Year 10

Physics booklet

Topic 3 – Magnetism and Electromagnetism

Name: _____

Magnetism and Electromagnetism

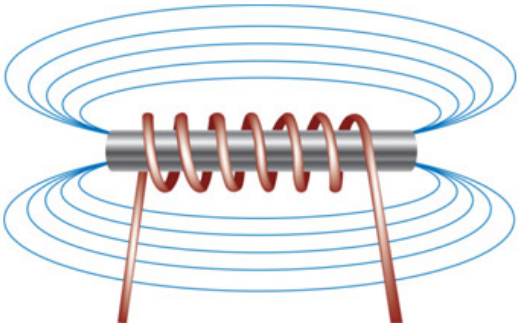
Give a definition for each of these key words:

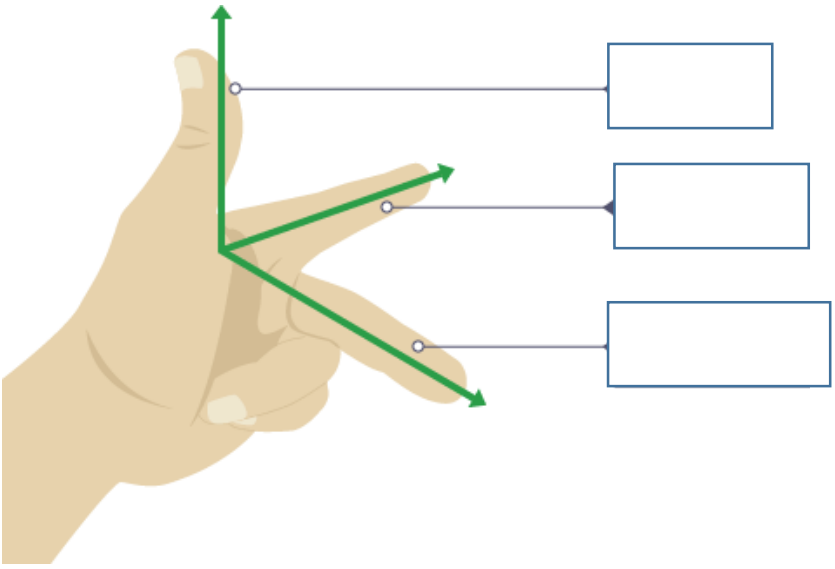
Bar magnet	
Magnetic pole	
Magnetic field lines	
Induced magnetism	
Solenoid	
Electromagnet	
Motor	
The motor effect	
Magnetic flux density	

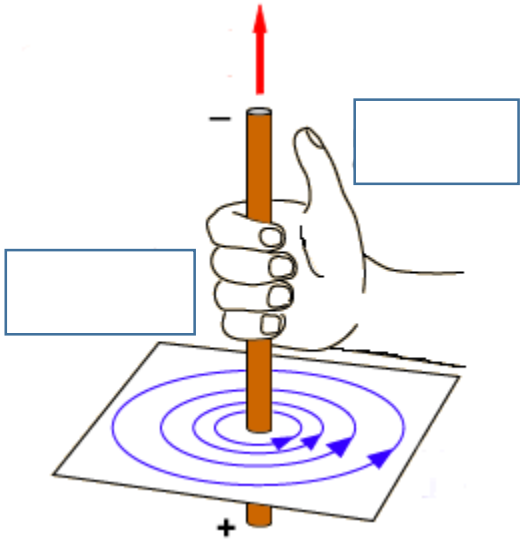
Electromagnetism equations:

