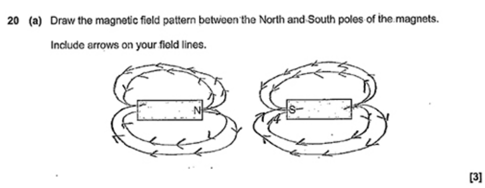
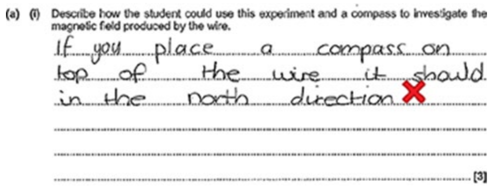
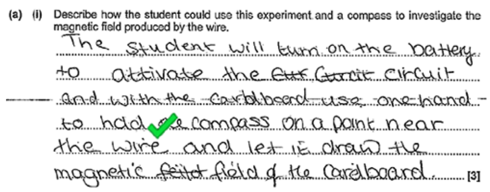
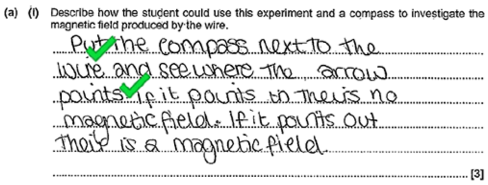
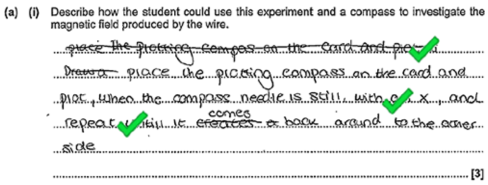
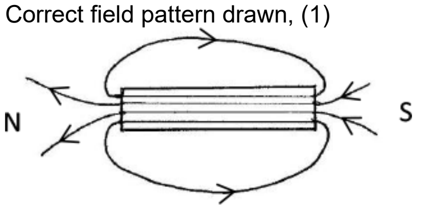
Mark scheme – Magnets and Magnetic Fields (F)

Question			Answer/Indicative content	Marks	Guidance
1			C	1 (AO1.1)	
			Total	**1**	
2			C	1 (AO2.2)	
			Total	**1**	
3	a		**Mistakes:** When a (voltage) flows through them a magnetic field is created. ✓ The magnetic field can be increased by (decreasing) the number of turns...... ✓	2 (AO3.1b) (AO3.1b)	Must circle 'voltage, or 'flows through', or whole sentence Should circle 'decreasing (the number of turns)' but NOT the increasing current bit. If a candidate circles 'magnetic field can be increased' and then circles all or part of the increasing current bit, award 1 mark only for this sentence. **<u>Examiner's Comments</u>** Most candidates identified one error (for example voltage or decreasing), and some two. A number tried to ring entire sentences without identifying the individual errors in the sentences. This approach was an allowed approach for the second sentence (where the two errors are unambiguous), but not for the third sentence where if one statement is correct the other will be incorrect. The magnetic field will only increase if the number of turns increases, or if the number of turns is decreased then the magnetic field will decrease.
	b		One straight line between the middle of the two poles ✓ At least 2 correctly curved lines between the edges of the poles, one above and one below ✓ Arrows on field lines going N to S ✓	3 (AO1.2) (AO1.2) (AO1.2)	Ignore any field lines not between the labelled poles Allow dotted lines. Straight line by eye (rulers not used) Concave smooth curves Any wrong arrow loses this mark

					<u>Examiner's Comments</u> The question required candidates to sketch of the magnetic field 'between the North and South poles' and this was emphasised in the diagram by only labelling a single N and S. The three marks were given for: symmetrical(ish) convex cured lines joining the top and bottom of the adjacent poles, a straight line from the centre of the N to the centre of the S, and arrows on the lines going from N to S. **Misconception** A common misconception is for candidates to see one familiar thing in the stem of a question and assume that is what they are being asked to do. A number of candidates drew the 'standard' magnetic field around a bar magnet. Exemplar 4 is a response where the candidate has not understood the question. However, because they drew the field directions correctly they gained a consolation mark. **Exemplar 4** 
	c		**Any one from**: Induced magnets lose their magnetism (when away from a magnetic field)/AW ORA ✓ Permanent magnets retain their magnetism (when away from a magnetic field)/AW ✓	1 (AO1.1)	**<u>Examiner's Comments</u>** Around half the candidates correctly identified that induced magnetism was temporary. A common misconception was to explain induced magnetism in terms of electromagnets.
			Total	**6**	

