4. Electricity and magnetism

4.1 Simple phenomena of magnetism

Paper 3 and 4

Answer Key

Paper 3

Q1.

Question	Answer	Marks
(a)(i)	(soft) iron	B1
(a)(ii)	steel	B1
(a)(iii)	magnet does not attract a non-magnetic material	B1
(b)	any **four** from: (when switch closed) there is a complete circuit current in the circuit magnetic effect (of current / in coil) owtte (coil and nail become) electromagnet (springy) iron (strip) attracted to (nail / electromagnet) circuit broken owtte springy iron strip springs back / makes contact (again) owtte	B4

Q2.

Question	Answer	Marks
(a)	two N / north poles on either side of gap	B1
(b)	use of (plotting) compass or iron filings	B1
	use of (plotting) compass to show direction (of magnetic field line)	B1
	further details to method any **two** from: • idea of sprinkle / scatter iron filings (around magnets) • tap card • to arrange filings along field lines / to show (magnetic field) pattern • place compass near magnet • mark point at end of arrow • move compass **OR** multiple compasses in different positions • idea of plotting more than one line	B2

Q3.

Question	Answer	Marks
(a)(i)	(nails or magnetic material or it) becomes magnetised **OR** is a magnet	B1
	(nails or magnetic material or it touching magnet has) the opposite pole to the pole on magnet	B1
(a)(ii)	steel nails retain magnetism **OR** are magnetic	B1
(b)(i)	no **OR** zero reading on voltmeter	B1
(b)(ii)	(as conductor / wire) is cutting / linking with magnetic field (of magnet)	B1

Q4.

Question	Answer	Marks
(a)	any **two** from: • (bar XY) is a (permanent) magnet • (because) end X is repelled (by magnet/S pole) • (so) end X is a S pole.	**B2**
(b)	(plotting) compass placed at one point on / near magnet	**B1**
	(repeatedly mark and) move compass in direction of arrow	**B1**
	start from different positions (to show pattern)	**B1**

Q5.

Question	Answer	Marks
(a)(i)	electro(magnet)	**B1**
(a)(ii)	switch on and off / can control its strength	**B1**
(a)(iii)	1 increase current / emf / supply voltage	**B1**
	2 more turns (on coil)	**B1**
(a)(iv)	scrap yard / metal separators / (door / alarm)bell / buzzers / relay / motor / MRI scanners / (magnetic) locks / (loud)speakers	**B1**
(b)(i)	steel cannot be temporary magnet OR steel (will be) permanently magnetised owtte	**B1**
(b)(ii)	not work / reduced strength owtte	**B1**

Q6.

Question	Answer	Marks
(a)	first method (use of plotting) compass(es)	**B1**
	idea of mark arrow position OR move compass in direction of arrow	**B1**
	start from different position(s) OR join up marks/draw lines (to show pattern)	**B1**
	OR alternative method (use of plotting) compass(es)	**(B1)**
	place number of compasses around magnet	**(B1)**
	idea that arrows line up to show pattern	**(B1)**
(b)	(metal bar XY/it is soft) iron OR magnetic material/bar/metal	**B1**
	(so XY) must be unmagnetised	**B1**
	(because end X of XY or bar) attracts to (both) N pole and S pole	**B1**

Q7.

Question	Answer	Marks
(a)(i)	plastic strip **AND** glass lens	**B1**
(a)(ii)	iron bar	**B1**
(b)	end of magnet X labelled S (pole) **AND** end of magnet Y nearest magnet X labelled N (pole) **AND** other end is S (pole)	**B1**

Q8.

Question	Answer	Marks
(a)(i)	N marked on left AND S on the right of magnet	**B1**
(a)(ii)	(soft-iron / bar / it) is attracted to the (N pole of the) magnet	**B1**
	(soft-iron / bar / it) becomes induced magnet	**B1**
	with opposite pole nearest to magnet	**B1**

Q9.

Question	Answer	Marks
	1 (bar P–Q is a) (permanent) magnet	**M1**
	(because magnet) repels end Q	**A1**
	2 (bar R–S is an) unmagnetised magnetic material	**M1**
	(because magnet) attracts both ends (of R–S)	**A1**

Q10.

