



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Cycle Final Examination 2024

Applied Technology

Common Level

Monday 17 June Morning 9:30 - 11:00

120 marks

Examination Number

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Date of Birth

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For example, 3rd February
2005 is entered as 03 02 05

Centre Stamp

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.

This examination booklet will be scanned and your work will be presented to an examiner on screen. Anything that you write outside of the answer areas may not be seen by the examiner.

Acknowledgements

- Graphic Q1(a) (i) page 3. https://www.pngitem.com/middle/bhJxh_bullet-train-png-photos-japanese-bullet-train-png/
- Graphic Q1(a) (iii) page 3. <https://africachinapresscentre.org/2021/07/20/worlds-first-600km-h-high-speed-maglev-train-to-roll-out-in-china/>
- Graphic Q1(g) (iv) page 8. <https://www.indiamart.com/proddetail/philip-head-stainless-steel-screw-17802941530.html>
- Graphic Q1(g) (iv) page 8. <https://www.aluids.com/product/screw-cheese-head-m4-x-12/>
- Graphic Q2(a) page 9. <https://extra.ie/2021/12/31/news/irish-news/wexford-flooding>
- Graphic Q3(a) Page 13. <https://www.zerbsdsf.xyz/products.aspx?cname=segway+scooter&cid=24>
- Graphic Q3(a) Page 13. <https://cusackelectrical.ie/products/12773>
- Graphic Q4(a) (i) Page 16. <https://rts.org.uk/article/remembering-logie-baird-ninety-years>

Question 1

(a) An image of a Japanese bullet train is shown.

(i) Describe **one** feature of this train that allows it to move at very high speed.

Feature:



Japanese bullet train

(ii) Aluminium is commonly used in the manufacture of trains.
Use a tick (✓) to show if each of the following statements is true or false.

Statement	True	False
Aluminium is harder than stainless steel		
Aluminium is heavier than mild steel		
Aluminium is lighter than brass		
Aluminium is brittle like glass		

(iii) China recently put into service its *Maglev* passenger train.
This train does not sit on the track but instead hovers above it using magnetic levitation.

Suggest **two** advantages of using this technology for trains.

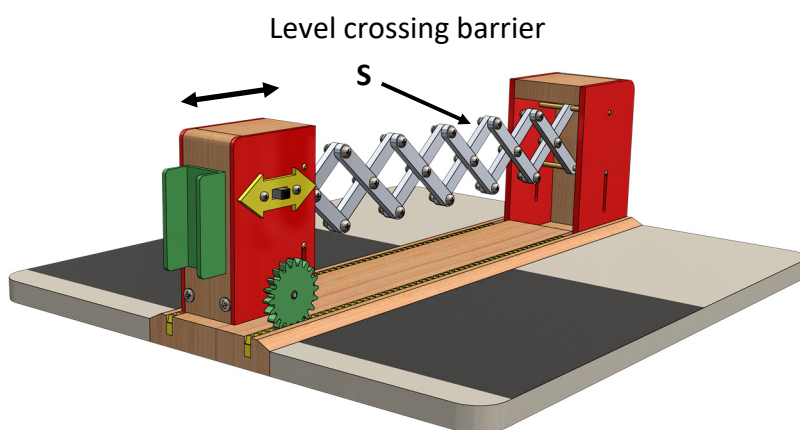


Advantage 1:
Advantage 2:

- (b) A student's design for a working model of a level crossing barrier is shown.

- (i) Name the mechanism shown at S.

Mechanism:

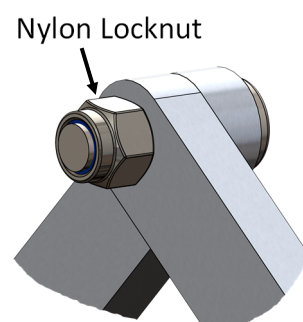


- (ii) Name a suitable material from which to manufacture the links for this mechanism.

Material:

- (iii) A *nylon locknut* is used to join the links of the mechanism. Give a reason for this choice of fastener.

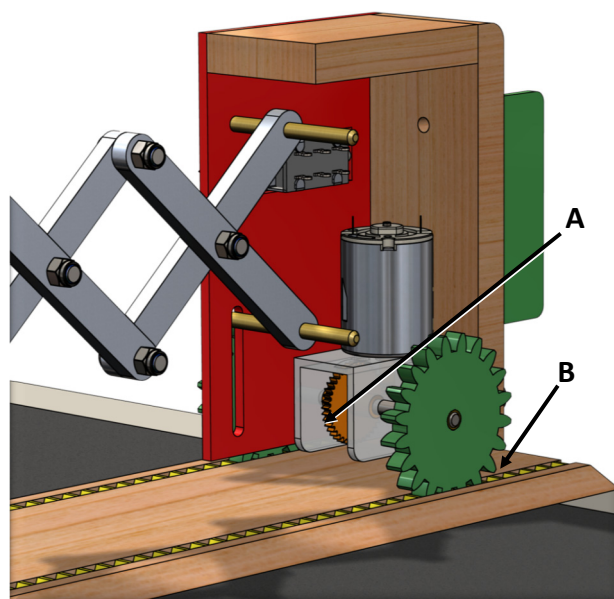
Reason:



