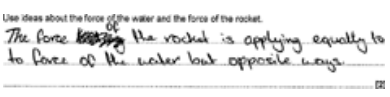
Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1	a	i	Upwards force = normal contact force ✓ Downwards force = weight ✓	2 (AO 1.1 x 2)	**Examiner's Comments** Most candidates correctly identified weight as the correct response for the downwards force, but only the most successful candidates correctly identified the upwards force as normal contact force.
		ii	**Any two from:** The water pushes on the rocket and the rocket pushes on the water ✓ The forces act in opposite directions ✓ The forces are the same size (and type) ✓ Each force acts on a different object ✓	2 (AO 2.1 x 2)	**ALLOW** 2 marks for Forces are equal and opposite **ALLOW** Upwards and downwards forces **ALLOW** Forces are equal **ALLOW** 1 mark for stating 'For every action there is an equal and opposite reaction' if no other mark has been awarded **Examiner's Comments** Question 19 (a) (ii) was generally poorly answered. Only the highest performing candidates were able to explain Newton's third law with reference to the two forces given in the question. High performing candidates who wrote Newton's third law as 'For every action there is an equal and opposite reaction', but did not correctly explain how it applied in the context of the question, were given a mark for this correct recall. Exemplar 2  The candidate correctly identified that the force of the rocket and the force of the water are equal and in opposite directions, and so achieved 2 marks.

		iii	The upwards force needs to be greater/stronger than the downwards force / **AW** /**ORA**✓	1 (AO 2.1)	**ALLOW** the thrust needs to be greater/stronger than the weight/force due to gravity **IGNORE** pressure **Examiner's Comments** Question 19 (a) (iii) was generally well answered by most candidates.
	b	i	**First check the answer on the answer line** **If answer = 2250 (J) award 2 marks** E = 5x10x45 ✓ E = 2250 (J) ✓	2 (AO 2.1) (AO 2.1)	**Examiner's Comments** Question 19 (b) (i) was a simple substitution into the given formula and most candidates generally answered well.
		ii	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 2500 W award 3 marks** (P = E / t) P = 12500 / 5 ✓ P = 2500 ✓ W or watts ✓	3 (AO 2.1) (AO 2.1) (AO 1.2)	Unit mark is an independent mark **ALLOW** J/s **Examiner's Comments** This was another simple substitution into the given formula, which most candidates generally answered well, although only the higher performing candidates scored the third mark for the unit.
			Total	**10**	
2		i	3 m / s^2 ✓	1 (AO 1.2)	**Examiner's Comments** Most candidates incorrectly estimated 50 m / s^2.
		ii	**First check the answer on the answer line** **If answer = 5 400 (N) award 2 marks** (F =) 1800 x (a)(i) ✓ (F =) 5400 (N) ✓	2 (2 × AO 2.1)	**ECF** from (a)(i) If a = 50 (m / s^2), F = 90 000 (N) ✓ If a = 100 (m / s^2), F = 180 000 (N) ✓ **Examiner's Comments** Most of the candidates gained 2 marks, multiplying the mass by their estimate for the acceleration.
			Total	**3**	
3			**C**	1 (AO 1.1)	**Examiner's Comments** Very few candidates chose the correct

					option (C). There was no pattern in the incorrect responses.
			Total	**1**	
4			D	1 (AO 2.1)	
			Total	**1**	
5			**C**	1 (AO 2.1)	
			Total	**1**	
6			B ✓	1 (AO1.1)	**Examiner's Comments** This question tested the understanding of the definition of acceleration and the equation relating force, mass and acceleration.
			Total	**1**	
7		i	Steady/uniform/constant speed/velocity ✓	1 (AO2.1)	**ALLOW** no acceleration/deceleration **Examiner's Comments** **Assessment for learning** Newton's First Law and equilibrium constitute a difficult area and should feature in discussions in as many situations as possible.
		ii	Accelerates / increases in speed ✓ because forces are unbalanced / forwards force > resistive force ✓	2 (2 × AO2.1)	**ECF** (a)(i) **ALLOW** until resistive force reaches new forward force **Examiner's Comments** Virtually all candidates clearly believed that, if the forces balance out in part (i), the swimmer can't go anywhere, so must be stationary. Many candidates who did not achieve a mark in part (a)(i) did get credit in part (a)(ii) by stating that the forward force overwhelms the resistive force, so the swimmer moves forward. Many candidates who had answered

					‘stationary’ in (i), gained a mark for ‘moves forwards’ without the word ‘accelerates’ in (ii) as there is an implicit acceleration in the situation described.
			Total	**3**	
8			D ✓	1 (AO1.1)	
			Total	**1**	