HILLCREST HIGH SCHOOL
PHYSICAL SCIENCE
GRADE 10
PAPER 1 - Physics

NOVEMBER 2015
TIME: 2 HRS

Total 135

Instructions

1. Answer ALL the questions.

2. This question paper consists of TWO sections:

3. SECTION A (20)
   SECTION B (117)

   Answer SECTIONS A and B in the ANSWER BOOK.

4. Non-programmable calculators may be used.

5. Appropriate mathematical instruments may be used.

6. Number the answers correctly according to the numbering system used in this question paper.

7. Data sheets and a periodic table are attached for your use.

8. Give brief motivations, discussions, et cetera where required.

9. Numbers must be rounded off to **two decimal** places.

10. **Mrs Grobler's class must answer Q 8.1 and Q 9.1**

11. **Mr Sibiya and Miss Badenhorst's classes must answer Q 8.2 and Q 9.2**

SECTION A

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A – D) next to the question number (1.1 – 1.10) in the ANSWER BOOK.

1.1 The particles that can be removed from an atom, are the...

A. electrons

B. protons

C. nucleons

D. neutrons

1.2 If all conductors in a scientific investigation, are made of copper wire, which one of the following will have the greatest resistance?

A. Long, thin and hot

B. Short, thin and cool

C. Long, thick and hot

D. Short, thick and cool

1.3 The angle between the direction of a disturbance and the direction of propagation of a particle in a longitudinal wave is:

A. 0^0

B. 45^0

C. 60^0

D. 90^0

1.4 The area under a velocity-time graph indicates the:

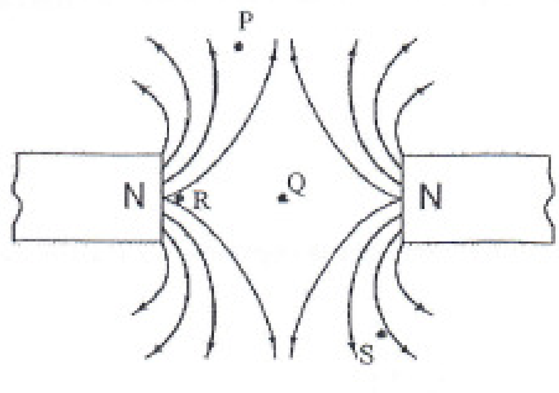
A. Acceleration

B. Average velocity

C. Slope

D. Displacement

1.5 The diagram below shows the lines of a magnetic force between two north magnetic poles. At which point is the magnetic field strength the strongest?



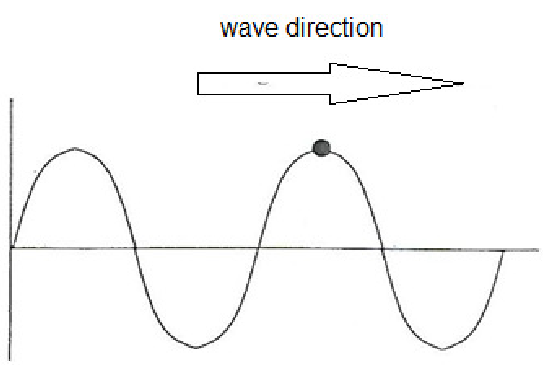
A. P

B. Q

C. R

D. S

1.6 The diagram below represents a ball floating on the crest of a wave.



As the wave passes, the ball will move...

A. To the right

B. Simultaneously downwards and to the right

C. Downwards

D. Upwards

1.7 Which one of the following pairs of quantities are scalar quantities?

A. Velocity and acceleration

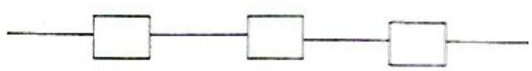
B. Distance and speed

C. Velocity and speed

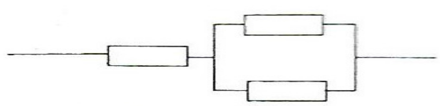
D. Distance and displacement

1.8 Which of the following connections in a circuit of 6 Ω resistors will result in an equivalent resistance of 4 Ω?

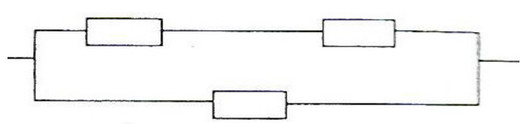
A.