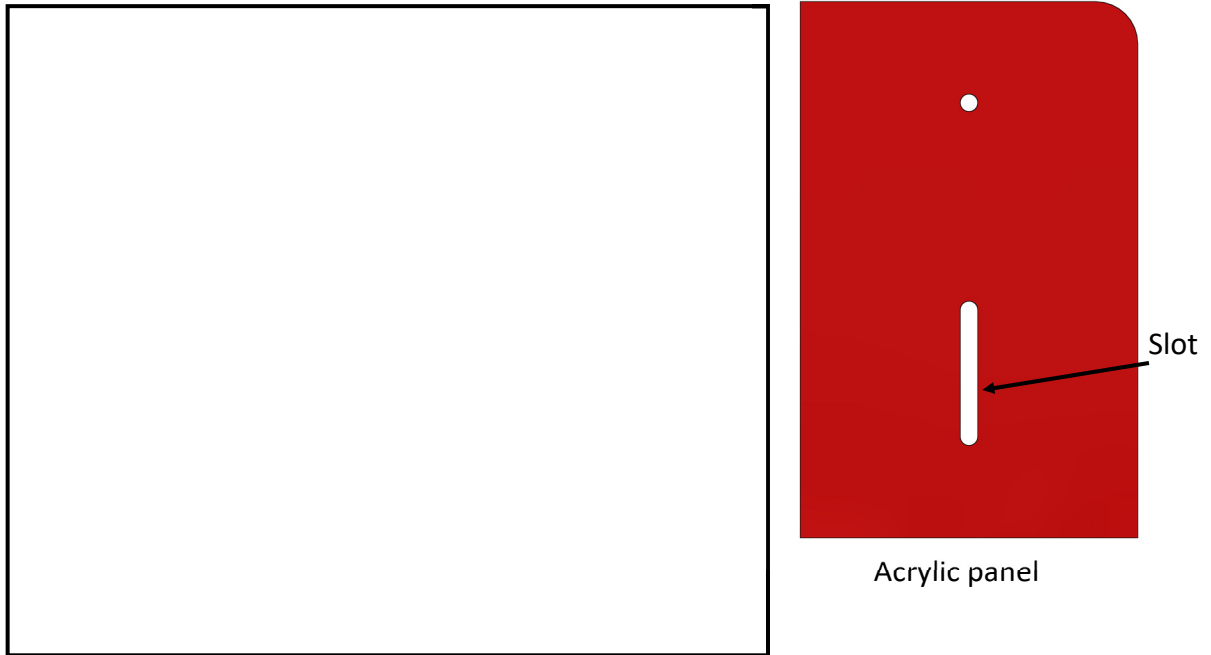
- (c) (i) Mechanism A, in the image opposite, transmits rotary motion through a 90° angle and mechanism B converts rotary motion to linear motion.

Name the mechanism at A and the mechanism B.

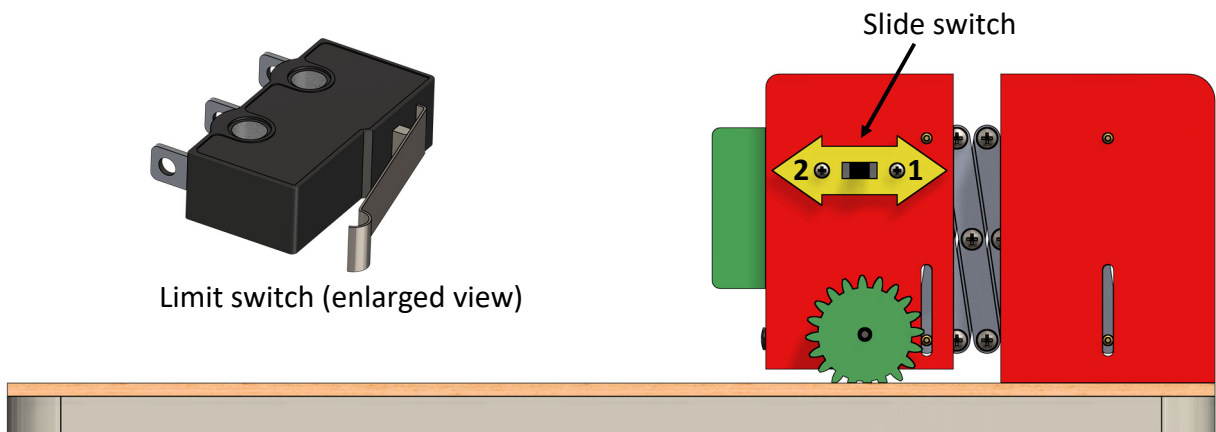
Mechanism A:
Mechanism B:



- (ii) In the space below describe, with the aid of sketches, the processes required to make the slot in the acrylic panel shown.



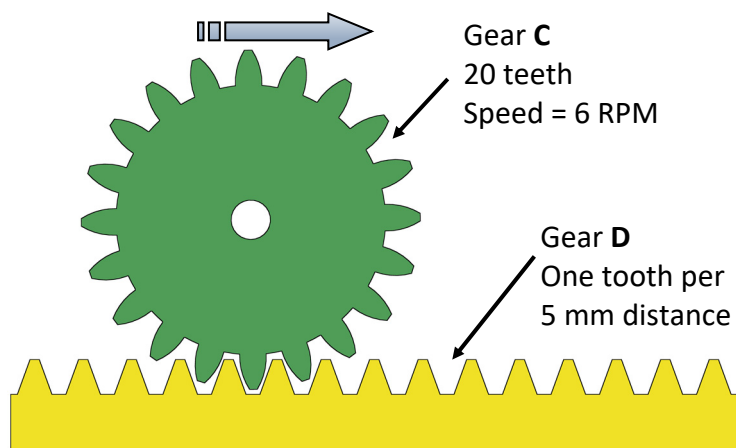
- (iii) The image below shows the barrier in its open position.
Limit switches as well as the slide switch are required for the operation of the barrier.



