



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2023

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.

The table below contains information about annotations used for marking throughout the examination paper.

Annotation	Use	Marks (if applicable)
✓ ₁	Valid information	1
✓ ₂	Valid information	2
✓ ₃	Valid information	3
✓ ₄	Valid information	4
SEEN	Surplus information seen by examiner	N/A
0	Incorrect answer	0
⌘	Page seen by examiner/ information not valid	N/A

Question 1

Lego is one of the most successful toy manufacturing companies in the world.

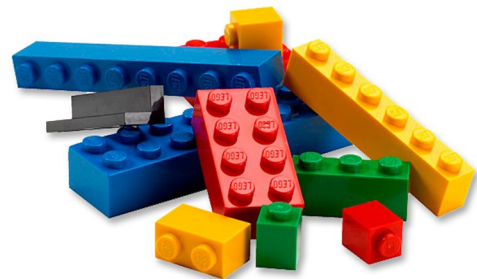
- (a) (i) Name **two** features of Lego products which make them such popular toys.



Name 2 features: Easy to connect parts (snap together), encourages creativity,	
possible to make many models from 1 kit, educational, spatial awareness,	1✓
durable plastic parts, colourful, strong, lightweight, precise, reusable, etc.	1✓

- (ii) Lego bricks are made from ABS thermoplastic. Explain the term **thermoplastic**.

Thermoplastic: Plastic can be reshaped	1✓
by heating	1✓
(reformed by heat /repeatedly)	



- (iii) Many Lego products are manufactured using automated systems. State **one** advantage to the use of automation in this type of industry.

1 Advantage: Manufacture of large numbers of	
same part (to same standard), safety ref.,	2✓
non stop production (no breaks), etc.	



- (iv) Lego use a percentage of recycled plastic as raw material. State **one** reason why this is important?

1 Reason: Environmentally friendly,	2✓
Lowers cost, sustainable, etc.	



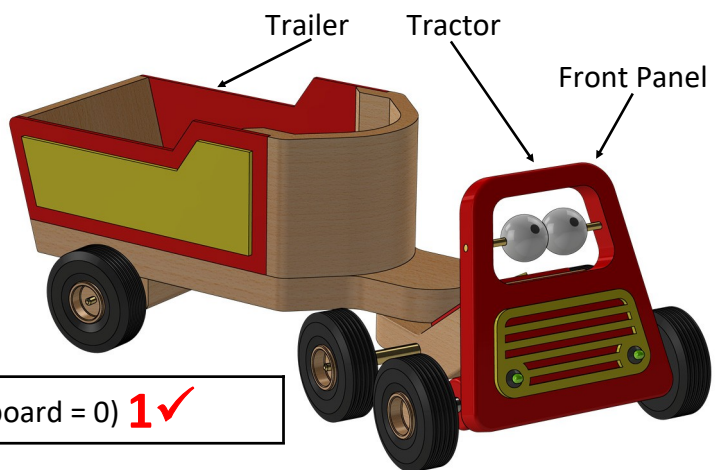
- (b) (i) State **two** advantages of using wood as a raw material for toy making.

2 Adv: Renewable (sustainable) material,	
low cost material, Easy to work,	2✓
attractive finish, non-toxic,	2✓
durable, natural, can be customised, etc.	



- (ii) A student design for a toy articulated truck (tractor and trailer) is shown. The tractor unit is powered using two gearbox motors and has two LEDs for headlights.

Name a suitable manufactured board from which to make the front panel.



Manuf board: MDF, Plywood, (Chipboard = 0) 1✓

- (iii) Using notes and sketches, describe how you would make the front panel from a square piece of your selected material. Name the tools and machines used.



Sketch : 1 mk

1✓

2 x appropriate tools/machines named: 2 x 1 mk

1✓

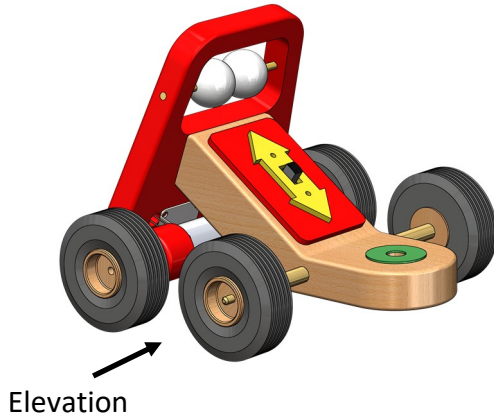
1✓

1 process described: 1 mk

1✓

(Alt: 2 process 2 x 2mks & 1 tool 1 mk)

- (c) (i) In the space opposite sketch a well proportioned elevation of the tractor unit viewed in the direction of the arrow shown below.



Body of model shown correctly in elevation: 1 mk **1✓**

2 wheels shown correctly in given elevation: 1mk **1✓**

Parts in proportion: 1 mk **1✓**

- (ii) The chassis of the tractor unit was finished with a clear lacquer. Describe the process necessary to prepare the wood before applying the lacquer.

Answer: 2 valid processes 2 x 1mk	
sanding (paper / block / sander),	1✓
Dust removal, white spirit	1✓
(steel wool / file = 0)	

Chassis



- (iii) The lacquer is to be applied using an aerosol can. Explain why a spray booth should be used when carrying out this process. Name **one** other precaution which should be taken for this process.

Reason for using a spray booth: 2 mks	2✓
Safety issues: fumes removed safely,	
Contain spray paint to local area, etc.	
1 x Precaution: 1 mk	1✓
Wear mask, no flames, turn on extractor.	



Spray Booth

(d) A view of one of the LED truck headlights is shown.

(i) What do the letters LED stand for?

