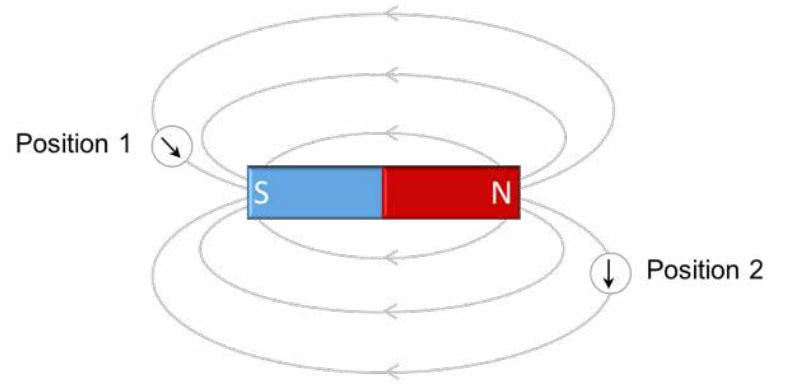
0 1 A student is experimenting with a plotting compass. The magnetic north pole of the compass needle located at the tip of the arrow, as shown in the below diagram.

0 1 . 1 Which of the following statements is correct? Tick **one** box.

- The needle will point towards geographic south ☐
- The needle will point towards magnetic north ☐
- The needle will align itself with the magnetic field of the Earth ☑
- The needle is an induced magnet ☐

TOP TIP: Remember that the south *magnetic* pole of the Earth is actually in the northern hemisphere (close to its north *geographic* pole). In other words, the north pole of a compass needle will point towards the south magnetic pole, which is in the geographic north. The phrase 'align itself with the magnetic field' is just a fancy way of saying 'line up with the magnetic field'.

0 1 . 2 The student uses the plotting compass to investigate the magnetic field around a bar magnet.



Draw arrows inside the circles at Position 1 and Position 2 to indicate the direction in which the compass needle will point when placed at these two locations.

Hence add arrows to each of the magnetic field lines in the above diagram.

0 2 Magnets may be classified as being either permanent or induced.

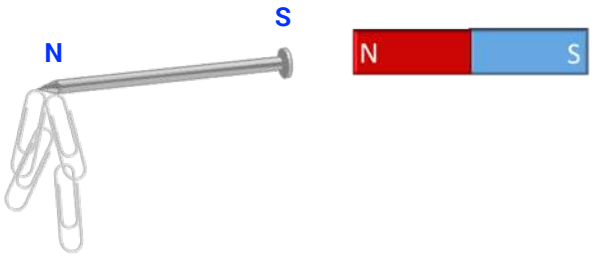
0 2 . 1 Explain the difference between a permanent and an induced magnet.

A permanent magnet produces its own magnetic field (and it always has a north and south pole) [1]. An induced magnet only becomes magnetic when it is placed into a magnetic field [1].

0 2 . 2 Explain how you could use the below experimental setup to determine whether a metal bar is a permanent or an induced magnet.

If the metal bar is a *permanent* magnet, it can be both attracted to and repelled by the bar magnet (it will be attracted to the bar magnet in one orientation, then be repelled by it when rotated through 180°) [1]. If the metal bar is an *induced* magnet, it will only ever be attracted to the bar magnet.

0 3 A bar magnet and an iron nail are being used to lift some paper clips from a table, as shown below.



0 3 . 1 Label the north and south poles of the iron nail with the letters **N** and **S**, respectively.