education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCE: PHYSICS (P1)

SEPTEMBER 2026

MARKS: 150

TIME: 3 hours

This question paper consists of 16 pages and 3 data sheets.

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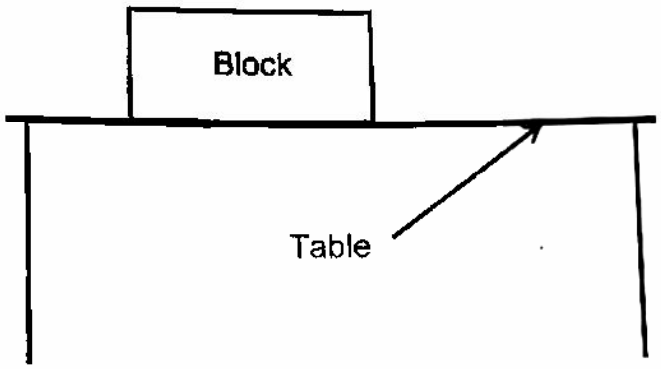
INSTRUCTIONS AND INFORMATION

1. Write your name on the ANSWER BOOK.
2. This question paper consists of TEN questions. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between two subquestions, e.g. between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
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. You are advised to use the attached DATA SHEETS.
11. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, e.g. 1.11 E.

1.1 A block is resting on a table as shown below. What is the reaction force to the weight of the block?



A The force of the table on the block.

B The force of the block on the table.

C The force of the block on the Earth.

D The force of the Earth on the block. (2)

1.2 A ball is projected vertically upwards with a velocity of 12 $m \cdot s^{-1}$ from the top of a building and it returns after some time. (Air friction is ignored).

Which of the following combinations of velocity and acceleration is true about the ball when it is at its maximum height?

	VELOCITY	ACCELERATION
A	12 $m \cdot s^{-1}$	0 $m \cdot s^{-2}$
B	0 $m \cdot s^{-1}$	12 $m \cdot s^{-2}$
C	12 $m \cdot s^{-1}$	9,8 $m \cdot s^{-2}$
D	0 $m \cdot s^{-1}$	9,8 $m \cdot s^{-2}$

(2)

1.3 Impulse is equal to the ...

A rate of change of momentum of an object.

B change in momentum of an object.

C rate of change of kinetic energy of an object.

D change in kinetic energy of an object. (2)

1.4 The power provided by an electrical motor is 40 W. What is the energy provided by the motor over a period of three hours?

A 432 000 J

B 7 200 J

C 120 J

D 13,33 J (2)

1.5 A source produces sound with a frequency of 800 Hz.

Scenario 1: The source approaches a stationary listener with velocity **v** and the listener records a frequency of f_1.

Scenario 2: The listener approaches a stationary source with velocity **v** and he records a frequency of f_2.

Which ONE of the following mathematical expressions are CORRECT regarding the two scenarios?

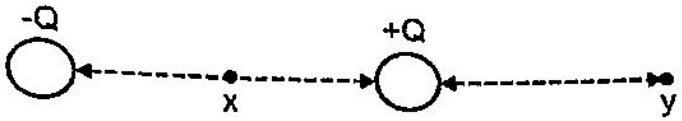
A $f_1 < f_2 < 800$ Hz

B $f_1 > f_2 > 800$ Hz

C $f_2 < f_1 < 800$ Hz

D $f_2 > f_1 > 800$ Hz (2)

1.6 Two charged spheres of **-Q** and **+Q** are put on a straight line. **X** and **Y** are two points that lie on the same straight line with the charged spheres as shown below.

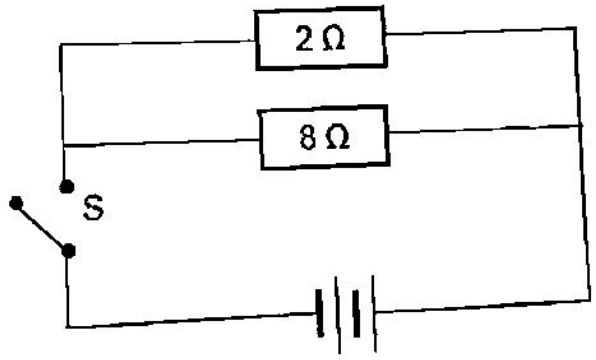


Which ONE of the following correctly represents the directions of the RESULTANT electric field strengths at points **X** and Y?