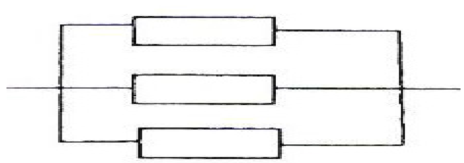
B.



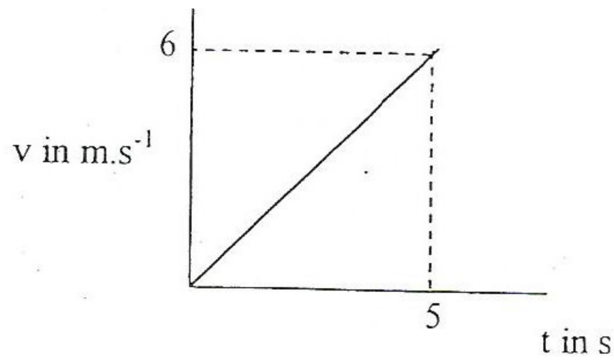
C.



D.



1.9 The following velocity-time graph shows an athlete's motion in the first 5 seconds of a 100 m sprint.



From the graph it is possible to deduce that the...

A. Athlete is sprinting at a constant velocity

B. Initial velocity is 6 $m.s^{-1}$

C. Athlete is running uphill

D. Athlete is accelerating for 5 seconds

1.10 A 10 Ω resistor has a potential difference of 10 V across its ends. How much energy is transferred to the 10 Ω resistor in 5 minutes?

A. 600 J

B. 3 kJ

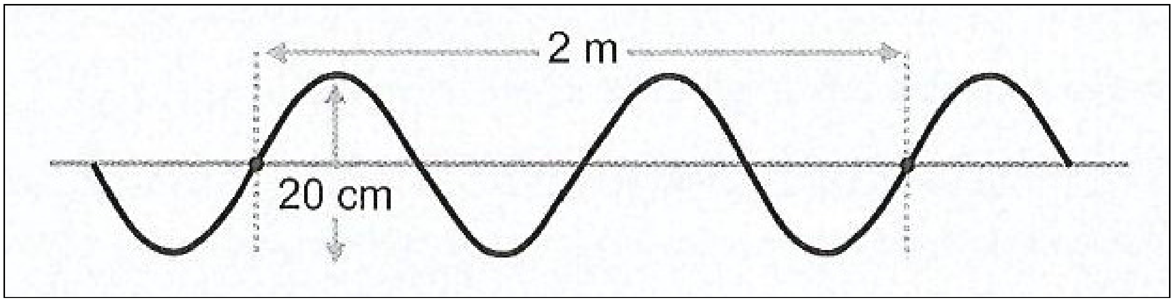
C. 50 J

D. 300 J **[2 x 10 = 20]**

SECTION B

QUESTION 2

The wave motion illustrated in the diagram below completes three vibrations in fifteen seconds.



2.1 Show by means of calculation, how long it takes four waves to pass a specific point? (3)

2.2.1 Define the term ***period***. (2)
2.2.2 What is the period of the above wave motion? (1)

2.3 Calculate the wavelength of the waves. (2)

2.4 Prove by means of calculation that the frequency of the waves is 0.2 Hz. (2)

2.5 Write down the amplitude of the wave in the correct SI-unit. (2)

2.6 Calculate the speed of the waves. (3)

2.7 Calculate the period of a wave with a speed of 3×10^8 $m.s^{-1}$ and a wavelength of 700 nm. (5)

2.8 Hoe does the ***speed***, ***frequency*** and ***wavelength*** of water waves change as they wash onto the sand from the sea? (3)

[22]

QUESTION 3

After the Air France Flight 447 plane that went missing over the Atlantic Ocean on 1 June 2009, the French government sent a submarine to the area where they suspected the accident happened. The submarine helped to find the wreckage of the plane and the so called "black box".

The submarine dove to the depth of 1015 m below the surface of the ocean. A pulse was sent from the submarine's **sonar** instruments and it reflected off the wreckage at the bottom of the ocean. The pulse returned 4.30 seconds after leaving the submarine. The speed of sound in seawater at that point in the ocean is 1522 $m.s^{-1}$.

