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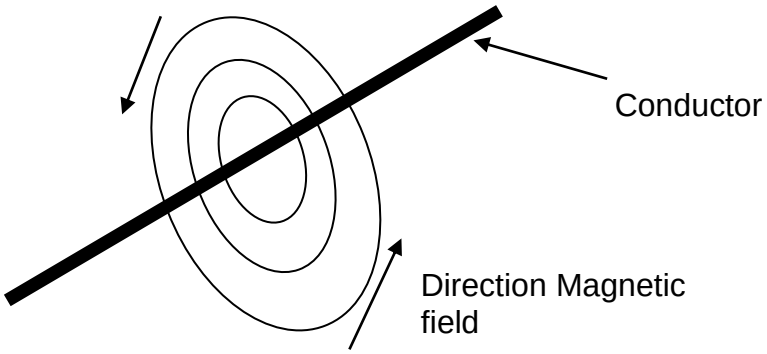
ANSWER BANK

ELEMENT ONE
Demonstrate knowledge of electromagnetism as applied to automotive units.

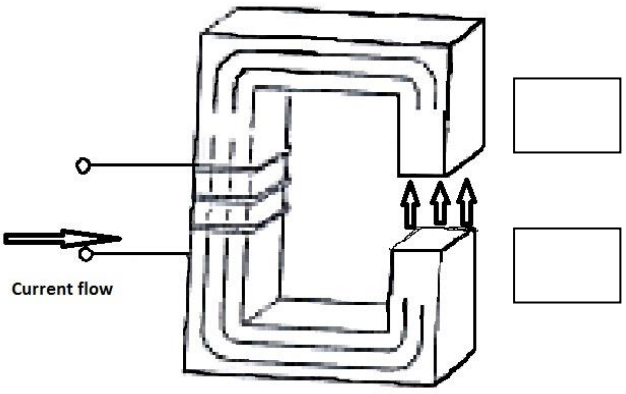
1. If you pass an electric current through a conductor a magnetic field will form circles around the current as in the diagram below.



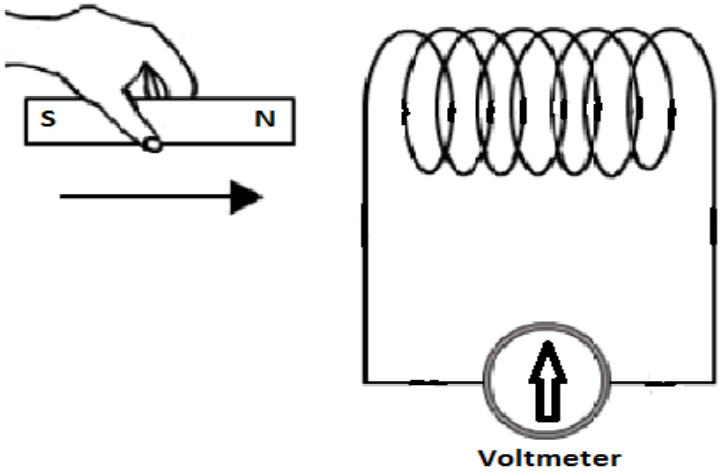
Describe how you would use Flemings right hand rule to determine the direction current flow.

You would clasp the wire with your right hand, fingers going in the direction of the magnetic field. Your thumb would be pointing in the direction of current flow which on this diagram would be from right to left.

2. Identify the polarity of the magnetic field on the diagram below. Enter N or S in the appropriate box.



3a; What would the voltmeter show when a magnet is moved through the coil of wire as in the diagram below?



The voltmeter would show a voltage depending on how fast the magnet moved, how strong the magnetic field was and how many coils of wire in the coil.

b; What would the voltmeter show if the magnet was stationary inside the coil of wire

