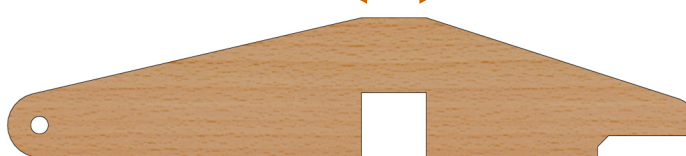
Explanation:

Horizontal grain, in Beam 1, is stronger in bending.

Short grain in Beam 2 would

Snap easily.

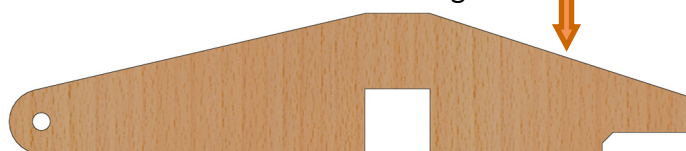
Direction of grain



Beam 1

1

Direction of grain

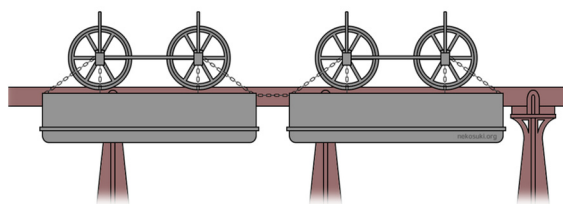


Beam 2

1

- (h) The first passenger-carrying monorail was invented by H.R. Palmer in England in 1824. This monorail was horse-drawn.

Views of horse-drawn monorail



- (i) Outline the first major technological development that made it possible for inventors to power machines without the use of horses.

Technological development: Steam engine / power

2

- (ii) Mass production became popular in the late 1910s.
Name the person who popularised this method of production.

Name: Henry Ford

1

- (iii) List **one** benefit of mass production for the consumer and **one** benefit for the producer.

Consumer: lower cost products / wider range of products / same quality

2

Producer: more units produced / increased productivity / consistent quality product

Higher profits / lower unit cost

2

- (iv) Outline **one** benefit of the use of industrial robots in the production of cars.

Faster car production,

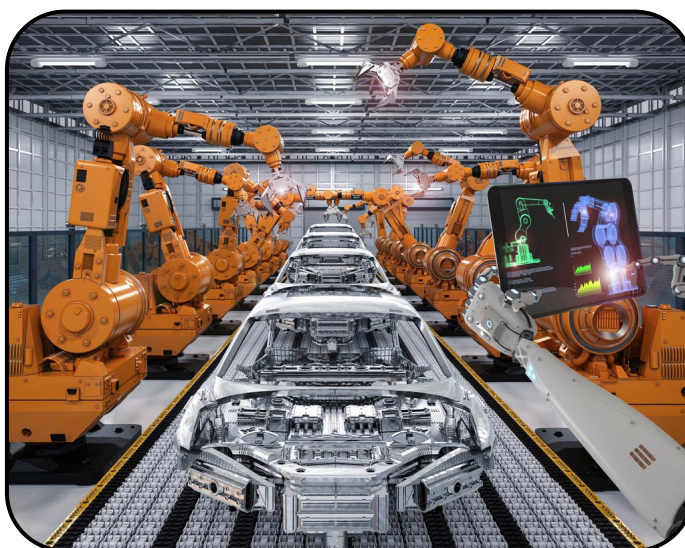
Consistently high quality,

Less manpower required,

Reduced accidents,

24 hour working

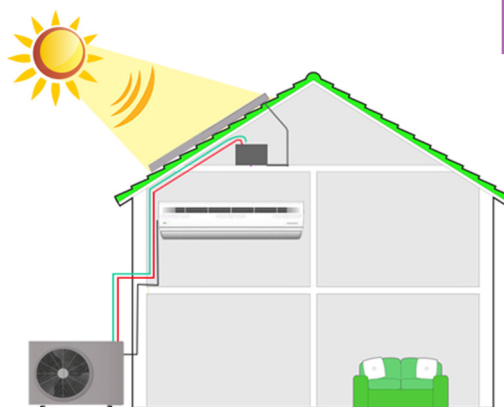
Robots work in more extreme condit



2

Question 3 30

- (a) Air conditioning is necessary in hot countries but requires expensive electrical energy to operate. For this reason many people are installing solar-powered air conditioning systems that make use of photovoltaic cells (PVs) on the roof of their homes.



