



Province of the
EASTERN CAPE
EDUCATION

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Provinsie van die Oos Kaap: Departement van Onderwys
Porafensie Ya Kapa Botjhabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2024

TECHNICAL SCIENCES P1

MARKS: 150

TIME: 3 hours



This question paper consists of 17 pages, including 2 data sheets.

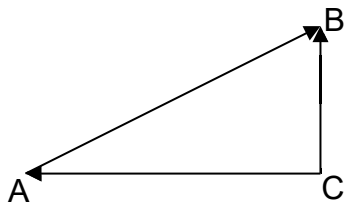
INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions in the ANSWER BOOK.
2. Start EACH question on a NEW page in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in this question paper.
4. You may use a non-programmable calculator.
5. LEAVE ONE line between subsections, for example between QUESTION 2.1 and QUESTION 2.2.
6. You are advised to use the attached DATA SHEETS.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your FINAL numerical answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions, etc. where required.
10. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, for example 1.11 A.

1.1 Consider the following vector diagram below.



Which vector represents the resultant of the other two vectors?

A CB

B AC

C AB

D BA

(2)

1.2 The direction of the magnetic field lines of a magnet is from ...

A the north pole to the south pole.

B the south pole to the north pole

C one end of the magnet to another.

D the positive pole to the negative pole.

(2)

1.3 The frictional force experienced by a moving object is known as ...

A static friction.

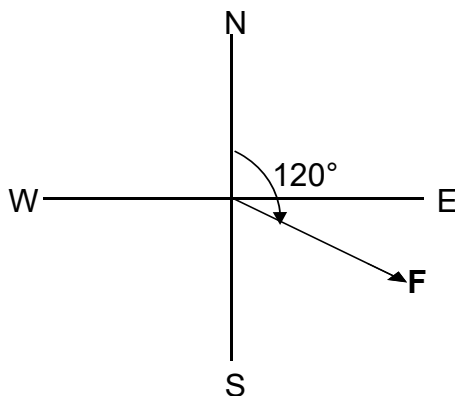
B force of friction.

C coefficient of static friction.

D kinetic friction.

(2)

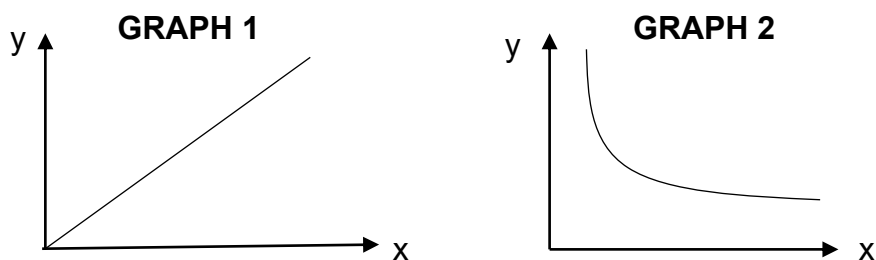
- 1.4 A force \mathbf{F} is applied to an object on the horizontal surface at a bearing of 120° .



Which ONE of the following CORRECTLY represents the component of \mathbf{F} in the southern direction?

- A $F \sin 120^\circ$
 - B $F \cos 30^\circ$
 - C $F \cos 60^\circ$
 - D $F \sin 30^\circ$ (2)
- 1.5 The region in space where a magnet experiences a force is known as the ...
- A magnetic storm.
 - B magnetic axis.
 - C magnetic pole.
 - D magnetic field. (2)

1.6 Consider the following two sketch graphs of experimental results.



Which ONE of the following combinations is CORRECT?

	GRAPH	RELATIONSHIP
A	1	$y \propto x$
B	1	$y \propto \frac{1}{x}$
C	2	$y = x^2$
D	2	$y \propto x$

(2)

1.7 The loudness of sound is determined by the ... of the sound waves.

- A pitch
- B frequency
- C amplitude
- D wavelength

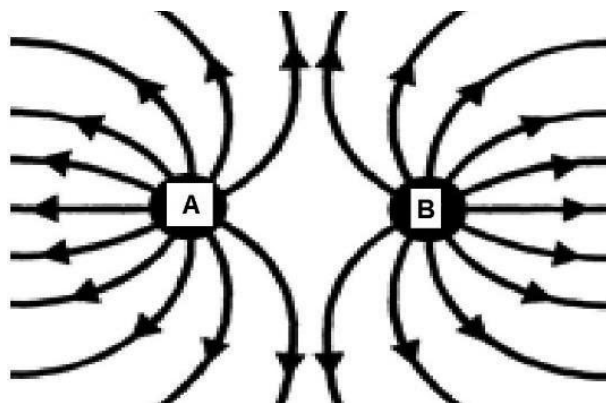
(2)

