



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Cycle Final Examination 2026

Engineering

Common Level

Friday 12 June Afternoon 1:30 - 3:00

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.

Questions do not necessarily carry equal marks.

Write your answers in blue or black pen. You may use pencil and colouring pencils for sketches and diagrams 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.

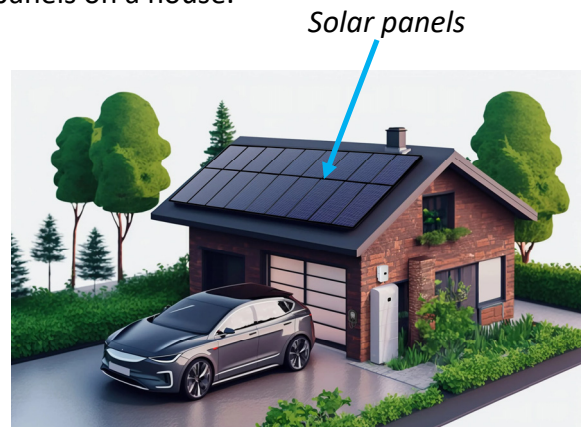
This examination booklet will be scanned and your work will be presented to an examiner on screen. Anything that you write outside of the answer areas may not be seen by the examiner.

Question 1

- (a) Solar panels are commonly installed on modern houses.
 (i) Explain two advantages of installing solar panels on a house.

Advantage 1:

Advantage 2:



House with solar panels installed

- (ii) State one other example of where solar panels may be installed.

Example:

- (b) Wristbands are wearable fashion accessories.

- (i) Circle the most suitable material for the manufacture of the wristbands shown.

Silicone	Acrylic	Bakelite
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- (ii) Name one property of the selected wristband material.

Property:



Wearable wristbands

- (iii) Describe one environmentally friendly method for the disposal of waste plastic.

Description:



- (c) (i) The frame of the electric scooter shown is manufactured from anodised aluminium. Explain why aluminium is a suitable material for the manufacture of the scooter frame.

Explanation:

- (ii) State one reason for anodising aluminium.

Reason:



- (iii) The handlebars on the electric scooter can be adjusted. Name the tool shown, used to adjust the electric scooter handlebars.

Name:



- (iv) Explain one benefit of using this tool to tighten or loosen bolts.

Benefit:



Adjustment of handlebars on electric scooter

- (d) (i) Smart technology mouthguards have been introduced in rugby to help detect concussion injuries.

Explain the meaning of the term '*Smart Technology*'.

Explanation:



- (ii) Give two other applications of smart technology.

Application 1:
Application 2:



- (e) (i) Circle the most suitable drill size for tapping the M5 hole on the drilled metal plate shown.

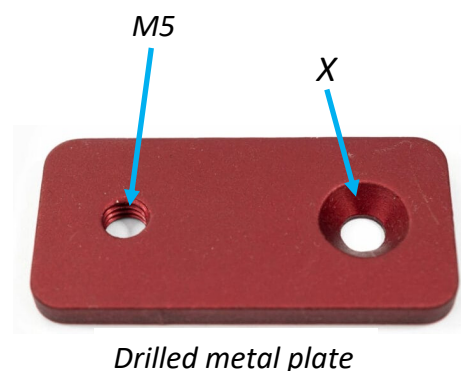
2.0 mm	5.0 mm	6.5 mm	4.2 mm
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- (ii) Name the type of hole marked X.

Name:

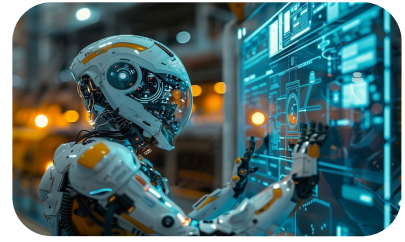
- (iii) Identify one safety precaution to be observed when drilling a metal plate.

Safety precaution:



Question 2

Robotics is the intersection of science, engineering and technology to produce machines to substitute human actions.



- (a) (i) State two applications of robotic technology.

Application 1:

Application 2:

- (ii) Outline one disadvantage of robotic technology.