Answer: L Light **1✓** E___Emitting **1✓** D___Diode **1✓**

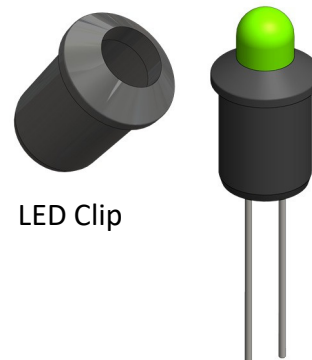
(ii) Place a tick (✓) in the appropriate box to indicate which leg of the LED is the Anode (positive leg).

	Short Leg	Long Leg
Anode		✓ 1✓



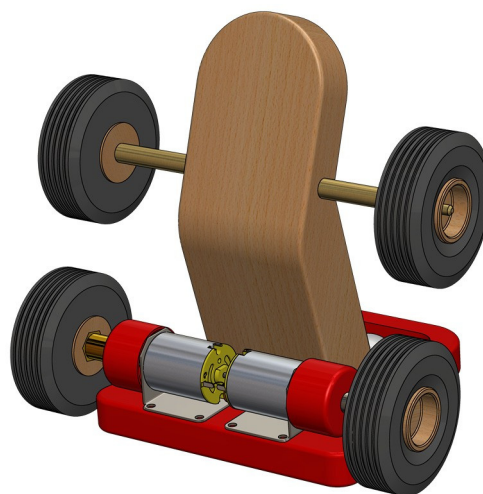
(iii) Explain why it is best practice to use an LED clip when inserting an LED into the front panel of the truck.

Explain: 2 mks Prevent damage to LED , 2✓
aesthetics, hold LED in place, looks good,
prevent 'short' on metallic surface



(iv) The underside of the tractor unit is shown.
Two gearbox motors, with a gear ratio of 100:1, power the tractor unit.
Explain what is meant by a gear ratio of 100:1.

Answer: 2 mks 2✓
100 turns of motor = 1 turn of axle
wheel turns 100 times slower,
VR (1:100 or 1/100)



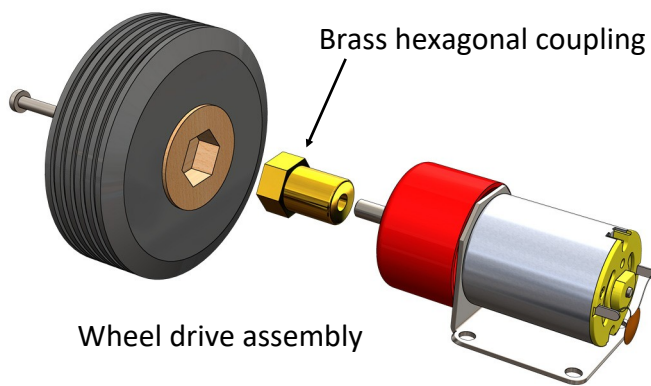
Underside of the Tractor Unit

(v) Explain why DC motors, without gearboxes, would not be suitable to power the truck.

Explain: 2 mks Wheels turn too fast , insufficient torque, vehicle will not move, 2✓
control difficult, etc

- (e) (i) A brass hexagonal coupling is used to connect the gearbox shaft to the wheel.
Explain why a hexagonal profile is used for this purpose?

Explain: 2 mks	2✓
enhanced grip on wheel/hub,	
no slippage, easy to remove wheel,	
positive drive, etc.	



- (ii) A plastic disc is used where the tractor and trailer units are connected.
Give **one** reason for using this plastic disc.

1 x Reason: 2 mks	2✓
Reduce friction between trailer/tractor,	
allow trailer to move independently,	
Prevent wear on wood, etc.	



- (iii) Wheels of commercial trucks use pneumatic tyres. Explain the term **pneumatic** and give **one** advantage of using pneumatic tyres.

Pneumatic: 2 mks	2✓
Air filled / inflated / powered, compressed air,	
Advantage: 2 mks	2✓
Air filled tyres allow smoother driving,	
better traction with surface,	
lighter than solid tyre	



- (iv) State **one** reason why trucks have a large number of wheels.

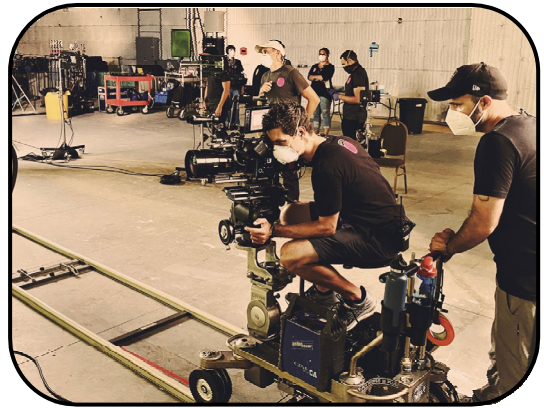
1 x Reason: 2 mks	Distribute the load over
large area & less pressure on road, grip	2✓



Question 2

Modern movie production uses a wide variety of technologies in manufacturing and distributing the film.

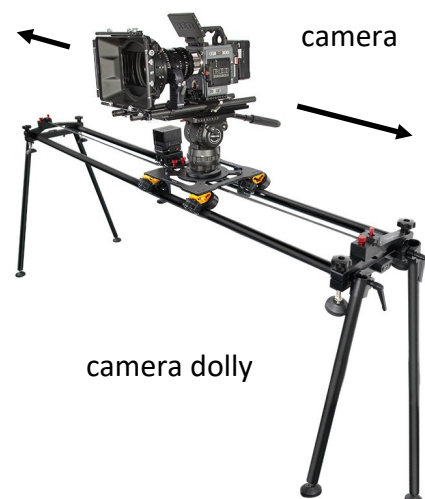
- (a) (i) Describe **two** ways in which digital technologies are used in the movie industry.