3.1 Calculate the distance from the submarine to the wreckage of the plane. (4)

3.2 What was the depth of the ocean at that point? (2)

[6]

QUESTION 4

4.1 What is meant by the dual nature of electromagnetic radiation? (2)

4.2 Briefly explain how electromagnetic waves are created and propagated through a medium. (2)

4.3 An electromagnetic wave with a wavelength of 2×10^{-12} m moves through space at a speed of 3×10^{8} $m.s^{-1}$.

4.3.1 Calculate the period of the wave. (5)

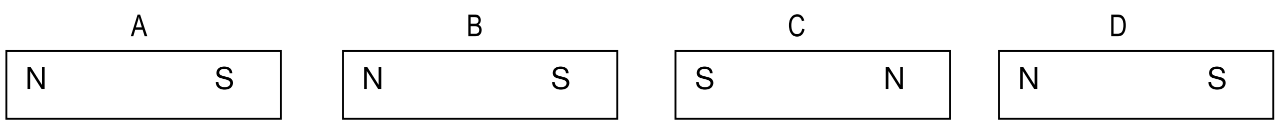
4.3.2 Calculate the energy of one photon of the above electromagnetic wave. (3)

4.3.3 The above electromagnetic wave is an example of a **gamma** ray. This type of wave is very dangerous and can cause serious damage. By referring to frequency, wavelength and the energy of the photons, explain the above statement and state the serious side effects of exposure. (3)

[15]

QUESTION 5

Four bar magnets are placed as shown in the diagram below.



5.1 Which pair(s) represent a force of repulsion between them? (2)

5.2 The magnets are now rearranged so that magnet B and D are next to each other. Draw a diagram to represent the magnetic field between these two magnets. (3)

5.3 During an investigation, Travis takes magnet A and brings it closer to a R5 coin. The coin suddenly "jumps" up to the magnet. The teacher then explains that the coin is ferromagnetic and it is due to magnetic domains that the coin was attracted to the magnet.

What is meant by:

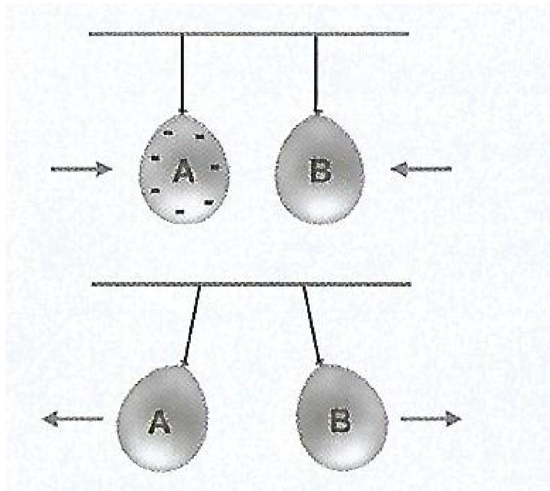
5.3.1 Domain (2)

5.3.2 Ferromagnetic and give 3 examples (2)

[9]

QUESTION 6

A is a negatively charged balloon. It attracts balloon B when brought closer to B. Balloon A and B touch each other and then move apart under mutual forces of repulsion.



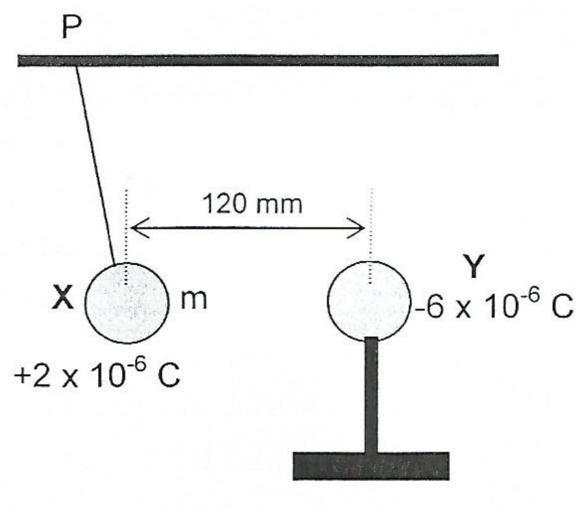
6.1 State whether the following statements are **true** or **false** regarding **balloon B before** it touches balloon A.