The voltmeter would show no volts

C; Justify your answer for b,

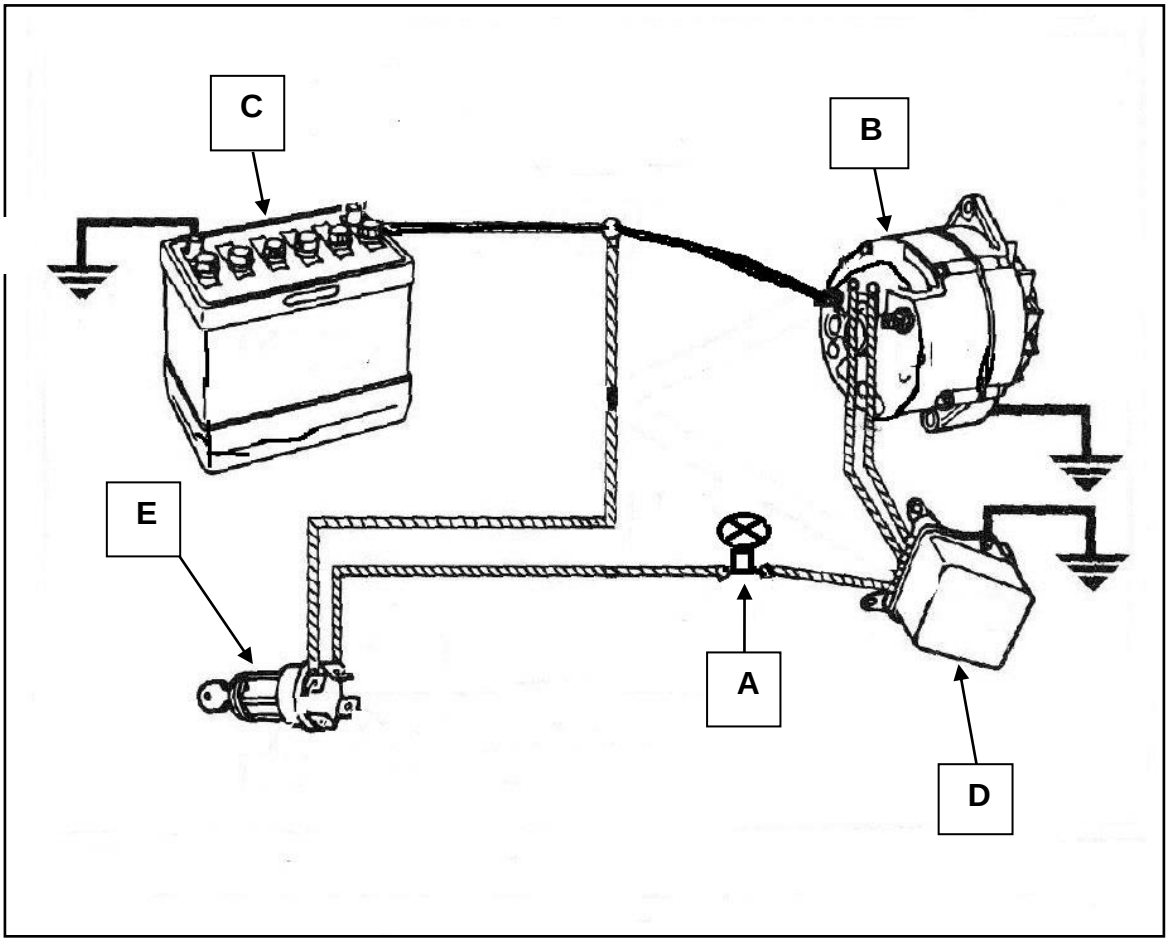
For voltage to be induced in the coil, something has to move, so either the magnetic field moves through the coil or the coil moves through the magnetic field.

ELEMENT TWO

Demonstrate knowledge of the operation of a charging system that uses an alternator.

1. Refer to the list provided to match each charging component with its correct location in the diagram below. Write the appropriate letter in the box next to its arrow.