	DIRECTION OF THE RESULTANT ELECTRIC FIELD STRENGTH AT X	DIRECTION OF THE RESULTANT ELECTRIC FIELD STRENGTH AT Y
A	Right	Left
B	Left	Left
C	Right	Right
D	Left	Right

(2)

1.7 In the circuit diagram shown below, the power dissipated by the 4 Ω resistor is equal to **P**.



The power dissipated by the 8 Ω resistor is …

A ½ **P**

B ¼ **P**

C 2 **P**

D 4 **P**

(2)

1.8 Fleming's Left hand rule is used to determine the direction of ...

A current flow in a circuit.

B induced emf in a conductor.

C magnetic field around a conductor.

D force experienced by a current-carrying conductor in a magnetic field. (2)

1.9 The component responsible for delivering current to the external circuit in a DC generator is the ...

A coil.

B battery.

C commutator.

D slip rings. (2)

1.10 An electron will be ejected from a metal surface if the ...

(i) threshold wavelength of a metal is longer than the wavelength of the photon.
(ii) threshold wavelength of a metal is shorter than the wavelength of the photon
(iii) threshold frequency of a metal is greater than the light frequency.

Which of the statements above is/are CORRECT?

A (i) only

B (i) and (ii) only

C (ii) and (iii) only

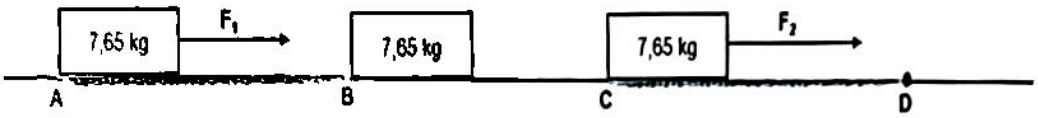
D (i) and (iii) only

(2)
[20]

QUESTION 2 (Start on a new page.)

A 7,65 kg block moves on a surface **ABCD**. It is first pulled on the rough part **AB** by a force F_1 at a constant velocity of 3 $m \cdot s^{-1}$. Upon reaching point **B**, the force F_1 is removed and the block slides from point **B** to **C** which is a smooth surface. At point **C**, a new force F_2 is applied on the block so that it moves from point **C** to **D**, which is rough, at an acceleration of 0,37 $m \cdot s^{-2}$.

The diagram below shows the motion of the block from point **A** to point **D**.



2.1 Define the term *resultant force*. (2)

2.2 What is the magnitude of the resultant force acting on the block as it moves from point **A** to **B**? (1)

2.3 Draw a labelled force diagram showing all the forces acting on the block as it moves through **AB**. (4)

2.4 What is the magnitude of the velocity of the block when it reaches point **C**? (1)

2.5 F_2 has a magnitude of 65 N. Calculate the kinetic frictional coefficient that the block experiences as it moves through **CD**. (4)

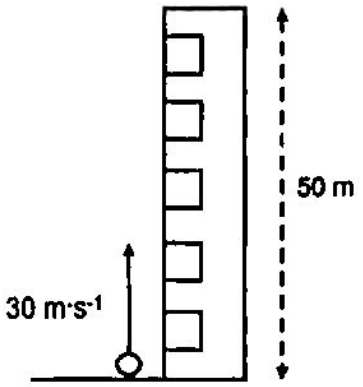
2.6 The surface **CD** is now replaced with a new one that has a greater kinetic frictional coefficient. How will this affect the acceleration of the block at **CD**? Write only INCREASE, DECREASE or REMAIN THE SAME.

Explain the answer using principles of physics. (4)
[16]

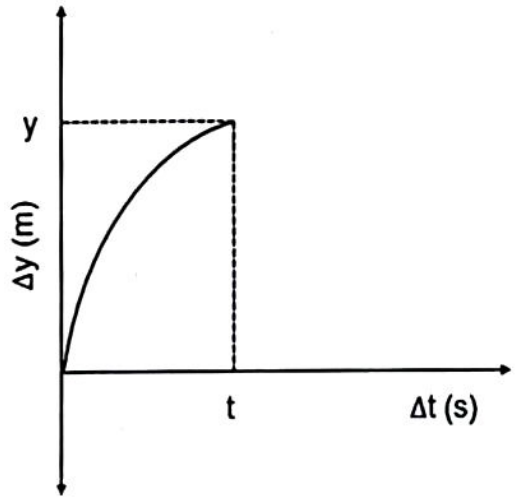
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QUESTION 3 (Start on a new page.)

A ball is thrown vertically upwards from the bottom of a 50 m tall building with a velocity of 30 $m \cdot s^{-1}$.



