

**M1.** (a) 1.2

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

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)*

**or** centre 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*

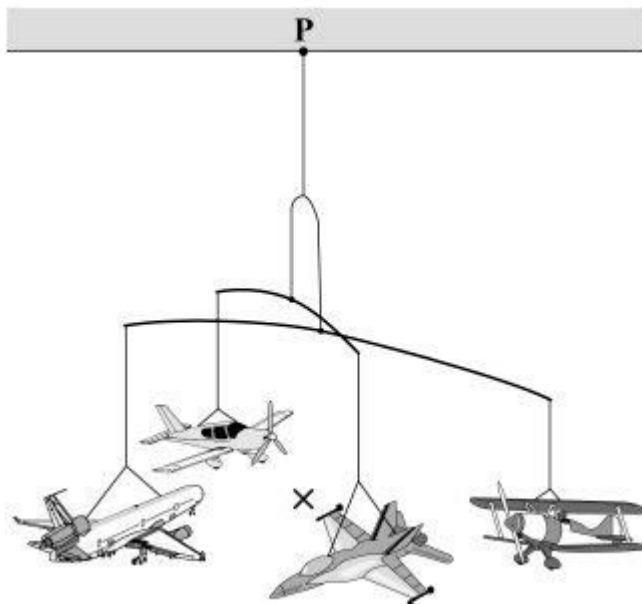
*do **not** credit 'long wheel base'*

*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]