Mark Scheme

Q1.

Question Number	Answer	Mark
	The only correct answer is B: force Q **A is incorrect** because the moment of force P about the axle is zero. **C is incorrect** because moment of force R about the axle is zero. **D is incorrect** because moment of force S about the axle is zero.	**(1)**

Q2.

Question Number:	Answer	Mark
(i)	C gravitational **The only correct answer is C** ***A*** *is not correct as the moon does not touch the Earth* ***B*** *is not correct as the Earth does not carry a charge* ***D*** *is not correct as the Earth has a magnetic field but it does not extend far enough to have any effect on the moon*	**(1)** AO 2 1

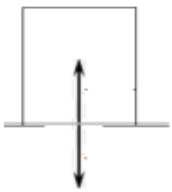
Question Number:	Answer	Mark
(ii)	C energy **The only correct answer is C** ***A*** *is not correct as velocity is a vector quantity* ***B*** *is not correct as momentum is a vector quantity* ***D*** *is not correct as acceleration is a vector quantity*	**(1)** AO 1 1

Q3.

Question Number:	Answer	Mark
(i)	A anticlockwise, slower than gear Q **The only correct answer is A** ***B*** *is not correct as P is the larger gear and can only move slower than gear Q and anticlockwise* ***C*** *is not correct as gear P must be moving anticlockwise as gear Q is moving clockwise* ***D*** *is not correct as gear P must be moving anticlockwise as gear Q is moving clockwise*	**(1)** AO 3 2a

Question Number:	Answer	Mark
(ii)	C 3:2 **The only correct answer is C** ***A*** *is not correct as it is a subtraction* ***B*** *is not correct as it is an addition* ***D*** *is not correct as it gives the ratio of teeth on Q to teeth on P*	**(1)** AO 1 2

Q4.

Question Number:	Answer	Additional guidance	Mark
	 arrowed line vertically downwards (anywhere) (1) same length as vertical arrow upwards (1)	more than one line drawn 1 mark maximum judge by eye	**(2)** AO 1 1

Q5.

Question Number:	Answer	Additional guidance	Mark
(i)	an explanation linking: wheel rubs on axle (as it rotates) OR friction (between the wheel and the axle) (1) causes heating/transfer of (thermal) energy/ work being done (1)	 allow generates heat	**(2)** AO 1 1

Question Number:	Answer	Additional guidance	Mark
(ii)	any one from: lubrication/oil (1) (ball) bearings / ball-race (1) go slower (1)	 anything that lubricates – grease etc.	**(1)** AO 1 1

Q6.

Question Number:	Answer	Additional Guidance	Mark
	recall clockwise moment = anticlockwise moment (1) moment = force x (perpendicular) distance (1) substitution (1) $m \times 17 = (6 \times 15) + (4.6 \times 10)$ rearrangement and evaluation (1) m = 8.0 (g)	calculations need not include *g* (which cancels out from all terms) substitution and rearrangement in either order $m \times 17 = 90+46$ $m = \frac{(6\times15)+(4.6\times10)}{17}$ $m = 136/ 17$ award full marks for correct answer without working	**(4)** AO 1 1 AO 2 1

Q7.

Question Number	Answer	Acceptable answers	Mark
(i)	force (1)	If than one word given then 0 marks.	**(1)**

Question Number	Answer	Acceptable answers	Mark
(ii)	B 0.07kg		**(1)**

Question Number	Answer	Acceptable answers	Mark
(iii)	Arrow pointing (vertically) upwards (1) Value of 1.2 (N) (written near to arrow) (1)	 Marks are independent of each other	**(2)**

Q8.