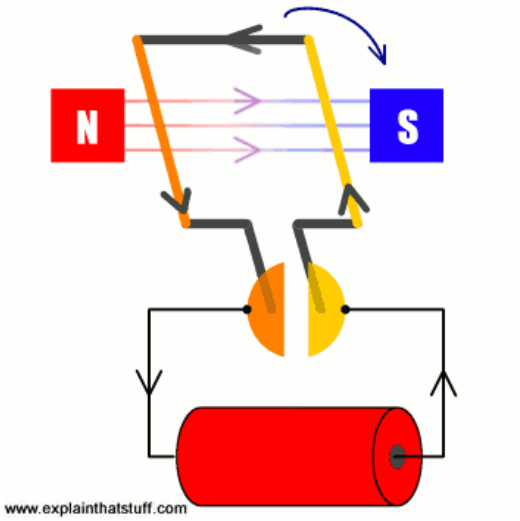
(write down equations that you need to know about electromagnetism)

Label these diagrams as fully as you can

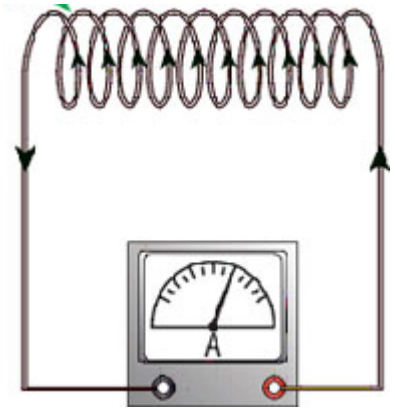








Sketch the magnetic field for the following



Questions

Is magnetism a contact or non-contact force? _____

Describe how an induced magnet is produced _____

_____

Explain what is meant by a permanent magnet and give examples of materials that can become magnetised. _____

_____

What are the advantages of using an electromagnet rather than a permanent magnet? _____

_____

Name three magnetic materials. _____

Describe why steel is magnetic. _____

Describe an experiment to distinguish between a magnetic material and a magnet _____

_____

_____

Explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic. _____

_____

Describe three ways of increasing the magnetic field strength of a solenoid. _____

_____

_____

Electric motors (fill in the blanks)

Electric motors use the _____. A simple electric motor can be built using a _____ of wire that is free to _____ between two opposite magnetic poles.

When an electric _____ flows through the coil, the coil experiences a _____ and moves. One side moves up and the other side moves down (based on Fleming's _____ hand rule)**.**

The direction of the current must be reversed every half turn, otherwise the coil comes to a halt again. This is achieved using a conducting ring split in two, called a split ring or _____

If you were to swap the poles of the magnet in an electric motor what would happen? _____

_____

Formula practice

Write the equation that links force on a current carrying conductor, magnetic flux density, current and length of the conductor in the magnetic field

Give the units for each quantity

Questions		
1	:	force on a conductor carrying a current = 6.27 N, magnetic flux density = 2.11 T, length = 4.76 m, current = ?
2	:	force on a conductor carrying a current = 0.32 N, current = 5.7 A, length = 7.58 m, magnetic flux density = ?
3	:	magnetic flux density = 7.35 T, current = 4.59 A, length = 1.45 m, force on a conductor carrying a current = ?
4	:	force on a conductor carrying a current = 6.2 N, magnetic flux density = 3.82 T, current = 9.22 A, length = ?
5	:	force on a conductor carrying a current = 8.69 N, current = 6.87 A, length = 3.43 m, magnetic flux density = ?
6	:	magnetic flux density = 0.54 T, current = 5.19 A, length = 0.21 m, force on a conductor carrying a current = ?
7	:	force on a conductor carrying a current = 5.26 N, magnetic flux density = 1.97 T, length = 4.61 m, current = ?
8	:	force on a conductor carrying a current = 5.88 N, magnetic flux density = 0.66 T, current = 5.37 A, length = ?

Past Exam Question Practice

Q1. This question is about magnetism.

(a) Which two materials are magnetic?

Tick **two** boxes.

Carbon	☐
Cobalt	☐
Copper	☐
Nickel	☐
Sodium	☐

(2)

(b) Describe how you could find the magnetic field pattern of a permanent bar magnet.

