

Arkwright Examiners' Report on the Aptitude Exam sat on Wednesday 7th February 2018

Candidates responded positively to this year's Arkwright Aptitude Exam. The inclusion of an extra question in each section made the exam more accessible with candidates able to find a question more to their liking. In their answers many candidates had taken on board the advice given in previous exam reports where we asked for better communication and they provided drawings and diagrams that were easier to understand, along with annotations that were easier to read. However, very many candidates still 'shoot themselves in the foot' by presenting intelligent answers in an often unintelligible way, making it difficult for the marker to understand their thinking. A few moments of consideration given to the way answers are presented will, in the future, benefit very many candidates. A simple piece of advice would be to draw all arrows in colour and to group annotations into boxes of text that do not run into other boxes of text.

In their responses to questions candidates have got better at responding to the requirement to display an understanding of materials and construction but, at the same time, it was felt that a deeper understanding of how things work practically was a little lacking this year with many candidates providing solutions to questions that just would not work. At the same time several candidates wrote up evaluations of their designs and this wasn't required or asked for. Very many candidates drew the workings of the inside of motors, which was felt to be unnecessary, but then failed to provide the motor's RPM, or then consider how this speed could be either reduced or increased.

Section A

In this section question 2 was the most popular followed by question 1 and then question 3. The vast majority of candidates could provide two working solutions to the problems set but occasionally failed to produce a third solution which was significantly different to the first two. A great deal of imagination was shown in response to questions in this section with some candidates producing outstanding designs – please see the exemplar material available on the website for examples of this. However, other candidates provided solutions that were a little far-fetched, either lacking practicality or simply not answering the question. In future candidates are urged to read the question thoroughly to ascertain the key requirements before embarking on their answers.

Question 1

Better responses to this question considered a) how the plastic could be gathered from the sea, b) how it could be lifted into the boat and, in some cases, c) how it could be stored and packaged, though this wasn't a requirement of the question. Several candidates failed to realise that the plastic was only on the surface of the water whilst others failed to consider how to get underneath the plastic to gather it up. Some candidates failed to realise that holes cut into the side of the boat would probably make it sink! There were lots of nets, many scoops and even a few hoovers.

Question 2

There was a very wide range of responses to this question from concrete-built bridges to submarines (yellow, of course!). Better candidates considered the environment and the fact that the need for medical equipment, food and water is normally an emergency so that speed of delivery becomes an issue, whereas weaker candidates assumed that quite a degree of building work could take place with posts being sunk into the banks of the flooded stream and such like. Nearly all candidates focused on supplying medical equipment only and disregarded the need for fresh water or food.

Question 3

Candidates who tackled this question often failed to come up with a third unique working concept. Better candidates drew a machine with an off-centre motorised weight designed to make the machine vibrate, and then went on to design a 'hand operated' system as alluded to in the question. This question was possibly the least popular because the activity of 'riddling' soil is probably quite alien to most teenagers. That said, the principle is quite easy to understand so it was surprising that so few candidates opted for this question which, it was felt, lent itself to lower-tech answers.

Section B

In this section question 4 was the most popular followed by question 5 then question 6. Most candidates displayed clever and innovative solutions to the set problems and this, in turn, revealed their potential as future engineers. However, it is clear that many candidates had difficulty in presenting their design thinking. Some candidates only provided orthographic views of their proposal: whilst this is often a good way of portraying design thinking it is probably better to combine this method of presentation with pictorial views to help convey information about constructional details and the way the design concept actually fits together and works. It is recognised that in the time allowed this is a difficult task but the level of difficulty does help markers to discriminate between the stronger and the weaker candidates.

Question 4

This very popular question generated an extremely broad and exciting range of responses with solutions ranging from quite discreet devices that nudged the rocker of the cradle up and down a few centimetres, to ones that attached to the end of the cot and swung like a pendulum, to designs that attached the side of the cot to a device fixed to an adjacent wall. Several candidates failed to consider the safety of the baby with some designs having a crank arm connected to the centre of the cot with the other end connected to a 240v electric motor running at 1400rpm! Too few candidates considered what speed the cot should oscillate at and very few candidates were able to show how a microphone - often included to sense when the baby cried - should be integrated into an electronic system. That said, the range and diversity of answers impressed the markers.

Question 5

In this question very many candidates produced designs that would create wear and tear on the sole of the trainer. Better candidates produced designs that simulated "regular use", as required, but many candidates produced devices that simply abraded the sole of the shoe often through the use of a conveyor belt covered with an abrasive material. Too many candidates felt that they had to design a fully animated leg to solve this problem but (as can be seen in the exemplar answer to this question on the website) this was not always a necessary function of the device. Better candidates designed clever devices that pressed the sole of the trainer repeatedly onto a range of different materials and surfaces. Too few candidates took the opportunity to display a knowledge of electronics by designing a system that operated for only 2000 cycles.

Question 6

This question, which arguably relies the most upon a knowledge of electronics to answer, was the least popular, even though, mechanically, it could be said that it is the easiest problem to solve. It was felt that the requirement for the gel to change automatically (every five seconds) was probably what put most candidates off this question. Candidates that did tackle this question often provided very successful solutions, producing designs that had great potential and designs that would work, probably more so than proposals presented for the other two questions in this section.