2 x Describe: 2 x 2mks digital capture (cameras),	2✓
digital manipulation of image (green screen), special effects, CGI,	2✓
movie released as digital image (mp4/AVI/DVD/on-line (streaming)) etc.	
Any valid digital output medium.	

- (ii) *Camera dollies* are used in movie production to create a smooth movement over an uneven surface.
Suggest **one** design feature of a camera dolly which makes this possible.

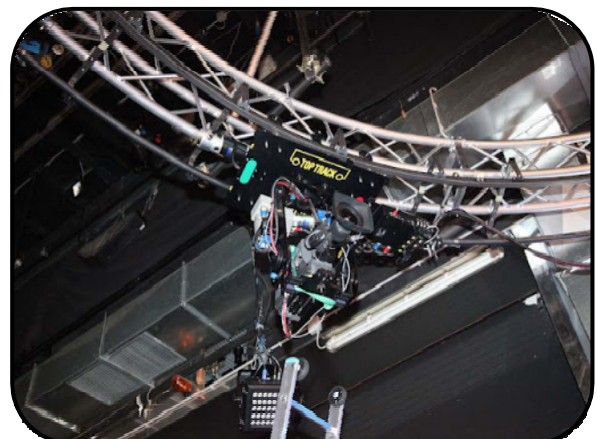
1 x Design feature : 2 mks	2✓
Legs adjustable to make a level track,	
slow motorised movement, wheels on rails,	
'Gimbal ' to stabilise camera, roller bearings, etc.	



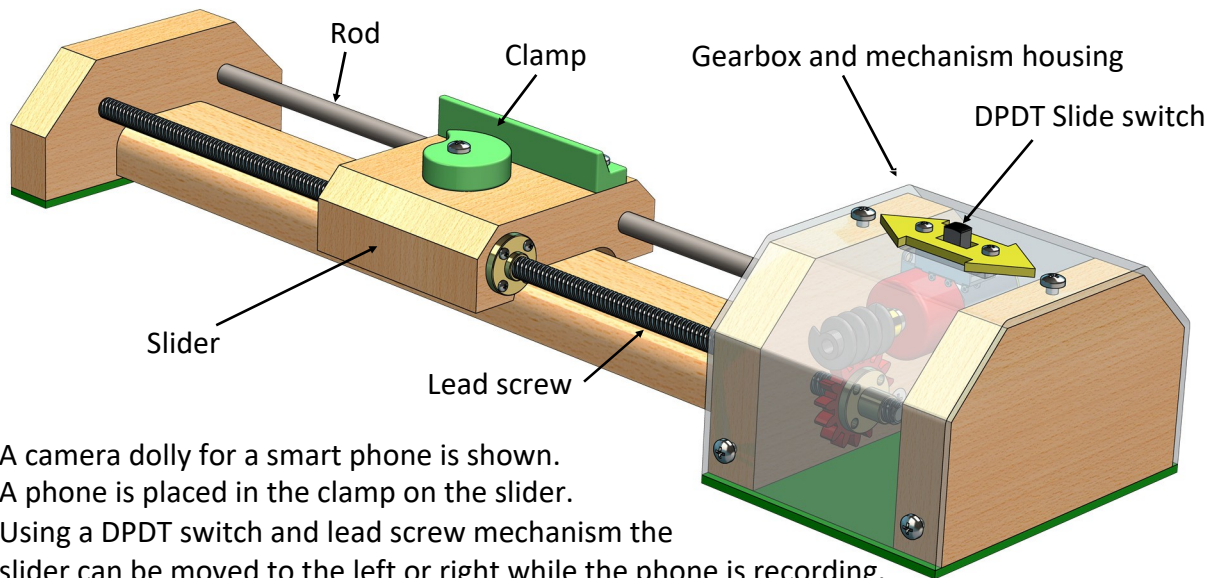
- (iii) The image shows a ceiling mounted dolly. The track is a triangulated-truss type structure.
Why is the truss triangulated?

Answer: 2 mks	2✓
Triangles allow maximum strength for	
minimum weight / structure,	
Stronger, will not distort, rigid, etc.	

Overhead trussed camera dolly



(b)



A camera dolly for a smart phone is shown. A phone is placed in the clamp on the slider. Using a DPDT switch and lead screw mechanism the slider can be moved to the left or right while the phone is recording.

- (i) Name a suitable hardwood for the wooden parts of the dolly and state **one** property of your chosen hardwood.

Hardwood: Named	2✓	Property: Appropriate property	2✓
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- (ii) In the space below, explain using notes and sketches, how the plastic base of the gearbox housing could be attached to the two wooden sides.

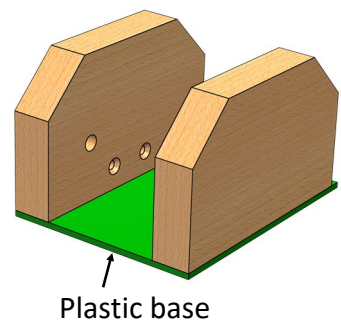
Sketched: 2mks

2✓

1 appropriate method of attachment: 1mk

1✓

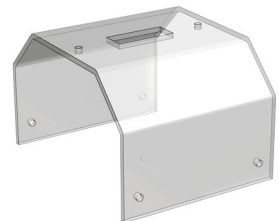
Drill & screw, drill & nail, glue, bracket.
(nail only =0)



- (iii) The cover of the motor housing is classed as a **shell structure**.
List **one** other example of shell structures in everyday use.

1 example 2 mk	2✓	2.
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Egg carton, helmet, basin, bowl, bucket, plastic bottle, tin can, vehicle (car, train, boat, plane) body, etc.



