



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Cycle Final Examination 2024

Engineering

Common Level

Friday 14 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 this 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) Bronze is an alloy commonly used to make trophies.

(i) Explain the term *alloy*.

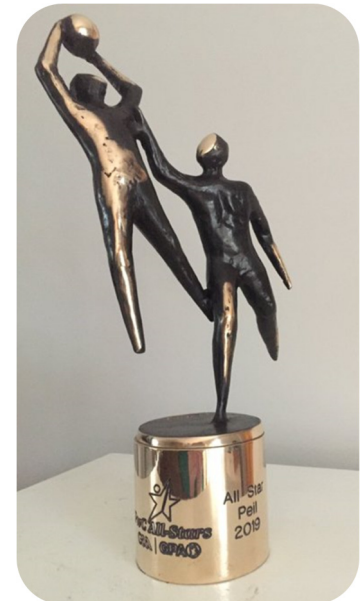
Explanation:

(ii) Name two metals present in the alloy bronze.

Metal 1:
Metal 2:

(iii) State one other application of bronze.

Application:



All-Star Award Trophy

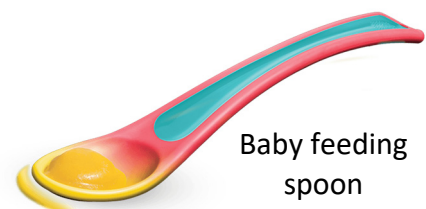
(b) The baby feeding spoons shown are made from a thermochromic smart material, which changes colour when hot.

(i) State one reason why thermochromic materials are suitable for the manufacture of baby feeding spoons.

Reason:

(ii) Suggest one other application for thermochromic smart materials.

Application:



Baby feeding spoon

- (c) (i) The *Fitbit Smart Watch* has changed the way we think about fitness. Outline two advantages for its use.

Advantage 1:
Advantage 2:

Fitbit Smart Watch



Silicone Infinity Band

- (ii) The *Fitbit* strap, called an *Infinity Band*, is made from a plastic called silicone. State one reason why silicone is a suitable material for the infinity band.

Reason:

- (d) (i) Self-Driving cars depend on autonomous technology. Explain the meaning of the word *autonomous*.

Explanation:



The Cruise Autonomous Car

- (ii) Identify two possible disadvantages associated with autonomous vehicles.

Disadvantage 1:
Disadvantage 2:

- (e) (i) An adjustable mobile phone holder is shown. Name a suitable material to make *Part X* and give a reason for your choice.

Material:
Reason:

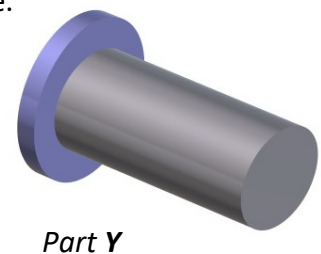


- (ii) Describe how you would bend *Part X* to shape.

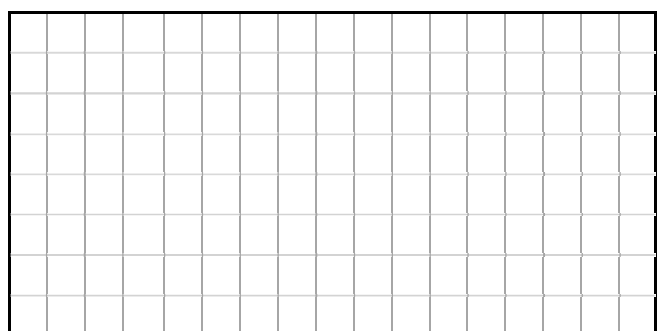
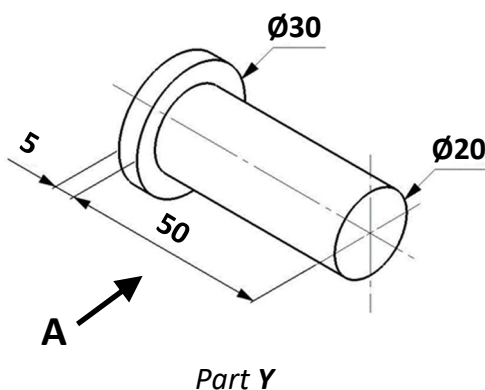
Description:

- (iii) List three steps involved in machining *Part Y* on a centre lathe.

1:
2:
3:



- (iv) In the grid provided draw an elevation of *Part Y* when viewed from arrow 'A'.



Note: Each grid square represents 5mm.