Explain why limit switches are required.

Explanation:

- (d)** Gear **C** rolls along gear **D**.
Using the information shown,
answer the following questions in
the spaces provided below.



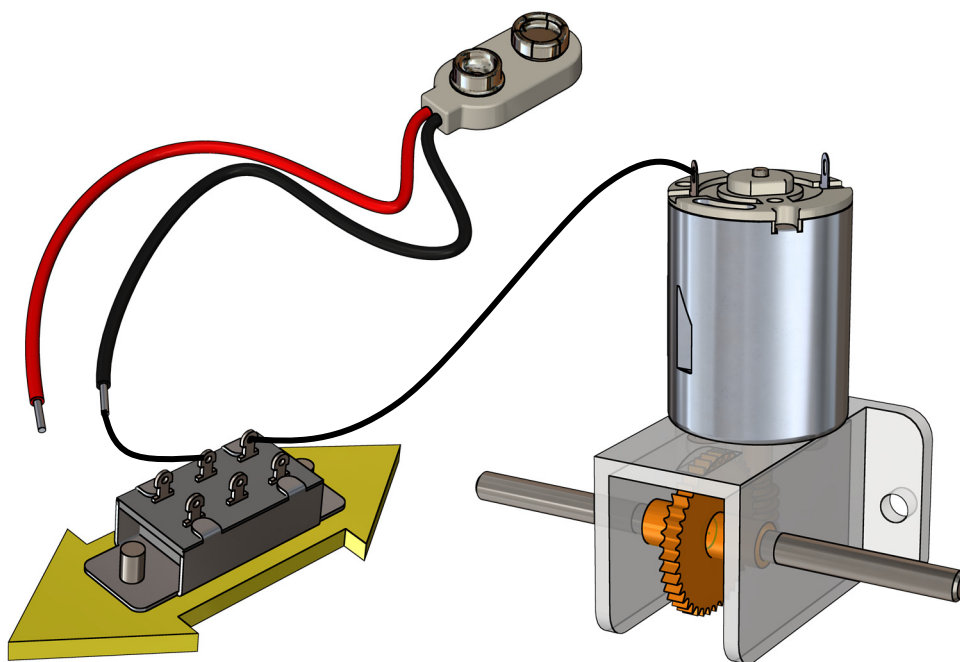
- (i) Through how many teeth on gear **D** will gear **C** roll in one minute?

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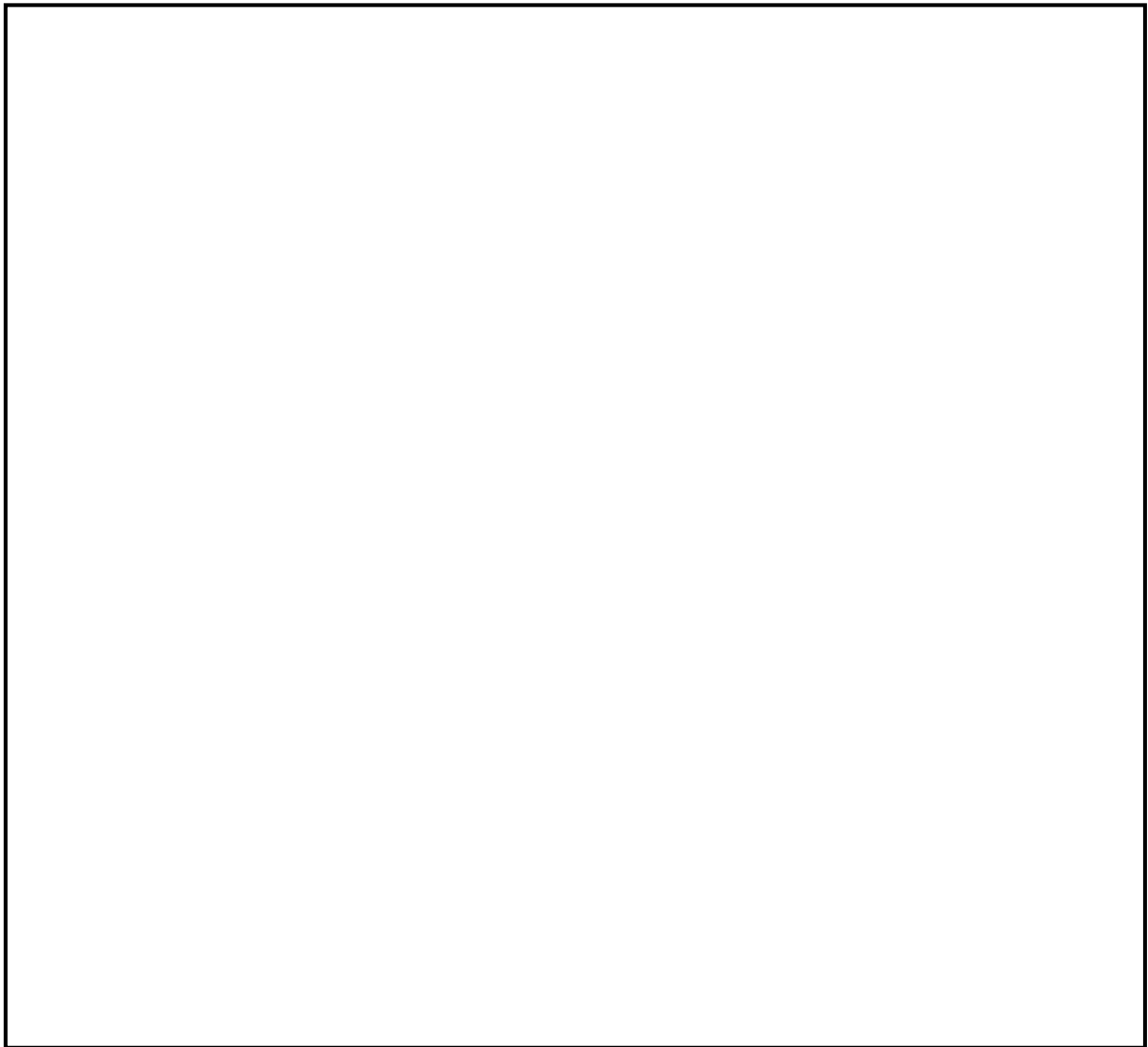
- (ii)** How long will it take gear **C** to travel a distance of 300 mm?