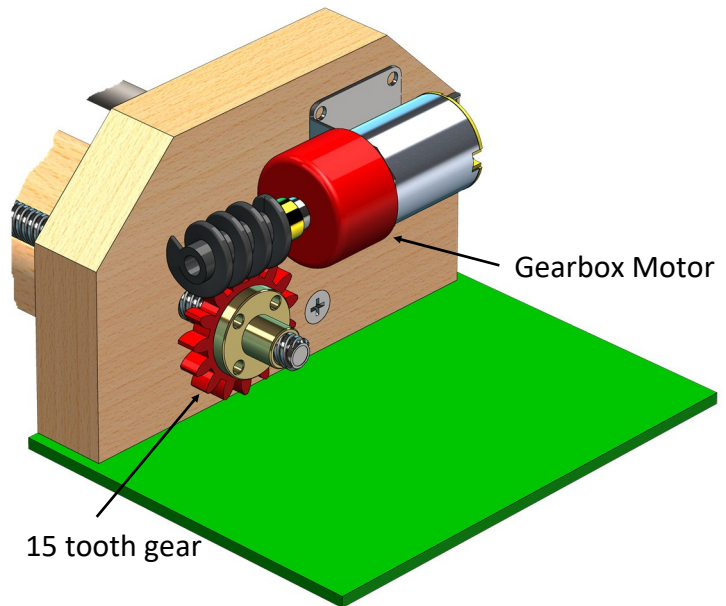
- (c) The dolly movement is produced by a gearbox motor which drives the mechanism shown.

(i) Name this mechanism.

Name: Worm	2✓

(ii) State **one** advantage of using this mechanism on the dolly.

1 x Advantage : 2 mks	2✓
Speed reduction, no slippage,	
locks slider, high VR, compact,	
high torque, 90 degree turn, etc.	



(iii) The output shaft of the gearbox rotates at 450 RPM.
Calculate the rotational speed of the 15 toothed gear.

Calculation:

$$450/15 = 30 \text{ RPM}$$

Reasonable attempt : 1 mark

correct answer : 2 mks

Answer: 30

2✓

(iv) Every rotation of the lead screw moves the slider a distance of 8mm.
Using your answer from the previous question, calculate the linear speed of the slider in millimetres per second.

Calculation:

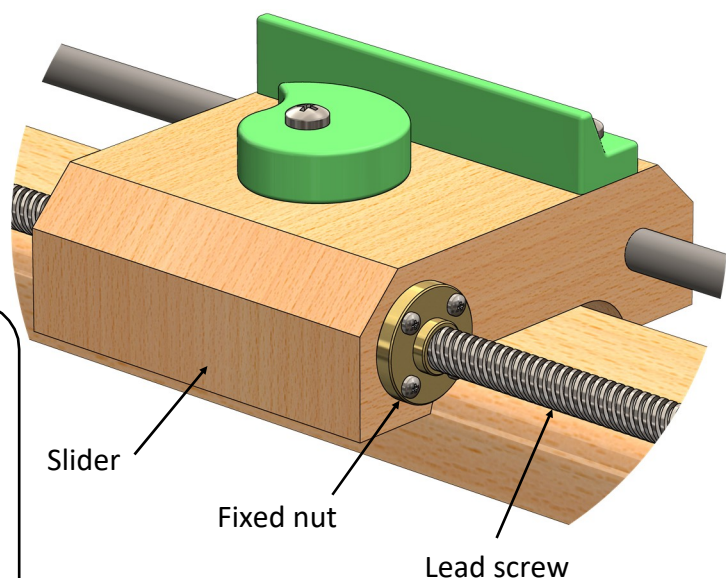
$$30 \times 8 = 240 \text{ mm/minute}$$

$$240/60 = 4 \text{ mm/second}$$

(allow for previous incorrect answer in calculation)

Reasonable attempt : 1 mark

Correct answer : 2 mks

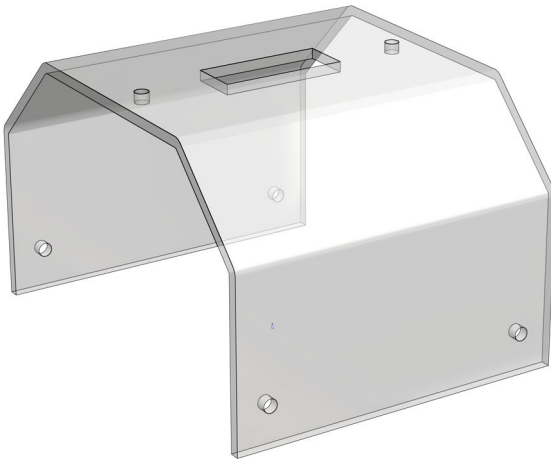


Answer: 4

2✓

- (d) (i) In the space provided draw the development of the housing cover shown in 3D below.

Show the position of all bend lines, holes and the rectangular slot for the slide switch.



- (ii) Name a suitable transparent material for this cover and give a reason for your choice.

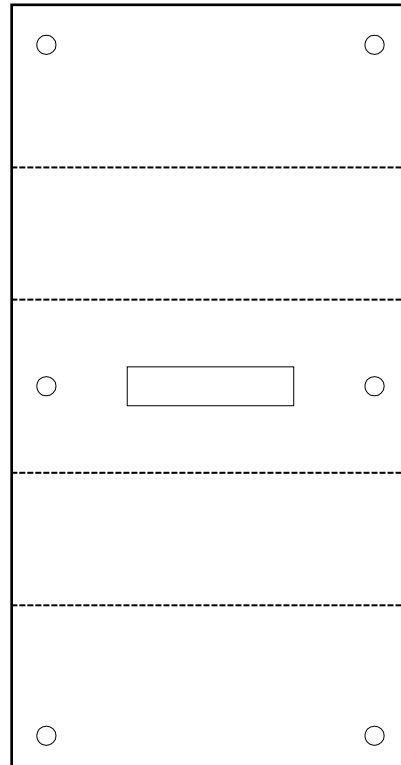
Material named : 2 mks HIPS, ASA, PC
acrylic, perspex, thermoplastic. 2✓
Reason: 2 mks - thermoplastic, 2✓
easy to shape / drill / finish / cut
(Transparent = 0)

Development

5 panels shown 2mk **2✓**

Slot shown correctly 1 mk **1✓**

Holes (min 3) shown correctly 1mk **1✓**



- (iii) Name the machine used to bend this cover and describe the process of making one of the bends.

