

Question	Answer	Marks	AO Element	Notes	Guidance
1(a)	$30 \times 20 \times 5$ or length \times width \times height or cross-sectional area \times length	1			
1(b)	$D = M / V$ in any acceptable form (1) $2400 \div 3000$ (1) $0.80 \text{ (g/cm}^3)$ or $0.8 \text{ (g/cm}^3)$ (1)	3			
2(a)	$43.9 - 19.7$ or 24.2 (cm)	1			
2(b)	any two from: measure the extension for different (number of 1.0 N) loads repeat each reading (as each (1.0 N) load is removed) AND calculate average (extension for each load) (take reading from ruler with) eye level with pin	2			
3(a)	1. straight line from (0,0) to (10,50) (1) 2. gradient/slope (1)	2			

Question	Answer	Marks	AO Element	Notes	Guidance
3(b)	$a = \Delta v \div \Delta t$ in any form OR (a =) $\Delta v \div \Delta t$ OR (a =) $(9-5) \div 10$ OR $4 \div 10$ (1) (a =) 0.40 m/s^2 (1)	2		Δ or change in t must be seen	
4(a)	$F = ma$ in any form OR (a =) F / m OR (a =) $3500 / 1400$ (a =) 2.5 m/s^2	2			
4(b)	$a = (v - u) / t$ in any form OR (t =) $(v - u) / a$ OR (t =) $(30 - 0) / 2.5$ OR $30 / 2.5$ (t =) 12 s	2			
4(c)	friction / air resistance / drag	1			
5	$B - 10 \text{ m/s}^2$	1			
6	C	1			
7	(d =) vt in any form: words, symbols, numbers	C1			

Question	Answer	Marks	AO Element	Notes	Guidance
	41 m or 40.8 m	A1			
8(a)	force × distance (from pivot) OR $80\ 000 \times 5.0$ (1) $400\ 000$ (1) Nm (1)	3			
8(b)	c.w. moment = a.c.w moment OR moment of load = moment of counterweight OR $5.0 \times 80\ 000 = \text{load} \times 8.0$ (1) $400\ 000 \div 8.0 = \text{load}$ (1) 50 000 (N) (1)	3			
9(a)	(KE =) $\frac{1}{2}mv^2$ in any form	C1			
	1200 J	A1			
9(b)	(G)PE (gained) = KE (lost) in any form	C1			
	(G)PE = mgh OR $h = \text{PE} \div mg$ in any form	C1			

Question	Answer	Marks	AO Element	Notes	Guidance
	1.8 m	A1			e.c.f. from (a)
9(c)	friction with air OR air resistance OR thermal energy / heat produced/lost	B1			
10(a)	$W = m \times g$ OR 15×10 150 (N)	2			
10(b)(i)	turning effect (of a force)	1			
10(b)(ii)	moment = force \cdot distance 425×2.5 1062.5 OR 1063 Nm	4			
10(b)(iii)	(move rope/tyre) closer to trunk owtē	1			
11(a)	(impulse =) Ft in any form (1) (impulse =) 2.4 Ns (1)	2			

Question	Answer	Marks	AO Element	Notes	Guidance
11(b)	$Ft = mv - mu$ in any form OR ($v - u =$) Ft / m (1) 43 m/s (1)	2			
12	energy cannot be created or destroyed (1) but can be transformed/changed (from one form to another) (1)	2			
13	$KE = 1/2 mv^2$ in any form OR ($KE = 1/2 \times 1.2 \times 10^6 \times 0.04^2$) (1) ($KE =$) 960 J (1)	2			
14	thermal (1) dissipated to the air / surroundings (1)	2			
15	3.9 (1) $280 / 72$ (1) ($P =$) F / A OR (pressure =) force / area (1) (area = $4 \times 18 =$) 72 (cm^2) (1) N/cm^2 (1)	5			

Question	Answer	Marks	AO Element	Notes	Guidance
16(a)	$1.6 \times 10^6 \text{ Pa}$ (1) $(p =) h\rho g$ (in any form) OR $150 \times 1000 \times 10$ OR 1.5×10^6 (1) 1.5×10^6 OR $1.0 \times 10^5 + \{150 \times 1000 \times 10\}$ OR $1.0 \times 10^5 + 1.5 \times 10^6$ OR 1.6×10^6 (1)	3			
16(b)	$5.6 \times 10^6 \text{ N}$ (1) $(F =) pA$ (in any form) OR $1.6 \times 10^6 \times 3.5$ (1)	2			
[Total: 60]					