1.8 Which ONE of the following combinations is **TRUE** when longitudinal waves move through a medium?

	WHAT IS TRANSFERRED BETWEEN TWO POINTS?	MOVEMENT OF PARTICLES
A	Energy	Parallel to the wave direction
B	Particles	Parallel to the wave direction
C	Energy	Perpendicular to the wave direction
D	Particles	Perpendicular to the wave direction

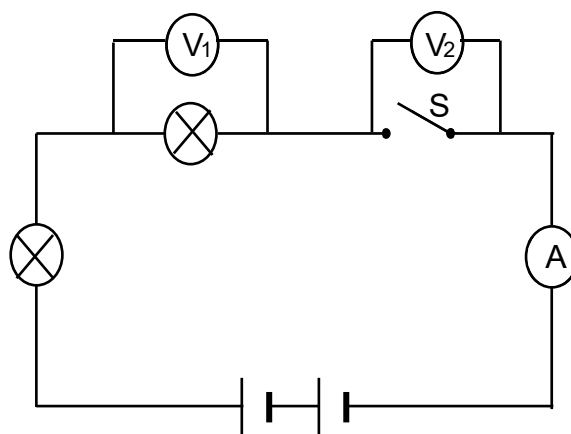
(2)

- 1.9 The electric field pattern for two charged spheres, **A** and **B**, is shown in the diagram below.



Which ONE of the following statements regarding the charges on spheres **A** and **B** is CORRECT?

- A Both spheres **A** and **B** are negatively charged.
 - B Both spheres **A** and **B** are positively charged.
 - C Sphere **A** is positively charged, and sphere **B** is negatively charged.
 - D Sphere **A** is negatively charged, and sphere **B** is positively charged. (2)
- 1.10 The potential difference of the battery in the circuit below is 12 V. The internal resistance of the battery is negligible. Two voltmeters, **V**₁ and **V**₂, are connected to the circuit as shown in the diagram below.



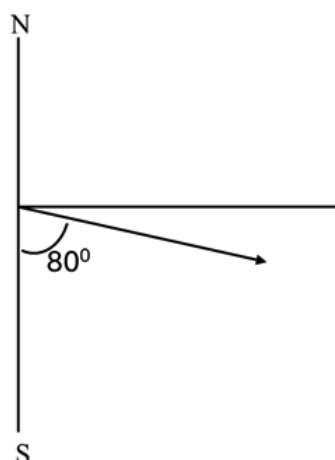
What are the CORRECT readings, in volts, on **V**₁ and **V**₂ if switch **S** is open?

- A **V**₁ = 0 and **V**₂ = 0
- B **V**₁ = 12 and **V**₂ = 0
- C **V**₁ = 0 and **V**₂ = 12
- D **V**₁ = 12 and **V**₂ = 12

(2)
[20]

QUESTION 2 (Start on a new page.)

- 2.1 Consider the following vector that makes an angle of 80° with the north-south line as indicated below.



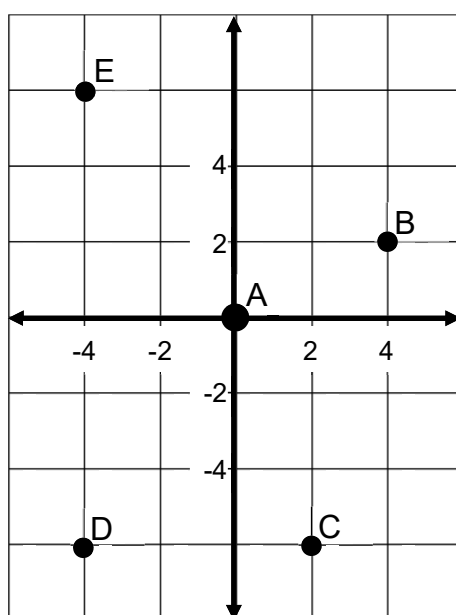
Write down the direction of the vector in terms of BEARING and COMPASS DIRECTION (in this order). (2)

- 2.2 Draw accurate diagrams representing the following vectors:

2.2.1 025° (2)

2.2.2 55° E (2)

- 2.3 Consider the following graph paper with the x -axis and y -axis in their normal positions. Each square on the graph paper is two units by two units. Five points (**A** to **E**) are shown on the graph paper.