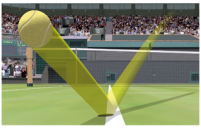
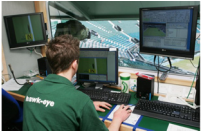
Question 2



Engineering has been instrumental in progressing the standards achieved within sports and plays a crucial role in assisting in the fairest outcome of sporting results.

- (a) Hawk-Eye was introduced in tennis to track the trajectory of a tennis ball by using cameras to triangulate the ball position. The system is made up of three main components listed in the table below.

Identify the components as either input, process or output.

Component		Answer:
Hawk-Eye camera		
Viewing screen		
Triangulation metric software		

- (b) (i) Name the mechanism shown opposite used to tension the tennis net.

Name:

- (ii) Explain how this mechanism is used to tension a tennis net.

Explanation:

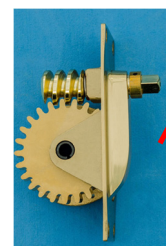
- (iii) Identify one other application of this mechanism.

Application:

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Tennis Net

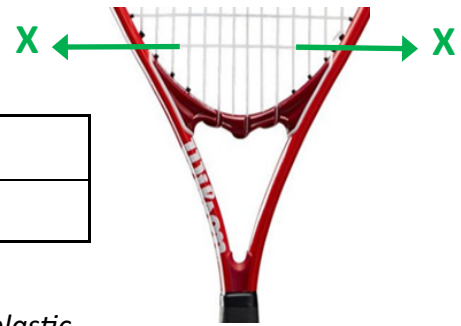


Mechanism

- (c) (i) Tennis racket strings are made from nylon. Identify the force acting on the string at X.

Force:

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- (ii) Nylon is a thermoplastic. Explain the term *thermoplastic*.

Explanation:



Wilson Pro Staff Precision
Tennis Racket

- (iii) Identify two other applications of Nylon.

Application 1:

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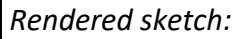
Application 2:

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- (iv) Explain one reason for using a thermoplastic over a thermosetting plastic.

Explanation:

- hold a single tennis racket
- have a place to store a water bottle
- hold three tennis balls.



- Material(s) used:

Material(s) used:

- Finish applied:

Finish applied:	

Question 3



With the help of Engineering over the past century, cars have been transformed in terms of appearance, materials and drive systems.

- (a) (i) Identify two differences between the design features of the Lotus Evija compared to the Ford Model T.

Difference 1:
Difference 2:



Ford Model T

- (ii) Identify two safety features in modern cars.

1:
2:

- (iii) Select one material which is suitable for use in the manufacture of the Lotus Evija and give a reason for your choice.

Material:
Reason:



Lotus Evija electric hypercar

- (iv) Describe the environmental impact of each of the cars shown above.

Ford Model T:
Lotus Evija:

(b) Prior to the introduction of electric vehicles, society depended on the internal combustion engine.

(i) Give one application of a four stroke engine.

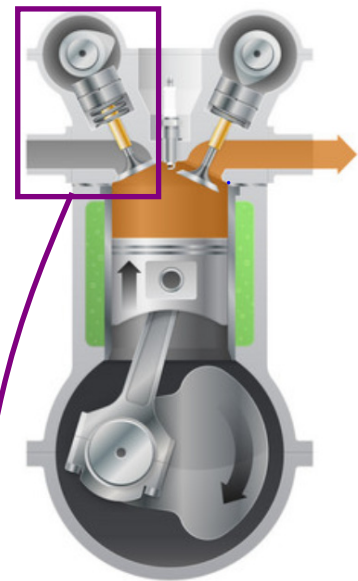
Application:

(ii) Name the engine stroke shown opposite.

Stroke:

(iii) Explain how a four stroke engine is lubricated.

Explanation:



Four stroke engine



Mechanism A

(iv) Describe the operation of mechanism **A**, shown above, in the engine.

Description:

- (c) A dash cam may be placed in a car to monitor car journeys.
- (i) Complete a rendered sketch of the HD dash cam shown.



HD dash cam

Rendered Sketch:

- (ii) Explain the term *HD*.

Explanation:

- (iii) Describe a method of securing a dash cam in a car.

Description:

(d)



Car Ignition



Windscreen wiper switch

A car windscreen wiper system shown opposite, has three inputs:

- Input A - Car Ignition
- Input B - Wiper Switch
- Input C - Rain Sensor.

Once the *Car Ignition* is turned on, either of the other two inputs can activate the wiper system.