Disadvantage:



Robotic arm

- (b) Explain why servo motors are suitable for use in robotic technology.

Explanation:



- (c) (i) Drive module controller units can be used to control servo motors.
Name component X shown on the drive module controller.

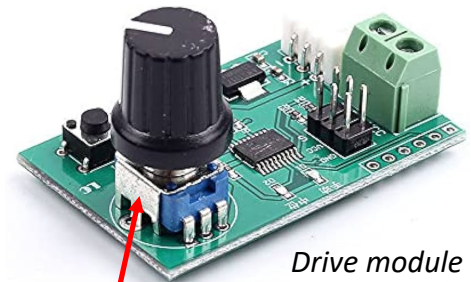
Name:

- (ii) Give one other application of component X.

Application:

- (iii) Draw the electronic symbol used to represent component X.

Symbol:



Drive module controller

Component X

- (d) Artificial Intelligence (AI) is enhancing the capabilities of robots, making them more efficient and versatile.

- (i) State one other application of Artificial Intelligence (AI).

Application:

- (ii) Outline two risks or disadvantages associated with the use of Artificial Intelligence (AI).

Risk/disadvantage 1:

Risk/disadvantage 2:



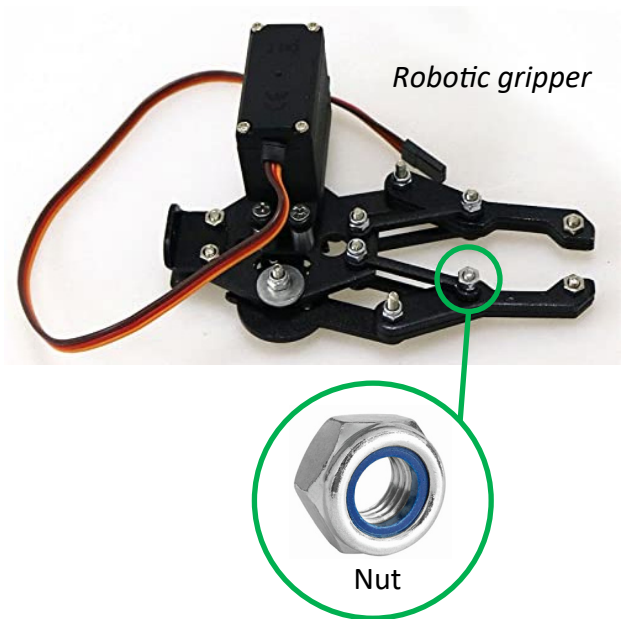
AI robotics

- (e) (i) Name the type of nut shown, used in the assembly of the robotic gripper.

Name:

- (ii) Explain why this nut is suitable for the assembly of a robotic gripper.

Explanation:



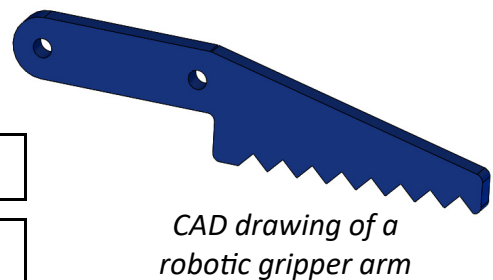
- (iii) The drawing of the robotic gripper arm shown below was produced using CAD. Explain the meaning of the term CAD.

C _____ A _____ D _____

- (iv) Name two suitable computer aided manufacturing (CAM) processes to manufacture the gripper arm shown.

Process 1:

Process 2:



- (v) In the space provided, draw a rendered sketch of the robotic gripper arm.

Rendered Sketch:

- (f) (i) Select the name of the drive mechanism shown.

Drive mechanism	Selection (tick one)
Bevel Gears	
Simple Gear Train	
Compound Gear Train	

- (ii) Explain the function of gear B in the drive mechanism.

Function:

- (iii) If gear A rotates clockwise, in which direction does gear C rotate?

