

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 1
accept some drag / air resistance

reduced resultant force 1

(ii) 0 1

upward force = weight (gravity) 1

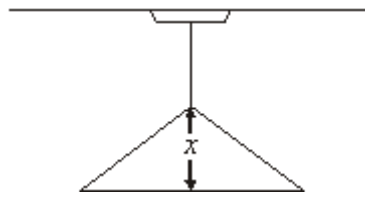
resultant force zero 1

[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

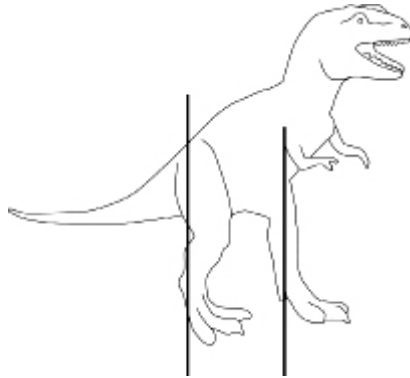
[6]

- 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

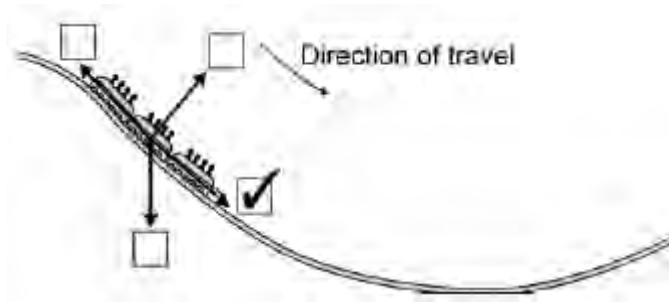
(b) any **two** from:

- 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]