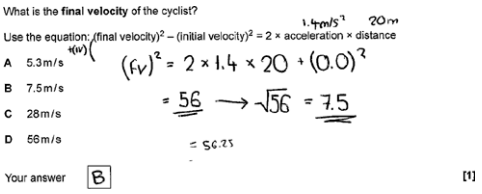
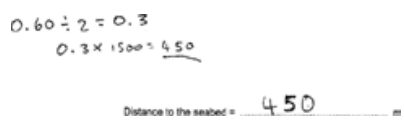
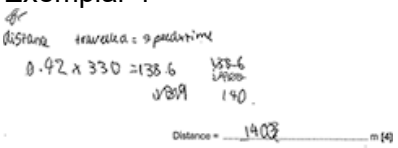
Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1			B	1 (AO 2.1)	**ALLOW** 80 **Examiner's Comments** Many successful candidates used the 'white space' to write out the calculations required.
			Total	**1**	
2			A	1 (AO 1.1)	
			Total	**1**	
3			B	1 (AO 2.1)	**Examiner's Comments** This is quite a challenging calculation for Foundation tier candidates. Many successful candidates used the space to rearrange the equation and calculate the final velocity. A common incorrect response was D; 56 is the square of the final velocity. Exemplar 1  What is the **final velocity** of the cyclist? Use the equation: (final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance A 5.3m/s B 7.5m/s C 28m/s D 56m/s $(fv)^2 = 2 \times 1.4 \times 20 + (0.0)^2$ $= 56 \rightarrow \sqrt{56} = 7.5$ Your answer B [1] The candidate used the space to organise their thoughts and come up with the correct response.
			Total	**1**	
4			D	1 (AO 1.2)	
			Total	**1**	
5			**First check the answer on the answer line** **If answer = 120 (m / s^2) award 2 marks** (deceleration =) 18 ÷ 0.15 ✓	2 (2 × AO 2.1)	**IGNORE** "-" **Examiner's Comments** Most candidates correctly substituted the data into the given equation.

			(deceleration =) 120 (m / s^2) ✓		A number of lower-scoring candidates incorrectly multiplied velocity by the time.
			Total	**2**	
6		i	(ultrasound pulse) may reflect off fish or different layers / rocks in seabed or named object in sea ✓	1 (AO 3.2a)	**ALLOW** not smooth (surface of seabed) **Examiner's Comments** There were many vague answers. Some candidates stated that the pulse was just reflected from the seabed without making reference to multiple reflections due to the uneven surface. The common correct answer was part of the pulse was reflected from fish. Examiners expected any additional reflection to be stated from a named object – object on its own did not score.
		ii	**First check the answer on the answer line** **If answer = 450 (m) award 3 marks** Time = 0.3 (s) (to the seabed) ✓ (distance =) 1500 x 0.3 ✓ (distance =) 450 (m) ✓	3 (AO 1.2) (AO 2.1) (AO 2.1)	**ALLOW** 1500 x 0.6 for 1 mark **ALLOW** 900 (m) for 2 marks **Examiner's Comments** Only a small minority of candidates scored full marks. The common incorrect answer was 900 m, which gained 2 marks. These candidates substituted the data into the given equation and calculated the distance travelled, but this was the distance the pulse travelled from the ship to the seabed and back to the ship. High-scoring candidates clearly showed that the time of 0.6 s was divided by 2 to give 0.3 s, and then used this value in the equation. A few candidates found the total distance the pulse travelled, before dividing by 2. Candidates should be encouraged to show their working. Exemplar 2

