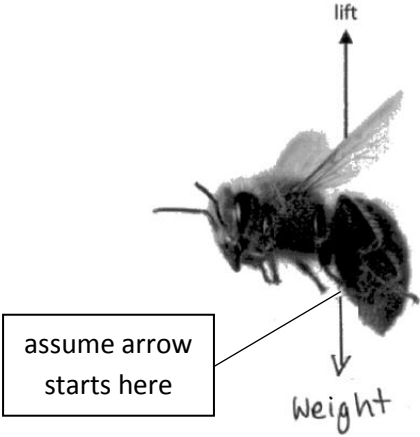
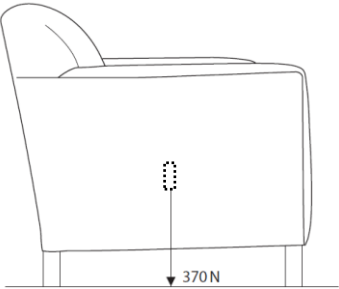


Question number	Answer	Notes	Marks
2 a	<p>downward arrow labelled 'weight' / 'air resistance';</p> <p>downward arrow is shorter than lift arrow (by eye);</p> 	<p>ignore horizontal arrows</p> <p>allow gravitational force, force due to gravity, W, mg, AR ignore spelling ignore 'gravity' 'G' judge length of arrow starting from the bottom of the bee ignore horizontal position of arrow</p>	2
b	<p>(i) B;</p> <p>(ii) A;</p> <p>(iii) (average) speed = <math>\frac{\text{distance (moved)}}{\text{time (taken)}}</math>;</p> <p>(iv) substitution; evaluation; e.g. (speed =) 19.5/35 (speed =) 0.56 (m/s)</p>	<p>allow rearrangements and standard symbols e.g. <math>v=s/t</math> <math>s=d/t</math></p> <p>allow distances used in range 19.5-20.0 (m) allow answers in range 0.55 - 0.57 (m/s) answer of 0.54 (using speed=19) gains 1 mark only</p> <p>0.5571429 allow 0.6 if supported by working</p>	<p>1</p> <p>1</p> <p>1</p> <p>2</p>

Question number	Answer	Notes	Marks
4	<p>MP1. find volume (of bolt);</p> <p>MP2. using displacement method;</p> <p>MP3. further detail of displacement method;</p> <p>MP4. correct use of density equation to find mass;</p> <p>MP5. further example of good practical technique;</p>	<p>MP2 MP3 MP5 can be awarded if seen on diagram</p> <p>e.g.</p> <ul style="list-style-type: none"> <li>• ensure bolt is fully submerged</li> <li>• measure volume of water before and after then find difference</li> <li>• (if using Archimedes can) ensure all displaced water is collected</li> </ul> <p>allow use of standard symbols</p> <p>e.g.</p> <ul style="list-style-type: none"> <li>• take repeats and average</li> <li>• use of appropriately sized measuring cylinder</li> <li>• make sure no water splashes out</li> <li>• read volume of water from bottom of meniscus</li> <li>• read at eye level to reduce parallax error</li> </ul>	5

Total for question 4 = 5 marks

Question number	Answer	Notes	Marks
6 a	<p>X drawn at the base of the weight arrow within area shown by the dashed box;</p> 		1
b (i)	pressure = force ÷ area;	allow rearrangements and standard symbols e.g. $p=F/A$	1
(ii)	<p>weight on each foot OR total area found;</p> <p>substitution;</p> <p>evaluation;</p> <p>matching unit;</p> <p>e.g.  force on each foot = 92.5 (N) OR total area = 20.8 (cm<sup>2</sup>)  (pressure =) 92.5 / 5.2 OR 370 / 20.8  (pressure =) 18  N/cm<sup>2</sup></p>	<p>allow 92.5 or 20.8 seen anywhere in working</p> <p>allow any valid unit of pressure if no valid working seen</p> <p>17.788..., 17.8 allow 10<sup>4</sup> Pa or 10<sup>4</sup> N/m<sup>2</sup></p> <p>ignored factor of 4 gives 71 N/cm<sup>2</sup> gains 3 marks</p> <p>used 5.2<sup>2</sup> for area gives 3.4 N/cm<sup>2</sup> gains 3 marks</p> <p>used 5.2<sup>2</sup> for area and ignored factor of 4 gives 13.7 N/cm<sup>2</sup> gains 2 marks</p>	4
c	<p>MP1. (cups) increase (surface) area;</p> <p>MP2. force (on floor) remains the same;</p> <p>MP3. (since <math>p=F/A</math>) pressure (on floor) is decreased;</p>	ignore 'force is more spread out' / eq	3

Total for question 6 = 9 marks

Question number	Answer	Notes	Marks
10 a	any two from: MP1. comets orbit the Sun but moons orbit planets; MP2. moons have (approximately) circular orbits but comets have elliptical orbits; MP3. a comet has variable speed but a moon's speed is (approximately) constant;	allow 'comet orbits are more elliptical'	2
b (i)	gravitational potential energy = mass x g x height;	allow rearrangements and standard symbols e.g. GPE = mgh reject 'gravity' for g	1
(ii)	substitution; rearrangement; evaluation to more than 1 significant figure;  e.g. $2.2 = 0.75 \times 1.6 \times \text{height}$ (height =) $2.2 / (0.75 \times 1.6)$ (height =) 1.83333...	award 2 marks max. if mass not converted to kg giving 0.00183	3
(iii)	2.2 (J);		1
(iv)	any three from: MP1. gravitational field strength is greater on the Earth;  MP2. (therefore) hammer has a greater weight on Earth;  MP3. (therefore) astronaut has to apply a greater force (to lift the hammer); MP4. hammer gains more GPE on Earth;	allow use of $g = 10$ in calculation condone 'gravity is more on Earth' OR allow 'downward force greater' condone 'hammer is heavier'  GPE on Earth is 15J gains MP1 and MP4	3
c	substitution; rearrangement; evaluation of time period; evaluation of number of orbits;  e.g. $7.66 = \frac{2\pi \times 6780}{T}$ (T =) $\frac{2\pi \times 6780}{7.66}$ (T =) 5560 (s) (number of orbits = $(24 \times 60 \times 60) / 5560$ =) 15.5	allow method of finding total distance travelled and dividing by distance of one orbit ( $2\pi r$ )   5561 allow 15, 16	4

Total for question 10 = 14 marks

Question number	Answer	Notes	Marks
12	any three from: MP1. pollen grain changes direction; MP2. (due to) collisions; MP3. by {smaller / tiny / water / invisible} particles; MP4. (this is) Brownian motion;	allow random motion	3

Total for question 12 = 3 marks