- (i) State the energy conversion associated with photovoltaic cells.

From	LIGHT	To	ELECTRICITY
------	-------	----	-------------

- (ii) The photovoltaic panel shown is designed to tilt and turn automatically. Give **one** reason why it is designed to do this.

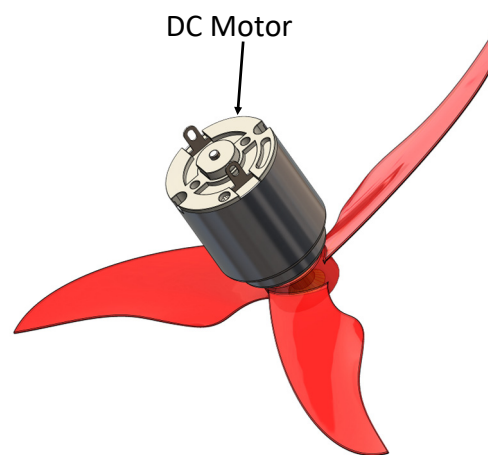
Reason: Follow the sun (as it changes position in the sky over the course of the day)
Points directly at the sun for more efficient solar conversion



- (iii) The novelty air-cooled hat shown uses a PV cell to drive a DC motor with attached fan blades.

DC motors are **polarised**.
Explain the term polarised and give a reason why this must be considered when attaching the fan blade to the motor.

Polarised: Depending on how the motor is connected to a power source, the motor turns clockwise or anticlockwise
Reason: The fan will either draw cold air into the hat or draw warm air out of the hat.



- (b) The image shows a student design for a study desk cooling fan with tilt and turn features. The fan activates automatically at a set temperature.

- (i) Name the temperature sensing component shown.

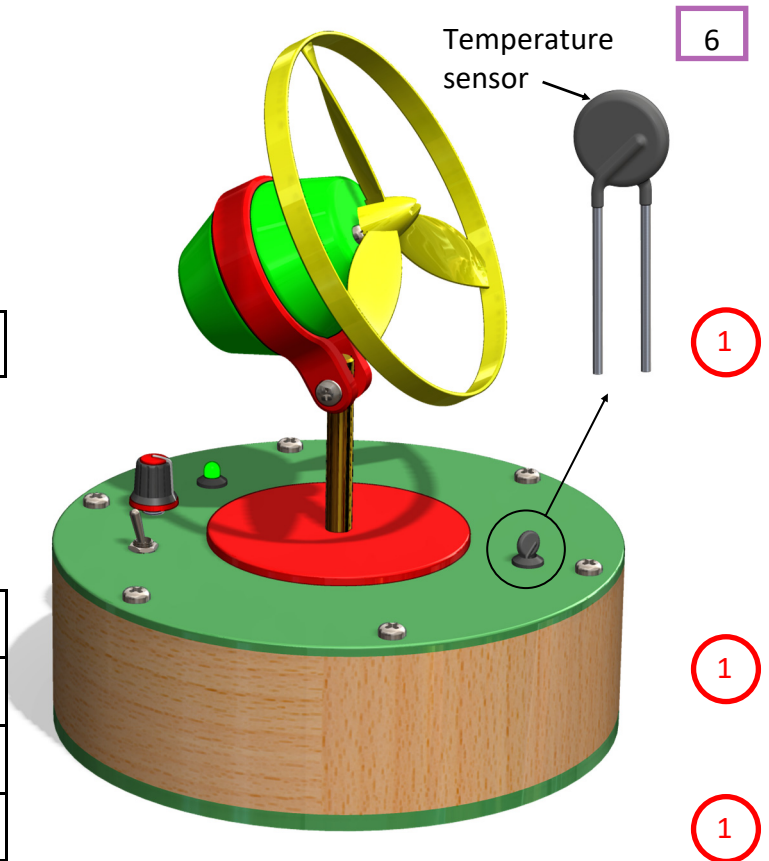
Name: Thermistor

- (ii) Name **two** other devices which use temperature sensors as part of their control system.

