M1. (a) 1.2

*allow **1** mark for conversion of 2.4 kN to 2400 N*
or for correct transformation without conversion
ie d = 2880 ÷ 2.4

2

metre(s)/m

1

(b) any **two** from:

- as the load increases the (total) clockwise moment increases
- danger is that the fork lift truck / the load will topple / tip forward
- (this will happen) when the total clockwise moment is equal to (or greater than) the anticlockwise moment
  accept moments will not be balanced
- (load above 10.0 kN) moves line of action (from C of M) outside base (area)

2

[5]

M2. (a) (i) will not fall over (1)

accept will not easily fall over (2)

orcentre of mass will remain above the base (1)

(line of action of the) weight will remain above within the base

accept centre of gravity / c of g / c of m / c m

if the monitor is given a small push (1)

depends on mark above

2

(ii) (total) clockwise moment = (total) anticlockwise moment

***or** they are equal / balanced*

1

(b) the position of the centre of mass has changed (1)the line of action of the weight is outside the base (1)producing a (resultant) moment (1)

points may be expressed in any order

3

[6]

M3. (a) (line of action of) its weight

1

falls inside its wheel base

accept 'falls between the wheels'

*the first **two** points may be credited by adding a vertical line from the centre of the X on the diagram (1)*
and labelling it weight / force / with a downwards arrow (1)
provided there is no contradiction between what is added to the diagram and anything which may be written

1

(so there is) no (resultant / clockwise) moment / turning effect

1

(b) centre of mass should be lower

accept '… centre of gravity'
accept 'weight / mass low down'
***not** just 'lower the roof'*

1

wheel base should be wider

accept 'long axle(s)' for 'wide wheel base'
allow bigger / larger wheel base
*do **not** credit '<u>long</u> wheel base'*

responses in either order

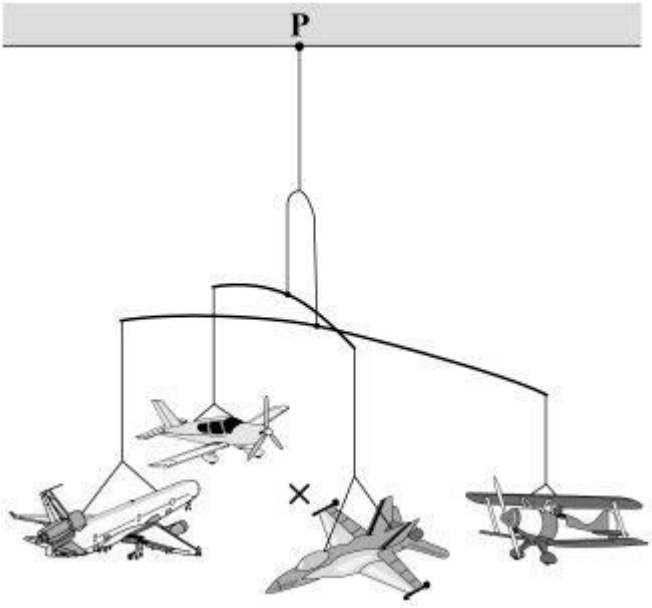
1

[5]

M4. (a) (i) centre of **X** directly below **P** and between the model aeroplanes

as judged by eye but between centre of propeller of top aeroplane and canopy of bottom aeroplane

example



1

(ii) the centre of mass is (vertically) below the point of suspension / P

1

the centre of mass is in the middle of the aeroplanes

accept the centre of mass is level with the aeroplanes

1

(b) centre of mass of the worker and the ladder (and device)

1

line of action of the weight is inside the base

accept the centre of mass is above / within / inside the base (of the ladder and device)

1

so there will not be a (resultant) moment

accept so he / it / the ladder will not topple even if he leans over

or it will (only) topple over if the line of action of the weight / the centre of mass is outside the base

accept each point, either on the diagram or in the written

*explanation, but do **not** accept the point if there is any contradiction between them*

1

[6]

M5. (a) the point at which the (total) mass seems to act / appears to be concentrated

accept 'weight' for 'mass'

accept the point at which gravity seems to act

*do **not** accept a definitive statement eg where (all) the mass is*

1

(b) wider / larger base

marks are for a correct comparison

1

lower centre of mass

accept lower centre of gravity / c of g

1

(c) line of action (of the weight) lies / falls inside the base

in each case the underlined term must be used correctly to gain the mark

1

the resultant moment returns mixer to its original position

accept there is no resultant moment / resultant moment is zero

accept resulting moment for resultant moment

*do **not** accept converse argument*

1

[5]