



Junior Cycle Final Examination 2022

Engineering

Common Level

Friday 17 June Afternoon 1:30 - 3:00

120 marks

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For example, 3rd February
is entered as 0302

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[illegible]

For Examiner Only	
Total	
Grade	

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.

Question 1

(a) Global Positioning System (GPS) technology is widely used in sport.

(i) Describe one use for GPS technology in sport.

Description:



Rugby player fitted with GPS tracker



(ii) State one other use for GPS technology, apart from sport.

Use:

(b) (i) The fork shown has been specifically designed for people with a disability. Why is the handle of the fork made from foam?

Reason:



Fork with contoured foam handle

- (ii) Draw an additional feature which may improve the design of the fork shown below.



- (c) (i) Explain why the stainless steel water bottle shown is double walled.

Explanation:



- (ii) State two reasons why stainless steel is suitable for the manufacture of a water bottle.

Reason 1:
Reason 2:

Double walled stainless steel water bottle

- (iii) The aluminium tumblers shown are anodised.
State two reasons for anodising aluminium.

Reason 1:

Reason 2:

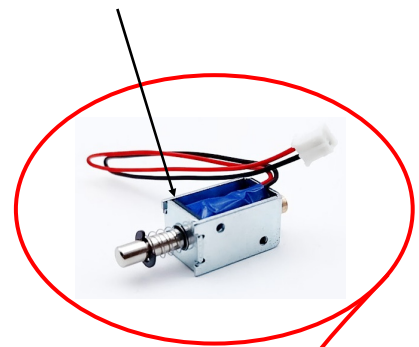


Anodised aluminium tumblers

- (d) (i) The solenoid shown is used in the operation of the Junior Cycle Engineering Project 2022, Model Marble Machine. Describe the operation of a solenoid.

Description:

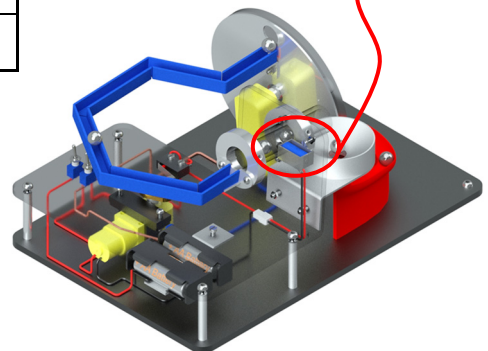
JSO - 0420L Solenoid



- (ii) Identify any two other uses for a solenoid.

Use 1:

Use 2:



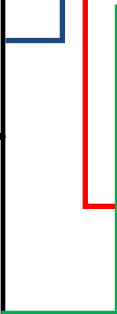
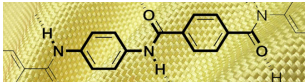
Junior Cycle Engineering Project 2022, Model Marble Machine

Question 2

For centuries, engineers have used innovative engineering solutions to solve problems for society and to improve the quality of life for people.



- (a) Three of the five inventors shown below have been matched to their invention. Match the remaining two inventors to their inventions.

 Stephanie Kwolek		an Irish scientist and Professor of Natural Philosophy at Maynooth College who is best known for his work on the induction coil. 
 Rev. Nicholas Callan		an Irish engineer who developed the first commercially built submarine which was formally commissioned by the US Navy. 
 John P. Holland		an American chemist who is known for inventing Kevlar, a synthetic fibre with exceptional strength, stiffness and heat resistance. 
 Henry Ford		an American inventor, designer and entrepreneur who was the co-founder of Apple Computers and developed the iPod, iPhone and iPad. 
 Steve Jobs		an Irish-American, who founded a Motor Company in his name, which developed the assembly line technique of mass production for his Model T automobile. 

- (b) (i) State two impacts of automobiles (cars) on society.

Impact 1:

Impact 2:

(ii) Outline one advantage and one disadvantage of mass production in engineering.

Advantage:

Disadvantage:



Mass production of cars

(iii) Identify two features in the design of modern cars that reduce their impact on the environment.

Feature 1:
Feature 2:

(c) (i) Circle the correct material which is alloyed with iron to make steel.

Aluminium	Silicone	Carbon	Lead
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(ii) Alloy steel is used in many engineering applications.
Explain two advantages of using alloys in engineering.

Advantage 1:
Advantage 2:

(iii) Explain why the wheels of a knurling tool are made from high speed steel (HSS).

Explanation:



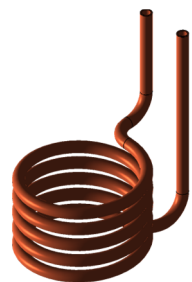
Knurling tool with HSS wheels

(d) (i) Circle the correct metal group for copper.

Ferrous metal	Non-ferrous metal
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(ii) Copper wire is used in the manufacture of an induction coil as shown. Name one property of copper which makes it suitable for wire manufacture.

