1		0.229 With Explanation	B1	Finding bound of s: 3.465 or 3.475 or 3.474999… or Finding bound of t: 8.1315 or 8.1325 or 8.132499…
			P1	Use of "upper bound" and "lower bound" in equation
			P1	Process of choosing correct bounds eg $\frac{\sqrt{3.475}}{8.1315}$ or $\frac{\sqrt{3.465}}{8.1325}$
			A1	For 0.2292… and 0.2288.. from correct working
			C1	For 0.229 from 0.2292.. and 0.2288.. since both LB and UB round to 0.229

2	(a)		0.625	B1	cao
	(b)		$9.75 \leq x < 9.85$	B2	for $9.75 \leq x < 9.85$
				[B1	for 9.75 or 9.85 (or $9.84\dot{9}$)]

3		Yes and correct working	B1	for 147.5 or 148.5 or 148.4999... or 11.75 or 11.85 or 11.84999...
			P1	substitutes $11.8 < \text{UB} \leq 11.85$ and $147.5 \leq \text{LB} < 148$ in the formula to work out petrol consumption
			A1	for 'Yes' and 8.03(3898305...) from correct working

4	0.43	B1	for one correct bound for mass or length eg 1967.5 **or** 1972.5 **or** 13.15 **or** 15.95 **or** 21.65 **or** 13.25 **or** 16.05 **or** 21.75	Can work in any units
		P1	for a correct process to find a bound for the volume, eg 13.15 × 15.95 × 21.65 (=454(0.925125)) **or** 13.25 × 16.05 × 21.75 (=462(5.409375))	Accept volumes truncated or rounded to at least 3 sig fig
		P1	for a correct process to find a bound for density, eg [mass LB] ÷ "462(5.409375)" (=0.425(367755)) where 1965 ≤ mass LB < 1970 **or** [mass UB] ÷ "454(0.925125)" (=0.434(3828506)) where 1970 < mass UB ≤ 1975	Accept densities truncated or rounded to at least 3 sig fig
		A1	for both correct bounds, 0.425(367755) **and** 0.434(3828506)	Accept bounds truncated or rounded to at least 3 sig fig At this point correct units must be used
		C1	(dep on A1) for a correct statement on degree of accuracy e.g. UB and LB both round to 0.43 to 2 decimal places or 2 significant figures	Must be 0.43 not 0.4

5	8.3 and 8.4	B1	for 8.3 in the correct position	
		B1	for 8.4 in the correct position	Accept $8.3\dot{9}$ or 8.399…

6 (a)	81.0662	M1	for one of 26.15 or 26.25 or 4.25 or 4.35	Accept $26.24\dot{9}$ for 26.25 and $4.34\dot{9}$ for 4.35
		M1	for a correct process to find the upper bound for D [UB of u]^2 ÷ [2 × LB of a] eg $\frac{26.25^2}{2\times4.25}$ where 26.2 < UB of $u \leq 26.25$ and $4.25 \leq$ LB of $a < 4.3$	Award for $\frac{26.25^2}{4.25}$
		A1	for answer given in the range 81.0661 to 81.0662 from correct working	
(b)	80	B1	for 80 ft answer to (a) with 78.6003	
	explanation	C1	for explanation relating to the upper bound found in (a) **Acceptable examples** bounds agree when rounded to 80 bounds agree to nearest 10 **Not acceptable examples** 80 79.83325 rounded to nearest tenth	

7	127.5 and 128.5	B1	for 127.5 in the correct position	
		B1	for 128.5 in the correct position	Accept $128.4\dot{9}$ or 128.499...

8	160 (supported)	B1	stating bound of 10.85 or 10.95	Accept $10.94\dot{9}$ or 10.9499... for 10.95
		M1	using both UB **and** LB to work out value of d eg [UB of c]^3 ÷ 8 **and** [LB of c]^3 ÷ 8 **or** gives a bound of 159.66... from correct working **or** gives a bound of 164.11... from correct working	10.9 < UB ≤ 10.98 10.85 ≤ LB < 10.9
		A1	for 159.66... **and** 164.11... from correct working	Accept bounds rounded or truncated to at least 4 sig fig
		C1	for 160 from 159.66... and 164.11... with a supporting reason eg "since both UB and LB round to 160"	

9	984.(3677853) and 969.(0181643)	B1	stating bound of 51.95 or 52.05 or 1.445 or 1.455	Accept $52.04\dot{9}$ or 52.0499… for 52.05 Accept $1.454\dot{9}$ or 1.4549… for 1.455
		P1	for process to rearrange formula to give g as the subject, eg $g=\frac{4\pi^2 l}{T^2}$ oe	Rearrangement may occur after substitution, in this case correct bounds are not needed for this mark
		P1	for process to use LB of l **and** UB of T in formula for g or T **or** process to use UB of l **and** LB of T in formula for g or T eg $\frac{4\pi^2[\text{LB of } l]}{[\text{UB of } T]^2}$ or $\frac{4\pi^2[\text{UB of } l]}{[\text{LB of } T]^2}$	51.95 ≤ [LB of l] < 52.0 1.45 < [UB of T] ≤ 1.455 52.0 < [UB of l] ≤ 52.05 1.445 ≤ [LB of T] < 1.45 Rearrangement may not be correct
		A1	for upper bound = 984.(3677853) or 984.(1125639..) **and** lower bound = 969.(0181643) or 968.(7669227..)	NB: correct answer without supportive working gets 0 marks Accept answers rounded or truncated to 3sf or better

10	6.35, 6.45	B1	for 6.35 in the correct position	
		B1	for 6.45 in the correct position	Accept $6.44\dot{9}$ oe or 6.4499… oe