Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination, 2018

Technology

Higher Level

Friday, 22 June
Morning, 9:30 - 12:00

There are **three** Sections in this paper. Attempt **all three** Sections.

Section A: Core - Short-answer questions.

Section B: Core - Long-answer questions.

Section C: Options - Long-answer questions.

Section A - Core *(72 marks)*

Instructions:

(a) *Answer **any twelve** of the fifteen questions in the spaces provided. All questions in Section A carry 6 marks.*

(b) *Draw all sketches in pencil.*

(c) *Hand up this booklet at the end of the examination.*

(d) *Write your examination number in the box provided and on all other pages used.*

Examination Number

Centre Number

Section	Mark
Section A	
Section B	
Section C	
Total	
Grade	

Section A. *Answer **any twelve** questions. All questions carry 6 marks.*

1. The impact of technological development over the past century has revolutionised the ways in which we work. Outline **one** impact of each of the following developments:

(i) Assembly line production.

_____

_____

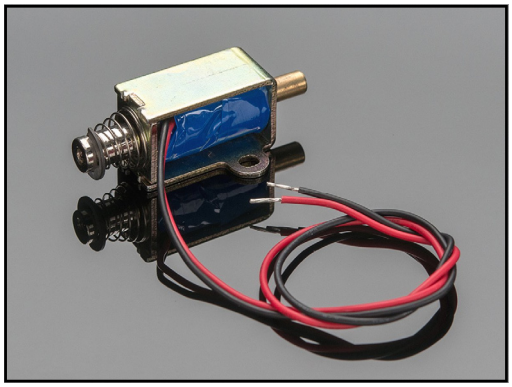
(ii) Computer aided manufacture.

_____

_____

2. (i) State **one** energy conversion that takes place when a solenoid activates.

_____



(ii) Describe the operation of a solenoid.

_____

_____

_____

3. Biometric software systems, such as facial recognition, are used in a range of modern applications. Suggest **one** use of facial recognition in **each** of the following:

(i) Retail marketing.

_____

_____

(ii) Security.

_____

_____

(iii) Authentication.

_____

_____

4. Calculate the output power of a solar motor on start-up, drawing a current of 30 mA when operated on a 12 V DC supply.

Calculation:

5. State **two** safety features integrated into power tools such as the bandsaw shown.

1. _____

_____

_____

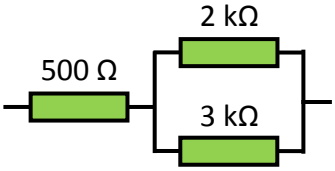
2. _____

_____

_____

6. Calculate the total resistance of the circuit shown.

Calculation:



7. State **two** features of the gearbox shown, which facilitate a smooth transmission of power with minimal noise.

Feature 1 _____

_____

Feature 2 _____

_____

8. Some of the most common cybersecurity risks are socially engineered malware, phishing attacks and unpatched software. Explain **any two** of these terms.

(i) Socially engineered malware.

_____

_____

(ii) Phishing.

_____

_____

(iii) Unpatched software.

_____

_____

9. Explain **each** of the following terms in relation to plastic materials.

(i) Monomer.

_____

_____

(ii) Brittleness.

_____

_____

10. ***Busybees Furniture*** is an Irish furniture retail company specialising in the upcycling and sale of furniture and home furnishings.

Explain the meaning of the following terms in relation to environmental sustainability.

(i) Upcycling.

_____

_____

_____

(ii) Carbon neutral.

_____

_____

_____

11. The device shown is cam operated.

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

_____

(ii) Describe, in detail, how this device operates as Cam C rotates.