2.3.1 Which ONE of points (**A** to **E**) is plotted at the origin? (1)

2.3.2 Give the coordinates of point **B**. (1)

2.3.3 A line is drawn from point **D** to **B**. Calculate the gradient of this line. (3)

2.4 Thabo walks 5 km due east to fetch his friend Sipho. Then they walk 3 km due north to their school.

2.4.1 Draw a labelled vector diagram (NOT TO SCALE) to show how Thabo's resultant displacement is determined. (3)

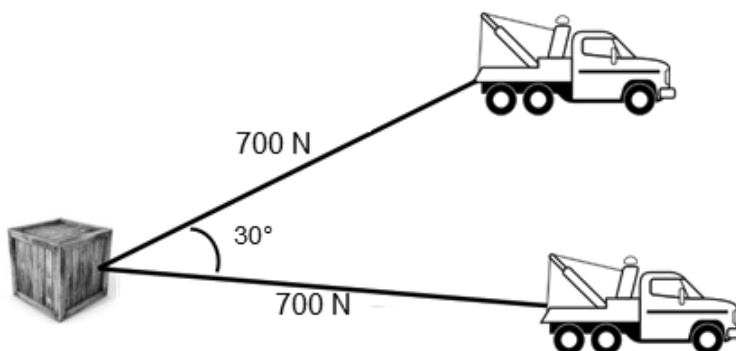
2.4.2 Calculate the magnitude of Thabo's resultant displacement. (3)

[17]

QUESTION 3: (Start on a new page.)

3.1 Define the term *co-planar vectors*. (2)

3.2 Two tow trucks are pulling a crate. Each tow truck exerts a horizontal force of 700 N on the crate. The angle between the two forces is 30° .

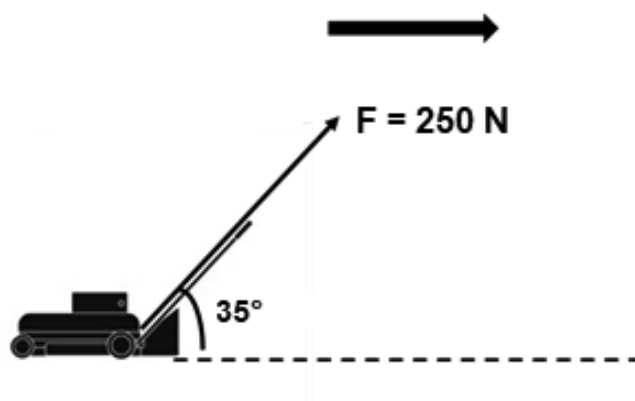


3.2.1 Determine the magnitude of the resultant force of the tow trucks on the crate by means of an accurate scale drawing. Use the TAIL-TO-HEAD method in which 1 mm represents 10 N. Indicate the necessary labels in your construction. (4)

3.2.2 What happens to the magnitude of the resultant force if the angle between the two forces decreases?

Write only INCREASE, DECREASE or REMAINS THE SAME. (1)

3.3 A lawn mower is pulled along a lawn from LEFT TO RIGHT. A force **F** of 250 N is applied to the handle of the mower. Force **F** makes an angle of 35° with the horizontal.



3.3.1 Determine the magnitudes of the horizontal and vertical components of force **F** by means of an accurate construction. Use the PARALLELOGRAM method and use scale: 10 mm = 25 N. Indicate the necessary labels in your construction. (4)

3.3.2 Determine, by means of calculations, the magnitudes of the horizontal and vertical components of force **F**. (4)

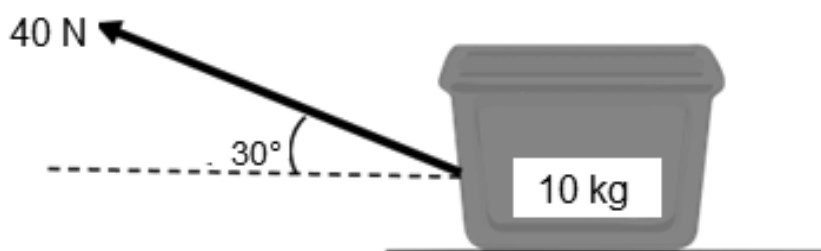
[15]

QUESTION 4 (Start on a new page.)