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- (e) Complete the wire connections for the slide switch, battery snap, and motor in the simplified barrier control circuit below (**four** additional connecting wires are required).



- (f) In the space below make an annotated sketch of an alternative design for a level crossing barrier.

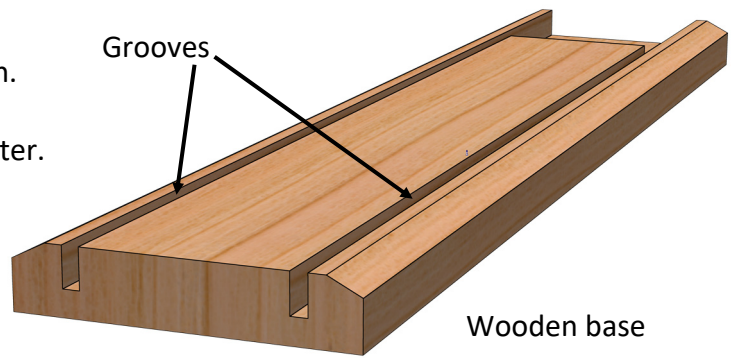


- (g) (i) In the table below use a tick (✓) to show which trees are deciduous and which are evergreen.

Tree	Deciduous	Evergreen
Oak		
Scots Pine		
Sycamore		
Douglas Fir		

- (ii) The solid wooden base on which the barrier runs is shown. The grooves were produced using a power tool called a router.

State **two** safety precautions that should be taken when using power tools.



Safety Precaution 1:
Safety Precaution 2:

- (iii) The acrylic side panel shown was attached to the wood using screws.

State which screw, **A** or **B**, should be used and explain why the edges of the holes are countersunk as shown.



A

B



Selected screw, A or B :	
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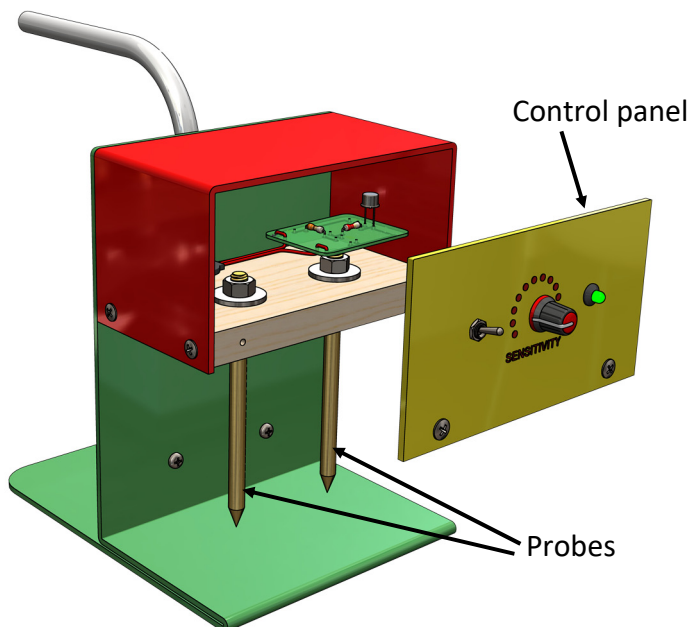
Countersunk - explanation:

Question 2

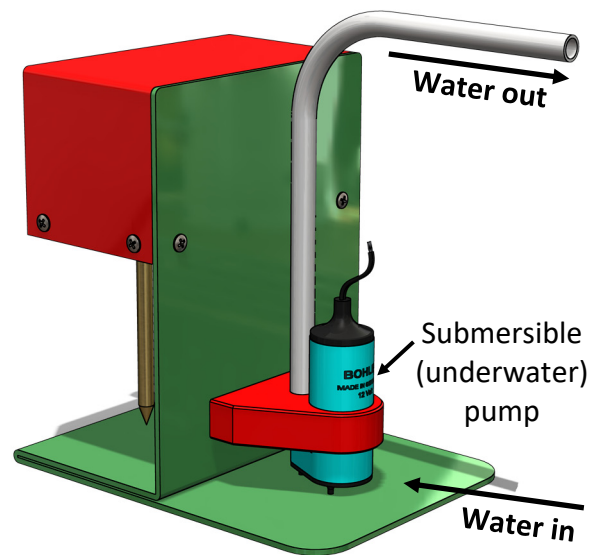
Seasonal flooding has always been a problem in Ireland.