6.1.1 B may be positively charged. (1)
6.1.2 B may be negatively charged. (1)
6.1.3 B may be neutral. (1)

[3]

QUESTION 7

A small conducting sphere X with a charge of $+2 \times 10^{-6}$C and an unknown mass is suspended by an inelastic thread which is tied to point P. Another small conducting sphere, Y, on an insulating stand with a charge of -6×10^{-6}C, is moved towards sphere X until there centres are 120 mm apart.



7.1 State Coulombs law in words. (2)

7.2 Sketch the electric field pattern for the two spheres. (3)

7.3 Calculate the magnitude of the electrostatic force that sphere Y exerts on sphere X. (4)

Sphere Y is then moved until it touches sphere X and is then moved back to its original position.

7.4 In which direction where electrons transferred? Only write down from **X to Y** or from **Y to X**. (1)

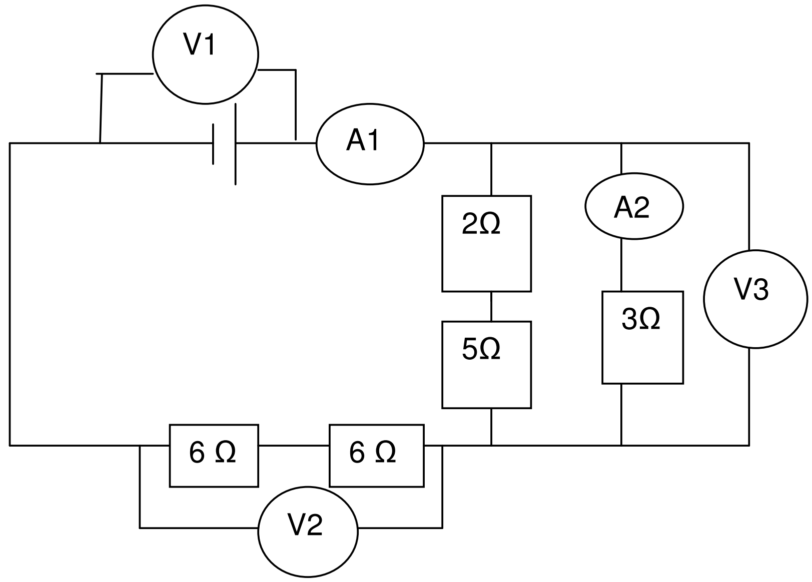
7.5 Is the new force between the two spheres attractive or repulsive? Explain your answer. (2)

7.6 Calculate the new charge on each sphere after they were moved apart. (3)

7.7 Calculate the amount of electrons transferred during their contact time. (5)

[20]

QUESTION 8.1 : Mrs Grobler's class only



In the circuit above, the cell has an emf of **12 V** and a negligible internal resistance. The magnitude of the resistors is indicated on the diagram.

8.1 Calculate the reading on A_1. (6)

8.2 Calculate the reading on V_2. (3)

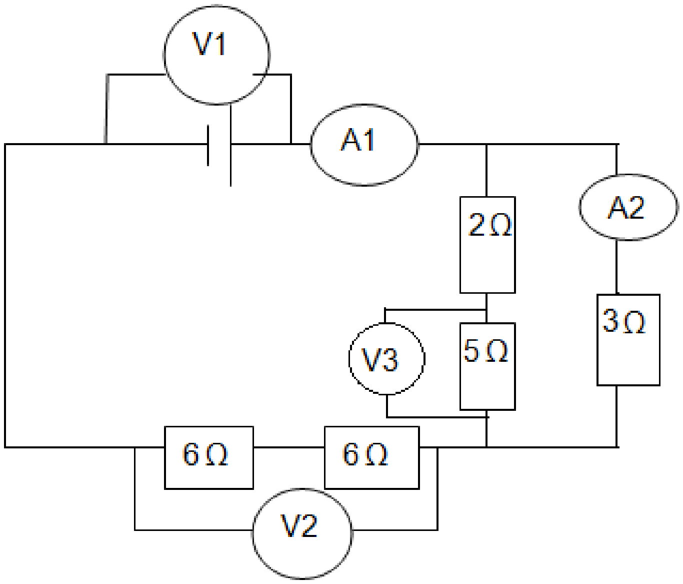
8.3 Calculate the reading on V_3. (3)

