

The Motor Project

An Electric Motor is a spinning electromagnet with **changing magnetic poles**** and includes at least one other magnetic field. Power to cause this rotation must be supplied by a DC power source (AC is too dangerous!). The purpose of this project is to allow students apply the knowledge gained about electricity and magnetism. Students will use research, the scientific method, and problem solving skills to design, test, and implement a working motor in two steps or phases:

Phase One

Operate an armature with changing polarity and one or more permanent magnets for duration of at least ten consecutive revolutions. The motor must start on its own (without being pushed or touched) when power is applied and complete the ten revolutions on 12 watts or less.

Phase Two

Operate an armature with changing polarity and one or more electromagnets for duration of at least ten consecutive revolutions. The motor must start on its own (without being pushed or touched) when power is applied and complete the ten revolutions on 12 watts or less.

Students wishing to bypass phase one completely (with no loss of credit) must complete a working phase two prior to the phase one deadline.

****NOTE: changing magnetic poles**** The induction motors pictured in some texts and on the web do not have magnets that change polarity and therefore do **not** satisfy this requirement.

An electric motor is described in your text in Chapter 24 pp. 656

Design research is encouraged on the Internet and with library references. The design need not be original or unique. Students may not use kits (sets of pre assembled parts) or pre-manufactured motor parts to complete the motor. This includes parts from disassembled motors. This project encourages students to use commonly available components, parts left over from other projects, or purchased from a hardware store.

Extra Credit, or higher grade value will be awarded to motors that are completed in advance of deadlines, or use lower power requirements, and or do Work ($W = \text{force} \times \text{distance}$). A chart will be provided to set the dates and levels for higher achievement.

Safety Net

Students successfully completing a phase one motor by the due date will receive a minimum of a "C" grade on the Motor Project if phase II is not completed.

Students successfully completing a phase one motor by the Extra Credit 8% deadline will receive a minimum of a "B-" grade on the Motor project if phase two not completed.

Low Wattage Thresholds extra credit value

Phase One	5% for less than 6 watts
Phase One	10% for less than 1 watt
Phase Two	10% if phase one skipped **
	5% if phase one done**

* Design Submission is a drawing and a written explanation

** by phase one deadline

April / May Calendar

20	21 electrostatics Project Introduction	22 No Class	23 Focus on magnetism	24 Early Design Submission* 15pts. (Both parts)
27 Development Day Student Holiday	28 Important in Class Demo Design Workshop in Z block 226 BYO Materials	29 Design Workshop in Z block 226 BYO M	30 <u>Design Submission*</u> <u>Due 10pts.</u> PHASE ONE Extra Credit 8%	2 PHASE ONE Extra Credit 7%
4 PHASE ONE Extra Credit 5%	5 PHASE ONE Extra Credit 4%	6 PHASE ONE Extra Credit 2% PHASE TWO Extra Credit 5%	7 <u>PHASE ONE Due: 70 pts.</u>	8 PHASE ONE LATE Credit - 20% PHASE TWO Extra Credit 4%
11 PHASE TWO Extra Credit 3%	12 PHASE TWO Extra Credit 2%	13 PHASE TWO Extra Credit 1%	14 <u>PHASE TWO Due 20 pts</u>	15 PHASE TWO LATE Credit - 50%
18 PHASE TWO LATE Credit -75% Game Over	19	20	21	22

... EVALUATED ON A 100 POINT SCALE ...

Hints

Start Early

Problem #1 **Friction** in the system ... choose the design carefully

Problem #2 **Distances too far** (great) ... solution careful symmetry

***** Trouble shooting : Be sure to change only **one variable at a time** use good science !!!

Problem #3 Bad **Connections**/contacts

Problem #5 **Improper** (backward) **Polarity**

Problem #6 Poor **Craftsmanship**

Problem #7 **Impatience** (start early get help!)