Machine name: 1 mk Heat bending machine : stripheater, line bender, oven 1✓
Bending Process (2 processes: 2 x 1 mk) 1✓
marking out, heating and bending at marked lines, 1✓
use of former to set bending angles.

- (e) (i) Describe, using the named parts of the slider, how the smart phone is held in place.

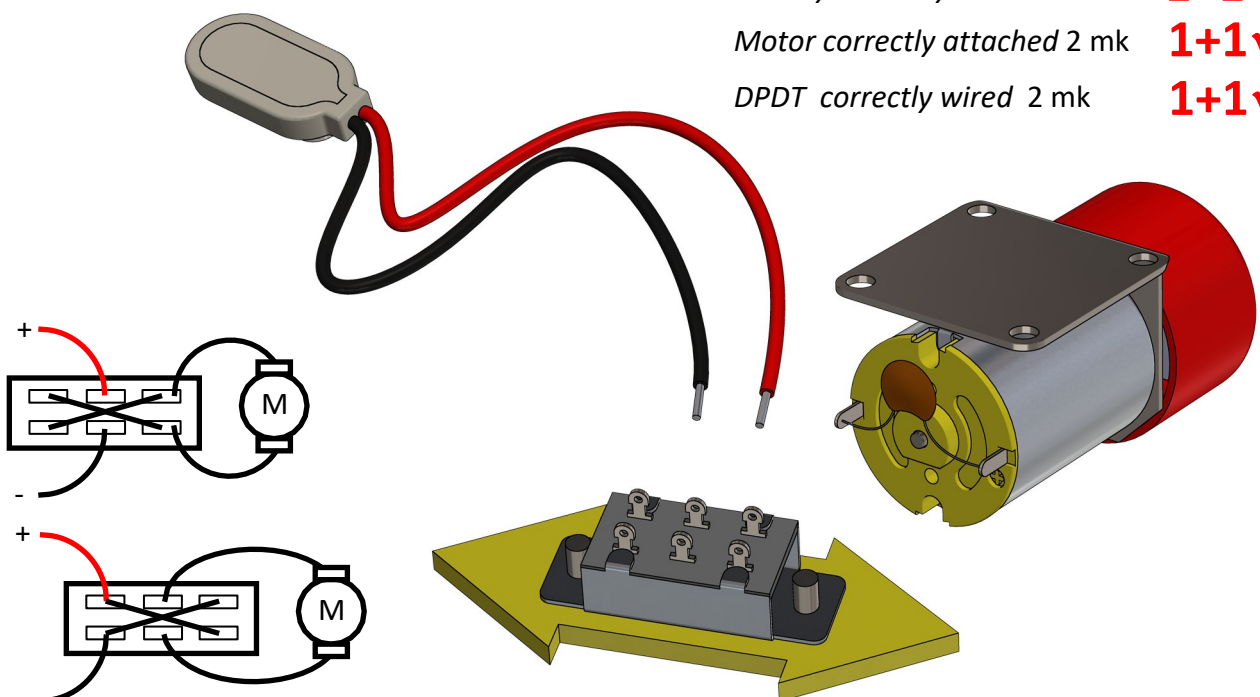
<i>Describe: 2 steps 2 x 1 mk</i>	
Cam rotated away from fence,	1✓
phone placed at fence,	1✓
cam rotated back to clamp phone,	
reference to use of screwdriver.	

- (ii) Name a manufacturing process which could be used to make both the cam and the fence from plastic.

<i>Name of process: 3 D printing</i>	1✓
injection moulding, CNC milling,	



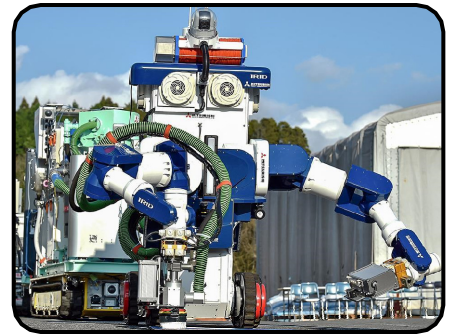
- (iii) The incomplete control circuit for the camera dolly is shown below. The circuit must control forward motion, backward motion and motor-off functions. Complete this circuit by sketching in the connecting wires of the three components.



Battery correctly attached 2 mk 1+1✓
 Motor correctly attached 2 mk 1+1✓
 DPDT correctly wired 2 mk 1+1✓

Question 3

- (a) In 2011, a tsunami (tidal wave) caused severe damage to the Fukushima nuclear power plant in Japan. Since then a number of robotic machines have been used as part of the clean-up operation in the nuclear plant.



- (i) Give **two** reasons why robots are particularly suited to these clean-up operations?

2 x Reason: 2 x 2 mks	2✓
Robots 'unaffected' by radiation / humans could not work in radiation zone,	2✓
Robots could work longer hours than humans,	
Robots more versatile in manipulating obstacles, etc.	

- (ii) Autonomous vehicles are viewed by many as the future of transport. Explain what is meant by the term **autonomous vehicle** and give **one** example.