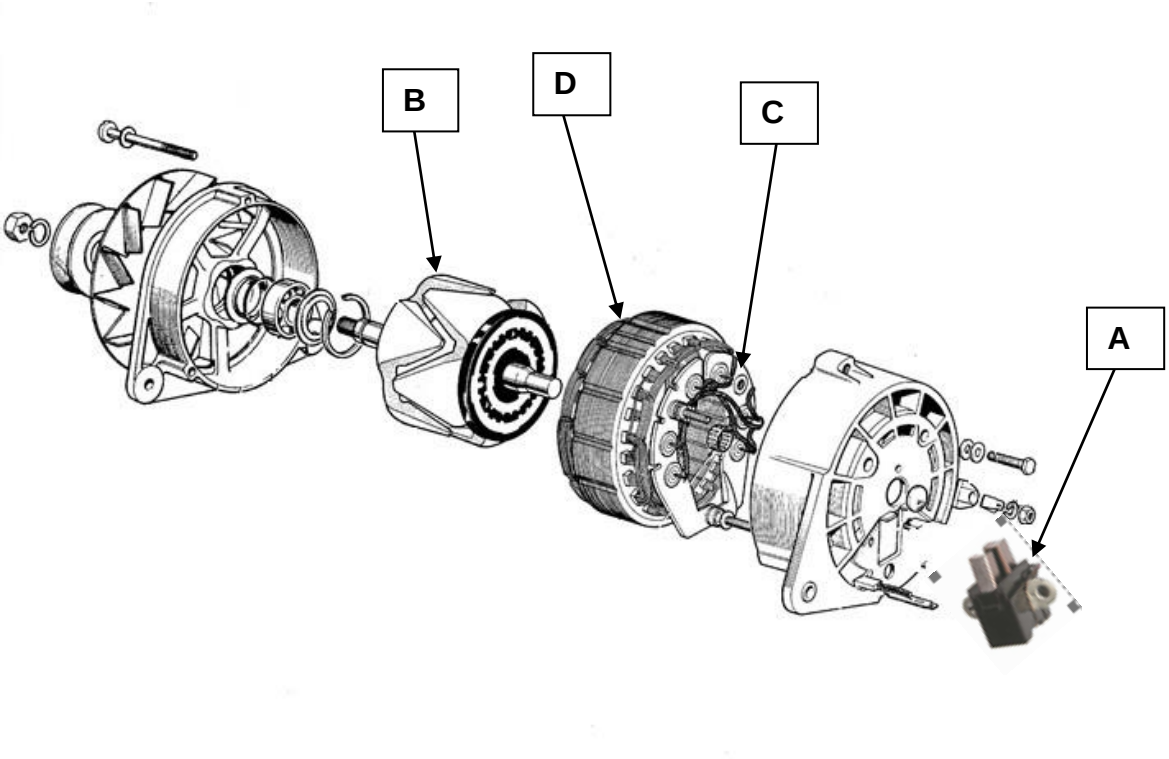
A. Charge indicator bulb
B. Alternator
C. Battery
D. Voltage regulator
E. Ignition switch



2. Identify the alternator components on the diagram below.

A: Brushes **B:** Rotor

C: Rectifier assembly **D:** Stator



3. Match the following functions to each of the charging system components in the table below.

A	Wiring loom	**A1**	1	Carries electrical current to components
B	Voltage regulator	**B3**	2	Changes alternating current to direct current
C	Charge indicator	**C9**	3	Controls the voltage output
D	Stator	**D10**	4	Provides voltage from the battery to the alternator
E	Rectifying diodes	**E2**	5	Drives the alternator at engine speed
F	Ignition switch	**F4**	6	Produces a variable strength magnetic field
G	Battery	**G8**	**7**	Produces alternating current
H	AC generator	**H7**	8	Chemically stores electricity
I	Rotor	**I6**	9	A warning lamp and can provide a path for current flow to the rotor
J	Drive belt	**J5**	10	Alternating current is induced in these windings

4. When talking about Alternators, what does the word ***Rectify* mean? and how does this happen?**

Rectify means that the alternators output current is changed (rectified) from Alternating current (AC) to Direct current (DC). This is done by the diodes in the rectifier which will only let the current flow in one direction to the battery.

