Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Cycle 2024

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.

2024.S69

2024J125C1EL

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

Date of Birth

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.

Japanese bullet train

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

Feature:
Aerodynamic, shape of train, etc.
2✓

(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		1✓
Aluminium is heavier than mild steel		1✓
Aluminium is lighter than brass	1✓	
Aluminium is brittle like glass		1✓

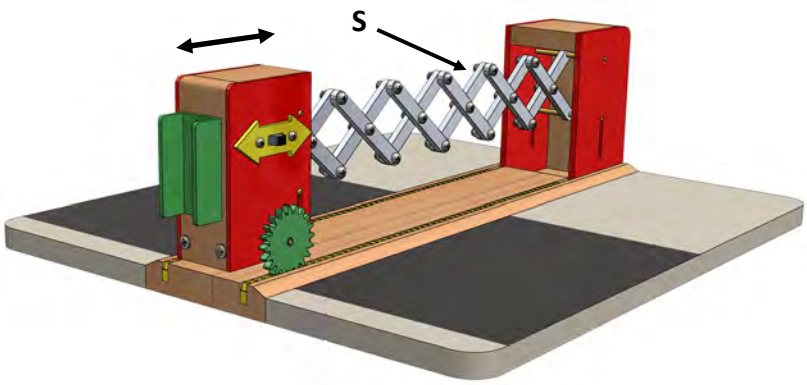
(iii) China recently put into service its *Maglev* passenger train.
This train does not sit on the track but instead hovers above it using magnetic levitation.

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

Advantage 1: no friction (with track), travel faster, smooth travel
2✓
Advantage 2:
2✓

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

Level crossing barrier



(i) Name the mechanism shown at **S**.

Mechanism: 1✓
Scissors mechanism

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

Material: any valid material 1✓

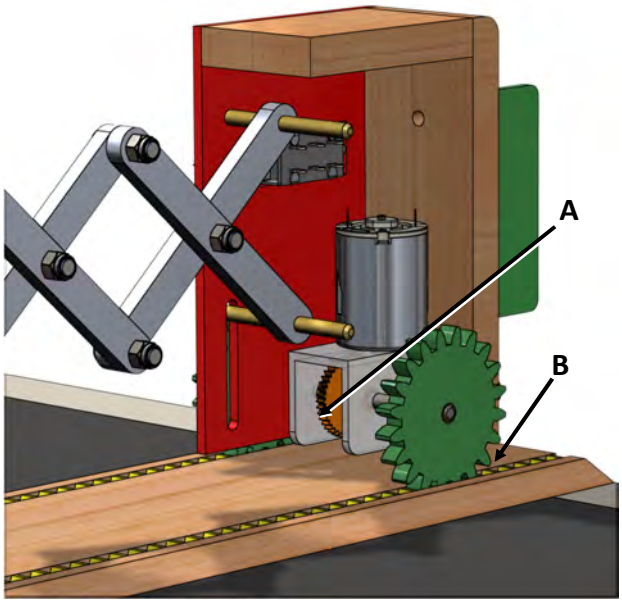
(iii) A *nylon locknut* is used to join the links of the mechanism. Give a reason for this choice of fastener.

Nylon Locknut

Reason: prevent bolt / links of mechanism opening
2✓

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

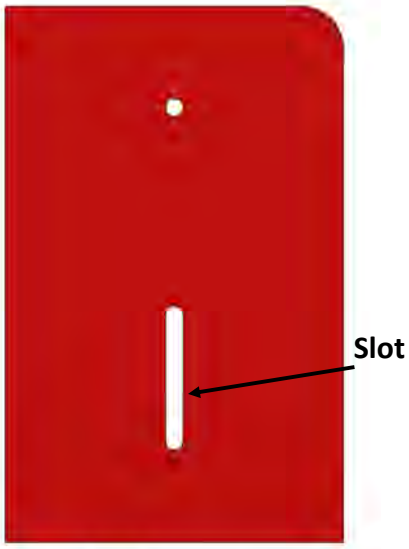
Name the mechanism at **A** and the mechanism **B**.