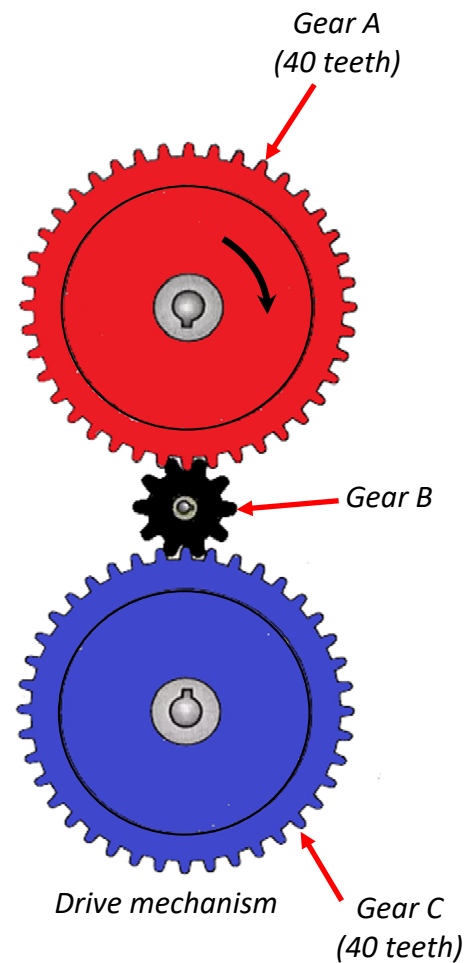
Direction:

- (iv) If gear A rotates at a speed of 100 RPM, select the correct speed of gear C.

Rotation speed	Selection (tick one)
1000 RPM	
10 RPM	
100 RPM	

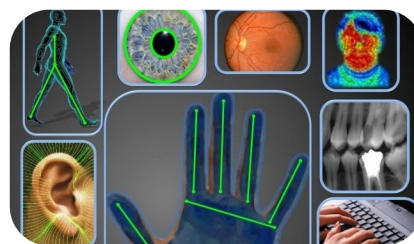
- (v) Explain the purpose of the keyway on the gear shown.

Explanation:



Question 3

Advances in engineering and biometric (body characteristic measurement) technology have improved personal and property security systems.



- (a) The following four terms are associated with security and safety systems:

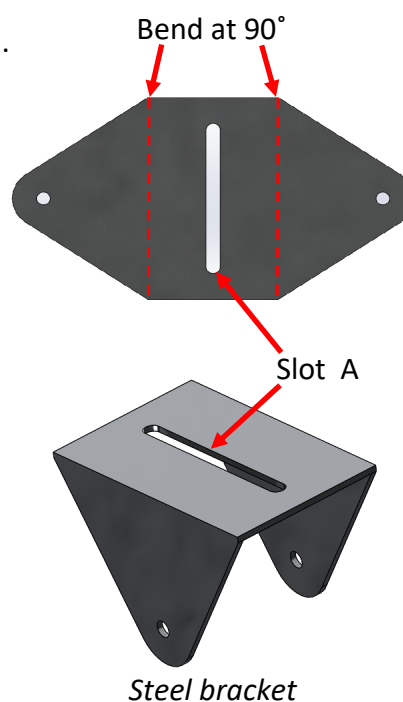
LED	Sensor	Visual Display Unit	SD Card
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Complete the table below by inserting the most suitable term, from the list above, next to the description of the term.

Term	Description
	A device that detects and responds to some type of input from the physical environment.
	A removable memory device used to store and transfer digital data.
	A semiconductor device that emits light when current flows through it.
	A device with a screen that displays and represents information in visual form.

- (b) (i) A steel bracket to mount a security camera is shown. Outline three steps required to manufacture slot A in this bracket.

Step 1:
Step 2:
Step 3:



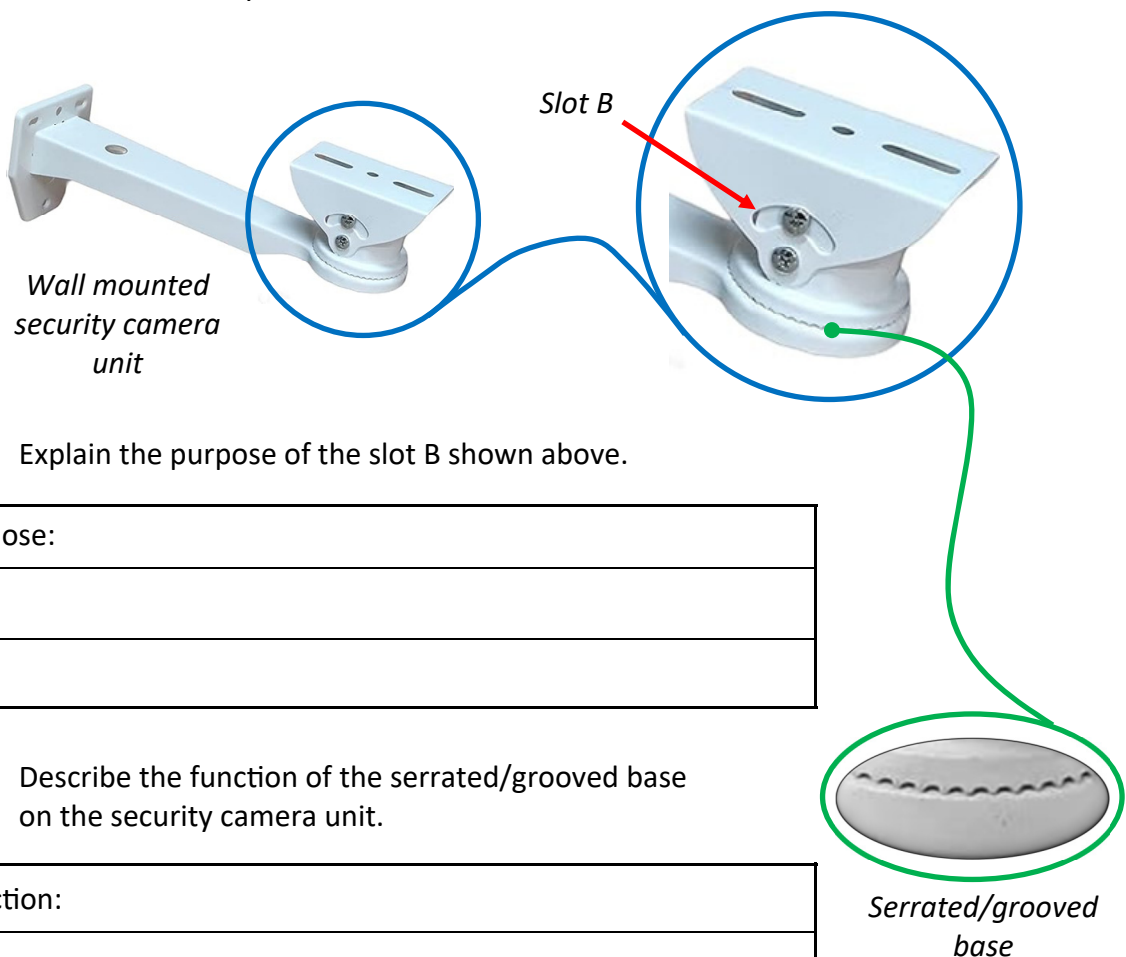
(ii) Describe how the steel bracket is bent to shape.

Description:

(iii) State a suitable finish for the steel bracket.

Finish:

(c) A wall mounted security camera unit is shown below.



(i) Explain the purpose of the slot B shown above.

Purpose:

(ii) Describe the function of the serrated/grooved base on the security camera unit.

Function:

- (d) The security safe shown is opened using biometric authentication to activate a digital logic gate. The safe door will only open when both facial and fingerprint recognition technology can identify the safe user.

The following information is relevant to open the safe.

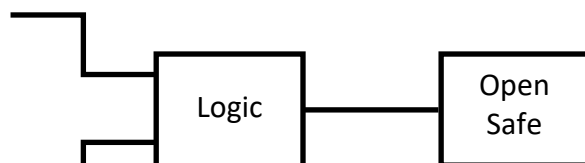
Input 1

Fingerprint recognition



Input 2

Facial recognition



Fingerprint
recognition

Facial
recognition

- (i) Name the logic gate used to open the safe shown above.

Name:

- (ii) Draw the logic symbol for the named logic gate.