5. Describe how increasing or decreasing the current going through the rotor will change the output of the alternator.

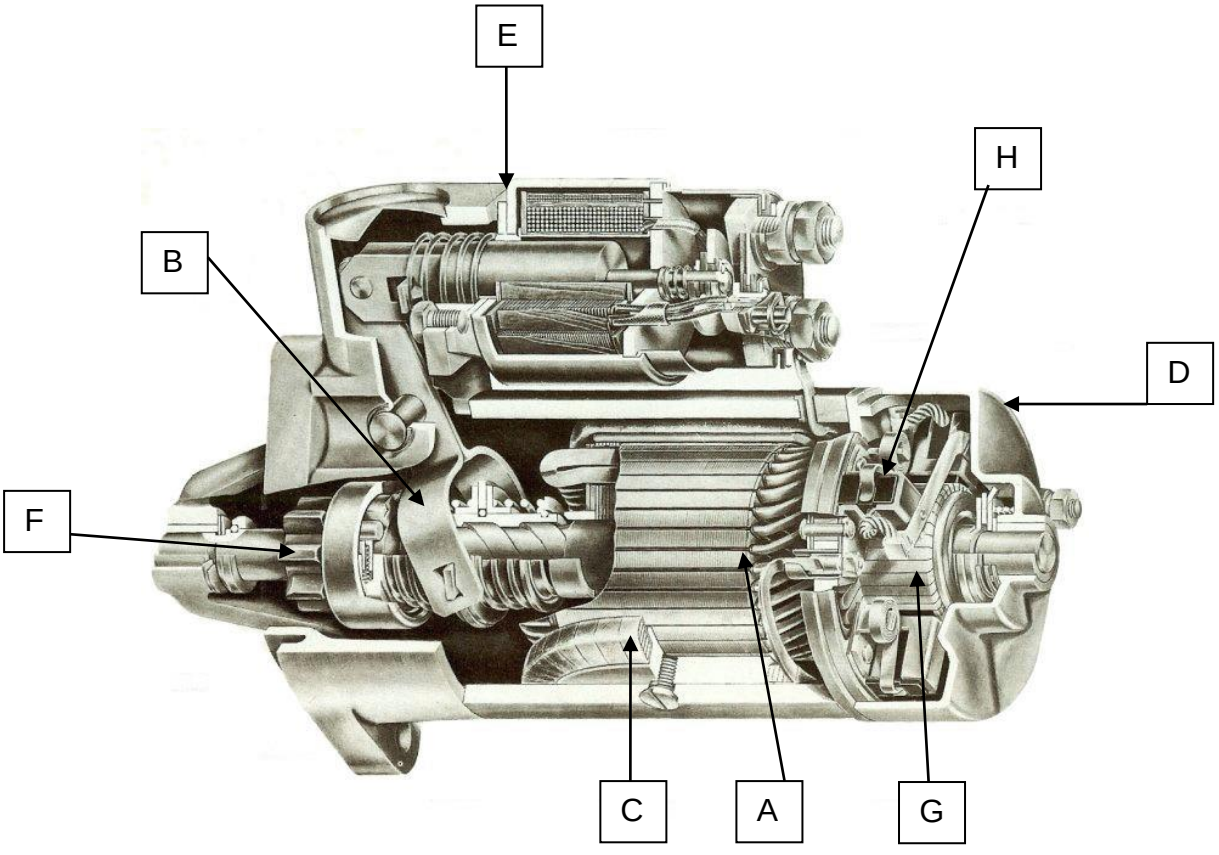
If the current flowing through the rotor is increased then so too is the strength of the magnetic field produced by the rotor. This will increase the strength of the current being induced in the stator windings and therefore increase the output current of the alternator.

The reverse is true if the rotor current is reduced, i.e. the strength of the magnetic field is reduced which decreases the induced current in the stator and the alternator output.

ELEMENT THREE
Demonstrate knowledge of the operation of a starting system.

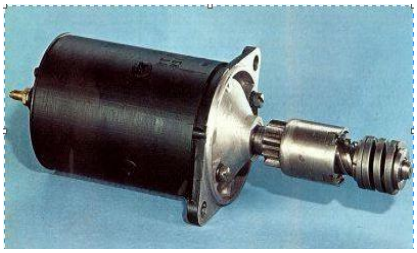
1. Identify the starter motor components on the cutaway diagram below.

A:	Armature	**B:**	Pinion Lever
C:	Field Winding	**D:**	Housing
E:	Solenoid	**F:**	Pinion Gear
G:	Commutator	**H:**	Brush



2. From the list provided identify the types of starter motor shown in the pictures below.

Inertia Pre-Engaged Gear Reduction



Starter type: *Inertia*

Starter type: *Gear reduction type*

Starter type*: Pre-engage type*

3. How does an inertia type starter get the pinion gear to engage the ring gear?

The pinion gear has an internal thread which fits over an external thread on the armature shaft. As the armature begins to spin the “inertia” effect of the stationary pinion gear makes it more inclined to wind down the shaft and into mesh with the ring gear on the flywheel.