Property:



Induction coil

(iii) The sculpture shown is made from bronze which is an alloy of copper and tin. Explain why bronze is a suitable metal for this sculpture.

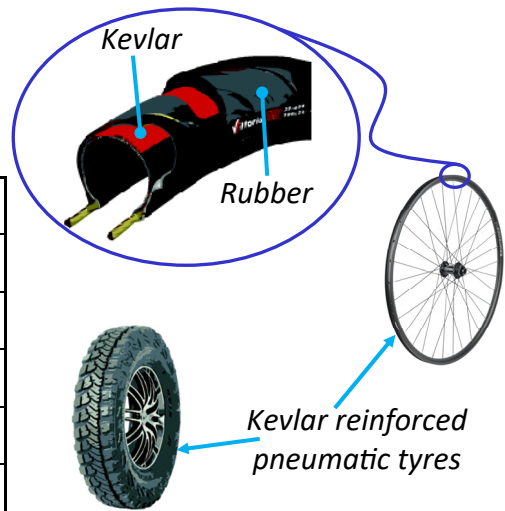
Explanation:



*The 'Pomodoro Sphere'
Trinity College Dublin*

- (e) (i) Kevlar reinforced pneumatic tyres are used on bicycles and cars.
Explain the term *pneumatic*.

Explanation:



- (ii) State one property of Kevlar which makes it suitable as a material for pneumatic tyres.

Property:

- (iii) A Kevlar pedal crank which has been 3D printed is shown opposite.
Describe the additive manufacturing process of 3D printing.

Description:



(iv) Name the bicycle drive mechanism shown.

Name:



Bicycle drive mechanism

(v) Explain why oil is applied to this drive mechanism.

Explanation:



Oil being applied to a bicycle chain

(f) Outline one positive and one negative impact of personal mobile devices on society.

Positive impact:

Personal mobile device



Negative impact:

Question 3

The *Bird Buddy* is a smart bird feeder. It includes features such as a high resolution camera and a built-in microphone to identify bird species and stream live video to a mobile app.



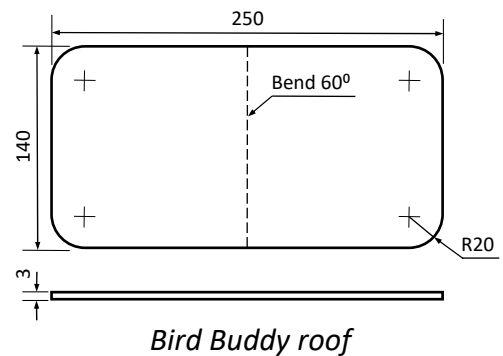
- (a) (i) The *Bird Buddy* is made from recycled polypropylene.

Explain why polypropylene is a suitable material for the bird feeder.

Explanation:

- (ii) Describe the steps required to accurately mark out and shape the *Bird Buddy* roof shown.

Description:

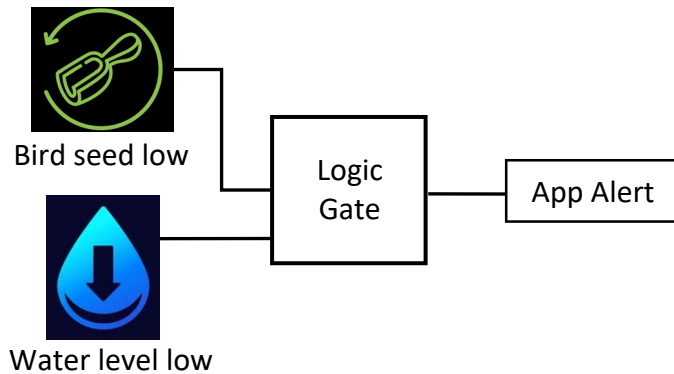


- (iii) Explain how the *Bird Buddy* roof may be accurately bent into shape.

Explanation:

- (b) (i) The *Bird Buddy* uses a digital logic gate and smart technology to alert the user when the feed containers need to be refilled. Explain the term smart technology.

Explanation:



The following information is relevant to activate the feed refill alert.

Bird seed full = Logic Level 0
 Bird seed low = Logic Level 1
 Water level full = Logic Level 0
 Water level low = Logic Level 1

- (ii) Name the logic gate which is most suitable to activate the app alert when either feeding system is depleted.

Name:

- (iii) Draw the symbol for this logic gate and complete the truth table.

Logic Gate Symbol

Input 1	Input 2	Output
1	0	1

- (c) (i) A solar panel attachment for the *Bird Buddy* is shown. Describe how the solar panel is used to power an electronic circuit.

Describe:



Solar panel attachment

(ii) Identify two other sources of renewable energy.

