Question	Answer	Marks	AO Element	Notes	Guidance
1	idea that mass is (a measure of) amount of matter in a body (1) idea that weight is a gravitational force (1)	**2**			
2	idea that mass is (a measure of) amount of matter in a body (1) idea that weight is a gravitational force (1)	**2**			
3(a)	0.80 N	**1**			
3(b)	(moment = force × distance =) 0.8 × 0.25 (1) (moment =) 0.20 N m (1)	**2**			
3(c)	same value as (b) with correct unit	**1**			
3(d)	F × 0.75 = 0.20 in any form **OR** (F =) 0.2 / 0.75 (1) *(*F = 0.2 / 0.75 =) 0.27 N (1)	**2**			

Question	Answer	Marks	AO Element	Notes	Guidance
4	any **two** from: (2) - <u>weight</u> **OR** <u>force</u> of / due to gravity acts down - (force of / due to) air resistance / drag / friction acts up / opposes motion - initially / up to 10 s: resultant force is downward **OR** downward force is greater than upward force - resultant force causes acceleration air resistance increases as speed increases / she accelerates any **two** from: (2) - acceleration (down) initially / for first 10 s - acceleration decreases as air resistance increases / resultant force decreases - zero acceleration / constant speed / terminal velocity reached when upwards force = downwards force **OR** when no / zero resultant **OR** when forces balanced **OR** when downward force = air resistance - terminal velocity / constant speed reached after (about) 10 s **OR** at 60 m / s	**4**			

Question	Answer	Marks	AO Element	Notes	Guidance
5(a)	total mass of passengers = 73 × 65 (kg) **OR** 4700 kg (1) (total mass of bus, driver and 73 passengers) = 21 000 kg (1)	**2**			
5(b)	(F =) ma in any form (1) (F =) 15 000 N (1)	**2**			
6(a)	(*W* =) *mg* **OR** $3.4 \times 10^3 \times 10$ (1) 3.4×10^4 N (1)	**2**			
6(b)(i)	moment = *Fx* in any form **OR** (moment) = *Fx* **OR** 0.50 (seen) (1) $3.4 \times 10^4 \times (1.8 - 1.3)$ **OR** $3.4 \times 10^4 \times 0.50$ (1) 1.7×10^4 N m (1)	**3**			
6(b)(ii)	(the point) where (all) the mass can be considered to be concentrated	**1**			
6(b)(iii)	$1.7 \times 10^4 / (1.3 + 0.70)$ **OR** $1.7 \times 10^4 / (2.0)$ (1) 8.5×10^3 N (1)	**2**			

Question	Answer	Marks	AO Element	Notes	Guidance
6(c)	(moment / it) increases (1) perpendicular distance (between P and line of action of) W increases (1)	**2**			
7(a)(i)	W = (4.8 × 10 =) 48 N	**1**			
7(a)(ii)	(P=) F ÷ A **OR** 48 ÷ (0.12 × 0.16) (1) 2500 Pa (1)	**2**			
7(b)	atmospheric pressure (in addition to liquid pressure)	**1**			
7(c)	P = hdg or in words **OR** (d=) P ÷ hg **OR** 2500 ÷ (0.32 × 10) **OR** d = M ÷ V = 4.8 ÷ (0.12 × 0.16 × 0.32) (1) 780 kg / m^3 (1)	**2**			
8(a)	average/overall/combined density (of the metal and air contained) less (than density of sea water)	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
8(b)	(P =) $h \times \rho \times g$ **OR** (V=) $A \times l$ in any form (1) (P= 1.2 × 1020 × 10 =) 12 000 (Pa) **OR** (V= 0.8 × 1.2 =) 0.96 (m^3) (1) $P = F \div A$ **OR** (F =) $P \times A$ **OR** (W =) $V \times \rho \times g$ (1) (F = 12240 × 0.80 =) 9800 N **OR** (F = W =) 9800 N (1)	**4**			
8(c)	same numerical answer as **(b)** (1) resultant/net (vertical) force = 0 **OR** downward force = upward force **OR** forces are balanced (1)	**2**			
9(a)	gradient changes **OR** graph is curved	**1**			
9(b)	mass of space rocket <u>decreases</u> **OR** gravitational field strength decreases	**1**			
10(a)	(measure of) quantity / amount of matter **OR** (property) that resists change in motion / speed / momentum **OR** measure of a body's inertia	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
10(b)(i)	$d = m / V$ **OR** in words **OR** $0.44 / 0.080^3$ **OR** $0.44 / 5.12 \times 10^{-4}$ **OR** $440 / 8^3$ **OR** 440 / 512 **OR** $0.44 / 8^3$ **OR** 0.44 / 512 0.86 g / cm^3 **OR** 860 kg / m^3 **OR** 8.6×10^{-4} kg / cm^3	**2**			
10(b)(ii)	sinks **OR** does not float AND (cube) denser (than oil)	**1**			
10(c)(i)	$W = mg$ **OR** (g =) W / m **OR** 0.70 / 0.44 1.6 N / kg	**2**			
10(c)(ii)	(P =) hdg **OR** $0.030 \times 850 \times 1.6$ 41 Pa	**2**			
11	column 1 box 3 mass same column 2 box 4 weight 1/6 column 3 box 3 deceleration same	**3**			

