**PHYSICS 1****2**

**MOTOR INVESTIGATION**

It is possible to make your own DC motor with only a few simple parts. Once you have made your motor you can test it by measuring how fast it spins for a given input. You can also measure how powerful and efficient it is by attaching weights and getting your motor to lift them.

An electric motor relies on the magnetic force on a current carrying loop in a magnetic field.

**F = nBIℓsin** where: F=force

n = number of loops

B = magnetic field strength

I = current

ℓ = length which current flows along

****= angle between B and I

There is a torque on the loop whenever its plane is not perpendicular to the field. Torque is a measure of the force that can cause an object to rotate about an axis. In the same way as force is what causes an object to accelerate in a straight line, torque is what causes an object to acquire angular acceleration. Torque is a vector quantity. The direction of the torque vector depends on the direction of the force on the axis. The magnitude of the torque depends on the strength of the field, current, number of turns and area of the coils.

**PART 1: Design an efficient motor**

* Build a motor.

You will need to research the components needed to create a motor, source the parts needed (many parts you can find around the home or buy at a hardware store), and put your motor together. Do not feel that you need to spend a lot of money to get a good mark, in the past small creative motors have scored higher than expensively built large motors. Please see your teacher if you have difficulty accessing materials (eg magnets).

* Test the efficiency of the motor.

Design a method of testing the efficiency of the motor and calculate this as a percentage.

**PART 2: Investigate the effect on efficiency of the motor when one variable is changed**

* Choose ONE variable to change and investigate how it effects the efficiency of your motor. Some variables you could consider changing include: magnet size/strength, number of coils, diameter of coil, thickness of wire
* Write an experimental report (as described over the page and in more depth in your text book, Chapter 10) based on this investigation

**Elements to be submitted to teacher**

1. The motor
2. The experimental report for the investigation you performed to test effect of changing a variable on the efficiency of the motor. This should include an explanation of how you measured the efficiency.

***Experimental write up must include***

***Title***

***Aim***: This is a statement describing in detail what will be investigated.

***Hypothesis***: A hypothesis is your prediction of the effect one variable will have on another. Justify your hypothesis. A good hypothesis is a statement that predicts the results of an experiment and can be tested using measurements. It should include the independent and dependent variables and the relationship between them.

***Variables***: Identify the independent, dependent and controlled variables. You should choose quantitative variables for both the independent and dependent variables.

***Method***: This summarises what you measured and how you measured it. It explains why you chose a particular method.

This should be written in sentences and paragraphs in past tense, it should explain what you actually did.

Include labelled diagrams to aid your explanation.

Explain how you avoided or reduced risks associated with your experiment.

***Results and analysis***: Draw up a table to record results, if numerical data is obtained. Results may also include written observations in a list or table, sketches, diagrams, photos, etc. Find the average of your results and percentages. Use correct SI units and include uncertainties. Make sure you include calculations, etc. if you’ve included any ‘processed’ information in the table

Include appropriate graphs.

***Discussion***: This should summarise what your results mean. What were your findings? Make reference to the data gathered. What implications are there based on your results? Do your results suggest there is a way to build or do something better? Compare to published information and physics concepts. Mention and account for any trends or outliers (explain them properly, referencing variables). Mention average in discussion (if appropriate). You could add further calculations here (depending on the experiment).

Briefly discuss any difficulties you had or suggestions of ways to do this investigation better.

How did you ensure that the measuring was accurate? What mistakes were made? Identify systematic and random errors. Suggest how errors could be reduced. Were there any hazards (dangerous things/situations)?

***Conclusion***: This should be a very short summary of what you found out and what it means. Have you tested your aim? Did your results support your hypothesis? Make an assessment of the reliability and validity of your experiment. Answer aim and then hypothesis.

***Acknowledgements***: You should thank anyone who helped you. If you worked alone then leave this section out.

***References***: A reference list details any sources used and should be linked to the information at the point it was used. Often a superscript number is used within the report at the point the information is used and then a numbered list is included at the end of the report.