The graph below shows the position vs time graph of the motion of the ball from the moment it was released until it reaches its maximum height.



Ignore the effects of air friction.

3.1 Define the term *projectile*. (2)

3.2 Using EQUATIONS OF MOTION ONLY:

3.2.1 Determine if **y** is ABOVE or BELOW the top of the building (4)

3.2.2 Calculate the value of **t** (3)

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3.3 Draw a labelled velocity vs time graph for the motion of the ball from the moment it was thrown until it reaches its maximum height.

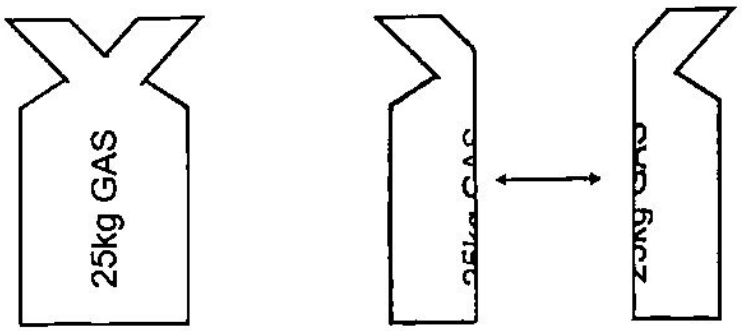
Show the following on the graph:

- Velocity at which the ball was thrown
- Time at which the ball reaches maximum height (2)

3.4 Calculate, using EQUATIONS OF MOTION ONLY, the velocity needed to be added to or subtracted from the 30 $m \cdot s^{-1}$ to ensure that the ball stops at the top of the building. (4)
[15]

QUESTION 4 (Start on a new page.)

A 25 kg gas cylinder rolling to the right in an isolated system at an unknown constant speed, suddenly explodes into two equal pieces **A** and **B**. After the explosion, piece **A** rolls to the left at 1,8 $m \cdot s^{-1}$ and piece **B** rolls to the right. The explosion is **elastic**.



Before explosion After explosion

4.1 Explain what is meant by an *isolated system*. (2)

4.2 Calculate the:

4.2.1 Momentum of piece **A** right after the explosion (4)

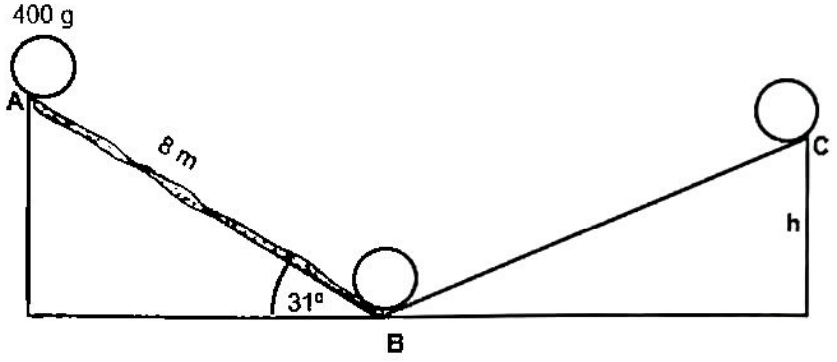
4.2.2 Speed of the cylinder before the explosion (6)

[12]

QUESTION 5 (Start on a new page.)

A ball with a mass of 400 g, initially at rest, rolls down a rough incline **AB** of length 8 m that makes an angle of 31° to the horizontal. Upon reaching point **B**, the ball rolls up the second SMOOTH incline and stops at point **C** which is at a height **h** above the ground.

Ignore the rotational effects of the ball as well as air friction.



5.1 State the *work-energy theorem* in words. (2)

5.2 Draw a labelled free-body diagram showing ALL the forces acting on the ball as it rolls from point **A** to **B**. (3)

The ball experiences a frictional force of 0,22 N.

5.3 Use ENERGY PRINCIPLES ONLY to calculate the:

5.3.1 Speed of the ball at point **B** (4)

5.3.2 Height **h** (3)

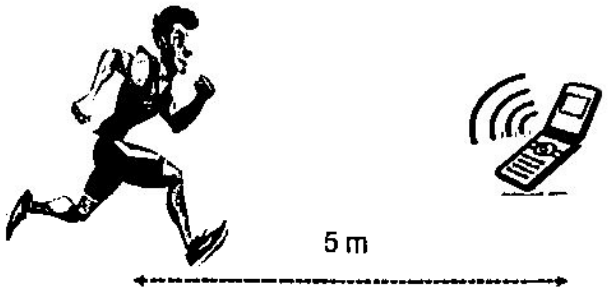
5.4 Calculate the work done by friction from point **A** to **B**. (3)
[15]

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QUESTION 6 (Start on a new page.)

