

M1. (a) terminal 1

(b) 5.4 (kg) 2
correct substitution of $54 = m \times 10$ gains 1 mark

(c) (i) $0 < a < 10$ 1

some upward force
accept some drag / air resistance 1

reduced resultant force 1

(ii) 0 1

upward force = weight (gravity) 1

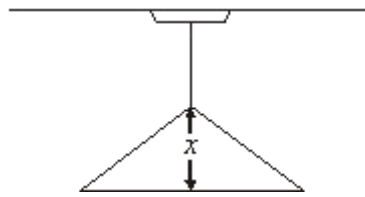
resultant force zero 1

[9]

M2. (a) centre of **X** should appear to be on the continued line of the flex and in the

body of the lamp as judged by eye

example



1

(b) below

1

(c) (D)→B→F→A→C→(E)

all four correct for 3 marks

or any two correct for 2 marks

or just one correct for 1 mark

3

[5]

M3. (a) (i) 0.6

allow 1 mark for correct substitution

2

newtons

accept N

*do **not** accept n*

accept Newtons

1

(ii) the same as

1

(b) (i) changed velocity

accept increased/ decreased for change

accept speed for velocity

accept change direction

accept getting faster/ slower

accept start/ stop moving

accept correct equation in terms of change in speed or

change in velocity

1

(ii) down(wards)

accept towards the ground

accept ↓

*do **not** accept south*

1

[6]

M4. *any evidence of idea that weight acts through/near centre of mass/gravity/brick*
 gains 1 mark

but clear indication that brick topples if
vertical line through centre of mass is outside base line of brick
or line of action of weight is outside base line of brick
 gains 2 marks

[2]

M5. (a) centre of X at the point where the axes cross
 to within 1 mm in any direction

1

(b) (i) (at / in the) centre (of the tyre)
 or unambiguously shown on the diagram

1

(ii) (this is) where axes of symmetry (of the tyre) cross / intersect / meet
 or point at which the mass of the tyre seems to be
 (concentrated)

1

[3]

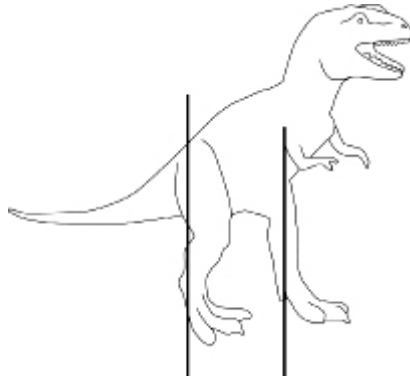
M6. (a) (i) moment

- 1
- (ii) rotation 1
- (iii) the girl moves nearer to point **P** 1
- (b) (i) **X** drawn in the centre of the space enclosed by the tyre
judge by eye 1
- (ii) below 1

[5]

M7. (a) (i) centre of **X** above the feet and in the body

*a vertical line from their X falls between two lines in diagram
- judged by eye*



1

- (ii) where the mass seems to be concentrated
accept it's above the base (area)
accept because otherwise it would topple
accept line of action (of weight) passes through the base
*do **not** accept where the mass is concentrated*

1

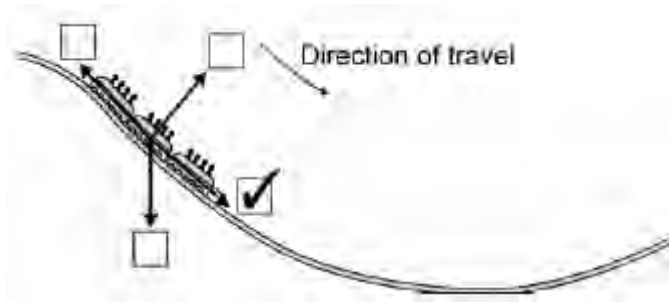
(b) any **two** from:

- make (the area of) feet / base bigger
- make feet wider apart
- makes legs shorter / heavier
- make head smaller / lighter
- make tail touch the ground / make the tail longer
accept 'make centre of mass / gravity lower'

2

[4]

M8. (a) correct box ticked



1

(b) (i) 30

ignore added units

1

(ii) 2250 **or** their (b)(i) \times 75 correctly calculated

*allow 1 mark for correct substitution ie 75×30 **or** their (b)(i) \times 75 provided no subsequent step shown*

an answer of 750 gains 1 mark only if answer to (b)(i) is 10

2

[4]

- M9. (a) (i) X placed at 50 cm mark** **1**
- (ii) point at which mass of object may be (thought to be) concentrated **1**
- (b) (i) Y placed between the centre of the rule and the upper part of mass **1**
- (ii) 16.5
allow for 1 mark
 $(16.5 + 16.6 + 16.5) / 3$ **2**
- 1.65
value consistent with mean value given
only penalise significant figures once **1**
- (iii) Marks awarded for this answer will be determined by the quality of communication as well as the standard of the scientific response. Examiners should apply a 'best-fit' approach to the marking.
- 0 marks**
 No relevant content
- Level 1 (1 – 2 marks)**
 A description of a method which would provide results which may not be valid
- Level 2 (3 – 4 marks)**
 A clear description of a method enabling some valid results to be obtained. A safety factor is mentioned
- Level 3 (5 – 6 marks)**
 A clear and detailed description of experiment. A safety factor is mentioned. Uncertainty is mentioned
- examples of the physics points made in the response:**
- additional apparatus**
- stopwatch

use of apparatus

- measure from hole to centre of the mass
- pull rule to one side, release
- time for 10 swings and repeat
- divide mean by 10
- change position of mass and repeat

fair test

- keep other factors constant
- time to same point on swing

risk assessment

- injury from sharp nail
- stand topple over
- rule hit someone

accuracy

- take more than 4 values of d
- estimate position of centre of slotted mass
- small amplitudes
- discard anomalous results
- use of fiducial marker

6

- (c) (i) initial reduction in T (reaching minimum value) as d increases

1

after 30 cm T increases for higher value of d

1

- (ii) (no)

any **two** from:

- fourth reading is close to mean
- range of data 0.2 s / very small
- variation in data is expected

2

[16]