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(3)

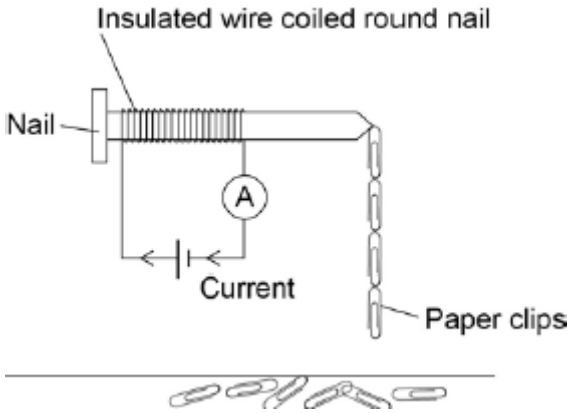
(c) A student investigates how the number of turns of wire on a solenoid affects the strength of the solenoid.

To test the strength of the solenoid she looks at how many paper clips the solenoid could lift.

Figure 1 shows how she sets up the equipment.

She keeps the current through the coil constant throughout the experiment.

Figure 1



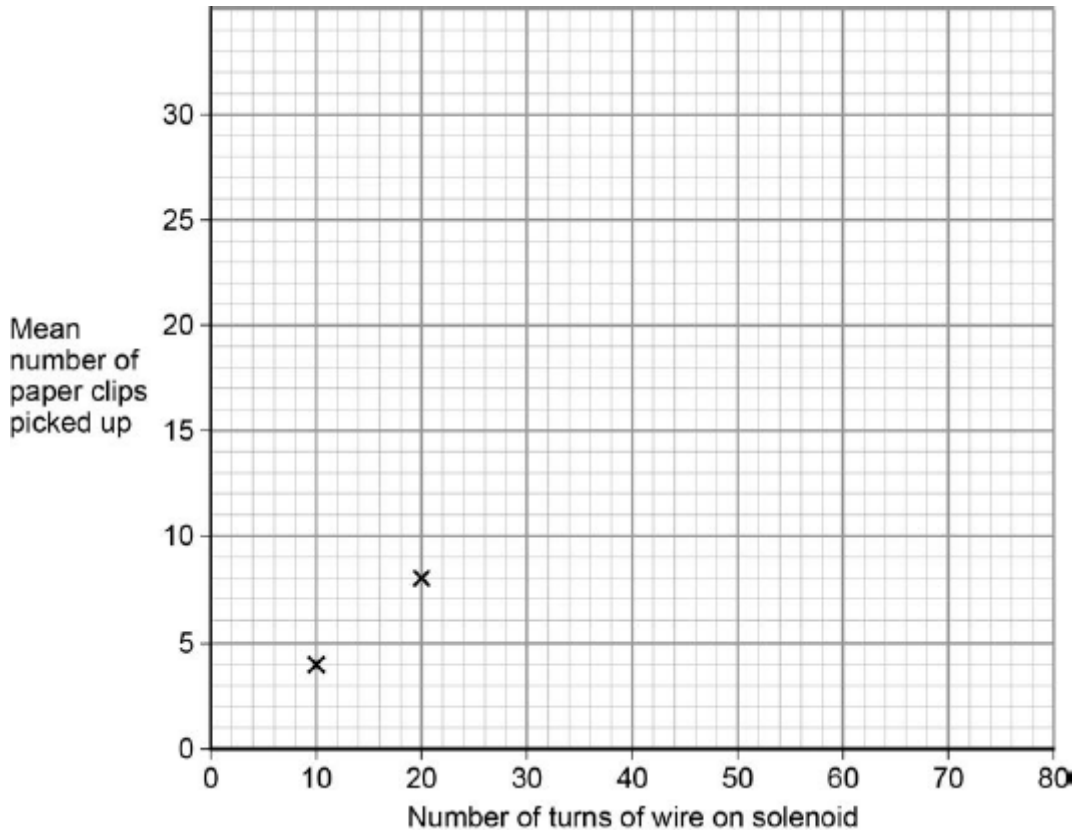
The table below shows the student's results.