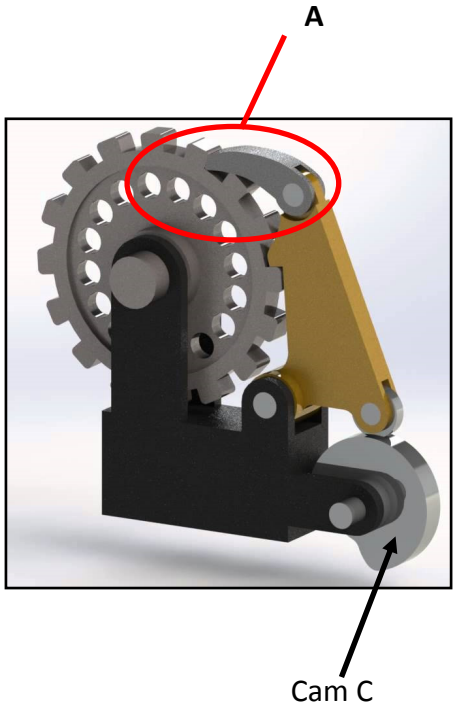
_____

_____

_____

_____

_____



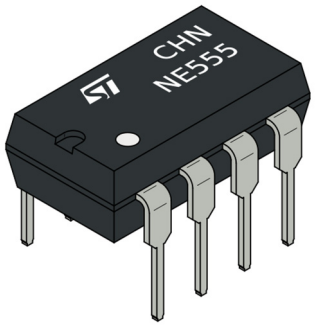
12. The image shows a winch used on a helicopter to lift loads.
The winch lifts a load with a mass of 65 kg through a vertical distance so that the load gains 7014.15 J in potential energy before coming to rest.

Assume g = 9.81 m/s^2

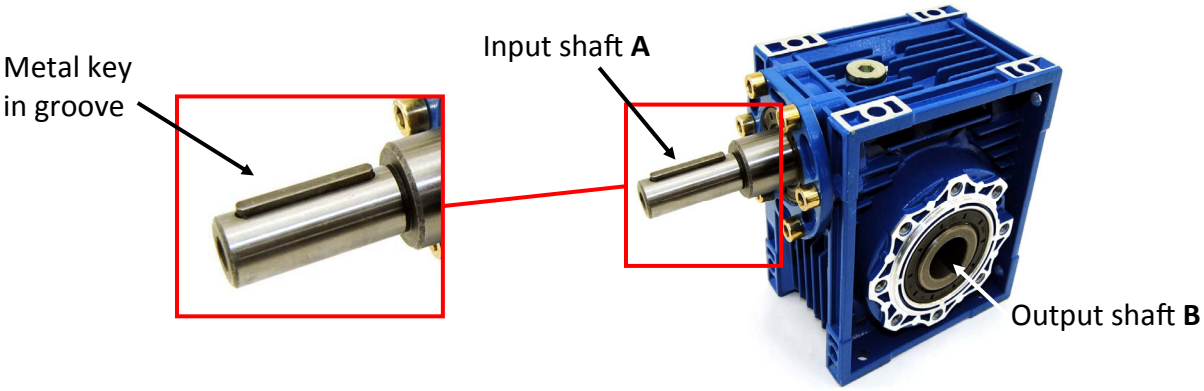
Calculate the vertical distance through which the load is lifted.

Calculation:

13. Sketch **any two** orthographic views of the integrated circuit chip shown.



14. The housing shown contains a mechanism to reduce the rotational speed of the output shaft at **B**.



(i) Name a mechanism which fits inside the housing and achieves a rotational speed reduction of 30:1.

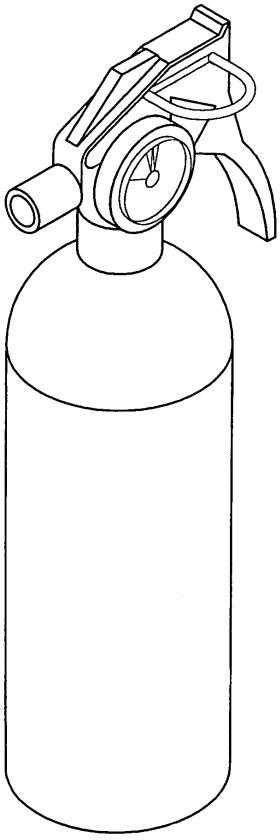
_____

(ii) Outline a function of the key and groove shown on input shaft **A**.

_____

_____

15. Use **two** techniques to enhance the graphic representation of the fire extinguisher shown.



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Section B - Core *(48 marks)*

*Answer **both** questions.*

Each question in Section B carries 24 marks.

Section C - Options *(80 marks)*

*Answer **two** of the five optional questions presented.*

All questions in Section C carry 40 marks.

Instructions:

(a) Answer these questions in the answerbook provided.

(b) Write your examination number on the answerbook.

(c) Draw all sketches in pencil.

(d) Hand up the answerbook at the end of the examination.

