3.22 Magnetism and the Motor Effect: 10-minute Pack

AQA 8464 · Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A plotting compass contains a small magnet that is free to rotate.

(a) State why a plotting compass needle points towards magnetic north when it is far away from any other magnets. **(1)**

(b) When the same plotting compass is placed close to a bar magnet, its needle instead points along the magnetic field lines of the bar magnet. Explain, in terms of the forces between magnetic poles, why the compass needle behaves in this way. **(3)**

(Total for Question 1 is 4 marks)

2 A solenoid carrying a current produces a magnetic field.

(a) Describe the shape of the magnetic field pattern outside a current-carrying solenoid, compared with the field pattern of a bar magnet. **(2)**

(b) Higher Tier only. State a method the student could use to work out which end of a current-carrying solenoid is its north pole, without using a compass. **(2)**

(Total for Question 2 is 4 marks)

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Mark scheme · 3.22 Magnetism and the Motor Effect: 10-minute Pack

Question 1

(a) the compass needle aligns with (the direction of) the Earth's magnetic field, oe **B1**

(a) Answer: The compass needle aligns with the Earth's magnetic field.

(b) the compass needle is itself a small permanent magnet, with its own north pole and south pole, oe **M1**

(b) the poles of the bar magnet attract the unlike poles of the needle and repel its like poles, so each end of the needle is pulled or pushed by the bar magnet's field, oe **M1**

(b) because the needle is free to pivot/rotate, it turns until it lines up with the (stronger, local) magnetic field of the bar magnet, i.e. it points along the bar magnet's field lines, oe **A1**

(b) Answer: The needle is a small permanent magnet with its own north and south poles. The bar magnet attracts the needle's unlike poles and repels its like poles, and because the needle can rotate freely it turns until it lines up with the bar magnet's field lines.

Question 2

(a) the field pattern outside the solenoid is the same shape as the field pattern of a bar magnet, oe **B1**

(a) field lines run from the north pole, curve around the outside, and return to the south pole (accept: it has a north pole at one end and a south pole at the other), oe **B1**

(a) Answer: The same shape as a bar magnet's field: lines run from the north pole, curve round the outside, and return to the south pole.

(b) use the right-hand grip rule, oe **B1**

(b) curl the fingers of the right hand in the direction of (conventional) current flow around the coil; the thumb then points towards the north pole, oe **B1**

(b) Answer: Use the right-hand grip rule: curl the fingers in the direction of current flow around the coil; the thumb points to the north pole.

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