Systems are required to help the public avoid flooding in their homes and businesses.

The images below show a student design for an automatic pumping system that will sense rising water levels and pump the water to an appropriate location.



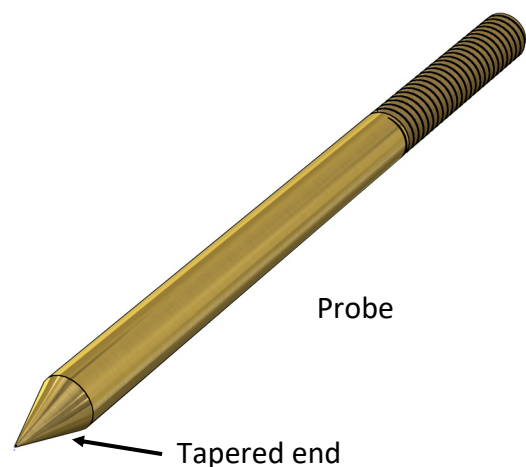
View with front control panel removed



Rear view

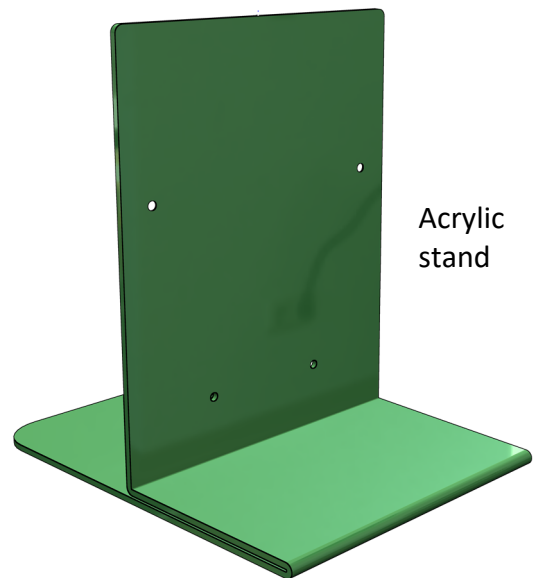
- (a) (i) Name a suitable material from which to make the probes and name a machine or tool with which to taper the ends of the probes.

Material:
Tool or machine for tapering:



- (ii)** The stand for the unit is made from acrylic. Acrylic is a thermoplastic. Explain the term thermoplastic.

Thermoplastic:



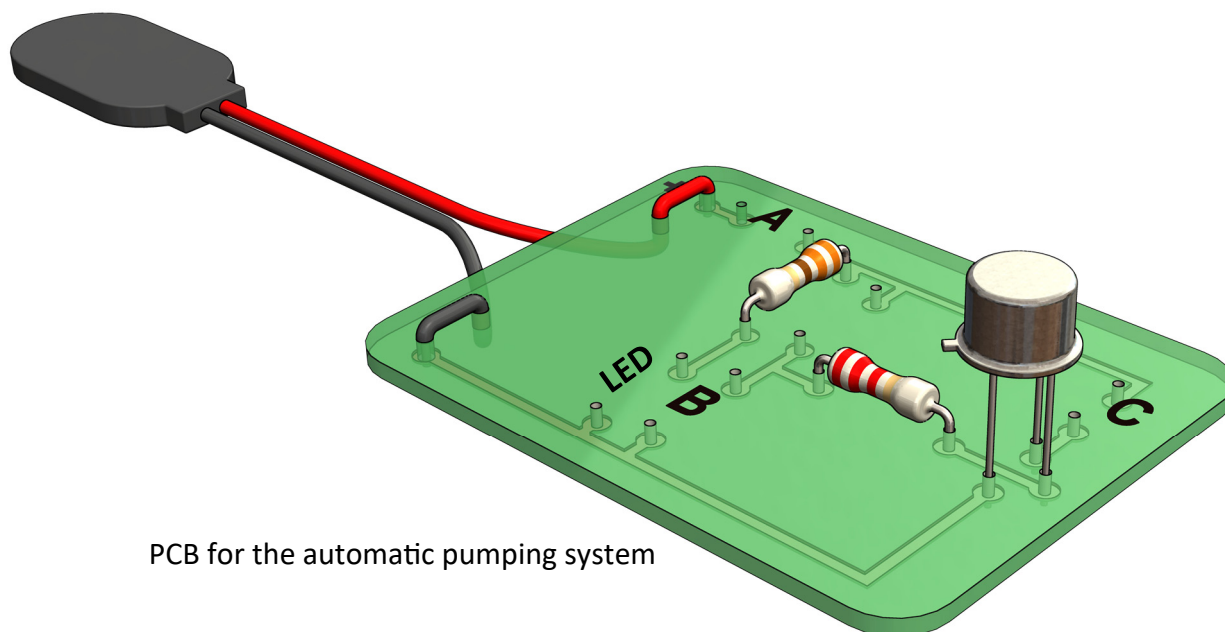
- (iii) In the space below make a sketch of the development of the stand. Show the bend lines and approximate locations of the holes.

