

APOLLO

Work, energy and power

HL

Physics

First assessment 2025

6 questions | mark schemes

8.	a	i	Identifies length of cylinder as $v\Delta t$ so volume as $S \times v \times \Delta t$ to show the result ✓		[1]
	a	ii	$\Delta p = \Delta m \times v$ OR $\rho \times S \times v \times \Delta t \times v$ ✓ Force is $\frac{\Delta p}{\Delta t} = \frac{\rho \times S \times v \times \Delta t \times v}{\Delta t}$ Hence result ✓	Award [1] if solved through $F = ma$ replacing $a = \frac{\Delta v}{\Delta t}$ (therefore not using v as about constant through interval Δt)	[2]
	b	i	Identifies orbital velocity as $v = \sqrt{\frac{GM}{r}}$ ✓ $E_K = \frac{1}{2}mv^2 = \frac{GMm}{2r}$ so $E_T = \frac{GMm}{2r} - \frac{GMm}{r}$ Hence result ✓		[2]
	b	ii	The total energy is reduced OR the satellite gets closer to the surface ✓ «From $v = \sqrt{\frac{GM}{r}}$ » the satellite moves faster ✓ «From $\rho S v^2$ » the opposing force increases « because v and ρ increase » ✓ The satellite burns / crashes / falls to Earth ✓		[4]
	c	i	$P = \frac{\Delta E}{\Delta t}$ ✓ $P = \frac{-4.5 \times 10^9}{30 \times 24 \times 3600} = -1.7 \times 10^3 W$ ✓	Ignore sign	[2]
	c	ii	Average height 417.5 km ✓ $v = \sqrt{\frac{6.67 \times 10^{-11} \times 5.98 \times 10^{24}}{(6.38 + 0.4175) \times 10^6}}$ OR $7.7 \times 10^3 m s^{-1}$ ✓	Accept 417.5 ± 0.3 for MP1	[2]
	c	iii	$\Delta T = \frac{Q}{mc}$ ✓ $\Delta T = \frac{4.5 \times 10^9}{4.2 \times 10^3 \times 500} = 21 K$ OR $21^\circ C$ ✓	Award [2] if 21 is seen as the answer without working	[2]

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	c	iv	Attempt to use $P = Fv$ ✓ $1.7 \times 10^3 W = F \times 7.7 \times 10^3 m s^{-1}$ ✓ $F = 0.22 N$ ✓	Allow ECF from c) i). Ignore sign. MP3 will vary depending on their values of c) i) and c) ii, between 0.21 and 0.23	[3]
	d		$V = \frac{E}{\text{E density}}$ ✓ $V = \frac{4.5 \times 10^9}{8.5 \times 10^9} = 0.53 m^3$ ✓	Award [2] if $0.53 << m^3 >>$ is seen as the answer without working	[2]

Mark-scheme answers

Physics HL | Paper 1A | Nov 2025 TZ1 | Q5 | 1 marks

5. D

Physics HL | Paper 1A | Nov 2025 TZ1 | Q6 | 1 marks

6. D

Physics HL | Paper 1A | Nov 2025 TZ3 | Q6 | 1 marks

6. D

Physics HL | Paper 1A | Specimen 2025 | Q3 | 1 marks

3. A

Physics HL | Paper 1A | Specimen 2025 | Q6 | 1 marks

6. B