8.4 Prove that the reading on A_2 is 0.6 A. (2)

8.5 Calculate the amount of charge that passes through the 5 Ω resistor in one hour. (5)

[19]

QUESTION 8.2 : Miss Badenhorst's and Mr Sibiya's classes only



In the circuit above, the cell has an emf of **12 V** and a internal resistance of 0,5 Ω. The magnitude of the resistors is indicated on the diagram.

8.1 Calculate the reading on A_1. (6)

8.2 Calculate the reading on V_2. (3)

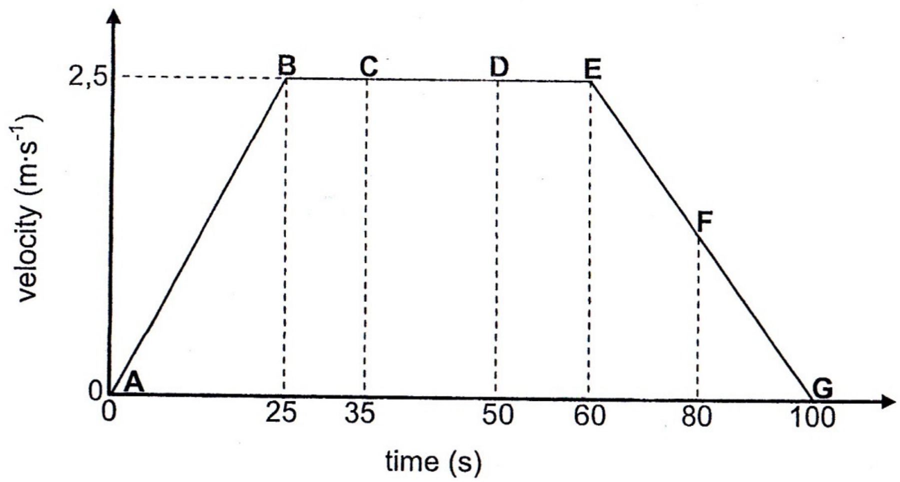
8.3 Calculate the reading on V_3. (5)

8.4 Calculate the amount of charge that passes through the 3 Ω resistor in one hour. (5)

[19]

QUESTION 9.1: Mrs Grobler's class only

Kial runs from point A in a straight line along a track ABCDEFG. The velocity-time graph below represents his motion.