Section B - Core *Answer Question 2 **and** Question 3.*

Question 2 *- Answer 2(a) **and** 2(b)*

2(a) Facebook's plan to use large solar-powered high-altitude drones to connect areas of the world having unreliable internet access marked a significant milestone on the 22 May 2017. The *Aquila* drone completed its second test flight and spent 1 hr 45 mins in the air.

(i) State **two** advantages of the use of wireless technology in underdeveloped countries.

(ii) State **two** other applications of drone technology.

2(b) Aquila is designed to stay in the air for periods of up to three months at a time. Its design includes sophisticated aerodynamics and GPS systems. The wings have been manufactured from a carbon fibre composite material.

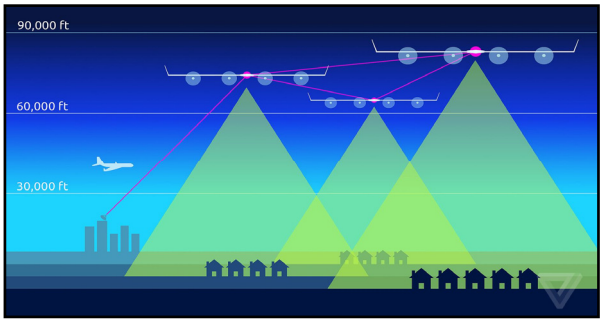
(i) Outline **two** reasons for using carbon fibre in the manufacture of Aquila.

(ii) Explain the terms *aerodynamics* and *GPS*.

(iii) Describe **two** design challenges in maintaining the 5000 Watts of power required to keep Aquila aloft at cruising speed during night-time.

*Answer 2(c) **or** 2(d)*

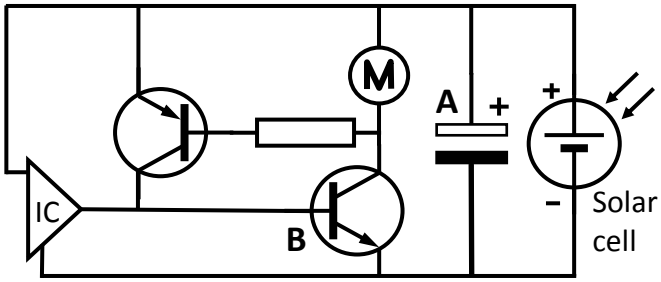
2(c) (i) Outline, with reference to the given image, the use of a fleet of solar drones to ensure uniform on-line coverage over a large area.



(ii) Explain the role of a *repeater* in wireless transmission.

OR

2(d) In order to deal with the limitations of using solar power to drive motors, a number of *solar engine* circuits have been developed similar to that shown. This circuit uses the 1381 voltage detector IC.



(i) Name **and** state the function of component **A**.

(ii) Explain the operation of the transistor **B** in this circuit.

Question 3 *- Answer 3(a)* ***and*** *3(b)*

3(a) The Spartak stadium in Russia has improved its certification in environmental standards as part of the *2018 FIFA World Cup Sustainability Strategy* with energy reductions ranging from 20% to 70%.

Outline **one** means of reducing the environmental impact in **each** of the following areas:

- Stadium and office lighting
- Transport access
- Waste management.

3(b) The Moscow Technological Institute reports the development of an autonomous robot called *AlanTim* which aims to recognise and manage aggressive situations among supporters.

(i) Outline **three** properties to be considered when choosing a material suitable for fabricating the casing of the robot. Suggest an appropriate plastic for manufacturing this casing.

(ii) Explain the term *centre of gravity* with reference to the design of *AlanTim*.

(iii) Outline, with annotated sketches, a method of providing *AlanTim* with mobility and manoeuvrability.

Answer 3(c) ***or*** *3(d)*

3(c) Computer control is used to regulate systems such as ticketing at sports, cultural and music events. These control systems make use of *sensors* and *feedback loops* with an *interface* used to interact with the public.

(i) Specify **one** device that might be used for paperless ticket entry to such events.

(ii) Explain the use of a feedback loop **and** an interface in a paperless ticketing system.

OR

3(d) The Health and Safety Authority (HSA) in Ireland reported 47 work related fatal accidents in 2017 and 46 fatal accidents in 2016. Agriculture, construction and transport had the highest number of fatalities.

(i) Outline how the HSA can contribute to a reduction in the incidence of workplace accidents.

