

Mark schemes

1	(a)	field	<i>correct order only</i>	1
		current		1
		force	<i>accept motion</i> <i>accept thrust</i>	1
	(b)	(i)	arrow pointing vertically downwards	1
		(ii)	increase current / p.d. <i>accept voltage for p.d.</i>	1
			increase strength of magnetic field <i>accept move poles closer together</i>	1
		(iii)	reverse (poles of) magnets	1
			reverse battery / current	1
	(c)	(i)	1.5 or 150% <i>efficiency = $120 / 80 (\times 100)$</i> <i>gains 1 mark</i> <i>an answer of 1.5 % or 150</i> <i>gains 1 mark</i>	2
		(ii)	efficiency greater than 100% or output is greater than input or output should be 40 (W)	1
		(iii)	recorded time much shorter than actual time <i>accept timer started too late</i> <i>accept timer stopped too soon</i>	1
				[12]
2	(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]

3

(a) motor

1

(b) increase the strength of the magnetic field

accept use a stronger magnet

use a larger / bigger magnet is insufficient

*do **not** accept move magnets closer*

1

increase the (size of the) current

accept use a current greater than 2 (A)

accept increase the p.d. / voltage (of the power supply)

increase the power supply is insufficient

1

- (c) any **one** from:
- (reverse the) direction of the current
accept swap the wires at the power supply connections
swap the wires around is insufficient
 - (change the) direction of the magnetic field
accept turn the magnet around
*do **not** accept use an a.c. supply*

1

- (d) The wire is parallel to the direction of the magnetic field.

1

[5]

4

- (a) (i) (closing the switch makes) a current (through the wire)

1

(the current flowing) creates a magnetic field (around the wire)

1

this field interacts with the permanent magnetic field

accept links / crosses attracts / repels is insufficient

1

- (ii) arrow drawn showing upwards force on XY

judge vertical by eye the arrow must be on or close to the wire XY

1

- (iii) motor

accept catapult

1

- (b) (i) the wire moves up and down
or
the wire vibrates

back and forth or side to side is insufficient for vibrate

1

- (ii) the force (continually) changes direction (from upwards to downwards, on the wire)

accept the direction of the magnetic field (of the wire) changes

1

[7]

5

- (a) a force

1

(b) any **two** from:

- more powerful magnet
do not allow 'bigger magnet'
- reduce the gap (between magnet and coil)
- increase the area of the coil
- more powerful cell
do not allow 'bigger cell'
accept battery for cell
accept add a cell
accept increase current / potential difference
- more turns (on the coil)
allow 'more coils on the coil'
do not allow 'bigger coil'

2

- (c) reverse the (polarity) of the cell
allow 'turn the cell the other way round'
accept battery for cell

1

reverse the (polarity) of the magnet
allow 'turn the magnet the other way up'

1

[5]

6

- (a) (i) the greater the speed (of a centrifuge), the greater the force
answers must be comparative
accept velocity for speed
accept positive correlation between speed and force
speed and force are not proportional – treat as neutral

1

the smaller the radius, the greater the force (at a given speed)
*allow (**G machine 1**) has / produces a greater force (than **G machine 2**) at the same speed*
must be comparative, eg a small radius produces a large force = 0
marks on own

1

as the speed increases the rate of change in force increases
accept force is proportional to the square of the speed
or
doubling speed, quadruples the force
accept any clearly correct conclusion

1

- (ii) 12000 (N)
- or**
- 12 k(N)
- 1
- (b) (i) the current (in the coil) creates a magnetic field (around the coil)
- accept the coil is an electromagnet*
- 1
- so the magnetic field of the coil interacts with the (permanent) magnetic field of the magnets (producing a force)
- accept the two magnetic fields interact (producing a force)*
- if no marks scored an answer in terms of current is perpendicular to the (permanent) magnetic field is worth max 1 mark*
- 1
- (ii) vertically downwards arrow on side A
- one arrow insufficient*
- and**
- vertically upwards arrow on side C
- 1
- (iii) the current is parallel to the magnetic field
- allow the current and magnetic field are in the same direction*
- allow it / the wire is parallel to the magnetic field*
- 1
- (c) increase the current / p.d. (of the coil)
- accept decrease resistance*
- accept voltage for p.d.*
- accept increase strength of magnetic field / electromagnet*
- 1
- (d) yes with suitable reason
- or**
- no with suitable reason
- eg**
- yes** – *it has increased our knowledge*
- yes** – *It has led to more (rapid) developments / discoveries (in technology / materials / transport) accept specific examples*
- no** – *the money would have been better spent elsewhere on such things as hospitals (must quote where, other things not enough)*
- no** mark for just **yes / no**
- reason must match **yes / no***
- 1

[10]