

Question	Answer	Mark
1(a)(i)	Magnetic field at Y: 'towards the bottom of the page' ticked Force at Y: 'to the left' ticked	B1 B1
(a)(ii)	There is a force on X because of the (magnetic) field caused by Y OR due to the (magnetic) field around/of Y OR the (magnetic) fields due to X and Y interacting	B1
(b)	Change in current/field is brief/for short time/occurs as switch closes Changing magnetic field/flux links with secondary coil/other coil/core OR field/flux lines cut coil Causes induced voltage/current	B1 B1 B1
		Total: 6

- 2 (a) brass: needle horizontal B1
 magnet: needle vertical, N pole up B1
- (b) (i) no forces/effect on needle B1
 (ii) needle aligns with field OR N or S pole attracted along field line or to (magnetic) S or N
 NOT points to N of Earth B1
- (c) steel, accept cobalt, nickel, ferrite, Magnadur, Alnico
 NOT iron B1
- 3 (a) at least 3 complete circles/ellipses, roughly centred on X M1
 spacing greater as radius increases A1
 at least 1 arrow to show clockwise field, no contradiction B1 [3]
- (b) use of compass/suspended small magnet B1
 observe needle/magnet on one field line B1
 observe needle/magnet on another field line B1
 mark on card OR needle/magnet shows direction of field B1 [4]
- OR
 (sprinkle) iron filings o.w.t.t.e. M1
 tap card A1
 direction/alignment of iron filings show field B1
 use compass/suspended small magnet to show field direction B1
- (c) wire X/Y is in a magnetic field / any reference to magnetic fields B1
 accept description involving poles that clearly implies fields B1
 current carrying conductor in field / fields interact/cut/combine/overlap [2]
- (d) top box only ticked B1 [1]

[Total: 10]

- 4 (a) (i) at least two lines (one left, one right) outside the coil of correct shape **or** at least two vertical lines inside the coil **or** two diverging and one central line at top and bottom C1
 at least four lines (two left, two right) outside the coil of correct shape **or** at least two lines (one left, one right) outside the coil of correct shape) and at least two vertical lines inside the coil
 (crossing or complete loops outside coil gains maximum of 1) A1 [2]
- (ii) lines closer where field is stronger o.w.t.t.e. **or** vice versa **or** spacing of lines B1 [1]
- (b) reduces (strength of) field B1
 (increasing the resistance) reduces the current B1 [2]
- (c) curved path upwards (might curve back to the left) B1
 well-drawn curved path (no straight section and circular by eye) B1 [2]
- (ii) curves in opposite direction to (c)(i) B1
 magnetic field reversed B1 [2]
- [Total: 9]**

- 5 (a) (i) (milliammeter) deflects/shows reading/current OR reading changes OR there is a current B1
 change of flux/field (lines) cut OR emf/current induced/produced B1 [2]
- (ii) greater deflection/current B1
 rate of change of flux (linkage) is greater o.w.t.t.e
 e.g. more magnetic field lines cutting coil (per second) OR field cut fast B1 [2]
- (b) (i) upwards/opposite to magnet's direction of travel ignore towards magnet B1
- (ii) current (in coil) causes a magnetic field B1
 force caused by overlapping (magnetic) fields B1 [3]
- [Total: 7]**

- 6 (a) (i) In the opposite direction OR downwards
Faster / fast B1
B1
- (ii) No voltage/current induced B1
Currents/voltages (induced) in each half of XY are equal and in opposite
directions/oppose each other B1
- (b) (i) Y-plates B1
- (ii) Up and down (repeatedly) owtte B1
- (iii) Off / zero B1 [7]