

M1. (a) motor effect 1

(b) increase the strength of the magnet
or
increase the current 1

(c) $4.8 \times 10^{-4} = F \times 8 \times 10^{-2}$ 1

$$F = 6 \times 10^{-3} \text{ (N)} \quad \text{1}$$

$$6 \times 10^{-3} = B \times 1.5 \times 5 \times 10^{-2} \quad \text{1}$$

$$B = \frac{6 \times 10^{-3}}{7.5 \times 10^{-2}} \quad \text{1}$$

$$B = 8 \times 10^{-2} \text{ or } 0.08 \quad \text{1}$$

*allow 8×10^{-2} or 0.08 with no working shown for 5 marks
a correct method with correct calculation using an incorrect
value of F gains 3 marks*

Tesla
accept T 1

do not accept t

[8]

M2. (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]

- M3.** (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]

M4. (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]

M5. (a) 960 (Nm)

1

see-saw is in equilibrium

accept see-saw is balanced

see-saw is stationary is insufficient

1

(total) clockwise moments = anticlockwise moment

accept no resultant moment

forces are balanced is insufficient

an answer clockwise moments balance the anticlockwise moments gains 2 marks

1

(b) (i) 600 (Nm)

1

(ii) 375 (N) **or** their (b)(i) \div 1.6 correctly calculated

*do **not** credit if (b)(i) is larger than 960*

*allow 1 mark for correct substitution **and** transformation ie*

$$\frac{600}{1.6} \text{ or } \frac{\text{their (b)(i)}}{1.6}$$

2

[6]

- M6.** (a) (i) current produces a magnetic field (around XY)
accept current (in XY) is perpendicular to the (permanent) magnetic field 1
- (creating) a force (acting) on XY / wire / upwards
reference to Fleming's left hand rule is insufficient 1
- (ii) motor (effect) 1
- (iii) vibrate / move up and down 1
- 5 times a second
only scores if first mark point scores
allow for 1 mark only an answer 'changes direction 5 times a second' 1
- (b) 0.005
allow 1 mark for calculating moment of the weight as 0.04 (Ncm) and allow 1 mark for correctly stating principle of moments or allow 2 marks for correct substitution
ie $F \times 8 = 2 \times 0.02$ or $F \times 8 = 0.04$ 3

[8]

M7. (a) 38 400

allow 6.4×6000 for 1 mark

2

Nm **or** newton metres

*do **not** credit 'nm', 'mN' or 'metre newtons'*

1

(b) 16 000 (N) **or** 16 kN

allow 1 mark for $38\,400 \div 2.4$

accept their (a) $\div 2.4$ correctly calculated for 2 marks

accept their (a) $\div 2.4$ for 1 mark

2

[5]

M8. (a) (i) turning
accept turning ringed in the box 1

(ii) point at which mass (or weight) may be thought to be concentrated
accept the point from which the weight appears to act
allow focused for concentrated
do not accept most / some of the mass
do not accept region / area for point 1

(b) 600 (Nm)
400 × 1.5 gains 1 mark provided no subsequent steps shown 2

(c) (i) plank rotates clockwise
accept girl moves downwards
do not accept rotates to the right 1

(total) CM > (total) ACM
accept moment is larger on the girl's side 1

weight of see-saw provides CM
answer must be in terms of moment
maximum of 2 marks if there is no reference to the weight of the see-saw 1

(ii) $W = 445$ (N)
 $W \times 1.5 = (270 \times 0.25) + (300 \times 2.0)$ gains 2 marks
allow for 1 mark:
total CM = total ACM either stated or implied
or
 $(270 \times 0.25) + (300 \times 2.0)$
if no other marks given 3

[10]

M9. (a) 60

allow 1 mark for correct substitution (with d in metres), ie $36 = F \times 0.6$

an answer of 0.6 or 6 gains 1 mark

2

(b) the line of action of the weight lies outside the base / bottom (of the bag)

accept line of action of the weight acts through the side

accept the weight (of the bag) acts outside the base / bottom (of the bag)

1

a resultant / overall / unbalanced moment acts (on the bag)

accept the bag is not in equilibrium

*do **not** accept the bag is unbalanced*

1

[4]