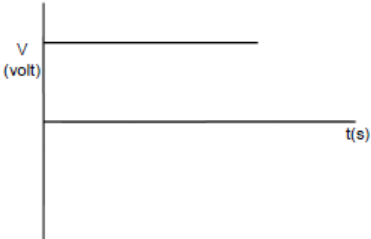
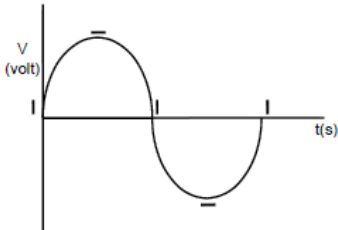
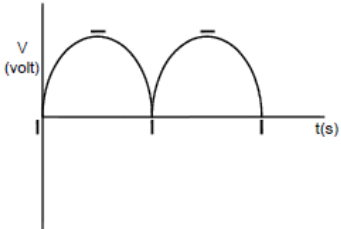


# Motors and Generators

Naam: \_\_\_\_\_

Jou Selnommer: \_\_\_\_\_

Jou e-posadres: \_\_\_\_\_

DIRECT CURRENT MOTOR	ALTERNATING CURRENT GENERATOR	DIRECT CURRENT GENERATOR
<ul style="list-style-type: none"> <li>Electrical energy → Mechanical E.</li> <li>Has cells and magnets → produces power.</li> <li>Has 1 split ring commutator with carbon brushes.</li> <li>Function: Turns current direction around every 180°.</li> <li>Battery delivers direct current.</li> </ul>  <ul style="list-style-type: none"> <li>Right hand rule: Fingers = south Thumb = current Palm = power</li> <li>Principle: Motor effect A current carrying conductor experiences a force in a magnet.</li> </ul>	<p>(Alternator)</p> <ul style="list-style-type: none"> <li>Mechanical E → Electrical E.</li> <li>Has power and magnet → provides current.</li> <li>Has 2 slip rings with carbon/copper brushes.</li> <li>Function: Conducts current</li> <li>Delivers alternating current</li> </ul>  <ul style="list-style-type: none"> <li>Right hand rule: Fingers = south Thumb = power Palm = current</li> <li>Principle: Electromagnetic induction = pace of change in magnetic flood coupling.</li> </ul>	<p>(Dynamo)</p> <ul style="list-style-type: none"> <li>Mechanical E → Electrical E.</li> <li>Has power and magnet → provides current.</li> <li>Has 1 split ring commutator.</li> <li>Delivers direct current</li> </ul>  <ul style="list-style-type: none"> <li>Right hand rule: Fingers = south Thumb = power Palm = current</li> <li>Principle: Electromagnetic induction = pace of change in magnetic flood coupling.</li> </ul>

- With force it does not matter whether it is in series or parallel, add everything up!
- If they don't indicate whether the value is WGK or max, then it's WGK.

**MOTORS AND GENERATORS**

Divide appliance into two parts:

1. -What happens in **spill**
2. What happens in the **external circuit**

**SPILL**

Motor: Gives current – gets movement      R.H. Rule  
 Generator: Gives movement – gets current      R.H. Rule

<b><u>EXTERNAL CIRCUIT</u></b>	
<b><u>CURRENT DIRECTION</u></b>	
Palm = power	Palm = I
<b>Split ring</b>	<b>Slip rings</b>
<p><b>Motor and generator</b></p> <p>Current in loop always in <b>the same direction</b> at the same <b>pole</b> (because the spill turns in the same direction)</p> <p>and</p> <p><b>the same direction</b> in <i>external circuit</i> (current cannot move over split)</p>	<p><b>Only generator</b></p> <p>Current direction in loop remains in <b>the same direction</b> at the same <b>pole</b> (because the spill always turns in the same direction)</p> <p>and</p> <p><b>alternating direction</b> in <i>external circuit</i> (current moves over solid ring)</p>

<b>EXTERNAL CIRCUIT</b>	
<b>CURRENT SIZE</b>	
<p><b>MOTOR</b> – Remains the same that gives direct current with batteries</p> <p><b>GENERATOR</b> – Changes the entire time because it is induced by turning the loop</p>	
<p>If the <b>movement direction</b> of the loop is <b>perpendicular</b> on the field lines, the size of the current is <b>maximum</b>.</p>	
<p>If the <b>movement direction</b> of the loop is in the <b>same</b> direction as the Field lines, the current is <b>zero</b>.</p>	
<p><b>DIRECT CURRENT GENERATOR (Split ring)</b></p> <p>Current direction remains the same but size changes</p>	<p><b>ALTERNATING CURRENT GENERATOR (Slip rings)</b></p> <p>Current direction <b>and</b> current size changes the entire time</p>

**ALTERNATING CURRENT**

We use **alternating current** generators at power stations to generate current.

