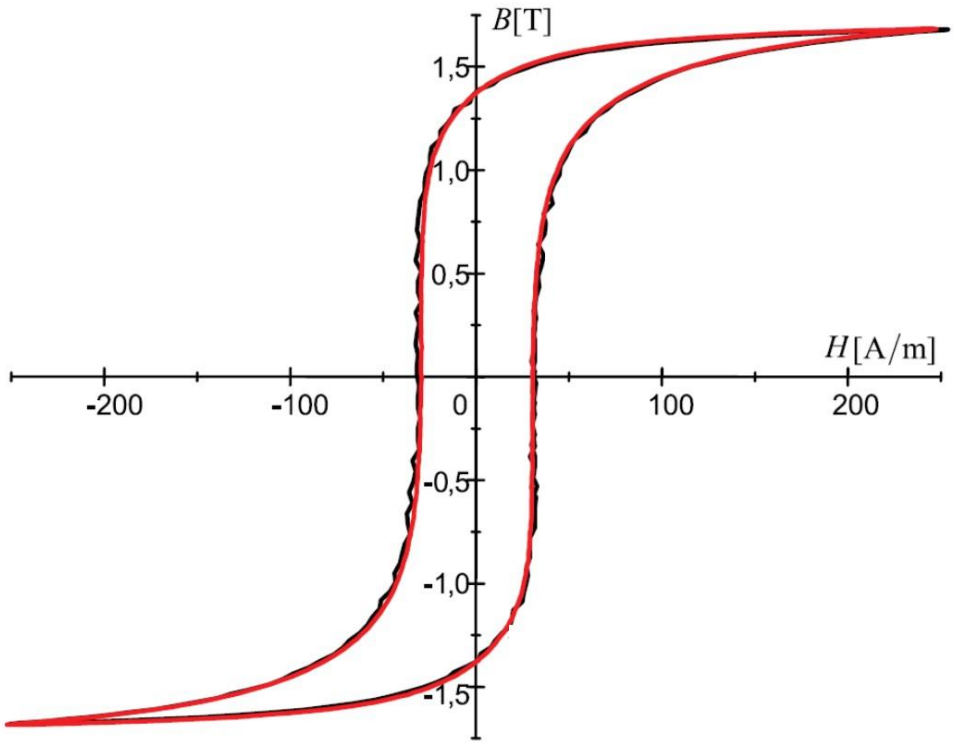
MMME2045 Functional Materials Practice Question 8-9

Question 8

The figure below shows a magnetic flux density (B) - magnetic field strength (H) hysteresis loop for one magnetic material.



(8a) Estimate the saturation flux density (B_s), remanence (B_r) and coercivity (H_c).

(8b) Is this material a hard magnet or a soft magnet?

Question 9

The table below is a list of magnetic material properties for three commonly used magnets.

Material	T_c/K	B_r/T	H_c/kA m^{-1}	$(BH)_{max}$/kJ m^{-3}
Magnet A	1160	1.35	64	44
Magnet B	1000	0.85	600	140
Magnet C	620	1.1	890	216

Question 9(a)

Do you think the above materials are soft or hard magnets? Give your reasoning behind your choice based on the magnetic properties listed.

Question 9(b)

Which property used in the above table is often quoted as a performance index for a magnetic material. Draw a line from the origin on your B-H plot crossing the B-H loop to indicate and explain where this property is calculated from.

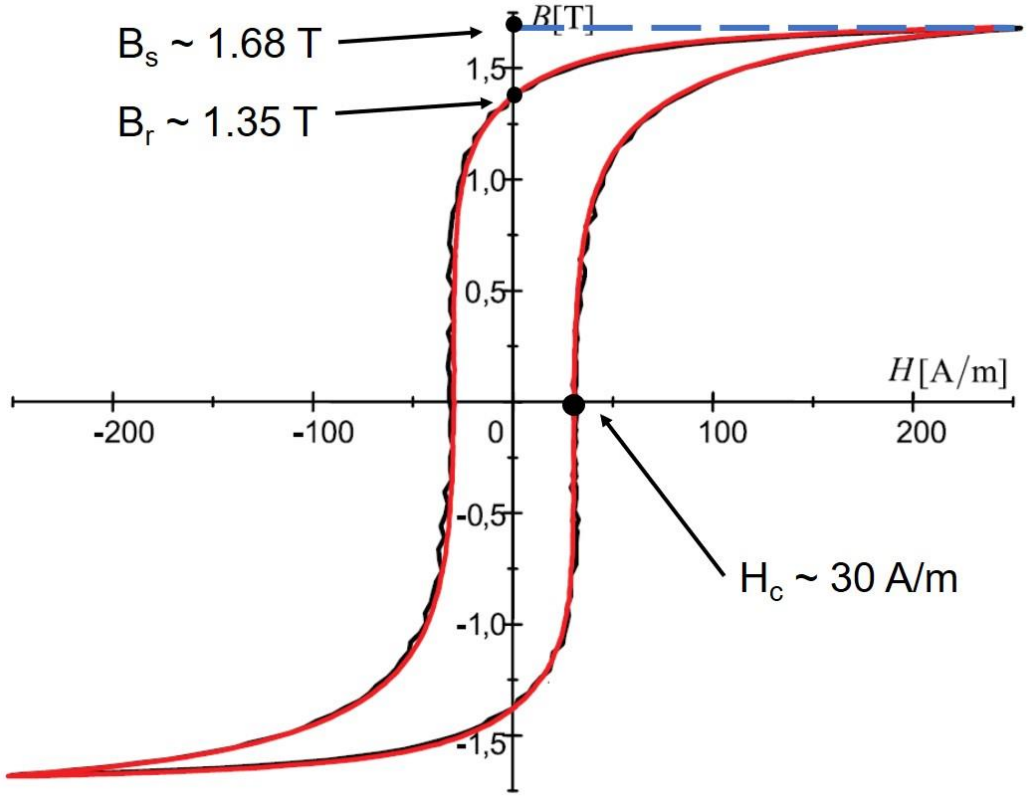
Solutions

(8a)

Saturation flux density (B_s): ~ 1.68 T

Remanence (B_r): ~1.35 T

Coercivity (H_c): ~30 A/m



(8b)

This material is a soft magnet as it has a low coercivity (H_c) ~ 30 A/m.

Note that soft magnets have low coercivity, typically less than 1,000 A/m.

Hard magnets have high coercivity, typically in the order of 10^4 - 10^6 A/m.

(9a)

The table is a list of hard magnetic materials, which exhibit high Coercivity in the order of 10^4 - 10^6 A/m.

(9b)

(BH)max.

Draw a line from origin in second quadrant on the B-H loop where B × H is a maximum.