Question number			Answer	Notes	Marks
3	(a)	(i)	8.2 (m/s) ;		1

		(ii)	any TWO from:
			
			   MP1. reference to weight and drag;
			
			   MP2. weight greater than drag;
			   MP3. resultant force causes acceleration;
			
			   MP4. drag increases with speed;
			
			PLUS
			
			weight = drag at terminal velocity/eq;
				ignore reference to upthrust
				
				accept water friction or water resistance for "drag" accept 'gravitational force' for 'weight'
				
				"F=ma" is insufficient by itself
					3

	(b)	(i)	pressure difference = height × density × g ;	accept depth for height accept accepted symbols e.g. p, h, d (for height), d or ρ (for density), accept any correct rearrangement reject 'gravity' for 'g'	1
		(ii)	substitution; evaluation; correct answer: 250 000 (Pa) e.g. pressure difference = height × density × g pressure difference = 25 × 1000 × 10 pressure difference = 250 000 (Pa)	accept use of 9.8(1) for 'g' giving 245 000 (Pa) POT error gives −1 except if no evidence of use of 'g'	2
		(iii)	addition of 1.0×10^5 to candidate's answer to (ii); correct answer: 3.5×10^5 (Pa)	accept answer not given in standard form	1
		(iv)	substitution into given equation; rearrangement; correct evaluation; correct answer: 0.13(14) (m³) e.g. $p_1 \times V_1 = p_2 \times V_2$ $1.0 \times 10^5 \times 0.46 = 3.5 \times 10^5 \times V_2$ $V_2 = (1.0 \times 10^5 \times 0.46) \div (3.5 \times 10^5)$ $V_2 = 0.1314$ (m³)	subs and rearrange can be in either order; condone use of 2.5×10^5 Pa giving V = 0.18… (m³) for 2 marks condone use of 2.45×10^5 Pa giving V = 0.188… (m3) for 2 marks	3

Total for Question 3 = 11 marks

Question number			Answer	Notes	Marks
4	(a)		correct symbols for all components; components connected in a series circuit; ammeter in series with lamp; voltmeter in parallel with lamp;	ignore ammeter and voltmeter	4
	(b)	(i)	all points plotted correctly;	within half a small square	1
		(ii)	curve passes within half a small square of all points;	by eye	1
	(c)	(i)	idea of taking more data at different voltages;		1

		(ii)	any TWO from:
			   MP1. current (in filament) heats up the filament;
			
			   MP2. resistance changes with temperature;
			   MP3. idea that change of resistance affects gradient (of graph);
				allow idea that higher voltage will increase the temperature of the filament
				 condone 'lamp' for filament
				
				 allow 'increasing resistance decreases current for the same voltage' for MP2 and MP3
					2

Total for Question 4 = 9 marks

Question number			Answer	Notes	Marks
8	(a)	(i)	balance;	condone scales reject scale	1
		(ii)	take repeats **and** either find mean, identify or remove anomalies;		1
	(b)		mass of air is 0.61 g; correct use of formula: density = mass/volume; correct evaluation to 2 sf; appropriate unit i.e. g/cm³; correct answer = 0.0012 g/cm³ e.g. mass of air = 15.61 − 15.00 = 0.61 density = mass ÷ volume density = 0.61 ÷ 490 density = 0.00124 g/cm³ density = 0.0012 g/cm³ to 2 sf	−1 POT error accept use of standard form i.e. $1.2(4) \times 10^{-3}$ g/cm³	4

	(c)		any THREE from:
			  MP1. any reference to displacement method;
			  MP2. measure original volume of water;
			  MP3. (fully) submerge balloon;
			  MP4. re-measure volume of water;
			  MP5. subtract one volume from the other;
				allow reference to displacement to a different vessel and use of measuring cylinder or beaker for three marks	3

Total for Question 8 = 9 marks

Question number			Answer	Notes	Marks
10	(a)	(i)	26(.4) (N) ;		1
		(ii)	(resultant) force = mass × acceleration;	allow acceptable symbols e.g. F, f, m, M, a, A allow any correct rearrangement;	1
		(iii)	conversion of 160 g to 0.16 kg; rearrangement or substitution; correct evaluation; correct answer: 165 (m/s^2) e.g. acceleration = resultant force ÷ mass acceleration = 26.4 ÷ 0.16 acceleration = 165 (m/s^2)	allow ECF for incorrect resultant force Condone rounding to 160 or 170.	3
		(iv)	any THREE from: MP1. weight decreases; MP2. air resistance increases; MP3. consistent inference of changing resultant force; MP4. (therefore) changing acceleration;	ignore references to running out of fuel reducing thrust/eq ignore references to energy DOP consistent with MP3	3
	(b)		any FOUR from: MP1. (observed) frequency decreases; MP2. speed of **waves** constant; MP3. wavefronts behind firework spread out/eq; MP4. causing an increased wavelength (at the observer); MP5. reference to f = speed ÷ wavelength;	ignore references to region in front of rocket or an approaching rocket allow any rearrangement	4

Total for Question 10 = 12 marks