Mechanism A: worm / gear 1✓
Mechanism B: rack (and pinion)
1✓

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

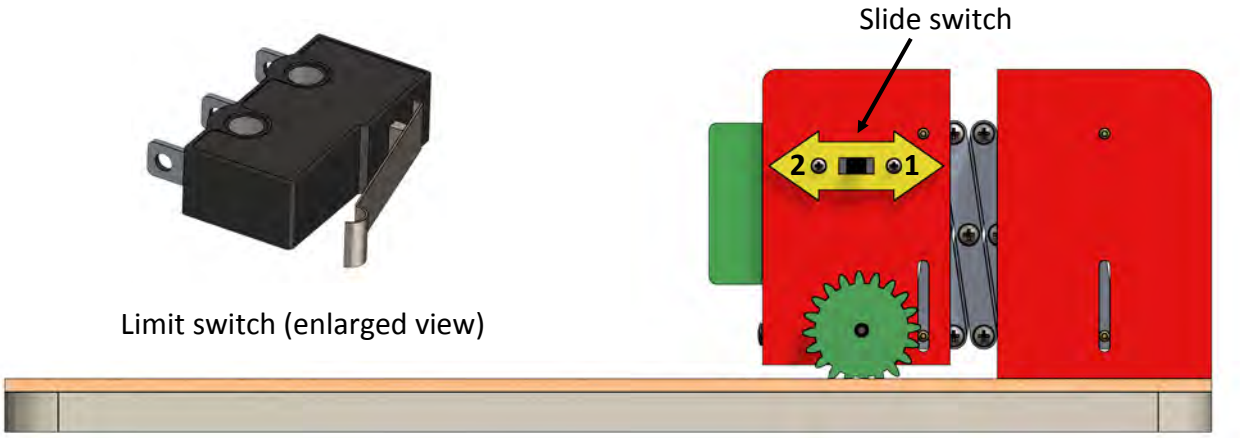
Sketch 1✓
Mark-out 1✓
Drill 1✓
Cut 1✓
Finish 1✓



Acrylic panel

(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.

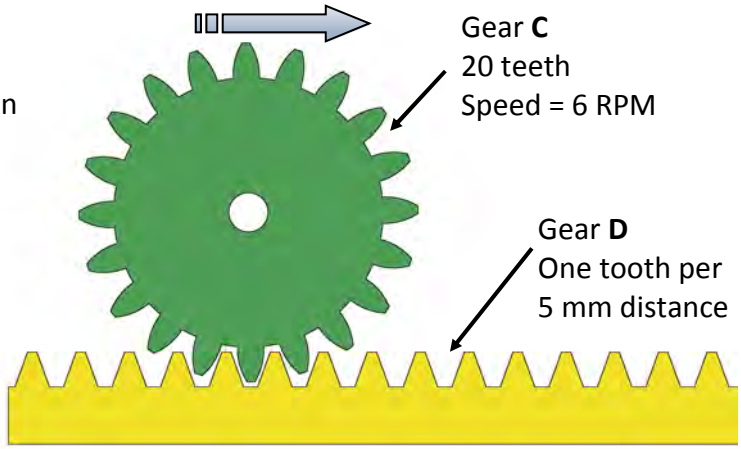
Limit switch (enlarged view)



Explain why limit switches are required.

Explanation: to stop motor (barrier) when it reaches fully open / fully closed position
2✓

(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?

6 RPM x 20 Teeth = **120** Teeth

2✓

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

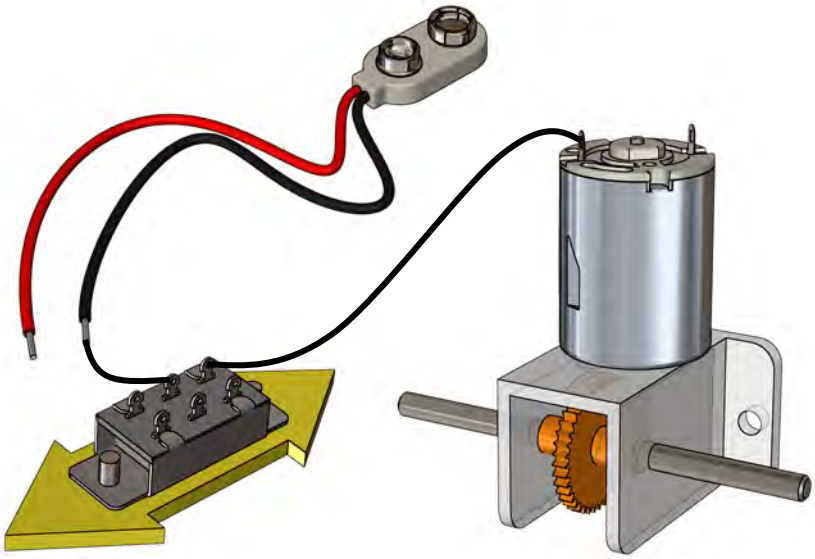
300 mm / 5 mm = 60 Teeth

120 Teeth in 1 minute

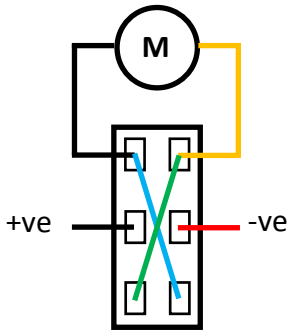
60 Teeth in **30** seconds

2✓

(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).