Question	Answer	Marks	AO Element	Notes	Guidance
12(a)	2.05×10^9 N	**B1**			
12(b)	use of *mgh* OR weight × *h*	**C1**			
	1.03×10^{12} J	**A1**			NOT ecf from **(a)**
13(a)(i)	180 N	**B1**			
13(a)(ii)	*(P =) F÷ A* **OR** 180÷(0.30 × 0.04)	**C1**			
	15 000 Pa	**A1**			
13(b)(i)	arrow (labelled *W*) from / to correct centre of mass	**B1**			
13(b)(ii)	force × (perpendicular) distance **OR** 40 × 0.60 **OR** 180 × 0.15 in **iii**.	**C1**			
	24 N m	**A1**			
13(b)(iii)	27 N m	**A1**			e.c.f. from **(a)(i)**

Question	Answer	Marks	AO Element	Notes	Guidance
14(a)	anticlockwise moment = clockwise moment **OR** 45 × 0.40 = 25 × *W*	**C1**			
	0.72 N	**A1**			
14(b)	0.072 kg **OR** 72 g	**B1**			e.c.f from **(a)**
15	(weight =) 3(.0) (N) (3) OR ALLOW 300 g = 0.3 kg (1) (weight =) mass × g (1)	**3**			
16	78 N (3) OR ALLOW (*m*=) *ρV* OR *ρ* = *m* / *V* in any form (1) *W* = *mg* (1)	**3**			
17	*W* = *mg* **OR** *W* = 10 × *m* (1) 12. 5 (1) kg (1)	**3**			

Question	Answer	Marks	AO Element	Notes	Guidance
18	W = m × g **OR** W = m × 10 **OR** (m =) W ÷ g in any form (1) 6.0 ÷ 10 (1) 0.6(0) (kg) (1)	**3**			
19(a)	density = mass ÷ volume in any form (1) 1260 ÷ 150 (1) 8.4 (1) g/cm^3 (1)	**4**			
19(b)	1.26 (kg)	**1**			
20	W = mg in any form (1) 0.25 × 10 (1) 2.5 (N) (1) both lines have 2.5 (N) (1)	**4**			
21(a)	mass in kg **AND** height in m (1) area in m^2 (1)	**2**			

Question	Answer	Marks	AO Element	Notes	Guidance
21(b)(i)	W = m × g (1) 4000 × 10 (1) 40 000 (N) (1)	**3**			
21(b)(ii)	P = F ÷ A in any recognisable form (1) (area =) 0.125 × 4 = 0.50 (m^2) (1) b(i) ÷ 5000 **OR** 40 000 ÷ 0.500 (1) 80 000 N / m^2 **OR** 80 000 Pa (1)	**4**			
22	W = m × g in any form **OR** (m=) W ÷ g **OR** 100 g weighs 1 N (1) 0.84 ÷ 10 **OR** 100 (g) × 0.84 (1) 0.084 (kg) **OR** 84 g (1)	**3**			
23	(W=) m × g (1) 650 × 8 (1) 5200 (N) (1)	**3**			

Question	Answer	Marks	AO Element	Notes	Guidance
24(a)	*w* = *m x g* in any recognised form 2250 / 10 225 (kg)	**3**			
24(b)(i)	moment = force x distance from pivot in any recognised form 400 x 0.4 **OR** 400 x 40 160 **OR** 16 000 Nm **OR** Ncm	**4**			
24(b)(ii)	apply force further from the pivot owtte	**1**			
25(a)(i)	*D* = *M* / *V* 450 ÷ 145 3.1 (g/cm^3)	**3**			
25(a)(ii)	*W* = *m x g* in any form 0.45 x 10 4.5 (N)	**3**			