Device 1: Fridge, Oven, Fire alarm

Device 2: Central heating system,

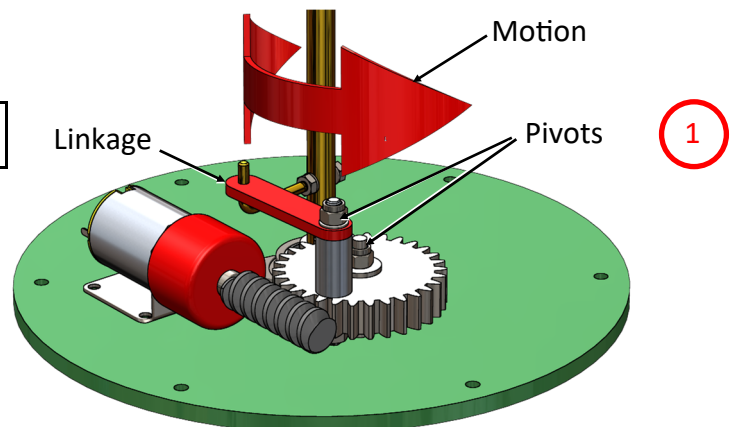
Greenhouse. Digital thermometer



- (iii) The fan turns from side to side when in use. The linkage mechanism for the fan is shown.

Name the type of motion produced by this linkage mechanism.

Motion: OSCILLATING



- (iv) Name **two** other devices that use this type of motion.

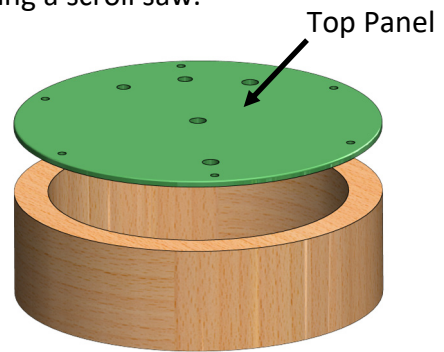
Device 1: Car window wiper, Swing, Metronome

Device 2: Grandfather clock

- (c) The circular top panel of the housing is to be cut out using a scroll saw.



Scroll Saw



- (i) List **two** specific safety precautions that should be observed when using a scroll saw.

Precaution 1: Safety glasses, No loose cloths / Hair / Hands safe, Ear protection

4

Precaution 2: Safe work area around saw, etc.

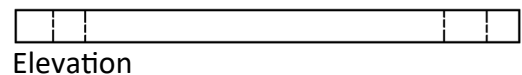
4

- (ii) Name **one** other tool which could be used to cut out the top panel.

Name: Coping / Fret / Piercing / Jig / Band saw, laser, CNC, router

4

- (iii) The elevation and plan of the linkage (connecting-rod) are shown. Make a 3D sketch of this part in the space provided (include shading as appropriate).