Autonomous vehicle: 2 mks Self driving vehicles (transport of people / goods)	2✓
(Named vehicle = 0)	
Example : 2 mks self driving cars, planetary exploration - Mars rover, etc	2✓
named vehicle, UGV, warehouse robot, robotic farm machinery, etc	
(lawnmower/vacuum cleaner = 0)	

- (iii) The image shows a robotic exoskeleton that can be used to enable a person with reduced mobility to walk.
Describe **two** other technological devices that make life easier for a person with a disability.

2 x Describe 2 x 2 mks -	
any appropriate assistive technology described	2✓
Mobility aids, hearing aids, computer software / hardware	2✓
Wearable technologies, IoT, voice apps, mobility scooters, etc.	
(Name = 1 mk & enhancement/appropriate function =1 mk)	
(wheelchair with no enhancement =0)	



Robotic exoskeleton

- (iv) Robots are becoming more commonplace in manufacturing industries. Outline **one** positive and **one** negative consequence of this increase in the use of robots.

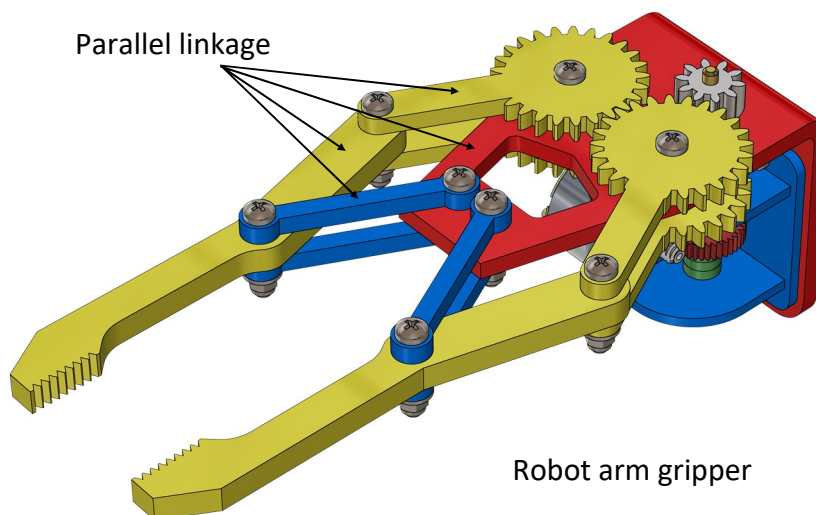
Positive consequence: 2 mks	2✓
Repetitive / dangerous work done by machine, work 24/7 etc.	
Negative consequence: 2 mks	2✓
Loss of work opportunities etc.	



Assembly line robot

- (b) A gripper for a robot arm is shown. The gripper opens and closes mechanically using a parallel linkage mechanism driven by a number of gears.

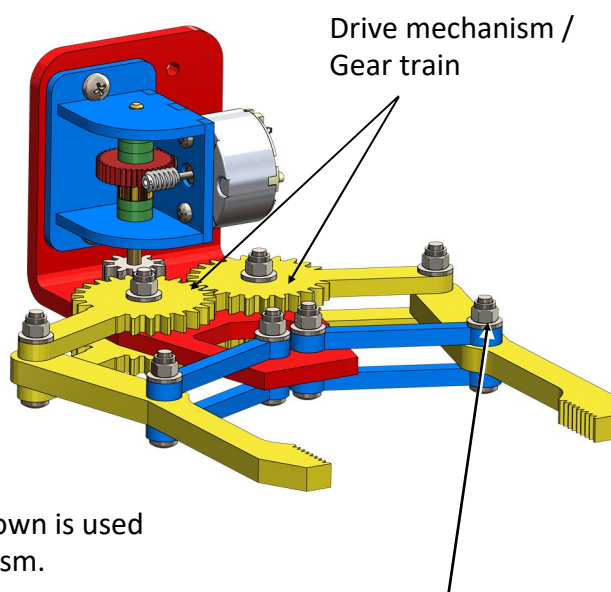
- (i) Name **one** other device or machine that uses a parallel linkage and state its function.



Name: 2 mks hoist, car jack, scissors lift, toolbox, wipers, lazy tongs, etc.	2✓
Function: 2 mks correctly named function linked to example	2✓

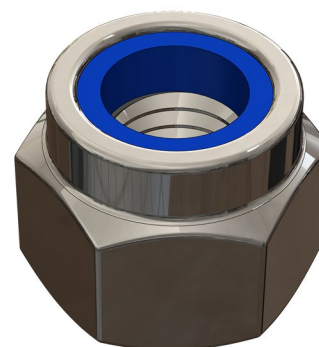
- (ii) The gear train shown was selected as a drive mechanism for the gripper. Give **two** reasons for selecting this type of drive mechanism.

2 x Reason : 2 x 1 mk
Alter speed of output gear, 1✓
alter direction of movement of jaws, 1✓
allow jaws to grip/ open & close easily.