Question	Answer	Marks
(a)	sample **A** – magnetic and magnetised sample **B** – magnetic but not magnetised sample **C** – non-magnetic	**B2**
(b)	use (same pole) of (permanent) magnet stroke bar (repeatedly) in same / one direction owtte OR place (bar / steel) in coil / solenoid current in coil OR connect coil to battery / power supply	**B2**

Q11.

Question	Answer	Marks
(a)(i)	N and S poles correctly labelled N S	B1
(a)(ii)	(iron bar and magnet) attract (each other)	B1
	(iron) bar becomes an induced magnet	B1
	with opposite pole next to pole of magnet	B1

Q12.

Question	Answer	Marks
(a)	3rd box ticked steel	B1
(b)	place ends/poles together	B1
	repulsion (takes place)	B1
(c)(i)	coil of wire	B1
	iron rod inside	B1
	coil connected to an (electrical) power supply OR current in coil	B1
(c)(ii)	number of turns (in coil)	B1
	current (in coil)	B1

Q13.

Question	Answer	Marks
(a)(i)	poles correctly labelled S N	B1
(a)(ii)	Any two from iron bar becomes induced magnet with S pole nearest to (N pole of) magnet opposite poles attract	B2
(b)(i)	ends of coil connected to power supply OR battery OR cell	B1
(b)(ii)	can be switched on/off OR magnetised/demagnetised (easily)	B1

Paper 4

Q14.

Question	Answer	Marks
(a)	(end of) one piece of steel brought close to (the end of) another piece owtte	B1
	look to see if there is repulsion/attraction **AND** test between different ends/poles owtte	B1
	any **two** from: • repeat a valid test between the other pieces • only magnets repel each other **OR** the pieces that repel are magnets • attractions at both ends indicates one of them is unmagnetised **OR** the piece that only attracts is unmagnetised **OR** the piece that does not repel (at both ends) is unmagnetised	B2

Q15.

Question	Answer	Marks
(a)	(minimum of) one complete loop above magnet **AND** one complete loop below magnet	M1
	additional field lines leaving both poles **OR** additional loops above and below	A1
	(minimum of) two correct arrows (from N to S)	B1
(b)	line with arrow to the left	B1
(c)(i)	(force to the) left **OR** (force) away from magnet 2 / towards magnet 1	B1
(c)(ii)	force (on N pole) is in direction of the (magnetic) field / owtte	B1

Q16.

Question	Answer	Marks
(a)	3 lines from N face to S face middle line must be straight AND perpendicular to end faces	B1
	at least 1 arrow from N to S AND NO arrows from S to N	B1
(b)(i)	needle perpendicular to end faces AND {arrow pointing to S OR correctly labelled N OR S}	B1
(b)(ii)	compass / needle / it aligns with field OR compass / needle / it points in direction of magnetic field OR compass / needle / it points to S(outh)	B1
	N pole of needle attracted to S of magnet(s) OR N pole repelled by N of magnets OR unlike poles attract / like poles repel	B1
(c)	heat OR hammer	B1
	with magnet lying (magnetically) E – W	B1
	OR place in coil / solenoid with a.c.	(M1)
	withdraw OR reduce current to 0	(A1)

Q17.

Question	Answer	Marks
(a)(i)	C pointing horizontally to right	**B1**
	B AND D pointing horizontally to left	**B1**
(a)(ii)	S on left AND N on right	**B1**
(b)	any one of the following methods:	
	1 heat magnet	**C1**
	to high temperature / red hot	**A1**
	2 hammer the magnet	**(B1)**
	repeatedly / in E–W direction	**(B1)**
	3 (place) magnet in a coil / solenoid carrying a.c.	**(M1)**
	remove magnet from coil OR decrease current (slowly) to zero	**(A1)**
(c)(i)	at least 3 concentric circles	**B1**
	closer together near the wire AND clockwise arrow	**B1**
(c)(ii)	arrows OR field reverses / is in opposite direction	**B1**