

SECTION B

Question			Marking details	Marks Available
7	(a)		<p>KE given to water (1)</p> <p>Air resistance (1)</p> <p>Award 2 marks for: Water runs out before pressure drops to 1 atm</p> <p>Accept PE given to water [even though water runs out in 1.6 m]</p> <p>Accept viscosity [or friction] of water</p> <p>Accept KE given to bottle [only 1/10th of mass of ball]</p> <p>Don't accept heat or sound</p>	2
	(b)		<p>$v = -20 \ln \left(1 - \frac{5.9}{1.5} \times 0.175 \right)$ (1)</p> <p>$v = 23.3 \text{ [m s}^{-1}\text{]}$ (1)</p>	2
	(c)		<p>kg s^{-1}, m^2, kg m^{-3} and m s^{-1} (0 or 1 unit correct 0 marks) (2 or 3 units correct 1 mark) (All 4 correct 2 marks) If all 4 units correct but algebra is incorrect then deduct 1 mark</p>	2
	(d)		<p>Rearranging i.e. $u = \frac{\Delta m / \Delta t}{\pi r^2 \rho}$ (1)</p> <p>Answer = $25 \text{ [m s}^{-1}\text{]}$ (1)</p>	2
	(e)		<p>Any 3 × (1) from:</p> <p>Rocket equation assumes constant u</p> <p>Volume increasing so pressure decreasing</p> <p>Pressure is decreasing so u is decreasing</p> <p>Thrust is decreasing</p>	3

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	(f)		$\Delta p = 6.8 \times 10^5 \text{ [Pa]} \text{ (1)}$ $u = \sqrt{\frac{2 \times 6.8 \times 10^5}{1000}} = 36.9 \text{ [m s}^{-1}\text{]} \text{ (1)}$	2
	(g)		mg - weight or gravitational force and $0.0107v^2$ - air resistance / drag accept <u>skin</u> / <u>air</u> friction (1) Weight decreases (1) Air resistance increases (1)	3
	(h)		Squaring equation 6 or rearranging equation 5 (1) Convincing algebra (1)	2
	(i)	I	Fast process or no time for heat to flow or equivalent	1
		II	The gas does <u>work</u> so <u>internal energy</u> decreases Or $\Delta U = -W$	1
			Question 7 Total	[20]