**Reason:** Must be transported over long distances. Small current and large potential difference to lose as little as possible energy (high voltage wires). Transformers only work with alternating current.

**WGK – VALUE OF CURRENT AND VOLTAGE**

The size of the current and voltage changes the entire time. Must therefore use average values = wgk values.

wgk of voltage:  $V_{wgk} = \frac{V_{max}}{\sqrt{2}}$

wgk of current:  $I_{wgk} = \frac{I_{max}}{\sqrt{2}}$

Ohm's law and the force equations can also be used in alternating circuits.

$R = \frac{V}{I}$	can be written as $R = \frac{V_{wgk}}{I_{wgk}}$
$P = VI$	can be written as $P_{wgk} = V_{wgk} \times I_{wgk}$
$I^2 R$	can be written as $I_{wgk}^2 \times R$
$\frac{V^2}{R}$	can be written as $\frac{V_{wgk}^2}{R}$

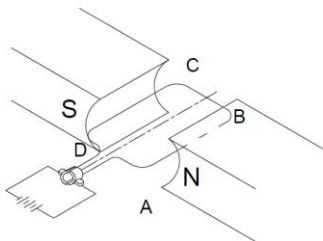
R is the total resistance of the circuit

**ELECTROMAGNETISM**

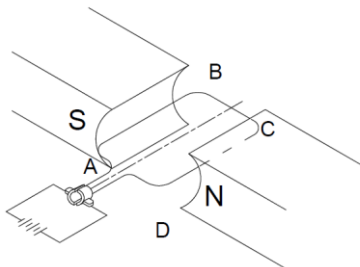
**Electrical motors and generators**

1. Use the right hand rule and indicate on the sketch in which direction the spill will turn in the following cases:

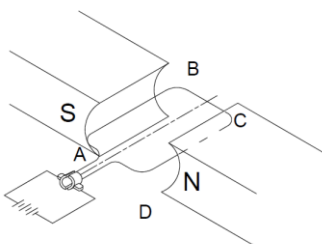
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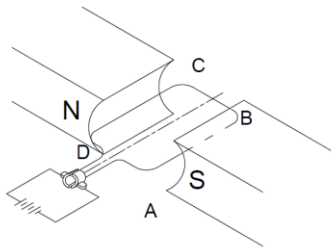
1.2



1.3

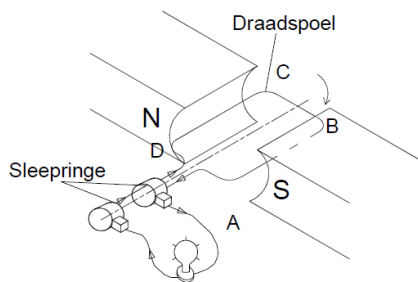


1.4

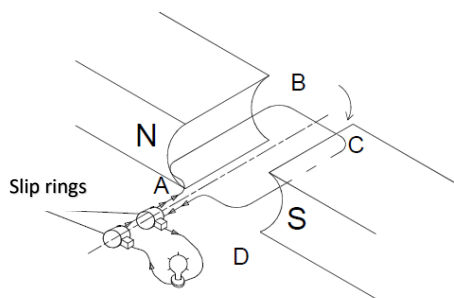


2. Indicate with the help of arrows in which direction the current will move in each of the following cases through the split and through the external circuit.

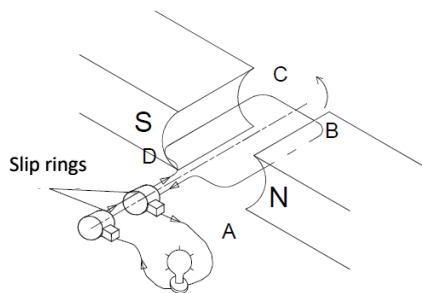
2.1



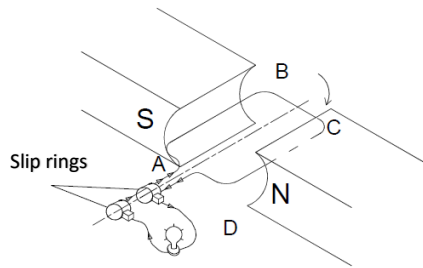
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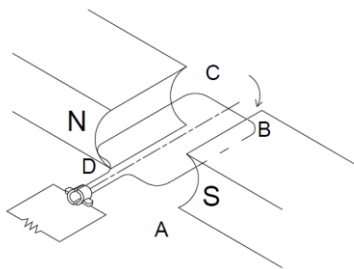
2.3