1✓
1✓
1✓
1✓



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

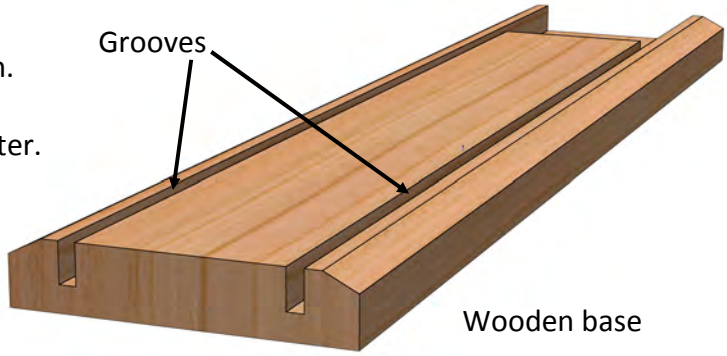
1✓
1✓
1✓

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

Tree	Deciduous	Evergreen
Oak	1✓	
Scots Pine		1✓
Sycamore	1✓	
Douglas Fir		1✓

(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:	2✓
Any **two** valid safety precautions - goggles, hair, location of power lead, etc.	
Safety Precaution 2:	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**:	A	1✓

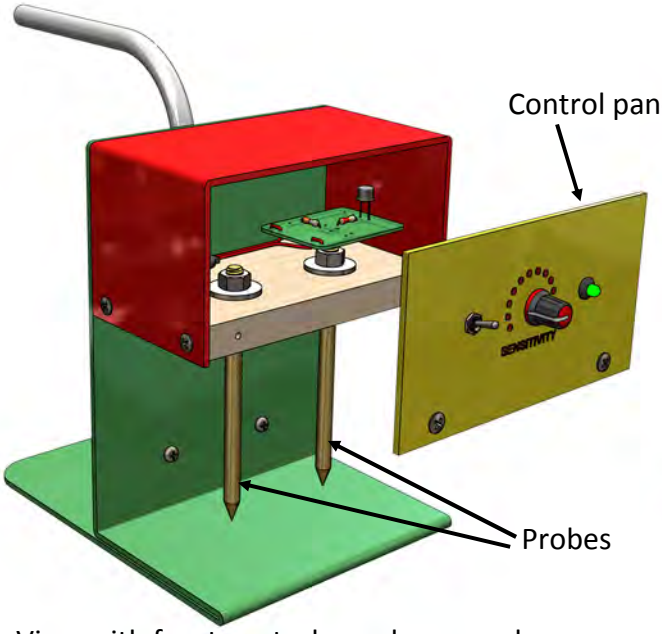
Countersunk - explanation: allow head of screw sit level with face of material.	2✓

Question 2

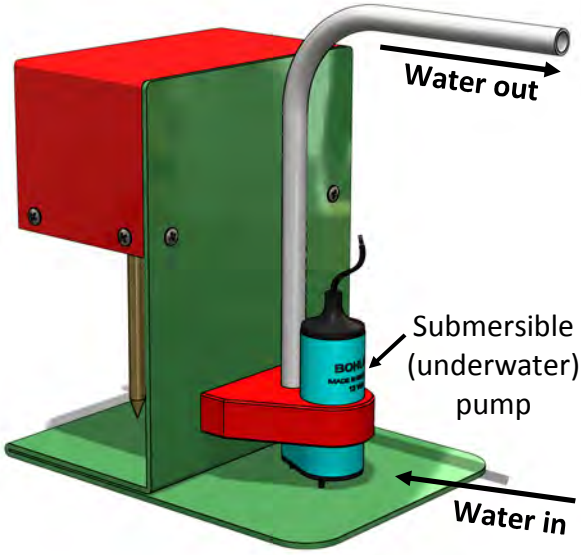
Seasonal flooding has always been a problem in Ireland.

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.



