

## 2023 Arkwright Aptitude Examination Examiners' report

It was pleasing to note the large number of entries for this year's Arkwright Scholarships and therefore the large number of students sitting the aptitude examination. We would, once again, like to thank teachers for encouraging their students to apply for the scholarship, and for preparing them for the examination.

This year the applicants who did well in the exam demonstrated good technical knowledge and therefore were able to access the full range of marks. The examiners, reflecting on the overall quality of the responses, again felt that there was a decline in the quality of the graphical presentation, and communication in general. There is an obvious time pressure in the exam to produce a well-considered response, however, the examiners felt that, too often, in the rush to complete their answers many candidates failed to consider how their work would be understood by a third party. Too many diagrams were over-complicated and difficult to understand and this, combined with sometimes illegible writing, meant that it was often difficult to award the full range of marks.

While the best responses were well-considered and demonstrated a good level of creativity, it was disappointing to note that some applicants failed to fully answer the questions they had chosen. A greater familiarity with the mark scheme prior to sitting the examination would be beneficial to many in the future.

### **Section A**

#### Question 1

While many of the designs proposed answered the question as intended, not enough attention had been paid by many candidates to the method of attachment to the wheelchair. Various types of clamps were suggested but these were often an afterthought and lacked the necessary detail to perform as intended.

Many applicants failed to appreciate the limitations of using a wheelchair and many of the proposed solutions were not feasible. Some of the suggested activities required considerable amounts of additional equipment and would require a support team to attach the various components; clearly these designs failed to meet the stated criteria that the accessories should be 'easy-to-use'.

The best responses provided creative solutions to simple tasks and were not overly complicated in assembly or operation.

## Question 2

There were many imaginative responses to this question, but often, too little consideration to how the targets would work. Solutions often relied on a 'black box' solution; typically, a 'hit' on the target would send a wireless signal to a 'microprocessor' which would produce any number of outcomes. Applicants should be reminded that the aptitude examination seeks to demonstrate a good technical understanding and, in many responses, this technical detail was lacking.

Better responses allowed the applicants to demonstrate their knowledge and understanding without overly complicating the solution. Good electronic solutions provided details of appropriate circuitry and mechanical outcomes demonstrated a good working knowledge of mechanisms. It was clear how such systems would work. One thing that was overlooked, however, was the fact that the target would soon become covered in paint, so bright colours and LEDs would soon be obliterated!

## Question 3

This question was generally well answered. Better applicants had considered the integrity of the fruit and included ways to prevent the fruit from getting damaged.

Some applicants considered the delivery of a single fruit from a hopper, whereas less considered answers failed to appreciate that the opening of a 'flap' would allow an unlimited stream of fruit to be dispensed. Good responses demonstrated outcomes of a size suitable for a school dining hall, with appropriate technology that would clearly work and where interactive elements were incorporated. It was nice to see that some applicants had considered the educational benefits of the user interface. It was felt, however, that too little thought was given to how the device might be fun to use. Some of the best answers included a system to limit the distribution of fruit to one piece per child.

## **Section B**

### Question 4

This was the least popular question in section B, and responses were generally poor. Solutions were often simplistic, being just a copy of one of the types of robots illustrated in the question paper.

A small number of applicants correctly answered the question by providing a technical explanation of how the various articulated joints would work. It was clear that most applicants who attempted this question lacked the depth of knowledge of mechanical systems to provide a good answer. This was especially true when allocating marks for 'materials, components and the method of construction' as outlined in the mark scheme on the front of the question paper.

### Question 5

Question 5 was the most popular choice in section B and generated a variety of functional outcomes. Better candidates produced a design in which a clamped toothbrush moved in a reciprocating motion, under pressure, over a fixed material, representing a row of teeth, using an abrasive solution to replicate the use of water and toothpaste.

However, what should have been a simple solution, often ended up as an overly complicated, over-engineered design that, in many cases, failed to fully address the problem. As an example, a number of applicants chose to design a test rig in the shape of a jaw and attempted to produce a mechanism which replicated the physical action of using a toothbrush.

### Question 6

The focus of this question was the design of a flowchart to control the movement of an automated fence-post marker and, with the exception of a small number of applicants who chose to design the actual machine, which was not required, the question was well answered. Most responses demonstrated a workable solution, with better scoring candidates incorporating a greater level of functionality and sophistication, such as continually monitoring the battery life and the contents of the paint reservoir.

However, despite producing a workable flowchart, a large number of candidates failed to explain how their design worked and their answers lacked justification for their design decisions, as outlined in the question and highlighted in the mark scheme. Candidates should be reminded of the need to fully read the question before starting their answer.