Logic gate symbol

- (e) (i) State one advantage of using biometric authentication in home security systems.

Advantage:

- (ii) Name one other type of biometric authentication.

Name:

- (iii) Explain why biometric technology is used in travel passports.

Explanation:



Biometric authentication

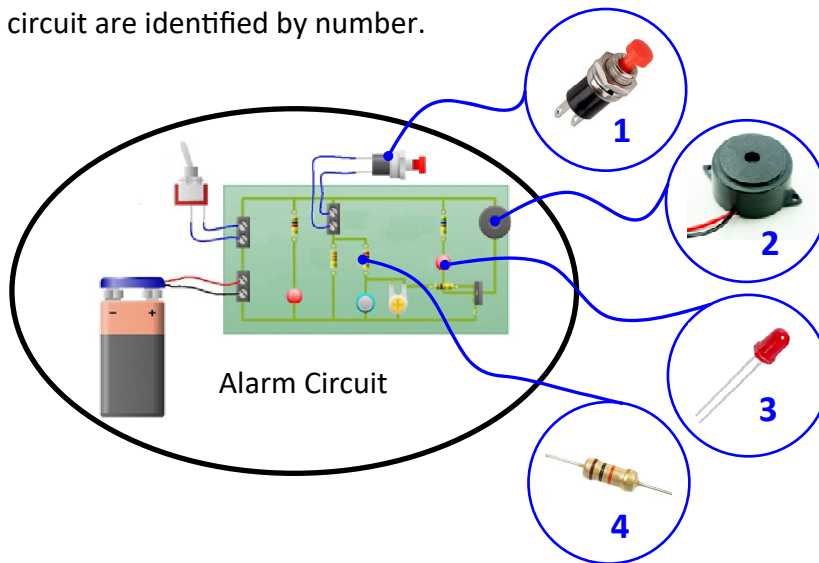


Biometric passport



Biometric symbol

- (f) A simple security alarm circuit is shown. Four electronic components used to build the circuit are identified by number.



Match each of the numbered electronic components to the correct electronic symbol shown below.



- (g) (i) Outline one security risk to personal information or personal data associated with online activity.

Risk:

- (ii) Explain two steps that can be taken to protect personal information and personal data online.

Step 1:

Step 2:

Question 4

The engineering design process plays an important role in development the design, safety features, and ergonomics of All Terrain Vehicles (ATVs) and their accessories.



- (a) (i) Identify two safety features incorporated in the design of ATVs.

Safety feature 1:

Safety feature 2:

- (ii) The design process involves a number of different stages to create a vehicle such as an ATV.

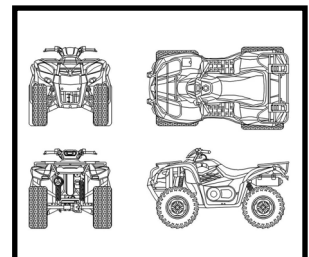
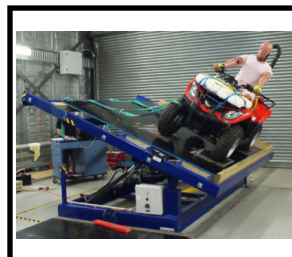
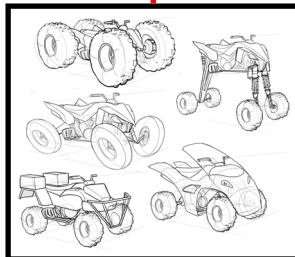
Match the stages of the design process with the appropriate image below.
The first match is completed for you.

Brainstorming

Manufacturing

Working Drawings

Testing



- (iii) Explain the purpose of 'testing' in the design process.

Purpose:



Testing an ATV

- (b) (i) Many ATVs have storage racks, made from tubular steel, fitted at the rear of the vehicle.

Name a suitable method used to join tubular steel.

Name:



- (ii) The metal bushing shown, used in attaching the storage rack to an ATV, is machined on a centre lathe.

List three lathe processes used to make the metal bushing shown.

Lathe process 1:

Lathe process 2:

Lathe process 3:



Metal bushing

- (iii) Operating features of ATVs may be classified as input or output devices.