A toolbox of mass 10 kg rests on a horizontal floor in the workshop.



- 4.1 Write down the magnitude of the frictional force on the toolbox while it is stationary. (1)
- 4.2 Name all the forces acting on the toolbox while it is stationary. (2)
- 4.3 A horizontal force of 18 N is then applied to the LEFT on the box but the box remains STATIONARY.
- 4.3.1 How many forces are now acting on the box? (1)
- 4.3.2 Write down the magnitude and direction of the frictional force acting on the box. (2)
- 4.3.3 Calculate the magnitude of the minimum force needed to start moving the box if the coefficient of static friction for the box is 0,3. (4)
- 4.4 The same toolbox is placed on a different horizontal surface and pulled with a force of 40 N, which makes an angle of 30° with the horizontal, as shown in the diagram below. The box is now moving to the left.

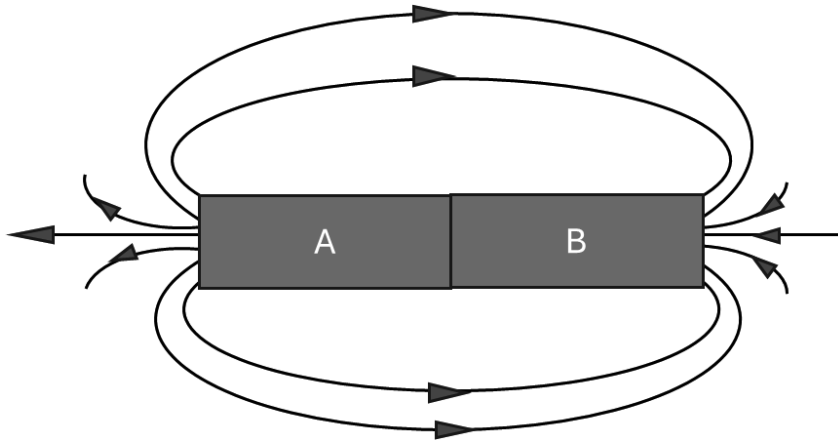


- 4.4.1 Name the type of frictional force that the floor exerts on the box while the box is moving to the left. (1)
- 4.4.2 Calculate the magnitude of the frictional force in QUESTION 4.4.1 if the coefficient of friction for the two surfaces in contact is 0,2. (6)

[17]

QUESTION 5 (Start on a new page.)

A bar magnet is used to investigate its magnetic field using iron filings shown in the diagram below. The following magnetic field pattern is observed.

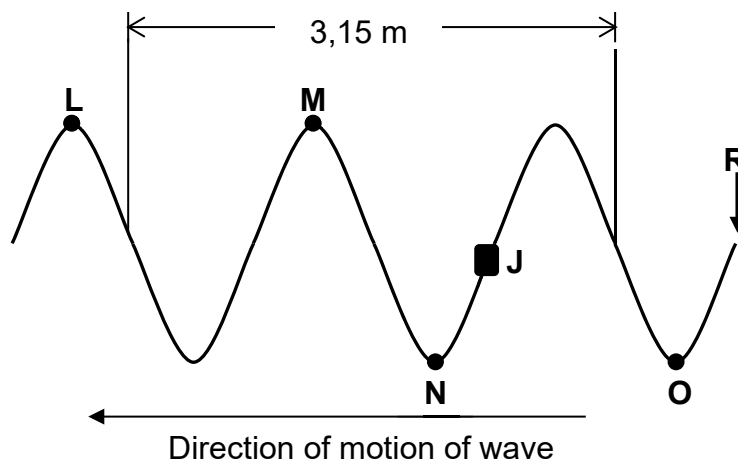


- 5.1 What is meant by a *magnetic field*? (2)
- 5.2 Identify pole **A** and give a reason for your answer. (2)
- 5.3 Write down FOUR properties of magnetic field lines. (4)
- 5.4 Give TWO uses of magnets in technology. (2)

[10]

QUESTION 6 (Start on a new page.)

Three water waves move past point **R** every two seconds. **J** is a piece of cork on the surface of the water and **L**, **M**, **N** and **O** represent four points on the wave.