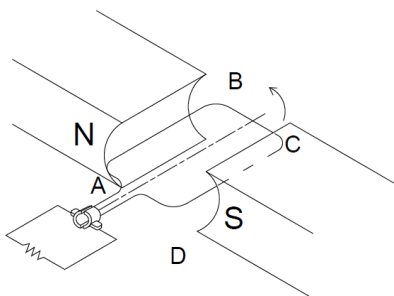
2.4



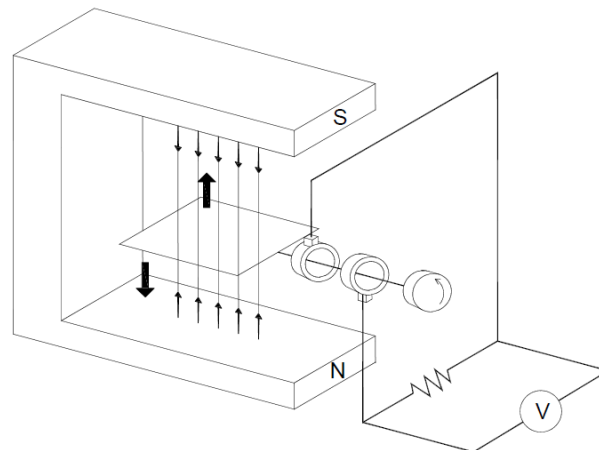
2.5



2.6

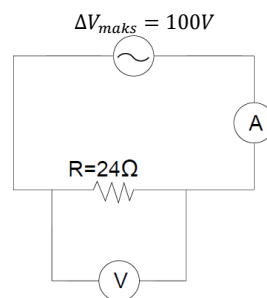


3. The sketch indicates an alternating current generator. The spill rotates anti-clockwise.
  - 3.1 Explain the principle on which the generator generates current.
  - 3.2 Draw a sketch of Volt generated opposed to time, in case 1 rotation lasts 4 seconds.
  - 3.3 The spill is now turned 2 times faster. Indicate on the previous sketch how the generated volt now compares with that of 3.2 for the following 4 seconds.
  - 3.4 The two slip rings are now replaced by a split ring commutator. Indicate on the sketch how the generated volt will be represented opposed to time from 8 to 12 seconds in comparison with 3.2.



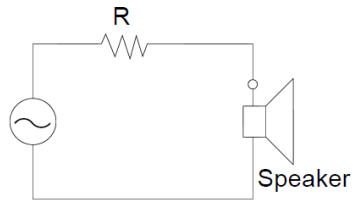
## ALTERNATING CURRENT

1. An alternating current ammeter gives a reading of 2,0A when it is connected in a circuit. What is the maximum value of the current in the circuit?
  
2.
  - 2.1 An alternating current voltage with a peak value of 200V is applied over a resistance of 100Ω. Calculate the wgc voltage and the wgc current in the resistance.
  - 2.2 Calculate the maximum current and the average force ability of the resistance
  
3. A Wgc voltage of 100V is applied over a resistance of 5Ω. Calculate:
  - 3.1 The maximum voltage
  - 3.2 The wgc current
  - 3.3 The maximum current
  - 3.4 The force delivered
  
4. What is the resistance of a light bulb that delivers an average force of 75 W if a wgc current of 5A flows through the light bulb?
  
5. A resistor of 24Ω is connected to an energy source that delivers a maximum of 100V. Calculate the reading on the ammeter and the voltmeter.



6. A signal generator delivers wgc voltage of 15V. If the size of the resistor is 8,2Ω and the resistance of the loudspeaker is 10,4Ω, calculate the wgc force delivered to the loudspeaker.





7. The diagram indicates three lightbulbs that are connected to 120V household voltage. Lamps 1 and 2 have 150W light bulbs and lamp 3 has a 100W light bulb. Calculate wkg current and the resistance of every light bulb.