Use a circle to classify as input or output each of the ATV operating features.

ATV operating feature	Circle (one option in each row)	
Front headlight	Input	Output
Push-button ignition	Input	Output
Anti-theft alarm	Input	Output

- (c) (i) Name the drive mechanism shown opposite which is used in an ATV.

Name:

- (ii) State two methods of lubricating the drive mechanism.

Method 1:

Method 2:



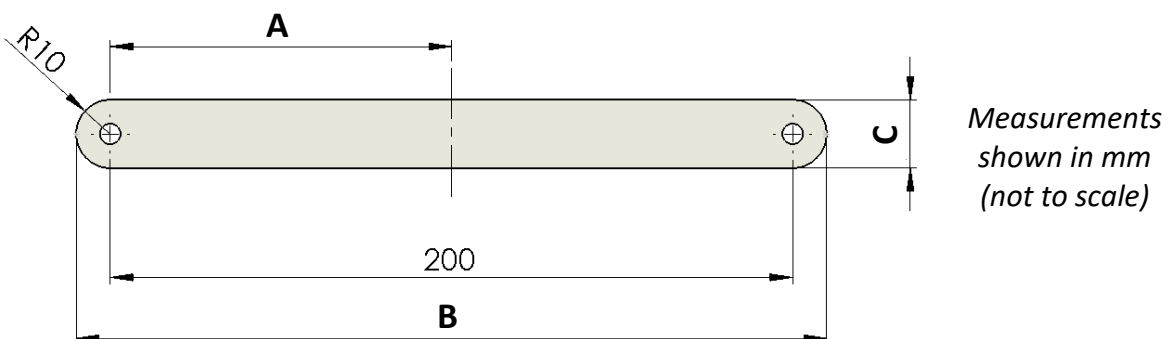
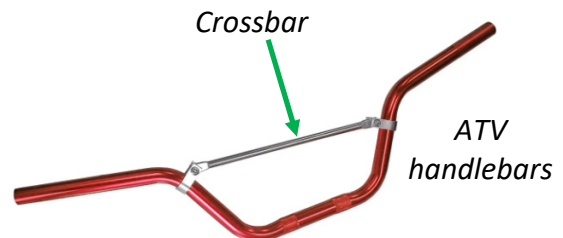
(iii) Identify two environmental impacts caused by the incorrect disposal of lubricants.

Impact 1:

Impact 2:

(d) A crossbar can be used to strengthen the handlebars of an ATV.

A dimensioned working drawing for an ATV crossbar, to be manufactured from mild steel, is shown below.



(i) Insert, in the table below, the correct measurement for dimension **A**, dimension **B**, and dimension **C** shown above.

Dimension identification	Measurement (<i>mm</i>)
Dimension A	
Dimension B	
Dimension C	

(ii) List three steps used to make the crossbar shown above in the engineering room.

Step 1:

Step 2:

Step 3:

- (e) Personal safety equipment such as a helmet, gloves, and eye goggles are vital for rider safety when operating an All Terrain Vehicle.

- (i) Design, using a rendered sketch, a storage unit for ATV personal safety equipment.

The storage unit should include:

- A method to hang a helmet
- An area to hold goggles and gloves.



*ATV personal
safety equipment*

Rendered sketch of storage unit

- (ii) Ergonomics is an important consideration in the design process.
Explain the meaning of the term '*ergonomics*'.

Explanation:

Acknowledgments

Question 1 images (Accessed: June 2024)

<https://pvgeneration.ie/wp-content/uploads/2024/01/Pv-Gen-Solar-PV-Ireland.jpg>
https://wristbandsupply.com/cdn/shop/products/SILICONE_GROUPED_WRISTBANDS_grande.jpg?v=1542237668
<https://sites.nicholas.duke.edu/stapletonlab/files/2023/09/Step-3-1024x910.jpg>
<https://www.aosom.ie/item/homcom-folding-kids-electric-scooter-7-14-adjustable-height-battery-power-pu-wheels~AA1-056V02RD.html>
<https://i.ebayimg.com/images/g/LhoAAOSwHk5iCxdU/s-l1200.jpg>
<https://i.ebayimg.com/images/g/e5sAAOSwJeJkYdvo/s-l1200.jpg>
<https://i.ebayimg.com/images/g/5YQAAOSwHnFV2h~2/s-l1200.jpg>
https://www.cahill.ie/images/products/Z/Zo/Zoom_scooter_electric4.jpg?width=1920&format=webp
<https://i.ebayimg.com/images/g/EzoAAOSwANFiuhhw/s-l1600.jpg>
https://www.reddit.com/r/rugbyunion/comments/vy5ncw/smart_mouthguards_to_be_used_at_world_cup
<https://x.com/preventbio/status/>
<https://sendcutsend.com/blog/tapping-laser-cut-holes-and-designing-for-countersinking>