A strong compression spring is attached at the end of the armature shaft which cushions the shock during the meshing of the pinion with the ring gear. Once the pinion and ring gear are fully engaged, power is transmitted to the flywheel, which cranks the engine from stationary to a speed sufficient for the engine to start.

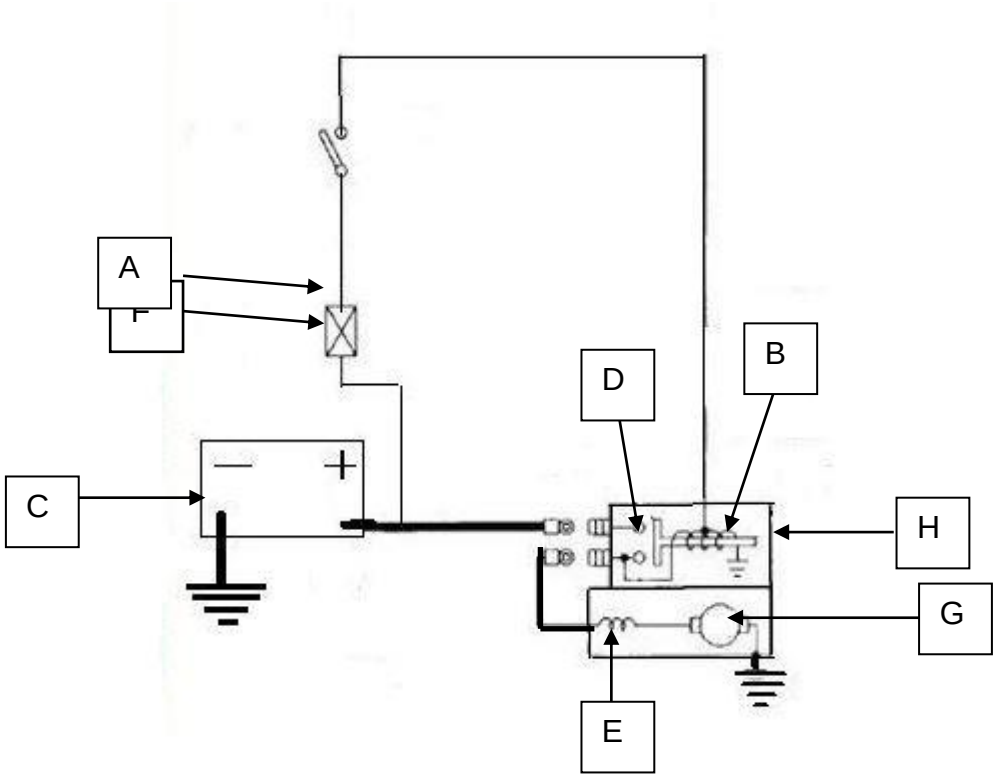
As the engine starts and the flywheel speed becomes greater than the cranking speed of the pinion the pinion is “screwed” out of mesh and back along the armature shaft where it started from.

4. How does a pre-engage type starter get the pinion gear to engage the ring gear?

As the name suggests the pinion is engaged with the ring gear before it begins to turn. This is done by the solenoid which uses an electromagnet to pull a lever attached to the pinion which slides on splines on the armature shaft. Only when the pinion is fully in mesh with the ring gear the solenoid closes a switch to allow current to the starter so that the armature can turn and the pinion can then crank the ring gear.

5. Identify the components in the diagram of the starter circuit below.

A. Starter switch
B. Solenoid coils
C. Battery
D. Solenoid switch contacts
E. Field coils
F. Fusible link
G. Armature
H. Solenoid



6. Outline the function of the starter circuit components listed below.

Solenoid:

1. When the starter switch is turned to “start” the solenoid plunger is pulled by the electromagnet. This moves the lever which engages the pinion with the ring gear on the flywheel.
2. It then closes the contacts which allow the current to flow to the starter.

Field coils:

Produces a strong magnetic field to oppose the magnetic field created by the armature to make the armature turn.

Battery:

Stores electrical current so it can be supplied to the starter motor on demand.

Starter switch:

Sends the small current to the starter solenoid to activate the starter motor.