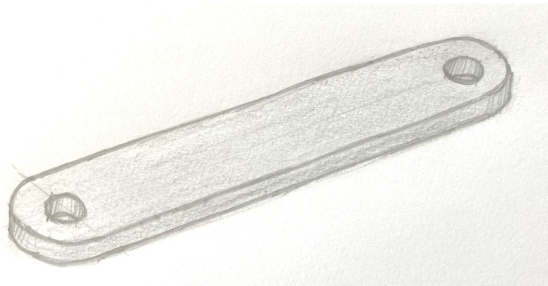


Elevation



Plan

3/2/1 mk

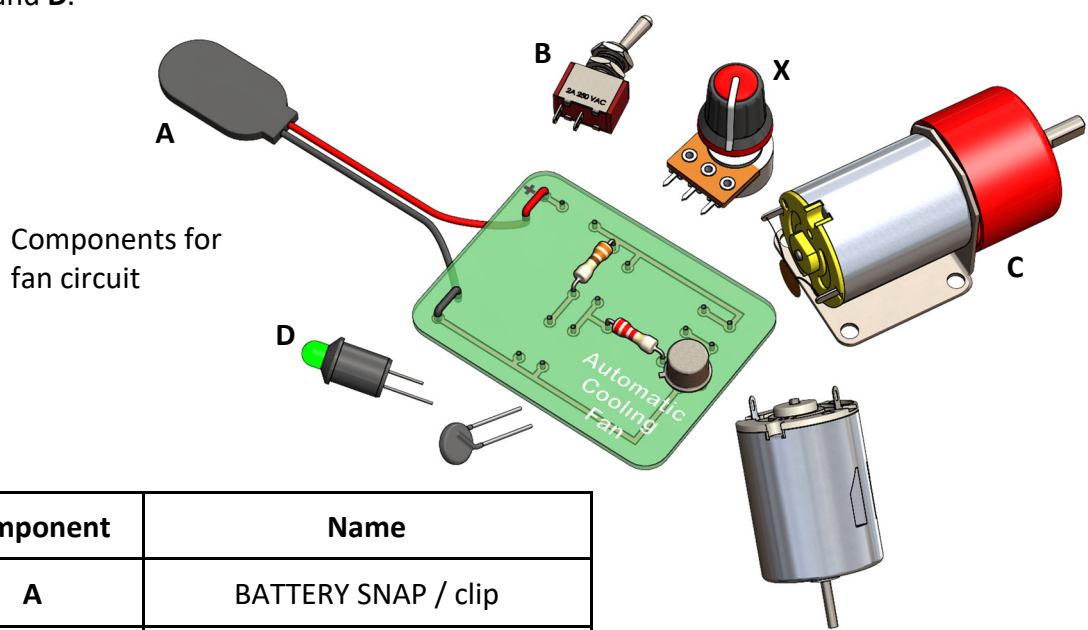


or



3

(d) (i) Complete the table below by naming the components of the circuit labelled A, B, C, and D.



Component	Name
A	BATTERY SNAP / clip
B	SWITCH
C	MOTOR / GEARBOX
D	LED / HOLDER

1
1
1
1

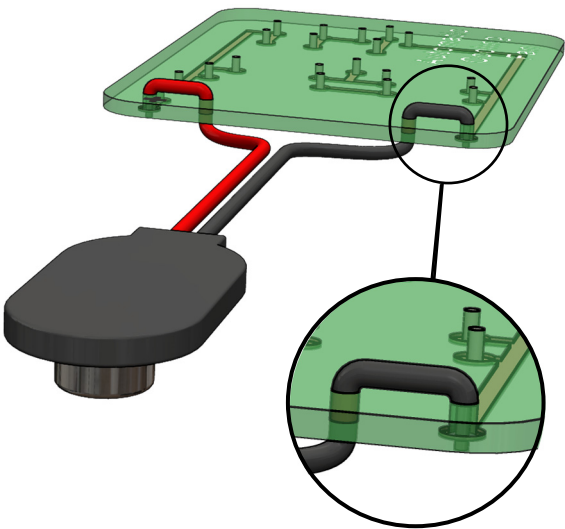
(ii) Name, and sketch the electronic symbol for the component labelled X in the image above.

Name	Symbol
VARIABLE RESISTOR	

1
1

(iii) Explain why the wires are looped through the PCB as shown.

Prevent battery snap from being accidentally removed from board.
Ensure battery snap is secured to PCB



1

[illegible]

Do not write on this page

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Junior Cycle Final Examination – Common Level

Applied Technology

Tuesday 14 June

Morning 9:30 - 11:00