(ii) Suggest **two** best practice guidelines to help prevent accidents in a technology room.

Section C - Options *Answer **any two** of the five optional questions.*

Option 1 - Applied Control Systems *- Answer 1(a) **and** 1(b)*

1(a) A smart card or chip card is a pocket-sized card that has an embedded integrated circuit. Smart cards are made of polyvinyl chloride and can be contactless.

(i) List **three** applications of smart cards.

(ii) Explain the features of an *embedded integrated circuit* and a *contactless card*.

1(b) A common security measure is the use of automated doors for entry to and exit from garages. It is essential that the door opens only for designated controllers.

The following sequence of operations is used:

- The user requests entry
- The system checks the user identification against the authorised list of users
- Entry is granted if the user has authorisation
- The door opens
- The door closes automatically after a period of 60 seconds.

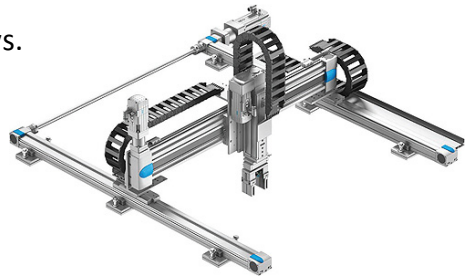
(i) Complete a flowchart for the operating sequence of the automated door system.

(ii) Suggest **one** activation method and **one** output component for the circuit.

(iii) Suggest a modification to your flowchart to close the door on request from the user.

*Answer 1(c) **or** 1(d)*

1(c) The robot shown is used to put individual chocolates into plastic trays.

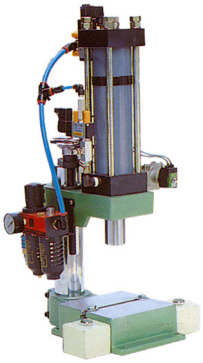


(i) Name the type of robot shown and describe the main features of its control system.

(ii) Describe, using annotated sketches, an *end effector* that could be used to place chocolates in trays without damage.

OR

1(d) A pneumatic press is used to place labels on chocolate boxes.



(i) Draw a pneumatic circuit diagram to control the press.

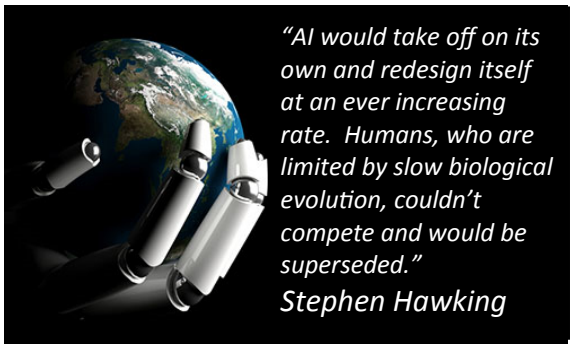
(ii) Outline **two** ways in which a consistent air supply of good quality is provided and maintained for pneumatic systems.

Option 2 - Electronics and Control - *Answer 2(a) **and** 2(b)*

2(a) Artificial Intelligence (AI) uses computer systems to control and perform tasks normally requiring human intelligence.

Outline, with examples, the use of AI in **each** of the following:

- Retailing
- Car technology
- Entertainment.

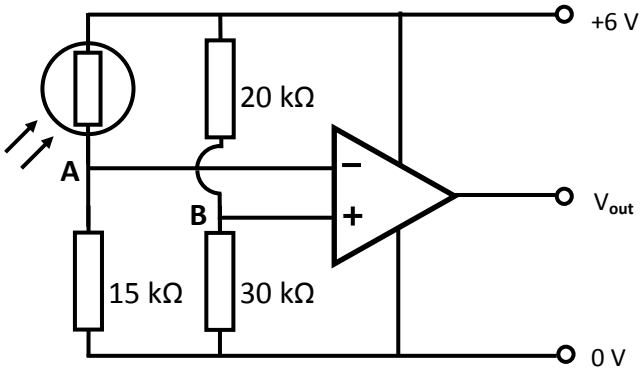


2(b) The sensor circuit shown is used in a rollercoaster ride at a theme park.

(i) Explain the operation of the circuit with reference to voltages at the points A and B.

(ii) Calculate the voltage at B.