Development:

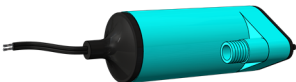
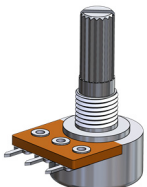
- (iv) Name a machine used to bend the acrylic stand and list **two** steps in the bending process.

Machine:
Step 1:
Step 2:

- (c) (i) The image shows the control circuit for the pumping system. In the table below, name each component and indicate its position (A, B, or C) on the PCB below.



PCB for the automatic pumping system

Component	Name	Position on PCB
		
		
		

- (ii) What do the letters **PCB** stand for?

P	C	B
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Question 3

- (a) Dean Kamen, an American inventor, developed the first commercial self-balancing electric two wheeled personal transporter. It was released in 2001. Many variations on this idea are now in production by other manufacturers.

In newer models of these devices, steering is achieved solely by leaning in the direction in which you want to move.



- (i) Suggest **one** advantage and **one** disadvantage of electric two wheeled personal transporters.

Advantage:
Disadvantage:

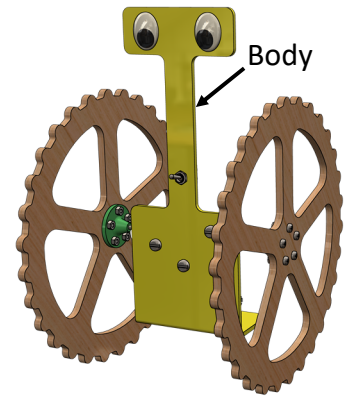
- (ii) Explain why two motors are required to operate this type of transporter.

Answer:

- (iii) Steel is used in the internal frame of these transporters.
State **one** property of steel that makes it a suitable choice of material.

Property:	
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- (b) A student's design for a self-balancing two wheeled toy with forward motion is shown. When testing the design the student discovered that the *centre of gravity* of the body of the toy was too high.

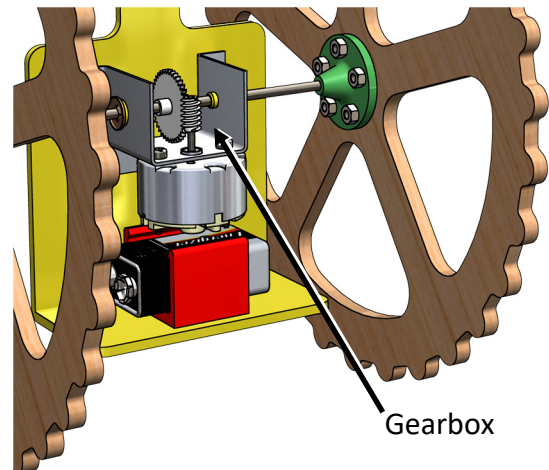


- (i) What would the student have observed in order to come to this conclusion and how could the problem be solved?

Observation:
Solution:

- (ii) The wheels were laser cut from a manufactured board. Name a suitable board for this purpose.

Manufactured board:

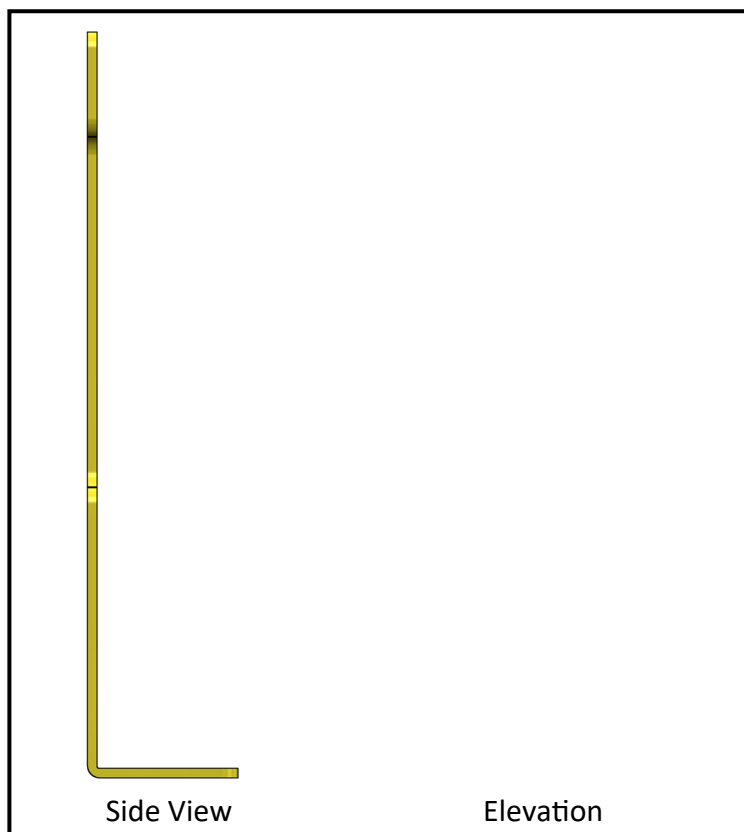
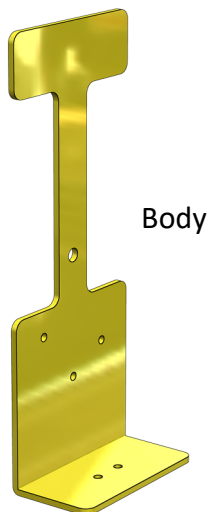


- (iii) To move the toy at a suitable speed and with sufficient *torque* the gearbox shown in the image above was selected.