Number of turns of wire on solenoid	Number of paper clips picked up by solenoid			
	Test 1	Test 2	Test 3	Mean
0	0	0	0	0
10	4	3	4	4
20	8	8	9	8
30	11	11	13	12
40	15	13	16	15
50	21	24	19	21
60	25	24	26	25

Use the data from the table above to complete the graph in **Figure 2**.

- The first two points have been plotted for you.
- Draw a line of best fit.

Figure 2



(3)

(d) Describe the pattern shown in the graph.

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.....

.....

.....

(2)

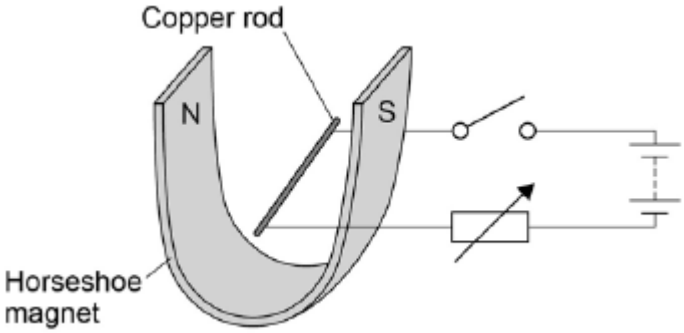
(e) Use your graph to predict how many paper clips the solenoid will pick up when 80 turns of wire are used.

Number of paper clips picked up = ...

(1)

(Total 11 marks)

Q2.A teacher used the equipment shown in the figure below to demonstrate the motor effect.



(a) Describe how Fleming's left-hand rule can be used to determine the direction in which the rod will move when the switch is closed, and state the direction.

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(4)

(b) Increasing the current can increase the force acting on the copper rod.

Give **one** other way in which the size of the force acting on the copper rod could be increased.

.....

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(1)

(c) The copper rod in the figure above has a length of 7 cm and a mass of 4×10^{-4} kg.

When there is a current of 1.12 A the resultant force on the copper rod is 0 N.

Calculate the magnetic flux density.

Gravitational field strength = 9.8 N / kg

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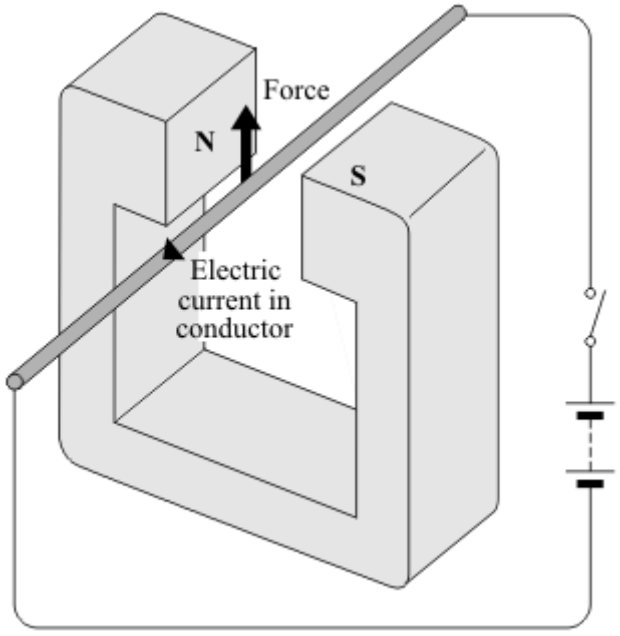
Magnetic flux density = ... T

(5)

(Total 10 marks)

Q3. When a conductor carrying an electric current is placed in a magnetic field a force may act on it.



(a) State **two** ways in which this force can be increased.

1 .....

2 .....

(2)

(b) State **two** ways in which this force can be made to act in the opposite direction.

1 .....

2 .....

(2)

(c) In what circumstance will **no** force act on a conductor carrying an electric current and in a magnetic field?

.....

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(1)

(Total 5 marks)

Show clearly how you work out your answer.

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Kinetic energy = ... J

(2)

(Total 7 marks)