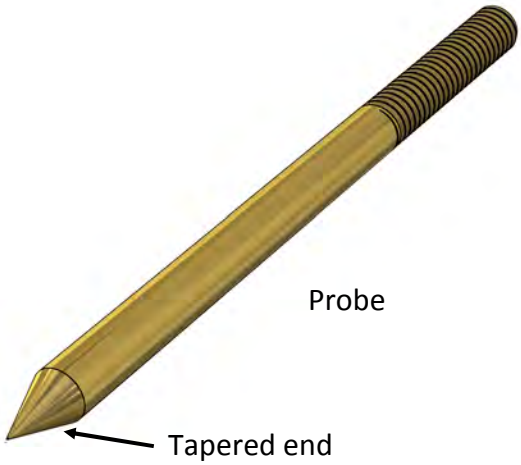
View with front control panel removed



Rear view

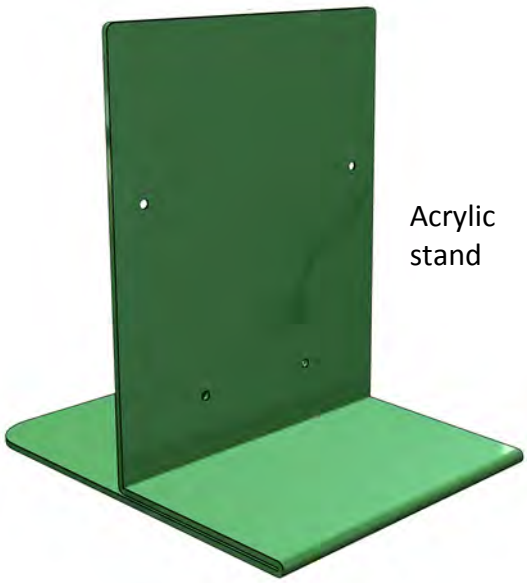
(a) **(i)** Identify a suitable material from which to make the probes and name a machine or tool with which to taper the ends of the probes.

Material : any valid metal	1✓
Tool or machine for tapering:	1✓



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

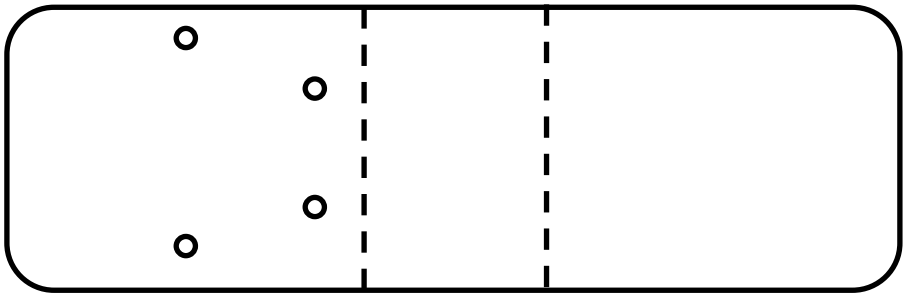
Thermoplastic: 2✓
can be shaped repeatedly by heating



Acrylic stand

(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:

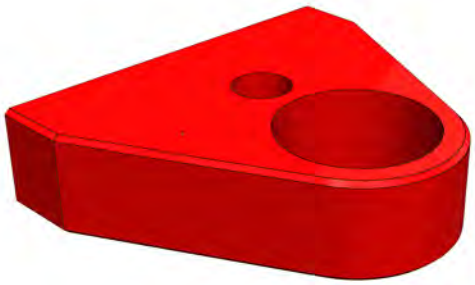


1✓
1✓
1✓

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

Machine: strip heater 1✓
Step 1: any **two** valid steps - marking out, heating, bending on former 2✓
Step 2: 2✓

(b) **(i)** An image of the 3D printed bracket for the submersible water pump is shown.
Give a reason for using 3D printing to make this part and name a suitable plastic for this purpose.



Reason: complex shape, easier to manufacture using 3D printing	1✓
Suitable plastic: PLA, ABS, ASA, PETP, ETG, PC, PP	2✓

(ii) Name an energy conversion taking place when the pump is operating.

From	electrical	To	kinetic

1✓ 1✓

(iii) The submersible water pump for this unit is a 12 volt pump with a pumping capacity of 8 litres per minute.
How many litres of water will the unit pump in one hour?

Submersible pump

Calculation: 2✓

8L/min x 60 min = **480** L

Answer: _____

(iv) On testing the power consumption of the pump it was found to consume 6 watts of power.
Calculate the current flowing through the motor of the pump.

Note: Power = Voltage × Current.