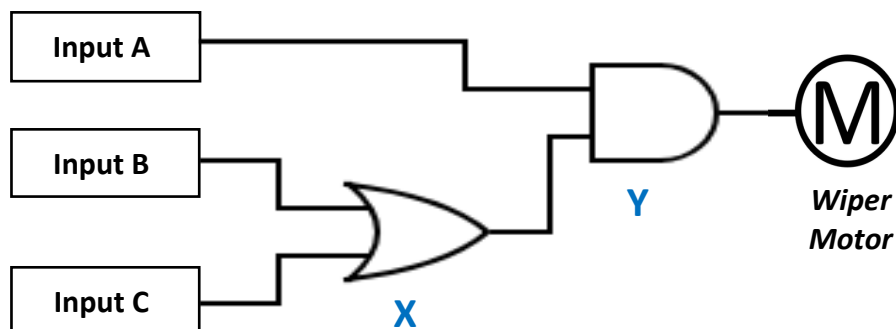
Rain Sensor

(i) Identify the logic gates at **X** and **Y** below:

Logic Gate at **X**:

Logic Gate at **Y**:

(ii) Complete the truth table below for the logic gates shown at **X** and **Y**.



Input A



Input B



Input C

Input A	Input B	Input C	Output
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1			
1			
1			
1			

Question 4

Engineers can help to tackle climate change, manage the environment and create a more sustainable way of living.



(a) Many types of renewable energies and technologies have been promoted in Ireland in recent years.

(i) Match the following renewable technologies with the corresponding energy conversion:

- 1) Wind Turbines
- 2) Battery operated devices
- 3) Solar Panels.

Energy Conversion	Renewable Technology
Kinetic Energy to Electrical Energy	
Light Energy to Electrical Energy	
Chemical Energy to Electrical Energy	

(ii) List one advantage and one disadvantage of renewable energy.

Advantage:
Disadvantage:

(iii) Name one other type of renewal energy and give an example of its use.

Name:
Use:

(b) Battery operated equipment is frequently used by engineers and construction workers.

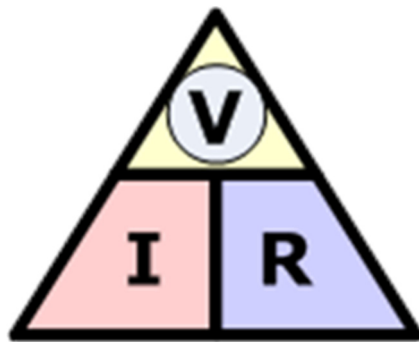
(i) State one advantage and one disadvantage of using battery operated equipment.

Advantage:
Disadvantage:



Husqvarna k535i battery powered disc cutter

(ii) The Husqvarna disc cutter uses a 36V Lithium-ion battery. The battery has 9A capacity. Using the formula for Ohms law, calculate the resistance in this battery.



V= Voltage

I = Current (Amps)

R = Resistance (Ohms)

$$\textcircled{V} = I \times R$$

Calculation:

- (c) The cutting disc shown is made from hardened steel with diamond particles bonded to the cutting surface. Heat treatment plays an important role in the manufacture of the cutting disc.



Cutting Disc

- (i) Explain how the heat treatment process of hardening is carried out.

Explanation:

Explanation:

- (ii) Hardened steel can be very brittle. Identify and explain one process that could be used to reduce some of the brittleness caused by the hardening process.

Identify:

Explanation:

Identify:
Explanation:

- (iii) Name two other heat treatment processes.

Process 1:

Process 2:

Process 1:
Process 2:

- (iv) State one reason why the cutting surface has diamond particles bonded to it.

Reason:

Reason:

(d) Upcycling is a process by which old products are modified and get a second life as a new product. Old electrical appliances and unwanted domestic items can be upcycled for use in our gardens and outdoor living spaces.

(i) Explain how the washing machine drum shown, may be upcycled for a different purpose.

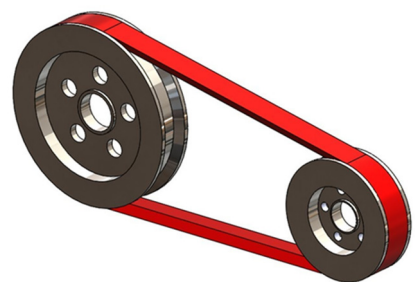


Washing Machine Drum

Explanation:

(ii) The drum of a washing machine is rotated using a vee belt and pulley mechanism. Describe one advantage of using a vee belt.

Advantage:



Vee belt and pulley

(iii) Give one reason for the drilled holes in the pulleys shown.