Question 2 images (Accessed: June 2024)

<https://www.collegetransitions.com/blog/best-robotics-colleges/>
<https://ca.robotshop.com/products/wlkata-6-axis-mini-robotic-arm-mirobot-education-kit>
<https://makerselectronics.com/product/servo-motor-half-metal-gear-mg995-towerpro-continuous-rotation>
<https://www.amazon.com/Module-Controller-Debugger-Celsius-Control/dp/B09GCFY954>
<https://www.coolest-gadgets.com/ai-in-robotics-statistics/>
<https://m.media-amazon.com/images/I/41VCMqcQ7vL.jpg>
<https://media.prod.bunnings.com.au/api/public/content/046c05caefdb4085a77b2671872084da?v=1a2a5391>
<https://www.iqsdirectory.com/articles/gearbox/gear-drive/function-of-an-idler-gear.jpg>
<https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.shutterstock.com>

Question 3 images (Accessed: June 2024)

https://media.licdn.com/dms/image/C4D12AQFTWK42ju1ReA/article-cover_image_shrink
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https://m.media-amazon.com/images/I/61b2m++z+yL._AC_UF894,1000_QL80_.jpg
<https://www.biotime-biometrics.com/wp-content/uploads/2021/05/28-589x321.png.webp>
<https://www.passport.gov.gr/media/images/articles/chipsign.jpggh>
https://secromix.com/wp-content/uploads/2024/03/SecroMix_Biometric_Authentication.png
<http://www.buildcircuit.com/wp-content/uploads/2012/07/sensor-alarm2-300x192.jpg>

Question 4 images (Accessed: June 2024)

https://clipart-library.com/new_gallery/80-808036_atv-png.png
https://freecadblock.com/wp-content/uploads/2019/12/QUAD_drawings_dwg_autocad.jpg
https://powersportsbusiness.com/wp-content/uploads/2024/06/Suzuki-KingQuad_ATV-Assembly-psb.jpg
<https://cdna.artstation.com/p/assets/images/images/050/880/884/large/jaume-guardiola-salvatella-vehicle-deformation-exercise-3.jpg?1655911914>
<https://www.researchgate.net/publication/259184742/figure/fig10/AS:297239428780035@1447878810177/ATV-tilt-table-static-stability-test-being-carried-out-at-Crashlab-UNSW-TARS-project.png>
[https://minibikes.store/image/cache/catalog/produkty2/torino1000w48v-new/Torino-1000w-48v-electric-quad-mini-atv-for-kids-pocket-nitro-motors%20\(3\)-400x306w.jpg](https://minibikes.store/image/cache/catalog/produkty2/torino1000w48v-new/Torino-1000w-48v-electric-quad-mini-atv-for-kids-pocket-nitro-motors%20(3)-400x306w.jpg)
<https://www.outdoorlife.com/wp-content/uploads/2019/01/23/TK6NZCFDYEKWCJJZUKANBYNSTI.jpg>
<https://cpimg.tistatic.com/01158279/b/4/Motorcycle-Chain-Sprocket-kit.jpg>
<https://ae01.alicdn.com/kf/Se1af833a47c748c69b8cb215050b83a5X/Mid-Handlebars-Handle-Bars-22MM-7-8-Gold-Blue-Green-Red-Black-Fit-For-ATV-Pit.jpg>
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Junior Cycle Final Examination – Common Level

Engineering

Friday 12 June

Afternoon 1:30 - 3:00