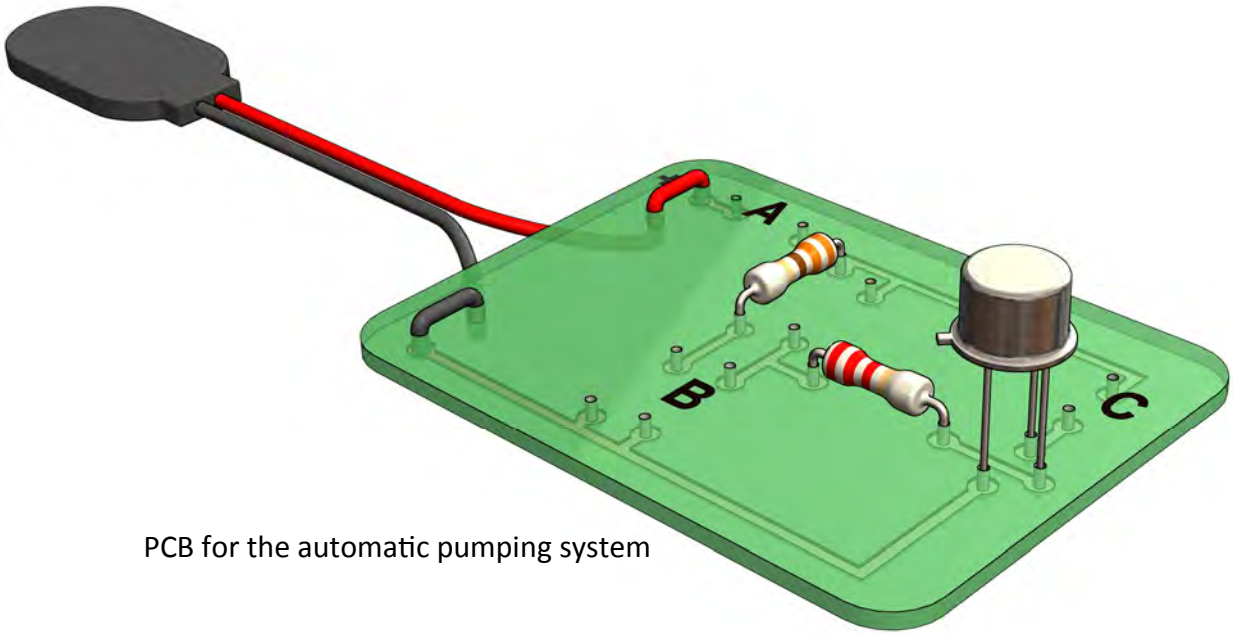
Calculation: 2✓

Current = Power / Voltage

= 6/12 = **0.5** Amps

Answer: _____

(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
	**Pump** 1✓	**C** 1✓
	**Variable Resistor** 1✓	**B** 1✓
	**Switch** 1✓	**A** 1✓

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

P: Printed 1✓	**C: Circuit** 1✓	**B: Board** 1✓

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: easy to 'steer/ turn', occupy a small space, etc.	2✓
Disadvantage: require recharging, safety, etc.	
	2✓

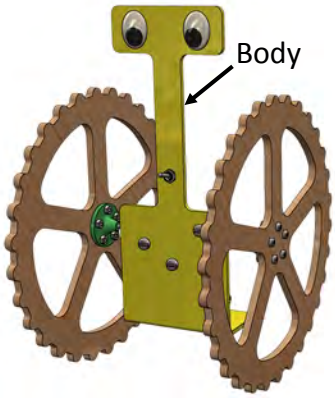
(ii) Explain why two motors are required to operate this type of transporter.

Answer: steering	2✓

(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:	**strength**	1✓

(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.

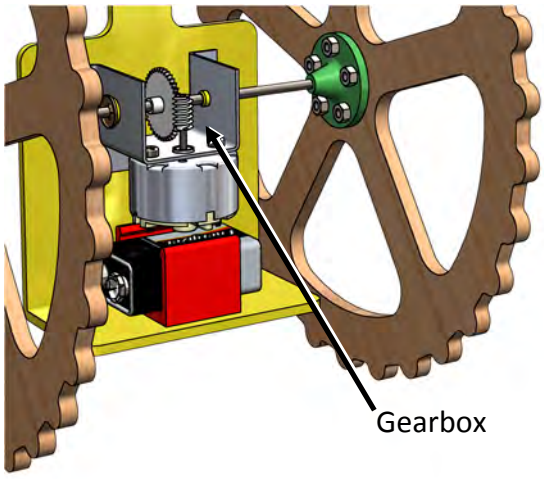


(i) What would the student have observed in order to come to this conclusion and how could the problem be solved?

Observation: body tipping over,	2✓
Solution: lower centre of gravity by adding weight to base or	2✓
Reducing height (and weight) of upper portion of stand	

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

Manufactured board: any valid board	1✓

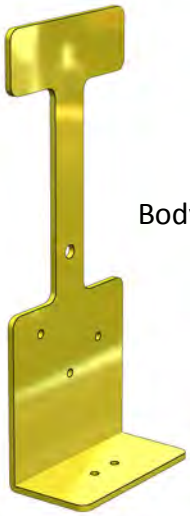


(iii) To move the toy at a suitable speed and with sufficient *torque* the gearbox shown in the image above was selected.