Source 1:

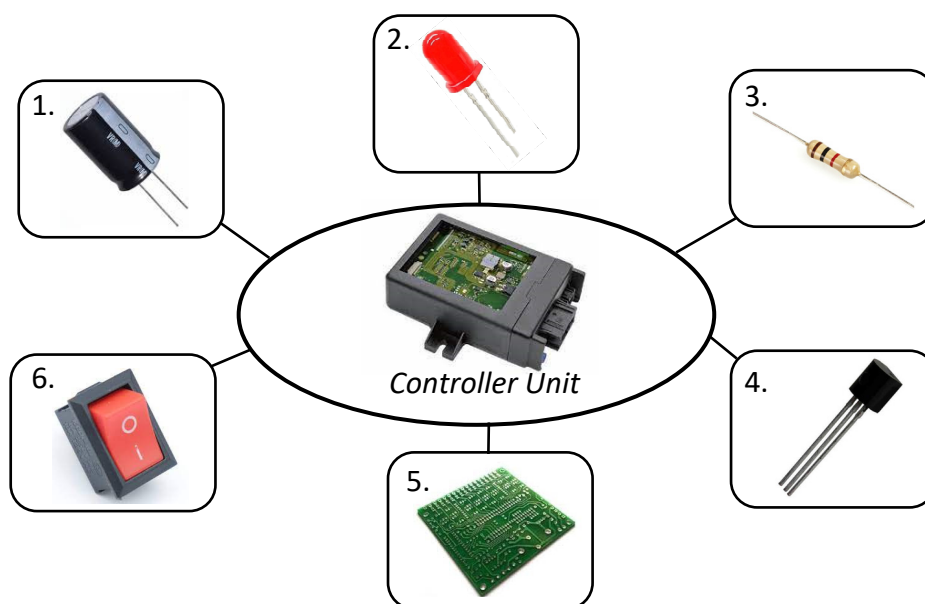
Source 2:

(d) Using rendered sketching, draw a design for a wall mounted bracket on which the *Bird Buddy* can be placed.

Rendered sketch of your design



(e) The electronic components shown may be included in a controller unit circuit.



(i) Match the number to the correct electronic component in the table below.

Electronic Component	Number
On/Off Switch	
Capacitor	
LED	
Transistor	
Resistor	
Printed Circuit Board	

(ii) Draw the electronic symbol for an LED.

Draw the symbol

(iii) State two safety precautions to be observed when soldering electronic components on a Printed Circuit Board.

Safety precaution 1:
Safety precaution 2:

Question 4

Modern engineering techniques play an important role in the world of leisure and recreation.



- (a) The following three engineering terms are associated with skateboard design:

Washer	Lamination	Bearing
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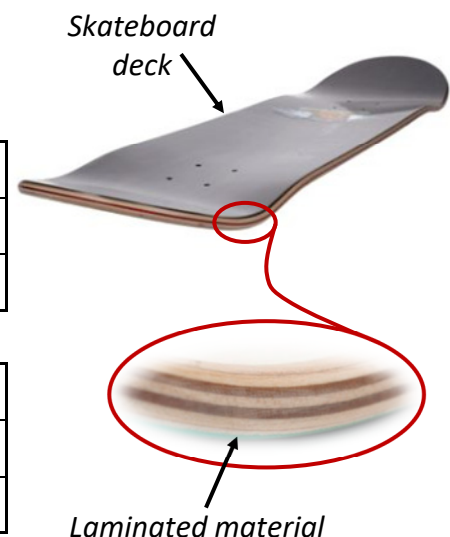
Complete the table below by inserting the most suitable term next to the description of the term.

Term	Description of Engineering Terms
	Is the process of manufacturing a material in multiple layers, creating a material with improved properties.
	A device that supports moving parts and allows them to move more smoothly by reducing friction.
	A small flat metal, rubber or plastic ring placed over a bolt before a nut is applied.