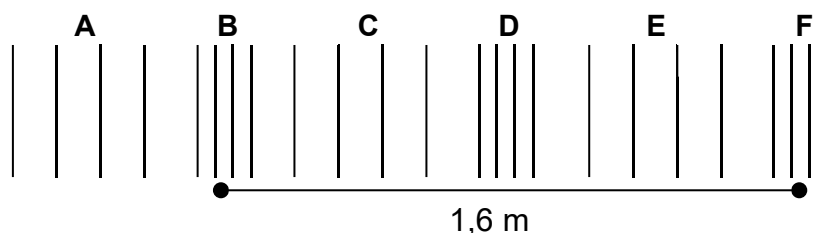


- 6.1 Define the term *wave*. (2)
- 6.2 Is this a TRANSVERSE or LONGITUDINAL wave? Explain your answer. (3)
- 6.3 Write down ANY TWO letters from **L**, **M**, **N** or **O** that represent two points on the wave that are:
- 6.3.1 In phase (2)
- 6.3.2 Out of phase (2)
- 6.4 In which direction does object **J** move? (1)
- 6.5 Calculate the speed of the wave. (3)
- 6.6 Calculate the period of this wave. (3)

[16]

QUESTION 7 (Start on a new page.)

- 7.1 The diagram below shows the pattern obtained for a sound wave with a frequency of 500 Hz.

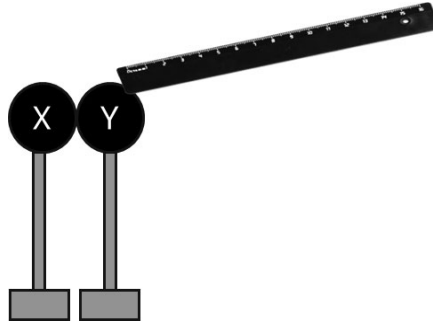


- 7.1.1 Define the term *frequency* of a wave. (2)
- 7.1.2 Write down the letters that represent TWO consecutive points on the wave which are IN PHASE. (2)
- 7.1.3 Name the section labelled **A**. (1)
- 7.1.4 Calculate the speed of this wave. (3)
- 7.2 The amplitude is increased while the frequency remains the same (500 Hz). How will this change affect each of the following?
- 7.2.1 Pitch (1)
- 7.2.2 Loudness (1)
- Write only INCREASES, DECREASES or REMAINS THE SAME.
- 7.3 In an experiment, a learner wants to determine the speed of sound in air. He stands 136 m away from a high wall, claps his hands and listens to the echo. He hears the echo after 0,8 s. Use this information to calculate the speed of sound in air. (4)
- 7.4 Ultrasound has many technological uses in medical and other applications.
- 7.4.1 Define the term *ultrasound*. (2)
- 7.4.2 Name THREE uses of ultrasound in the medical field. (3)

[19]

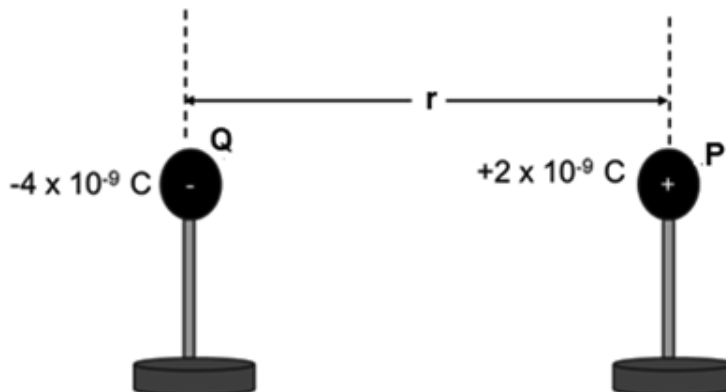
QUESTION 8 (Start on a new page.)

- 8.1 Spheres **X** and **Y** are identical, made of metal and in contact. A negatively charged, plastic ruler is brought closer until it touches sphere **Y**. When the ruler is removed, it is observed that the two spheres repel each other.



Explain why the spheres repel each other. (2)

- 8.2 **P** and **Q** are two small, metallic spheres on insulated stands. The magnitude of the force that **P** experiences due to the charge on **Q** is $7,2 \times 10^{-4} \text{ N}$.