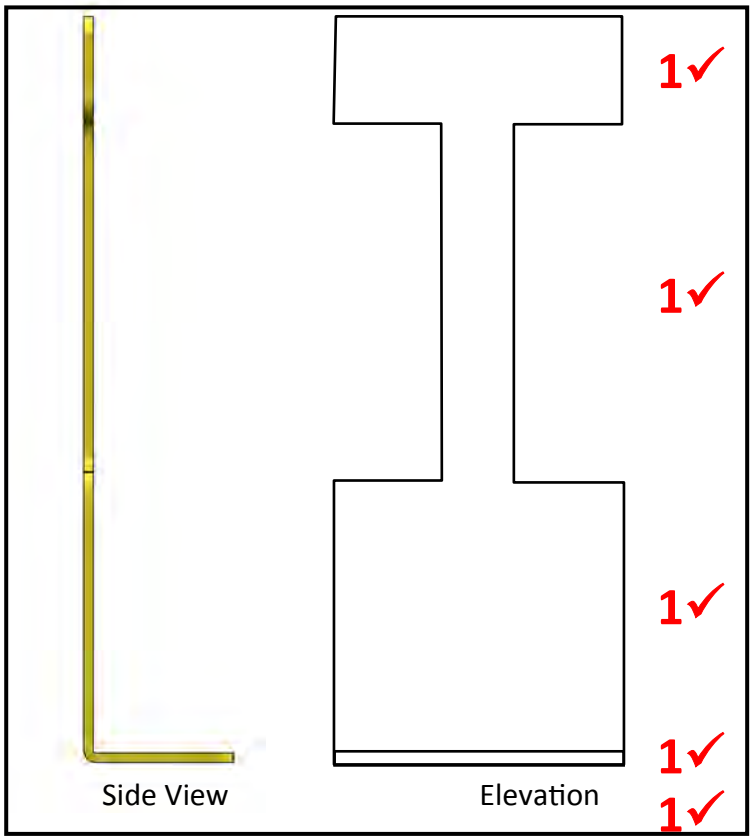
In this context, explain the term torque.

Torque: turning force	2✓

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

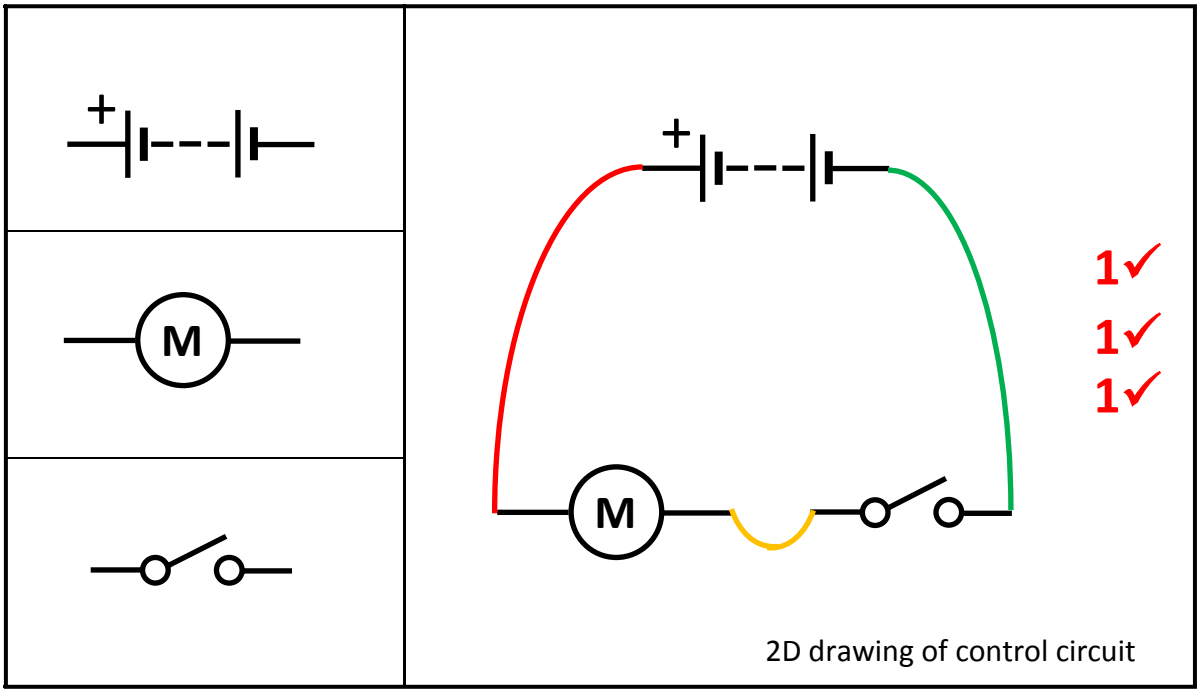


Body



1✓
1✓
1✓
1✓
1✓

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



1✓
1✓
1✓

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.