4	a		**always** points to North / South ✓✓ **OR** Points to (magnetic) North / South ✓ line up with the magnetic field lines of the Earth ✓ **OR** Compass needle shows (an angle of) dip ✓ Dip (angle) changes (from equator) ✓	2 (AO2 ×1.1)	**ALLOW** Points North/South wherever you are ✓✓ **<u>Examiner's Comments</u>** This was a challenging question for candidates. This question asks about a quite separate behaviour of a magnetic compass in the Earth's magnetic field. Wherever you might happen to be on the surface of the Earth a magnetic (dipping) compass will always point north (or south). There were very few candidates who referred to the angle of dip in the direction of the north (or south) magnetic pole. Or that at the magnetic poles a dipping compass dips vertically downward towards the core of the Earth.
	b	i	Any three from: place the compass onto the card or near to the wire (and turn on the current) ✓ plot / observe the direction of the compass / needle ✓ repeat idea of tip-to-tail / plotting onto the card ✓ repeat at different distances from the centre ✓	3 (AO3 × 1.2)	**<u>Examiner's Comments</u>** Q23 is an overlap question with J249/03. Identifying the command word 'describe' was key to candidates successfully answering this question. Those that did were able to apply their experience of practical activities supporting P4.1 and wrote down what they could do with a plotting compass in this experiment. Exemplar 14  (a) (i) Describe how the student could use this experiment and a compass to investigate the magnetic field produced by the wire. If you place a compass on top of the wire it should in the north direction ✗ [3] This candidate has not understood the question and is answering a different one about predicting how the compass will behave. Exemplar 15  (a) (i) Describe how the student could use this experiment and a compass to investigate the magnetic field produced by the wire. The student will turn on the battery to activate the circuit and with the cardboard use one hand to hold ✓ the compass on a point near the wire and let it draw the magnetic field of the cardboard [3] The candidate has not thought out what they were going to say, so they have only made one relevant point before running out of space.

					Exemplar 16  (a) (i) Describe how the student could use this experiment and a compass to investigate the magnetic field produced by the wire. Put the compass next to the wire and see where the arrow points. If it points in there is no magnetic field. If it points out their is a magnetic field. [3] If the candidate had written their answer as bullet points it would have helped them to identify that after the first two clear descriptions they were no longer describing how to investigate a magnetic field. Exemplar 17  (a) (i) Describe how the student could use this experiment and a compass to investigate the magnetic field produced by the wire. ~~place the plotting compass on the card and pen~~ ~~Draw a~~ place the plotting compass on the card and plot, when the compass needle is still, with a x, and repeat, until it ~~creates a back~~ comes around to the other side [3] This candidate's response is a good example of the effective use of short clear instructions when describing experimental procedures . It is much easier to follow this type of scientific writing rather than continuous descriptive prose in longer sentences. **AfL** Give the students the instructions for a practical activity as a single descriptive paragraph and ask them to summarise the instructions a fixed number of short bullet points. Alternatively ask them to write down the procedure after they have completed the activity, but keeping to a word limit.
		ii	one or more circles around wire ✓ clockwise arrow(s) ✓	2 (AO2 × 2.2)	**DO NOT ALLOW** a spiral BUT **ALLOW** if clockwise direction shown by an arrow on the spiral then ✓ **Examiner's Comments** Some good answers were drawn by candidates. However, the annotated field direction on the drawings were not always correct. The question explicitly asks for the shape of the field around **this** wire. A

					common misconception was to draw the field around a bar magnet.
			Total	**7**	
5	a	i	Any 3 from: Place magnet on a sheet of (plain) paper (1) Place the compass near the end of the magnet (1) Mark the position that the compass needle points to (1) Move the compass so the opposite end is at this position and mark the new position where the compass tip settles (1) Repeat above and below the magnet and then connect the marks together to construct a fieldline (1)	3	**ALLOW** full marks for a fully annotated diagram that demonstrates how the experiment would be undertaken
		ii	Place a clear / transparent / paper cover over the magnet (1) (Sprinkle) on iron filings (to show the field pattern) (1)	2	**DO NOT ALLOW** marks for diagram
	b		Any one from: Compass shows direction of field lines (1) Iron filings are easily spilt (1) Iron filings are difficult to remove from magnets (1) Iron filings carries a greater risk / **AW** (1) (Idea of) less accurate field pattern (1) Drawing provides a permanent record (1)	1	
	c		Correct field pattern drawn, (1)  e.g. Correct direction of arrow heads (1)	2	Minimum of 4 field lines No field lines crossing
	d		As the distance from the wire increases the strength of the magnetic field falls / **AW** (1) (idea of) the non-linear nature of the relationship (1)	2	
			Total	**10**	
6			B	1	
			Total	**1**	
7			A	1	
			Total	**1**	
8			B	1	

			Total	**1**	