Question	Answer	Marks	AO Element	Notes	Guidance
26(a)	$\rho = m / V$ in any form **OR** (m =) ρV **OR** (m =) $9000 \times 7.5 \times 10^{-5}$ 0.68 kg	**2**		allow 680 g	
26(b)(i)	$W = mg$ in any form **OR** (W =) mg **OR** (W =) 0.68×10 (W =) 6.8 N	**2**			
26(b)(ii)	any **one** of: weight has direction / mass does not weight is a vector / mass is not weight varies / mass does not mass is amount of matter weight is a force / mass is not	**1**			
27(a)	weight = mass × gravitational field strength in any form 20.0×10.0 200 (N)	**3**			
28(a)(i)	6500 (g)	**1**			
28(a)(ii)	density = mass ÷ volume in any form 1.3 g / cm^3	**3**			

Question	Answer	Marks	AO Element	Notes	Guidance
28(b)	density (of brush) is less (than) density of paint	**1**			
29(a)	W = m × g **OR** 15 × 10 150 (N)	**2**			
29(b)(i)	turning effect (of a force)	**1**			
29(b)(ii)	moment = force · distance 425 × 2.5 1062.5 **OR** 1063 N m	**4**			
29(b)(iii)	(move rope/tyre) closer to trunk owtte	**1**			
30(a)	any **two** from: use a ruler with mm (scale) ruler close(r) to book/no space between book and ruler have zero on ruler at one end of book take reading with eye in line with end of book owtte	**2**			

Question	Answer	Marks	AO Element	Notes	Guidance
30(b)	use large number of pages i.e. more than 50 measure (total) thickness (with ruler) divide (total) thickness by number of pages	**3**			
30(c)	convert g to kg or 400 ÷ 1000 Weight = mass · gravitational field strength in any form (weight =) 4.0 (unit) N or newtons	**4**			
31(a)(i)	(weight is) force/pull of gravity (acting on an object)	**1**			
31(a)(ii)	mass x acceleration due to gravity **OR** *mg* **OR** 350 × 7.5 2600 N	**2**			

Question	Answer	Marks	AO Element	Notes	Guidance
31(b)	(ρ =) m / V in any form 0.27 (kg / m^3) **OR** (g / m^3) balloon moves/floats <u>up</u> (floats when) density of balloon less than density of atmosphere **OR** (sinks when) density of balloon greater than atmosphere **OR** (ρ =) m / V in any form 110 g balloon rises (floats when) mass/weight of balloon less than mass/weight of atmosphere (of same volume as balloon) **OR** (sinks when) mass/weight of balloon greater than mass/weight of atmosphere (of same volume as balloon)	**4**			
32	C - 5.0 kg	**1**			
33(a)	160(g)	**B1**			

Question	Answer	Marks	AO Element	Notes	Guidance
33(b)	(density =) mass÷volume, in any form	**C1**			
	candidate's **(a)** ÷ 200	**C1**			
	0.8 (g/cm^3)	**A1**			
34(a)	267 (g)	**B1**			
34(b)	LHS goes down **OR** RHS goes up	**B1**			
34(c)	density = mass / volume, in any form e.g. words, symbols, numbers	**C1**			
	267 / 30	**C1**			
	8.9	**A1**			
	g/cm^3	**B1**			
35(a)	measuring cylinder / graduated cylinder	**B1**			

Question	Answer	Marks	AO Element	Notes	Guidance
35(b)	balance	**B1**			accept spring balance accept (weighing) scales
35(c)	find mass of empty cylinder	**B1**			
	find mass of cylinder + liquid	**B1**			
	subtract values	**B1**			**NOT** if stated the wrong way round accept valid alternative methods
36	weight of the rule / it is bigger	**B1**			
37	B - Weight is a force.	**1**			
38	(weight =) mass × g OR 1.6 × 10 OR mass = W ÷ g (1) (weight =) 16 (N) (1)	**2**		(weight =) 16 (N) gains 2 marks	
39	400 (g) = 0.4 (kg) (1) $w = m \times g$ in any form (1) 0.4 × 10 (1) (weight) = 4(.0) (N) (1)	**4**			

Question	Answer	Marks	AO Element	Notes	Guidance
40	W = m x g (1) (W =) 0.21 × 10 (1) 2.1 (N) (1)	**3**			
					[Total: 181]