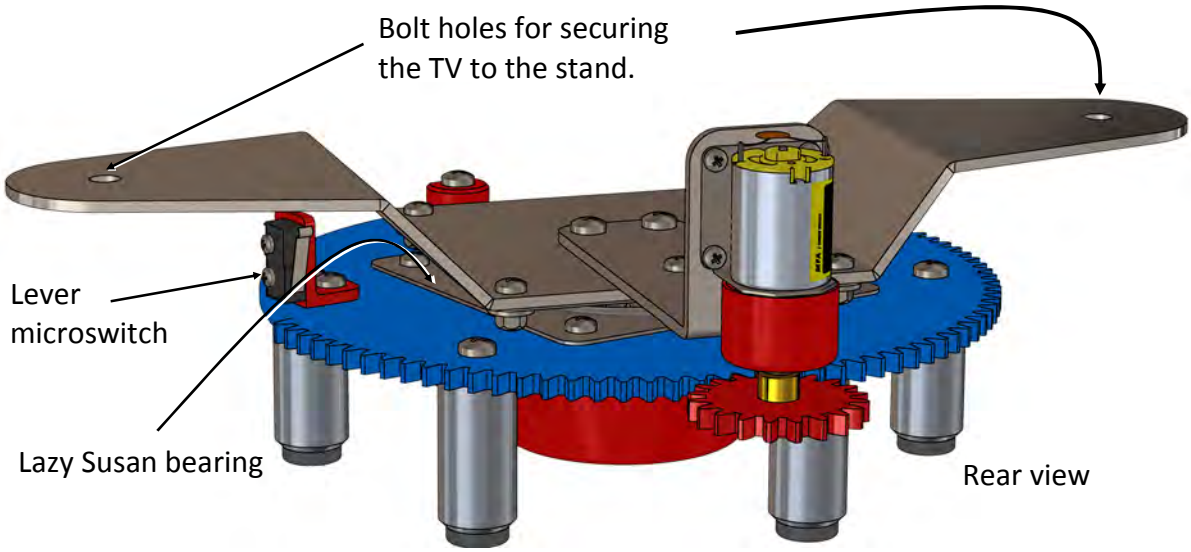
1. any two valid advances : HiDef screens, satellite & multichannel, etc.	2✓
2. internet access on TV, gameplaying, etc.	2✓

(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: thermal cameras, night vision cameras, heating lamps, heat sensors, etc.	1✓

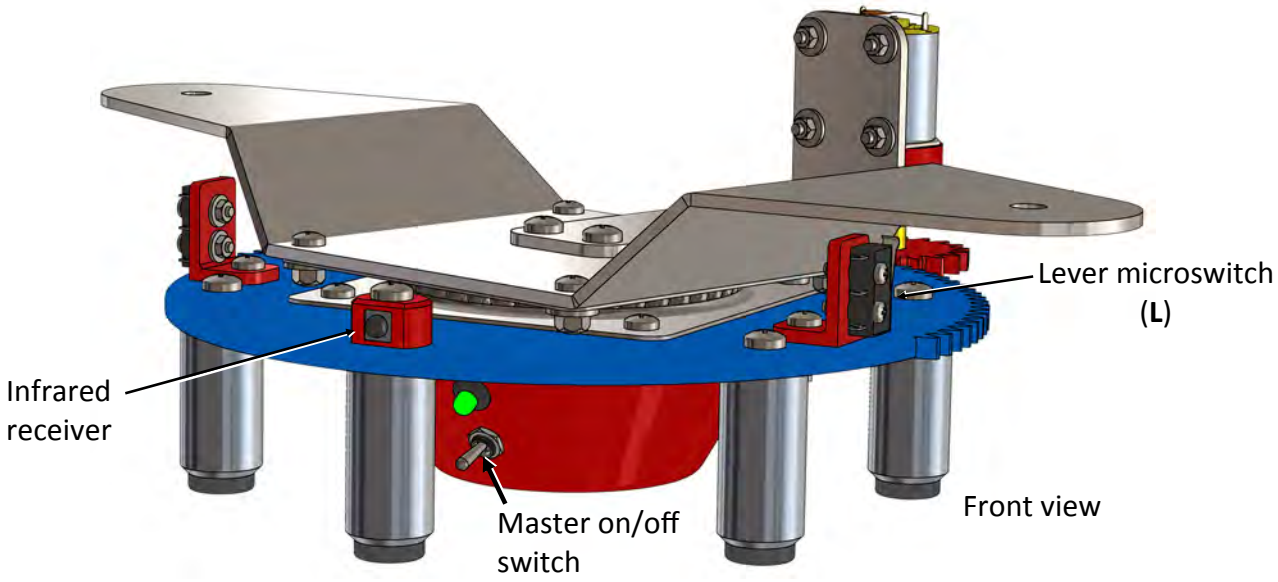
(iii) A student design for a remote controlled rotary TV stand is shown.