9.1 Define the term acceleration. (2)

9.2 Using the information on the graph, describe Kial's motion from A to B. (3)

9.3 Without using equations of motion, calculate:

9.3.1 Kial's acceleration between E and G. (3)

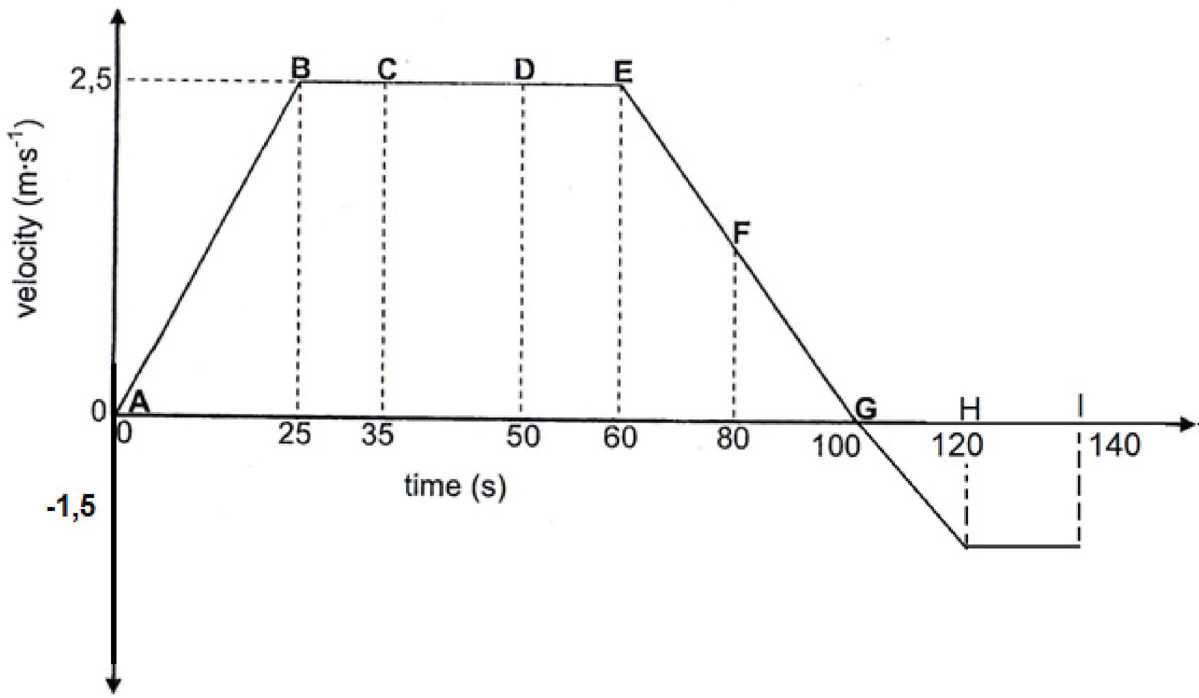
9.3.2 Distance covered by Kial in 100 seconds. (4)

9.4 Draw the acceleration-time graph for the first 25 seconds of Kial's motion. (2)

[14]

Question 9.2 : Miss Badenhorst's and Mr Sibiya's classes only

Kial runs from point A in a straight line along a track ABCDEFGHI. The velocity-time graph below represents his motion.



9.1 Define the term acceleration. (2)

9.2 Using the information on the graph, describe Kial's motion from A to B. (3)

9.3 Without using equations of motion, calculate:
 9.3.1 Kial's acceleration between E and G. (3)
 9.3.2 Kial's displacement in 140 seconds. (4)

9.4 Draw the acceleration-time graph for the first 25 seconds of Kial's motion. (2)

[14]

QUESTION 10

The brakes of a car on a straight stretch of road are able to decelerate the car at 10 $m.s^{-2}$. If the car is moving at 25 $km.h^{-1}$ and the driver's reaction time (the delay between the time that the driver senses the need to brake and actually does so), is 0.6s, calculate the distance the driver would eventually cover before the car comes to a complete stop. (7)

[7]

SUBTOTAL SECTION B = 115
GRAND TOTAL = 135

FORMULA SHEET

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9,8\ m\cdot s^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^{8}\ m\cdot s^{-1}$
Gravitational constant *Swaartekrgkonstante*	G	$6,67 \times 10^{-11}\ N\cdot m^{2}\cdot kg^{-2}$
Coulomb's constant *Coulomb se konstante*	k	$9,0 \times 10^{9}\ N\cdot m^{2}\cdot C^{-2}$
Charge on electron *Lading op elektron*	e^{-}	$-1,6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}\ kg$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}\ J\cdot s$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

$v_f = v_i + a\Delta t$	$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$ or/*of* $v_f^2 = v_i^2 + 2a\Delta y$	$\Delta x = \left(\frac{v_f + v_i}{2}\right)\Delta t$

WAVES, SOUND AND LIGHT/*GOLWE, KLANK EN LIG*

$v = f\lambda$	$T = \frac{1}{f}$ $\Delta x = v.\Delta t$

$E = hf$ or/*of* $E = h\frac{c}{\lambda}$

ELECTROSTATICS/*ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$ $(k = 9,0 \times 10^9\ N\cdot m^2\cdot C^{-2})$

$n = \frac{Q}{e}$

CURRENT ELECTRICITY/*STROOMELEKTRISITEIT*

$I=\frac{Q}{\Delta t}$	$R=\frac{V}{I}$
$emf\,/\,emk=I(R+r)$	$R=r_1+r_2+r_3+...$
$\frac{1}{R_p}=\frac{1}{r_1}+\frac{1}{r_2}+\frac{1}{r_3}+...$	

$W = VQ$ $W = \frac{V^2.\Delta t}{R}$