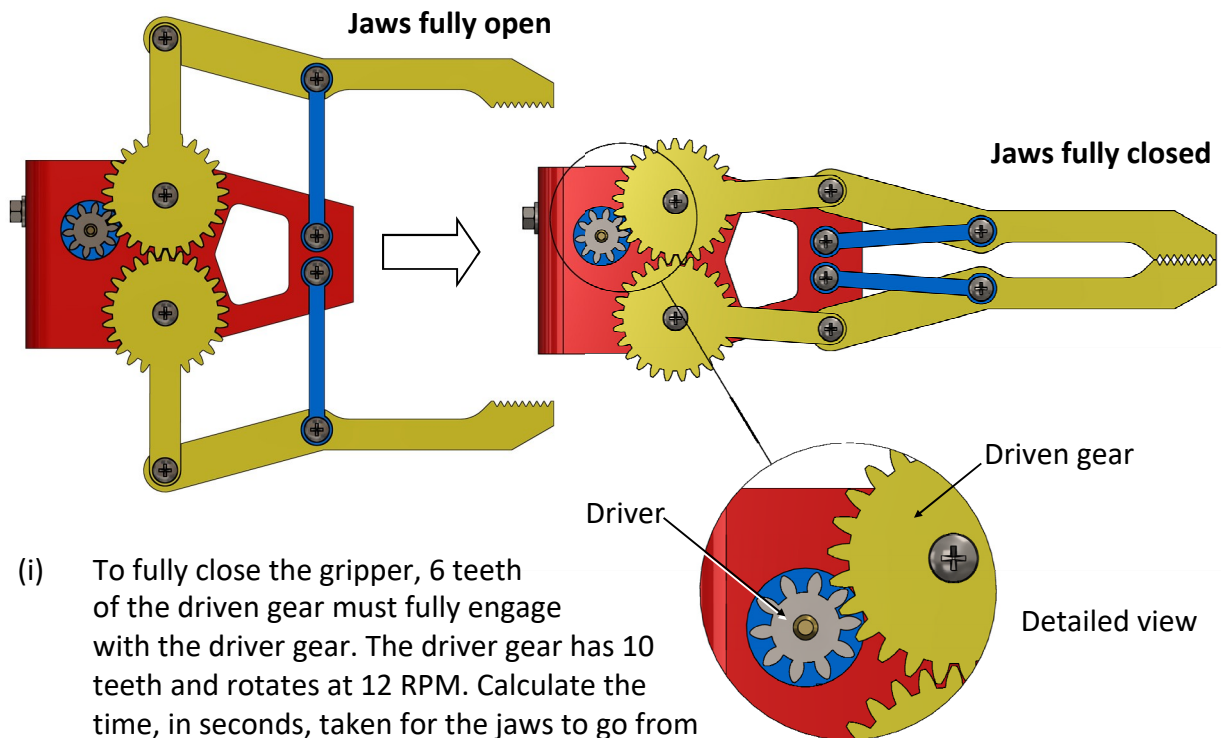
- (iii) The locking nut shown ('nyloc nut') shown is used in the assembly of the gripper mechanism. Give a reason for its use.

1 x Reason: 2 mks Prevent parts becoming loose 2✓
locks nut in place, prevents nut turning.



Enlarged view of locking

(c)



- (i) To fully close the gripper, 6 teeth of the driven gear must fully engage with the driver gear. The driver gear has 10 teeth and rotates at 12 RPM. Calculate the time, in seconds, taken for the jaws to go from the fully open to the fully closed position.

Calculation:

$$\begin{aligned}
 12 \text{ RPM} &= 12 \times 10 \text{ teeth rotate in 60 sec} \\
 &= 120 \text{ T in 60 sec} \\
 &= 1 \text{ T in } 60/120 \text{ sec} \\
 &= 6 \text{ T in } (6 \times 60)/120 \\
 &= 3 \text{ sec}
 \end{aligned}$$

Reasonable attempt : 1 mark

Correct answer : 2 mks

Answer: 3

2✓

- (ii) A drilling machine (bench drill) is used when manufacturing the gripper arms. State **two** safety precautions which should be observed when using a drilling machine.

Safety Precautions: 2 x 2 mks clamping piece, supporting piece (wood),	2✓
safety goggles, no loose cloths / tie back hair, etc.	2✓



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Cycle Examination 2023

Applied Technology

Coursework Briefs

Common Level

To be completed by 28 April 2023

220 marks

Instructions to candidates

1. Select **one** brief from the three options provided.
2. Your completed coursework submitted for assessment must consist of **two** items:
 - an **Artefact** *and*
 - a **My Design Journey** folio.
3. Please familiarise yourself with the adjusted assessment arrangements for candidates taking the state examinations in the 2022/23 school year, that were issued by the Department of Education. As a result of these adjustments only three of the six headings in your My Design Journey folio must be presented in 2023. The other three headings are not examinable and will not have marks allocated to them.
Therefore, candidates are only required to complete the following **three** headings in 2023:

- **My Preferred Design & justification**
- **Manufacturing sequence**
- **Evaluation & Reflection on learning.**

As a result of these changes, the total mark allocation for this coursework in 2023 is 220 marks, instead of the usual 280 mark total. However, the relative weighting between the Coursework (70%) and the written paper (30%) will be retained. This will be achieved by reweighting the coursework before it is combined with the mark for the written component.

4. Your Design Journey folio should consist of a maximum of **10** single-sided A4 pages in total. Your folio can be presented in A4, A3, or a combination of both formats. Each A3 page presented equals two A4 pages.
5. Coursework should demonstrate an appropriate range of skills, processes, and techniques.
6. Where specialised processes (CAD, CAM, control technology etc.) are used, these should be supported in your Design Journey folio by the inclusion of drawings/flowcharts/program code and/or descriptions/photographs as appropriate.
7. Primary research should be included where appropriate.
8. When using secondary research sources, including the Internet, the sources must be acknowledged. Research material copied directly from the Internet or from other sources and presented as your own work will not receive any marks.
9. Your **Examination Number** must be written clearly on both your completed artefact and on your Design Journey folio.
10. The completed coursework, artefact and folio, must be available for assessment by **28 April 2023**.

Authentication of coursework:

1. The coursework submitted for assessment must be **your own individual work** and must be completed in school under the supervision of the class teacher.
2. Your artefact must not be removed from the school under any circumstances as doing so may result in the coursework being considered invalid.
3. It is your responsibility, as the candidate, to comply with these requirements. If you fail to comply with these requirements, your teacher will not be able to validate, and sign off, on your coursework and you will not receive any marks for it.