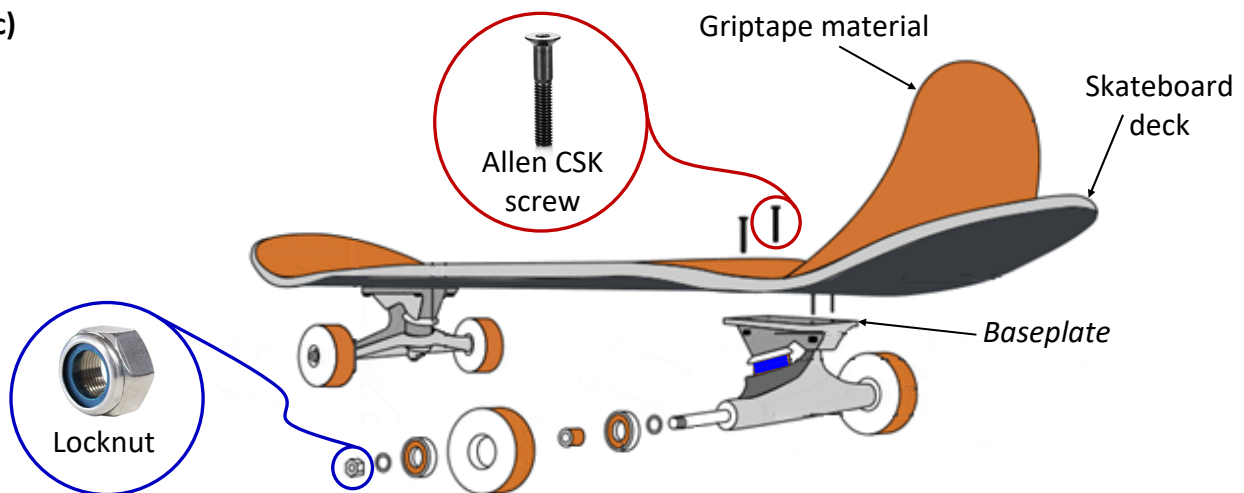
- (b) State two properties of the skateboard deck which are improved by the process of lamination during manufacture.

Property 1:

Property 2:



(c)



- (i) Explain why adhesive is the most suitable method for attaching the griptape material to a skateboard deck.

Explanation:

- (ii) State one reason for the use of a locknut in the wheel assembly of a skateboard.

Reason:

- (iii) Outline one advantage of using an Allen CSK screw for the assembly of the skateboard deck to the baseplate.

Advantage:



- (iv) List three lathe processes used to produce the skateboard bushing shown.

1:

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2:

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3:

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(d) The skateboard wheel shown is made from the thermosetting polymer polyurethane.

(i) Explain the term thermosetting.

Explanation:



Skateboard wheel

(ii) Circle the two plastic products which are made from thermosetting plastics.



(e) Upcycling is the process of transforming by-products, waste materials or unwanted products into new products of higher quality.

Describe, with the aid of a diagram, one upcycled use for a skateboard deck.



Description:	Diagram

Acknowledgements

Question 1 images (Accessed: October 2021)

<https://mclloyd.com/outdoor-sport/?lang=en>
<https://shop.disabilityhorizons.com/products/knork-knife-and-fork-in-one-contoured-foam-handle>
<https://www.meubles.ie/built-500ml-double-walled-stainless-steel-water-bottle-silver>
<https://www.amazon.com/Aluminum-Stemless-Fashion-4-Color>
<https://www.alibaba.com/JSO-0420-solenoid-electromagnet>

Question 2 images (Accessed: November 2021)

<https://twitter.com/siemenssoftware>
<https://simple.wikipedia.org>
<https://www.eiscolabs.com/products/ph0840>
<https://www.nationalhistoricalships.org.uk/register/427/holland-1>
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<https://www.technologystudent.com/joints/kevlar4a.png>
<https://www.altitude.ie/components/wheels>
<https://www.solidprint3d.co.uk/3d-printing-and-bike-manufacturing/>
<https://www.amazon.com/LulzBot-TAZ-6-3D-Printer/>
<https://www.istockphoto.com/vector/bike-chain-with-cogwheels>
<http://yapbicycle.co/wp-content/uploads/2016/08/blog2c.png>
<https://www.google.com/imgres?imgurl=https%3A%2F%2Fi5.walmartimages.com/Waterproof-Bike-Bicycle-Mobile-Phone-Holder-Bag-Front-Tube-Touch-Screen-Phone-Pouch-FramePannier>

Question 3 images (Accessed: December 2021)

<https://www.kickstarter.com/projects/mybirdbuddy/bird-buddy-a-smart-bird-feeder>
https://cdn.shopify.com/s/files/1/0558/0718/0983/files/bird_buddy_solar_roof_4.png?v=1629133421
<https://www.continental-automotive.com/getattachment/>

Question 4 images (Accessed: December 2021)

<https://m.made-in-china.com/product/Skateboard-Stuff-Canada-Maple-Old-School-Skateboards>
<https://www.blue-tomato.com/en-GB/product/Skateboard+Deck-600492/>
<https://lushlongboards.com/Horizontally-pressed-skateboard.jpg>
<https://www.sh-yntall.com/project/skate-board-structure.html>
<https://static.connect2india.com/product-flat-countersunk-screw-allen-csk.jpg>
<https://www.ebay.com/b/Mini-Logo-Skateboard-Wheels/>
<https://www.alibaba.com/13A-250V-high-quality-bakelite-switch>
<https://images.allianceonline.co.uk/Products/CFB000051.jpg>
<https://www.polypipe.com/gutters>
https://assets.katogroup.eu/i/katogroup/PS20001200_02_scanpan-classic-ps2000
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Junior Cycle Final Examination – Common Level

Engineering

Friday 17 June

Afternoon 1:30 - 3:00