Reason:

Acknowledgements

Question 1 images (Accessed: April 2021)

https://www.google.com/search?q=gaa+allstar+trophy+bronze+2020&tbm=isch&ved=2ahUKEwjI7-eZ2bzwAhVLIvWkHcG-DSkQ2-cCegQIA-BAA&oeq=gaa+allstar+trophy+bronze+2020&gs_lcp=CgNpbWcQAzIECCMQJ1DVElJVEmdUHGgAcAB4AIABX4gBX5IBATGYAQCgAQGqAQnd3Mtd2l6LWltZ8ABAQ&sclient=img&ei=deKXYIjhEMuS8gLB_bblAg&bih=802&biw=1351&rlz=1C1GCEA_enIE859IE859&hl=en#imgsrc=AR1wBxAMr2XPcM
<https://disabilityhorizons.com/2020/02/8-disability-living-aids-to-help-with-everyday-tasks-at-home/>
<https://erlandsson-hjorth.se/en/maskiner/strands-pelarbormmaskin-s25/>

Question 2 images (Accessed: May 2021)

<https://www.perfect-tennis.com/court-pace-index-explained/>
<http://ftptennis.net/ftp-tennis-college/ftp-tennis-college-courses/technical-tennis/the-serve/section-02-the-serve-introduction/section-01-introduction-to-the-serve/>
<https://en.wikipedia.org/wiki/Hawk-Eye>
https://www.google.com/url?sa=i&url=https%3A%2F%2Flearn.sparkfun.com%2Ftutorials%2Fpolarity%2Fdiode-and-led-polarit-ty&psig=AOvVaw1OgP_dTwWRW7ISfTMfpi8B&ust=1620656717496000&source=images&cd=vfe&ved=0CAMQjB1qFwoTCIjz9fPmvPACFQAAAAAdAAAAABAD
<https://www.radiotimes.com/tv/sport/tennis/wimbledon-2019-hawk-eye/>
<https://www.ontheluce.com/visiting-wimbledon-tennis-championships/>
<https://www.networksports.ca/tennis-post-winders-c-w-handle.html>
<https://www.e-tennis.com/wilson-pro-staff-precision-xl-110-tennis-racquet-wr019310.html>

Question 3 images (Accessed: May 2021)

[https://www.quoteme.ie/blog/open-driving-other-cars-insurance/vintage cars - Google Search](https://www.quoteme.ie/blog/open-driving-other-cars-insurance/vintage-cars-Google-Search)
<https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.theverge.com%2F2019%2F7%2F16%2F20696638%2Fotus-evija-hypercar-specs-price-photos&psig=AOvVaw1kuLhcQE-Y5wkVpg4oR-Tud&ust=1621256632249000&source=images&cd=vfe&ved=0CAMQjB1qFwoTCICHZOKhZvACFQAAAAAdAAAAABAD>
<https://www.joom.com/en/products/5b6d5fa58b4513015c49f5c8>
<https://www.saveautoglass.net/faq>
<https://eurofrance24.com/catalog/product/view/id/144846/category/215/>
<https://keystagewiki.com/index.php/Motor>
<https://www.vectorstock.com/royalty-free-vector/four-stroke-engine-vector-20120974>
https://www.winparts.ie/interior-fabrics/car-audio-accessories/cameras-dash-cams/dash-cam/c1618/mio-mivue-792-wifi-pro-dashcam/p1461178.html?a=t4u/0/0/1618/1461178&gclid=CjwKCAiA3L6PBhBvEiwAINIJ9DzaHc2l-FMdxPP2VQ5bV7x5wnaqhGEXf2zsvvzRgdna9iETrtJP5BoC28oQAvD_BwE

Question 4 images (Accessed: May 2021)

<https://www.forbes.com/sites/josephholt/2020/01/28/sustainability-in-business-is-more-an-opportunity-than-a-threat/>
<https://archers.ie/indesit-8kg-my-time-washing-machine--ewd81483wuk/>
<https://www.atkins.ie/garden-machinery/sitework/consaws/husqvarna-k535i-battery-consaw-hvk535i>
<https://www.amazon.de/-/en/Whirlpool-Washing-Machine-Original-481241818718/dp/B00GV7H86K>
<https://images.app.goo.gl/ybm6djjUf5aa1zLW7>
https://www.electronics-tutorials.ws/dccircuits/dcp_2.html

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Junior Cycle Final Examination – Common Level

Engineering

Friday 14 June

Afternoon 1:30 - 3:00