Note:

- *The circumstances in which the Minister for Education may withhold marks from candidates are set out in the “Rules and Programme for Secondary Schools”.*
- *Anyone who helps a candidate to break examination rules can be prosecuted under the Education Act 1998.*

Coursework Briefs 2023

Select **one** of the following briefs.

1. **The excessive use of large delivery vehicles diminishes air quality, causes traffic congestion and noise pollution in many of our urban areas.**

Design and make a working model of a battery powered 'Electric Cargo Trike'.

The cargo trike should include forward, reverse, left and right control (manual steering may be used). The trike should include a suitable cargo space for goods.

Your solution should incorporate a control system of your choice and should be aesthetically pleasing.

2. **A toy can be a source of entertainment, learning, and development for children. Electro-mechanical toys are popular with children of all ages. These toys often feature secondary motion mechanisms.**

Design and make an electro-mechanical child's toy. The toy should include at least **one** of the following secondary motion mechanisms: a crank and slider, a treadle linkage, a quick return mechanism, or a rack and pinion.

Your solution should incorporate a control system of your choice and should be aesthetically pleasing.

3. **Water sports are a popular source of exercise and entertainment. However, awareness of safety is very important for all water-based activities.**

Design and make a working model of an animated display which highlights an aspect of safety to participants in a water sport of your choice.

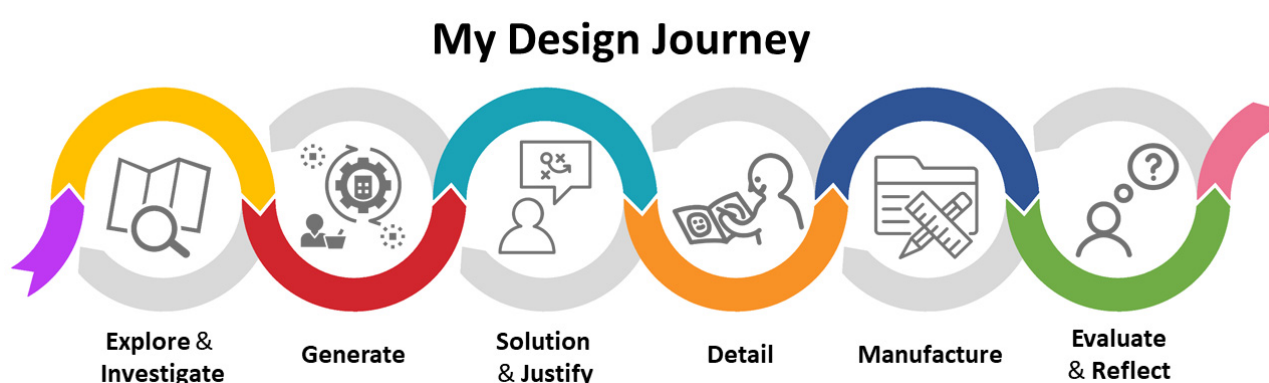
Your solution should incorporate a control system of your choice and should be aesthetically pleasing.

Information for candidates

Your Design Journey

The graphic below shows a design process which you could follow in the design and realisation of your Applied Technology coursework. This graphic maps your journey through a sequence of engagements with the coursework folio and artefact. On completion of this journey, you should have a completed folio and artefact and will have gained knowledge, skills and experience through undertaking the process.

As outlined earlier, only three headings of the design journey are examinable in 2023.



Allocation of Marks

The completed coursework will be assessed using the following mark allocations:

- My Design Journey folio 60 marks
- Artefact 160 marks

Note: For 2023, the total marks for the coursework will be 220 marks instead of 280 marks.

The 70% coursework weighting (280 marks) will be retained by re-weighting the coursework mark before it is added to the written mark.

Storage of Coursework

On completion of the coursework, school authorities should ensure that the finished artefact and Design Journey folio are kept in a secure place until the examining process (including appeals) has concluded.

Outline marking scheme

An outline of the headings that will be used to assess your completed coursework is given below. While the general mark allocations will largely remain the same, assumptions about future mark breakdowns should be avoided.

My Design Journey - Folder			
Phases of Design Journey	Description	Suggested pages	Marks
Phase 1 Exploration and Investigation of Brief	<i>Not examinable for 2023</i>		
Phase 2 Generation of Ideas	<i>Not examinable for 2023</i>		
Phase 3 My Preferred Solution and Justification	Presentation of your preferred design solution.	2 – 3	20
	Outline and justify the design decisions made to arrive at your preferred solution.		
Phase 4 Details for Manufacture	<i>Not examinable for 2023</i>		
Phase 5 Manufacturing Sequence	Detailed record of all manufacturing processes and the sequence used to complete the artefact (include photos if appropriate). Details of any modifications made during the manufacturing and assembly processes and reasons for such changes (if and where relevant).	3 – 4	25
Phase 6 Evaluation & Reflection on learning	Discuss the successes, challenges, the skills, learning and experiences gained through completing your coursework.	1 - 3	15
Artefact			
Artefact satisfies brief	The requirements of the chosen brief are fulfilled by the artefact presented.		20
Creativity and Inventiveness	Expression of creativity and inventiveness in the solution developed and the artefact presented.		20
Functionality	Do all elements of the artefact function as planned in the Design Journey folio?		20
Appropriate use of materials, processes, components, and techniques	Materials, processes, components and techniques used which are appropriate to their purpose and function. Limited use of commercial components.		20
Production skills and processes	Processing of materials showing a range and depth of appropriate and varied skills with due regard to health and safety.		35
Assembly	How well the artefact is assembled using appropriate methods.		25
Detailed finish and overall presentation	High quality finish, well presented with all parts well integrated and labelled where appropriate.		20
Overall Coursework Total in 2023			220