(iii) Using your answer from (ii) above, calculate the resistance of the LDR when the voltage at point A is the same as the voltage at point B.



*Answer 2(c) **or** 2(d)*

2(c) The output from the circuit in ***2(b)*** above controls a mains-powered electric motor via a relay.

(i) Outline **two** functions of a relay in a motor circuit.

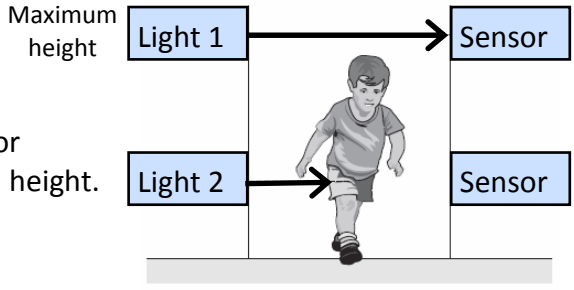
(ii) Explain the abbreviations NC, NO and COM in this context.

OR

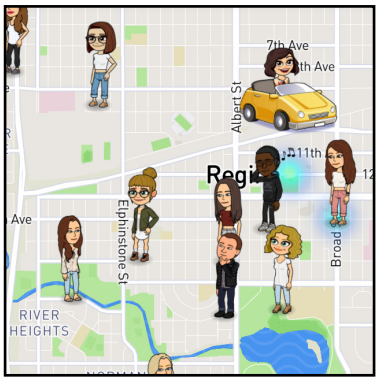
2(d) There is a height restriction on a rollercoaster ride implemented via the sensor system shown.

(i) Using logic gates, draw a circuit that could use the sensor outputs to detect if a participant is **above** the maximum height.

(ii) Suggest electronic components for the light **and** sensor systems.



Option 3 - Information and Communications Technology - *Answer 3(a) **and** 3(b)*



3(a) On 21 June 2017, Snapchat launched a new location sharing feature called Snap Map, where users are encouraged to *"see what's happening, find your friends, and get inspired to go on an adventure."*

(i) Suggest **two** dangers of this location sharing feature.

(ii) Outline your understanding of privacy settings and their importance in social media.

3(b) A typical laptop computer is shown.

(i) Name **two** input devices used in a laptop.

(ii) Describe **two** methods of reducing heat build up in laptop computers.

(iii) When purchasing a laptop, describe the importance of **each** of the following elements, giving appropriate units and indicative sizes as necessary:

- Processor
- Installed memory (RAM)
- Operating system
- Hard drive.

*Answer 3(c) **or** 3(d)*

3(c) Video conferencing, also known as *telepresence*, is a two-way interactive communication similar to a telephone call but including video.

(i) Outline the equipment required to facilitate a video conference.

(ii) Explain the terms TCP/IP **and** VoIP.

OR

3(d) (i) Networks can be subject to security issues. Explain the possible impact on a network of *worms* and *distributed denial of service* (DDoS) attacks.

(ii) Outline the equipment needed and the set-up required for the provision of on-line access to a range of devices on a wireless home network.

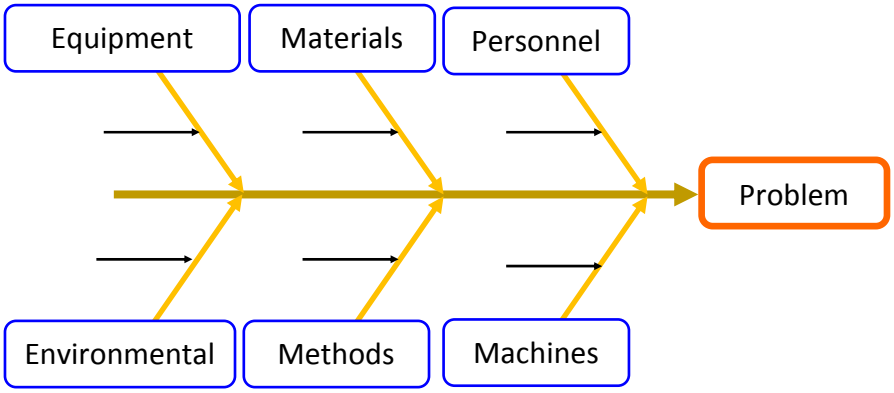
4(a) (i) In Ireland, the National Standards Authority of Ireland (NSAI) certifies companies that meet the ISO standards.