Question Number	Answer	Additional guidance	Mark
(i)	recall of moment = force x distance (1) (moment of force from person =) 600 x 0.5 **and** (moment of weight of rock =) 1800 x 0.2 (1) **moment** of force from person is less than **moment** of weight of rock. (1)	may be implied in a calculation 300 (Nm) 360 (Nm) independent mark accept reverse argument	**(3)**

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation that links increase distance between person and pivot/ reduce distance between rock and pivot / increase force from person (1) increase the moment of the force from the person / decrease the moment of the weight of the rock (1)	 use longer lever / hold lever nearer the end / move pivot nearer to rock / get someone to help to push value of new distance and calculation of new moment	(2)

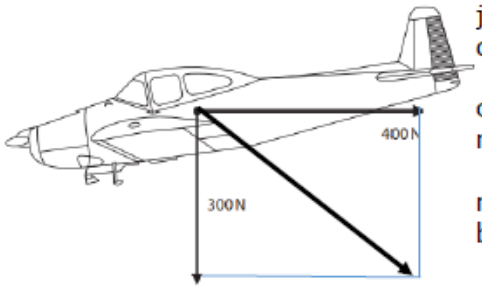
Q9.

Question Number	Answer	Additional guidance	Mark
(i)	(In every second), distance moved by chain around large gear = distance moved by chain around small gear (1) 2 x 48 = turns x 12 rearrangement and evaluation (1) 8 (turns each second)	accept use of gear ratio seen or implied e.g. 4:1 or 4/1 or 48:12 or 48/12 or converse e.g. 1:4 award full marks for the correct answer without working	(2)

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation linking reduces friction/amount of thermal energy transferred (1) extra useful energy is available/less input energy is required (1) efficiency = useful energy transferred (by the bicycle) ÷ total energy supplied (to the bicycle) (1)	 (oil provides) lubrication less energy wasted allow for the last **two** mark points; **either** less input energy is required to produce the same output for **2** marks **or** more output energy is available for the same input energy for **2** marks	**(3)**

Q10.

Question Number:	Answer	Additional guidance	Mark
(i)	0.9 (k N) (1) up / upwards / ascending (1)	accept .9 or 0.90 north N ↑	**(2)** AO 3 2a AO 3 2b

Question Number:	Answer	Additional guidance	Mark
(ii)		judge length and direction by eye construction lines need not be shown magnitude need not be stated allow missing arrowhead if direction and length are correct reject answers which have any additional vectors drawn	**(1)** AO 3 2b

Question Number:	Answer	Additional Guidance	Mark
(iii)	recall and substitution (1) GPE = 750 x 10 x 1300 evaluation (1) (energy =) 9 800 000 (J)	 no POT error (could have missed out g) allow answers in standard form 9.8×10^6 allow answers that round to 9 800 000 e.g. 9 750 000 J allow 9800 kJ or 9.8MJ allow 9 555 000 J allow negative values award full marks for correct answer without working	**(2)** AO 2 1

Q11.

Question Number:	Answer	Additional guidance	Mark
(i)	substitution(1) (moment) =650 x 0.75 evaluation(1) 490 unit (1) Nm	 accept any value that rounds to 490 e.g. 487.5 allow a maximum of 1 mark out of the first two marking points for a power of ten error independent mark award full marks for the correct answer without any working	**(3)** AO 1 1 AO 2 1

Question Number:	Answer	Additional guidance	Mark
(ii)	(sum of the) clockwise moments (about a point) = (sum of the) anticlockwise moments (about that point) (1)	idea that moments on each side of a pivot can be balanced	**(1)** AO 1 1

Question Number:	Answer	Additional guidance	Mark
(iii)	 substitution(1) 160 x distance of effort from pivot = 490 rearrangement (1) distance of effort from pivot = $\frac{490}{160}$ evaluation (1) 3.1(m)	substitution and rearrangement in either order accept 160 x distance of effort from pivot = 487.5 160 x distance from pivot =650 x 0.75 accept $\frac{650 \times 0.75}{160}$ $\frac{487.5}{160}$ accept any value which rounds to 3 maximum of two marks for a power of ten error award full marks for the correct answer without working	**(1)** AO 2 1