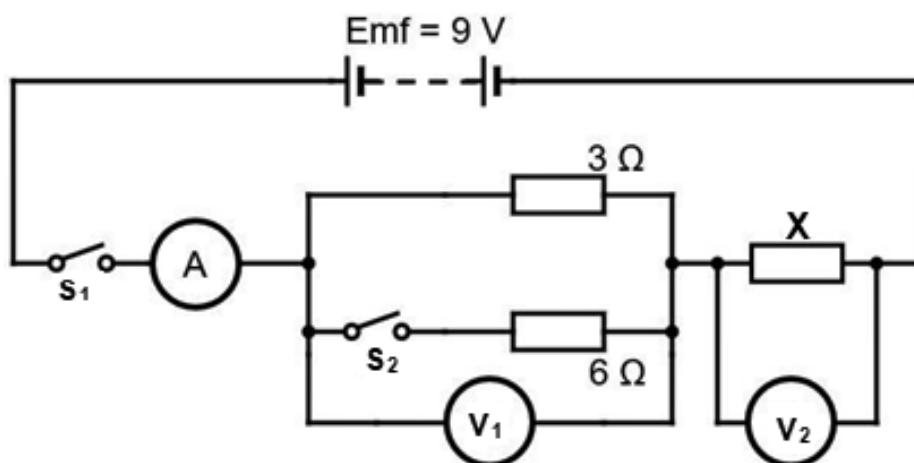


- 8.2.1 Define the term *electric field*. (2)
- 8.2.2 Draw the resultant electric field pattern around and between **P** and **Q**. (3)
- 8.2.3 Calculate the magnitude of the electric field of **P** at **Q**. (4)
- 8.2.4 Calculate the distance **r** between **P** and **Q**. (5)

[16]

QUESTION 9 (Start on a new page.)

In the circuit diagram the emf of the battery is 9 V. The internal resistance of the battery and the connecting wires are negligible.



- 9.1 State Ohm's law in words. (2)
- 9.2 When ONLY switch S_1 is closed, the current in the ammeter is 0,9 A.
- 9.2.1 Calculate the resistance of resistor X . (4)
- 9.2.2 Calculate the potential difference V_1 across the $3\ \Omega$ resistor. (3)
- 9.3 Switch S_2 is now CLOSED as well. Calculate the:
- 9.3.1 Equivalent resistance of the parallel combination (3)
- 9.3.2 Total resistance of the circuit (2)
- 9.3.3 Total current in the circuit (3)
- 9.3.4 Current in the $6\ \Omega$ resistor (3)

[20]**TOTAL: 150**

**DATA FOR TECHNICAL SCIENCES GRADE 11
PAPER 1**

**GEGEWENS VIR TEGNIESE WETENSKAPPE GRAAD 11
VRAESTEL 1**

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESE KONSTANTES

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Acceleration due to gravity <i>Swaartekragversnelling</i>	g	$9,8 \text{ m}\cdot\text{s}^{-2}$
Speed of light in a vacuum <i>Spoed van lig in 'n vakuum</i>	c	$3,0 \times 10^8 \text{ m}\cdot\text{s}^{-1}$
Planck's constant <i>Planck se konstante</i>	h	$6,63 \times 10^{-34} \text{ J}\cdot\text{s}$
Electron mass <i>Elektronmassa</i>	m_e	$9,11 \times 10^{-31} \text{ kg}$
Permittivity of free space <i>Permittiwiteit van vrye ruimte</i>	ϵ_0	$8,85 \times 10^{-12} \text{ F}\cdot\text{m}^{-1}$
Coulomb's constant <i>Coulomb se konstante</i>	k	$9,0 \times 10^9 \text{ Nm}^2\cdot\text{C}^{-2}$

TABLE 2: FORMULAE/TABEL 2: FORMULES

FORCE/KRAG

$F_{\text{net}} = ma$	$F_g = mg$
$f_s^{\text{max}} = \mu_s N$	$f_k = \mu_k N$

WAVES, SOUND AND LIGHT/ GOLWE, KLANK EN LIG

$v = f\lambda$	$T = \frac{1}{f}$
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ELECTROSTATICS / ELEKTROSTATIKA

$F = \frac{kQ_1Q_2}{r^2}$	$E = \frac{F}{Q}$
$E = \frac{V}{d}$	

CURRENT ELECTRICITY/STROOMELEKTRISITEIT

$R = \frac{V}{I}$	$W = VQ$
$R_s = R_1 + R_2 + \dots$ $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots / R_p = \frac{R_1 \times R_2}{R_1 + R_2}$	$q = I \Delta t$

