

**FOR SCHOLARSHIPS TO BE
AWARDED IN SEPTEMBER 2022**

**WEDNESDAY 2nd FEBRUARY 2022 - AFTERNOON
DURATION - 2 HOURS, 10 MINUTES
(to include 10 minutes reading time)**

INSTRUCTIONS TO CANDIDATES

You are required to answer **ONE** question from Section A (1 HOUR)
and **ONE** question from Section B (1 HOUR)

In **Section A** you are asked to provide **THREE** solutions to a problem.
You will be marked on the following:

| | Mark |
|--|-------------|
| a) Quality of your THREE solutions – how well you solve the problem along with the flair and imagination of your ideas. | 30 |
| b) Technical knowledge & reasoning of your solution – how well they may work, with operating principals explained and justified. – how much technical / engineering knowledge you demonstrate in your ideas and annotations. | 15 |
| SECTION A TOTAL | 45 |

In **Section B** you are asked to solve a more focused problem, providing only **ONE** detailed solution.
You will be marked on the following:

| | Mark |
|--|-------------|
| a) How well your solution works | 30 |
| b) The consideration and application of engineering knowledge. This could include mechanisms, structures, electronics, components, materials, flow charts, coding etc., | 15 |
| SECTION B TOTAL | 45 |

| | |
|---|------------|
| Communication in diagrams, annotations and readability | 10 |
| GRAND TOTAL | 100 |

Please fill in the information box at the bottom of each answer sheet with:

- ◆ Your candidate name and school name clearly printed on each sheet.
- ◆ The number of the question you have chosen to answer.
- ◆ The page number.

Please start each question on a fresh sheet of paper

Applicants must not discuss the exam on social media or in any other way

DO NOT TURN THE PAGE UNTIL YOU ARE INSTRUCTED TO DO SO

Section A – Suggested time 1 hour

OPEN-ENDED QUESTIONS

In this section you will be assessed on your ability to solve the problem set in a **CREATIVE AND INNOVATIVE** way, by providing initial concepts.

Answer **ONE** question only from the following **THREE** questions.

Within your answer, you must provide three distinctly different solutions.

Question 1

Following heavy rain gardens and lawns often get water-logged. If the water is not able to drain away from a lawn the grass can get damaged. A gardener wants to quickly solve this problem by making a pattern of small holes, about 75mm deep, across the whole surface of the lawn, to allow water to drain away.

Design three pieces of equipment that can be either hand or battery powered, which could be used to improve the drainage of the lawn.



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Question 2

For a variety of reasons, many people have the use of only one arm. Produce **one** solution only for **each** of the following three tasks:

Chopping vegetables;

Putting on a pair of socks;

Unscrewing a jar.

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Question 3

You have been asked by a company that makes 600mm long elastic bungee cords, to produce a testing rig that would assess the strength and/or durability of their product. They would like three different concepts to discuss.



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End of Section A

Section B – Suggested time 1 hour

FOCUSED QUESTIONS

In this section you will be assessed on your ability to present ONE DETAILED TECHNICAL SOLUTION to the given problem focusing on functionality, components, materials and construction.

Answer ONE question only from the following THREE questions.

Question 4

The UK plans to send its first lunar rover to the Moon. The rover, which has a footprint of around 300mm by 300mm, will walk using legs rather than wheels and be powered by solar cells and batteries.



You have been asked to devise a way of collecting a 10 mm³ sample of moon dust which will later be analysed by instruments within the rover. The sample will need to be stored in the base of the rover and you must consider the opening and closing of an access flap to enable this. The base will be 50mm above the surface of the moon when collecting the sample.

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Question 5

Many homes have wood burning stoves. Splitting big logs into smaller sizes for these stoves using an axe can be a tiring and dangerous task.

Design a mechanical 'log splitter' for home use, that will speed up the task of splitting logs and be both safe to use and compact for the purposes of storage. The maximum size log to split will be 300mm diameter and 300mm long.



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Question 6

During the winter months farmers need to feed their sheep with food pellets. However, access to their fields on remote mountains can be difficult. Design a device that will automatically dispense 20kg of food pellets once a day. The farmer will pre-load the device with 100kg of the food pellets. The device can be powered by a 12V battery and motor and the battery will be kept charged using wind power.



END

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