Question number	Answer	Notes	Marks
2 (a) (i)	downward arrow labelled weight; downward arrow is equal in length to upthrust arrow;	ignore starting point of arrow allow 'gravitational force', 'force due to gravity' reject 'gravity' judge by eye	2
(ii)	(a quantity with) magnitude; and direction;	allow size, amount ignore quantity, measurement	2
(iii)	any correct vector; e.g. velocity, displacement, acceleration, momentum etc.	ignore force, any named force e.g. weight, upthrust etc	1
(b) (i)	pressure (difference) = height $\times$ density $\times$ g;	allow standard symbols and rearrangements e.g. $p = h \times \rho \times g$ allow d for density ignore "gravity" for g	1
(ii)	substitution; evaluation of pressure difference in Pa OR kPa to at least 3s.f.; addition of surface pressure (100 kPa) to give answer; e.g. $p = 15.8 \times 1030 \times 10$ $p = 162740$ Pa OR 162.74 kPa $p = 162.74 + 100$ (= 260 kPa)	allow g = 9.8, 9.81 -1 for POT error unless due to physics error reject this mark if inconsistent units used allow final answer in Pa or kPa allow 262 740 (Pa)	3
(iii)	any two from: MP1. idea that {weight of ship / downwards force} is greater; MP2. larger pressure difference (when deeper in water); MP3. larger upthrust force (needed to keep forces balanced);	allow ship is heavier, ship has more mass allow larger pressure (on bottom of ship)	2

Total for Question 2 = 11 marks

Question number	Answer	Notes	Marks
4 (a) (i)	weight = mass × gravitational field strength;	allow rearrangements and standard symbols e.g. W = m × *g* ignore 'gravity' for *g*	1
(ii)	substitution or rearrangement; evaluation; e.g. 520 = mass × 10 OR mass = W / g (mass =) 52 (kg)	 allow *g* = 9.8, 9.81 allow 53.1, 53.0, 53	2
(b) (i)	evidence of counting squares to find area; number of squares in range 37-42; evaluation of area of one square; evaluation of total area; e.g. dots seen in each square in diagram number of squares = 39 area of one square = (2 × 2) = 4 cm^2 total area = (4 × 39) = 156 cm^2	allow attempt to find area by splitting into rectangles / triangles allow if 2 × 2 seen in working allow ecf from incorrect number of squares allow 148-168	4
(ii)	pressure = force / area;	allow standard symbols and rearrangements e.g. p = F / A	1
(iii)	dimensionally correct substitution; evidence of doubling area or halving pressure to account for both feet; evaluation with matching unit; e.g. (pressure =) 520 / 156 area = 156 × 2 OR pressure = 3.2 ÷ 2 (pressure =) 1.7 N/cm^2	allow ecf from (b)(i) allow N/cm^2, N/m^2 or Pa if no marks awarded for calculation allow 1 mark if valid unit for pressure given allow 1.5-1.8 N/cm^2 allow 15 000-18 000 N/m^2	3

Total for Question 4 = 11 marks

Question number	Answer	Notes	Marks
12 (a)	comet drawn in orbit around the Sun; orbital path is elliptical;	 judge by eye allow partially drawn ellipse Sun need not be at a focus of the ellipse, but should not be at the centre of the ellipse	2
(b)	attempted use of orbital speed formula; valid substitution into orbital speed formula; correct evaluation of time period for either planet; attempt to divide T for Saturn by T for Mars; correct final evaluation of ratio; e.g. $v = 2 \times \pi \times r / T$ $24.1 = 2 \times \pi \times 2.28 \times 10^8 / T$ $T_{Mars} = 5.94 \times 10^7$ (s) OR $T_{Saturn} = 9.26 \times 10^8$ (s) $n = T_{Saturn} / T_{Mars}$ 15.6	allow for either planet seen anywhere in working $9.70 = 2 \times \pi \times 1.43 \times 10^9 / T$ 5.944… 9.2628… allow range of 15-16	5

Total for Question 12 = 7 marks