In this context, explain the term torque.

Torque:

- (c) (i) A side view (end view) of the body of the toy is shown.
Sketch a projection of an elevation of the body in the space provided (holes may be omitted).



- (ii) Using the given symbols for the circuit components, make a 2D drawing of the control circuit for the toy in the space below.

	2D drawing of control circuit

Question 4

In 1926, John Logie Baird, a Scottish inventor, gave the first public demonstration of a true television system, launching a revolution in communication and entertainment.



John Logie Baird

- (a) (i) There have been many advances in the technology of televisions in recent years. List **two** such advances.

1.

2.

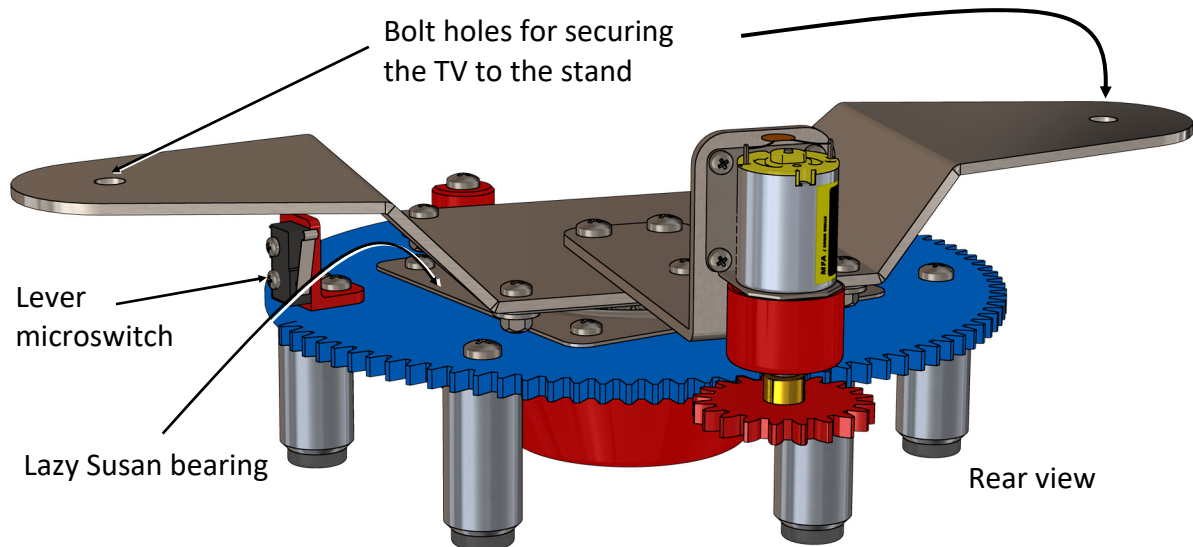
- (ii) Infrared light is used extensively in technology. One of the most common examples is in the operation of a TV remote control.



Name **one** other device that uses infrared light.

Answer:

- (iii) A student design for a remote controlled rotary TV stand is shown.