					 In this response, the candidate has clearly shown the division by 2. Then the candidate has substituted the data into the given equation to determine the distance to the seabed. Since the equation given does not need to be rearranged, there was no need to write down the given equation. If the equation had needed to be rearranged, then the rearranged equation should be written down in a candidate's answer.
			Total	**4**	
7			C	1 (AO 2.2)	**Examiner's Comments** Although the majority of the candidates correctly identified that it took 1 second for the drive to react there were many incorrect responses. Distractor B was often chosen, perhaps indicating that the graph was not correctly interpreted. Candidates should be encouraged to read all the responses eliminating those that are wrong. Then carefully looking at the remaining responses. A number of candidates chose A, perhaps not understanding the terms 'brake' and 'react'.
			Total	**1**	
8	a	i	Ruler / metre rule / tape measure ✓	1 (AO 1.2)	**ALLOW** metre stick / rule
		ii	Stop clock / stopwatch / (mobile phone) timer ✓	1 (AO 1.2)	**ALLOW** light gates
	b	i	1 (s) ✓	1 (AO 2.2)	
		ii	4.5 (s) ✓	1 (AO 2.2)	**Examiner's Comments** The first parts of this question offered

					a gentle introduction to Section B and many candidates were given full marks.
		iii	Increase ✓	1 (AO 3.1a)	**ALLOW** (accelerate) quicker/faster / more/higher (acceleration) **Examiner's Comments** Responses to this section often referred to speed rather than acceleration. A change in a factor such as acceleration can only be an increase or a decrease, or possibly stay the same. Higher performing candidates realised this and simply wrote 'increases' and were given the mark.
		iv	Line drawn with increased slope ✓	1 (AO 3.2b)	**IGNORE** any lines on the graph after the increased gradient **ALLOW** line starting from anywhere on the x-axis **Examiner's Comments** This was generally well answered by all candidates, and use of a ruler was widespread.
	c		Magnitude ✓ Direction ✓	2 (2 x AO 1.1)	Answers can be in either order **Examiner's Comments** This section was well answered by more successful candidates. A common error was that acceleration was one of the components, rather than magnitude.
			Total	**8**	
9			**B**	1 (AO 1.2)	**Examiner's Comments** Many successful candidates used the space to calculate the mean.
			Total	**1**	
10	a		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 140 (m) award 4 marks** distance travelled = speed × time ✓	4 (AO1.2) (AO2.1) (AO2.1) (AO1.2)	**Examiner's Comments** The majority of candidates were able to calculate the distance. Of these candidates, just over half were able to

			(distance travelled =) 330 × 0.42 ✓ (distance travelled =) 138.6 or 139 ✓ (distance travelled =) 140 (m) (to 2sf) ✓		correctly round the distance to two significant figures. One common error was the rounding of 138 to 14 (omitting the zero). Exemplar 1  This candidate has demonstrated how to respond to a calculation question well. The candidate has written the equation that is to be used (in this case from the data sheet). Then the correct numbers from the question have been substituted. The candidate when reading the question has underlined the numerical data values. Then the candidate has evaluated the equation and written the answer displayed by the calculator 138.6 – this response would have scored the candidate 3 marks. The candidate then correctly rounds the response to two significant figures.
	b		Idea time measured is incorrect ✓ due to child's reaction time / distracted / child hears a different firework / sound cannot be heard clearly / wind may have an effect ✓ OR Idea speed of sound varies ✓ Air is different temperature / density ✓	2 (AO3.2b) (AO3.2a)	**DO NOT ACCEPT** faulty stopwatch **ALLOW** different altitudes **Examiner's Comments** For this question, candidates needed to identify that the distance calculated depended on the time measured and the speed of sound. To gain full marks, candidates needed to identify the quantity that was not accurate and suggest a reason as to why this quantity may have been different.
			Total	**6**	
11		i	P ✓	1 (AO2.2)	**Examiner's Comments** Candidates here needed to realise that constant speed meant uniform

					gradient (+ or −) while the displacement from the starting point could not be negative.
		ii	Y ✓	1 (AO2.2)	**Examiner's Comments** More successful responses here recognised that the velocity alternated between positive and negative values as the swimmer changed direction and also recalled that the question stem referred to 'constant speed'.
			Total	**2**	
12			C ✓	1 (AO2.1)	
			Total	**1**	
13			D ✓	1 (AO2.1)	
			Total	**1**	