Explain the term ISO.

(ii) Describe, using a laptop computer as the example, **each** of the following quality characteristics:

- Reliability
- Conformance
- Durability.

4(b) Cause and effect diagrams are used to identify causes of quality-related problems in products. This in turn helps us to develop better products.



(i) Discuss **three** potential consequences for a firm or company that produces a batch of faulty products.

(ii) Explain how human error can cause problems in the quality of a product produced on an assembly line.

(iii) Compile a cause and effect diagram, using the headings outlined above, or otherwise, to examine a scenario which has led to the production of a wind turbine with inadequate power output.

Over →

*Answer 4(c) **or** 4(d)*

4(c) The graphic shows a *fidget spinner* with a stainless steel bearing fitted in a precision-cut hole in its housing. In order for the bearing to fit correctly, the diameter of the hole must lie between 15.90 mm and 16.10 mm.

The manufacturing process used to produce the hole affects the accuracy of the hole. The manufacturer wishes to chose a suitable manufacturing process. Tests were carried out on two processes and the size (in mm) of the holes produced were recorded in the table below.

3D Printer	16.08	16.04	16.10	15.90	16.08	16.04	15.02	σ = .391
Laser Cutter	15.98	15.96	16.04	16.03	15.98	16.02	16.02	σ = .030

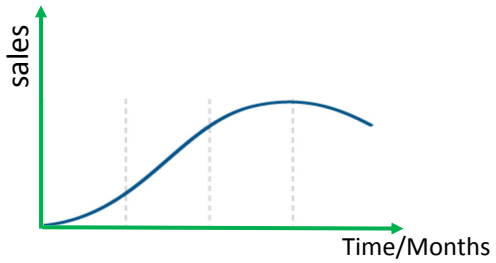
(i) Use the information in the table to calculate the Process Capability Index for **both** manufacturing processes.

where Cp = $\frac{\text{Tolerance Range}}{6\sigma}$

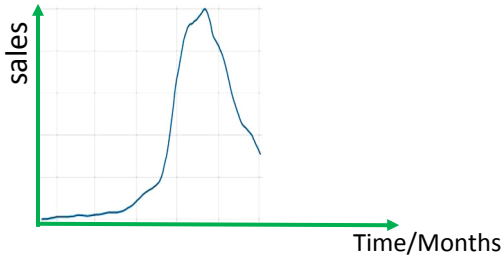
(ii) Select which of the processes should be used to manufacture the fidget spinner. Justify your selection.

OR

4(d) Graph **A** shows the expected lifecycle curve of successful products. Graph **B** shows the sales of fidget spinners from January to July 2017.



Graph **A**



Graph **B**

(i) Outline the **four** main stages of a product lifecycle.

(ii) Compare the lifecycle profile for fidget spinners (Graph B) with the lifecycle curve A. Comment on any differences you identify.

Option 5 - Materials Technology - *Answer 5(a)* ***and*** *5(b)*

5(a) Bicycle frames have been manufactured from a range of materials over the years.
Compare **any two** of the following materials in terms of strength, durability, weight and cost:

- Steel
- Aluminium
- Titanium
- Carbon fibre.

5(b) See.Sense® have created high-tech bicycle lights that increase light intensity and flash rate when they sense nearby objects, set off an alarm when in anti-theft mode and are controlled by a phone app.

(i) Suggest suitable materials for manufacturing **both** the lens **and** housing of the light. Justify your selections.

(ii) Design, with annotated sketches, a method for mounting the light on the handlebar of a bicycle.

(iii) Explain the use of hollow tube as a commonly used profile in the manufacture of bicycle frames.

Answer 5(c) ***or*** *5(d)*

5(c) Blow moulding may be used to manufacture water bottles for bicycles.

(i) Give **two** reasons why the blow moulding process may be suitable for the manufacture of water bottles.

(ii) Describe, with annotated sketches, the blow moulding process.

OR

5(d) The National Highway Traffic Safety Administration in the United States reports that 'bicycle helmets are the single most effective piece of equipment to reduce head injuries in the event of a crash'. Protection from impact injury is the most significant requirement of bicycle helmets.

(i) Describe *resistance to impact* as a material property.

(ii) Outline an impact test to compare materials for the manufacture of bicycle helmets.

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