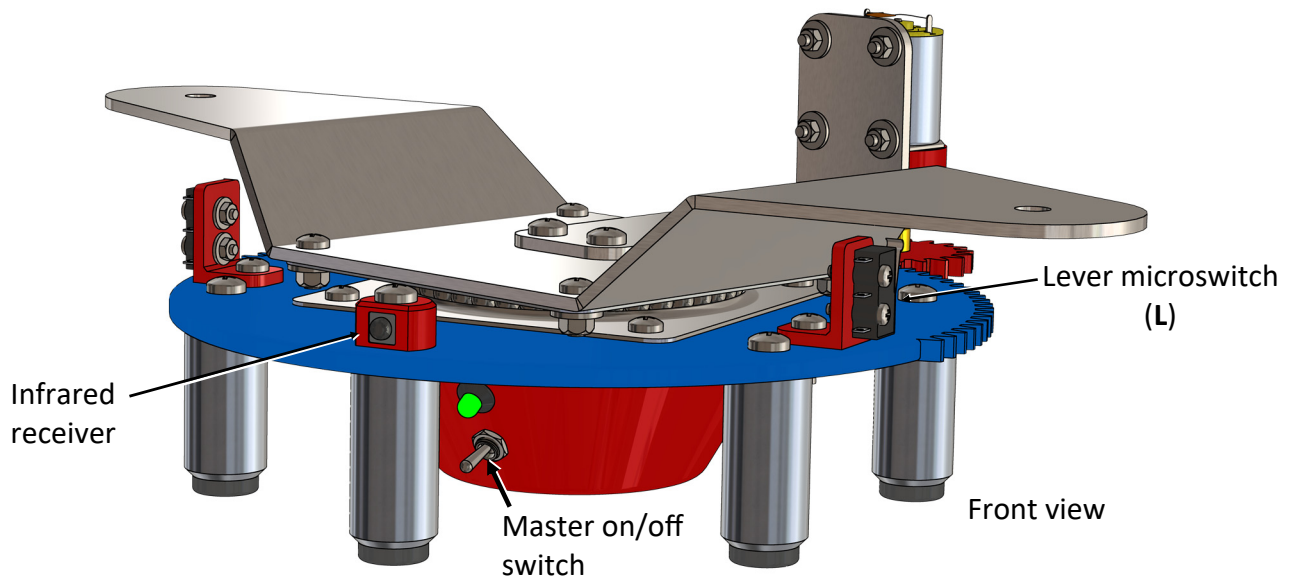


The upper part of the stand can rotate on a 'Lazy Susan' bearing powered by the electro-mechanical system shown.

Explain the purpose of a 'Lazy Susan' bearing in the design.

Answer:

- (b) The image shows a front view of the components of the control system for the stand.



When the master switch is on and the infrared remote control is pressed the stand rotates clockwise. When the stand reaches its fully rotated position it contacts microswitch L and the motor stops.

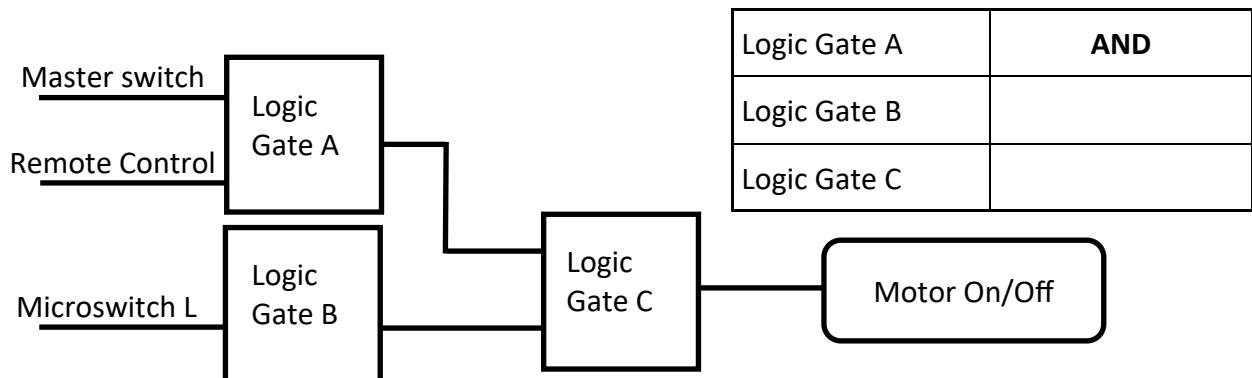
The inputs above can be summarised as follows:

Master switch on = Logic Level 1 (Master switch off = Logic Level 0)

Infrared remote pressed = Logic Level 1 (not pressed = 0)

Microswitch L pressed = Logic Level 1 (not pressed = 0)

- (i) Name the logic gates B and C required to make this system work.

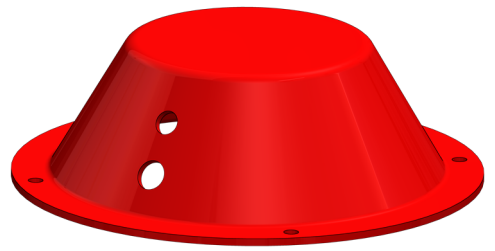


- (ii) Complete the truth table for the AND gate below.

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

(c) The circuit housing (for the stand) is made from High Impact Polystyrene sheet (HIPS).

- (i) Name the machine used to form the housing and number the remaining four steps **in their correct sequence** to produce the housing. The first step is numbered for you.



Circuit housing

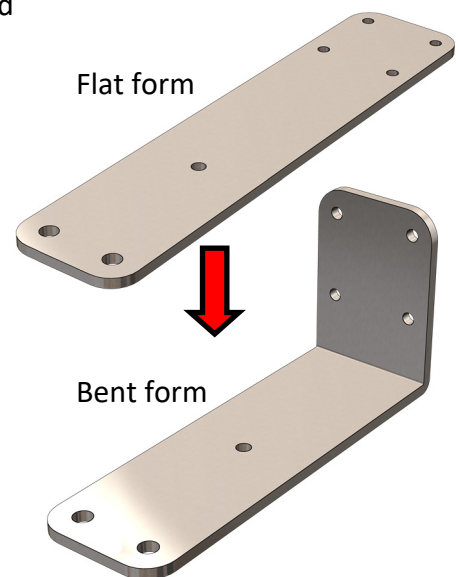
Name of machine:

Steps in the process	Sequence
After cooling reverse the vacuum pump to release the plastic.	
When the plastic is soft enough, switch off the heat and raise the platen.	
Place the former into the machine and clamp the plastic in place.	
Switch on the heating element in advance.	1
Switch on the vacuum pump and switch it off when plastic is formed.	

- (ii) The bracket on which the gearbox motor is mounted is shown in its flat form and in its bent form.

Select a suitable metal for the bracket and give a reason for its selection.

Suitable metal:
Reason for selection:



- (iii) Describe the process of bending the metal bracket.

Bending process:

[illegible]

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