

- M1.** (a) north (pole)
accept N
- north (pole)
both needed for mark 1
- (b) reverses
accept changes direction 1
- (c) (i) first finger:
(direction of) (magnetic) field 1
- second finger:
(direction of) (conventional) current 1
- (ii) into (plane of the) paper 1
- (iii) less current in wire
accept less current / voltage / more resistance / thinner wire 1
- weaker field
allow weaker magnets / magnets further apart
*do **not** accept smaller magnets* 1
- rotation of magnets (so) field is no longer perpendicular to wire 1

(d) (i) reverse one of the magnets
*do **not** accept there are no numbers on the scale*

1

(ii) systematic or zero error
accept all current values will be too big
accept it does not return to zero
accept it does not start at zero

1

[10]

M2. (a) motor (effect)

1

(b) (i) wire kicks further (forward)
accept moves for kicks
accept moves more
accept 'force (on the wire) increased' 1

(ii) wire kicks back(wards) / into (the space in) the (horseshoe) magnet
accept moves for kicks
accept 'direction of force reversed' 1

[3]

M3. (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]

M4. (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

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

1

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

1

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

1

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

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]

M5. (a) hydraulic (system)

1

(b) 15.40×10^2
or
1540

allow 1 mark for correct substitution, ie

$$8.75 \times 10^4 = \frac{F}{1.76 \times 10^{-2}}$$

or

$$87\,500 = \frac{F}{0.0176}$$

or

$$F = 8.75 \times 10^4 \times 1.76 \times 10^{-2}$$

or

$$F = 87\,500 \times 0.0176$$

2

(c) any **one** environmental **advantage**:

stating a converse statement is insufficient, or a disadvantage of the usual oil, ie the usual oil is non-renewable

plant oil is renewable

using plant oil will conserve (limited) supplies **or** extend lifetime of the usual / crude oil.

plant oil releases less carbon dioxide (when it is being produced / processed)

plant oil will add less carbon dioxide to the atmosphere (when it is being produced / processed, than the usual oil)

plant oil removes carbon dioxide from **or** adds oxygen to the air when it is growing

stating that plant oil is carbon neutral is insufficient

1

(d) (the current flowing through the coil) creates a magnetic field (around the coil)

1

(this magnetic field) interacts with the permanent magnetic field
or
current carrying conductor is in a (permanent) magnetic field
it must be clear which magnetic field is which

1

this produces a (resultant) force (and coil / cone moves)

1

when the direction of the current changes, the direction of the force changes
to the opposite direction

*accept for 2 marks the magnetic field of the coil interacts with
the permanent magnetic field*

1

[8]