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: reduce friction, allow stand to rotate freely, etc.	2✓

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

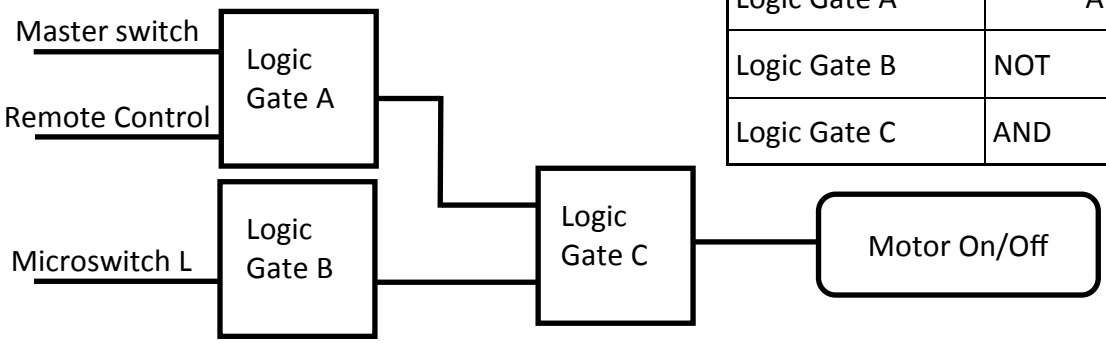


When the master switch is on and the infrared remote control is pressed the stand rotates clockwise. When the stand reaches its fully rotated position it contacts microswitch **L** and the motor stops.

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 A, B, and C required to make this system work.



Logic Gate A	AND
Logic Gate B	NOT 1✓
Logic Gate C	AND 1✓

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

Input 1	Input 2	Output
1	1	**1** 1✓
1	0	0 (given)
0	1	**0** 1✓
0	0	**0** 1✓

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

Circuit housing

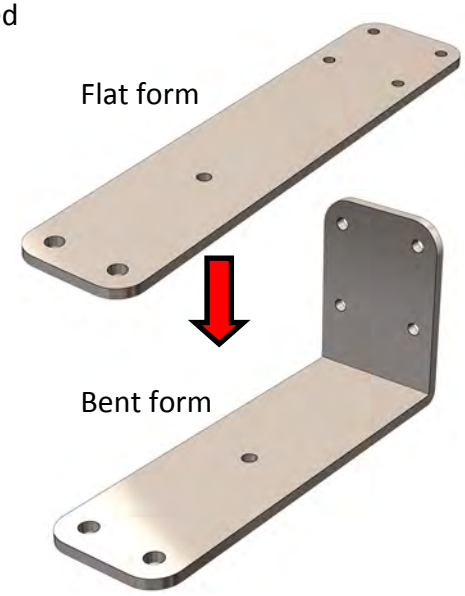
(i) Name the machine used to form the housing and number the remaining four steps **in their correct sequence** to produce the housing. The first step is numbered for you.

Name of machine: Vaccum forming	1✓

Steps in the process	Sequence
After cooling reverse the vacuum pump to release the plastic.	No.5 1✓
When the plastic is soft enough, switch off the heat and raise the platen.	No.4 1✓
Place the former into the machine and clamp the plastic in place.	No.2 1✓
Switch on the heating element in advance.	**1 (given)**
Switch on the vacuum pump and switch it off when plastic is formed.	No.3 1✓

(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: named metal	1✓
Reason for selection: valid reason	2✓

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

Bending process: 2 steps - mark out, clamp in position, bend	1✓
	1✓
	1✓

Additional writing space.
Label all work clearly with the question number and part.

Do not write on this page

Junior Cycle Final Examination – Common Level

Applied Technology

Monday 17 June

Morning 9:30 - 11:00