6.1 Jordan is standing 5 metres away from his phone when it suddenly rings. He hears the pitch of the sound from the phone at a frequency of 290 Hz. He runs towards the phone at a constant speed and reaches it in 0,5 seconds.

Take the speed of sound in air as 344 $m \cdot s^{-1}$.

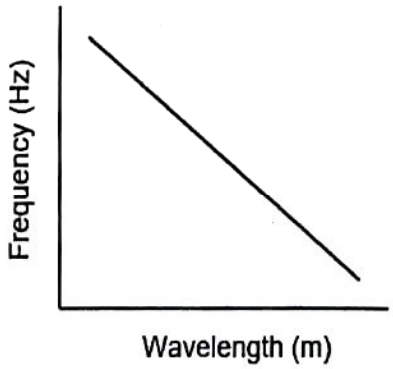


6.1.1 State the phenomenon described in the scenario above. (2)

6.1.2 Calculate the speed at which Jordan runs towards the phone. (2)

6.1.3 Calculate the wavelength of the sound that comes from the phone. (6)

6.2 The graph below shows data of a distant star that is moving relative to the Earth.



6.2.1 Is the star moving towards or away from the Earth? (1)

6.2.2 Explain your answer in QUESTION 6.2.1. (2)

[13]

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QUESTION 7 (Start on a new page.)

Two identical negatively charged spheres **A** and **B** are placed 5 mm apart. Charge **A** experiences an electrostatic force of 12,4 N as a result of **B**.



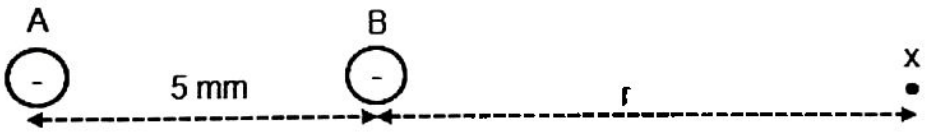
7.1 Draw the resultant electric field pattern that exists between charges **A** and **B**. (3)

7.2 State *Coulomb's law* in words. (2)

7.3 Calculate the charge on each sphere. (4)

7.4 How many electrons in excess does sphere **B** have? (3)

A net electric field strength of 7 500 $N.C^{-1}$ is experienced by a point **x**, which is a distance **r** from sphere **B**. See the diagram below.

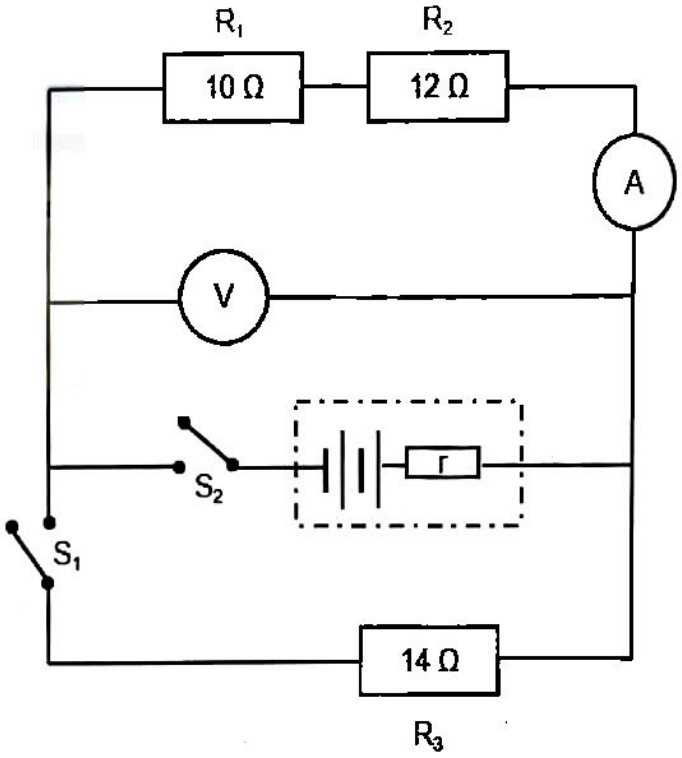


7.5 Calculate the magnitude of **r**. (6)
[18]

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QUESTION 8 (Start on a new page.)

The circuit diagram below shows three resistors, R_1 = 10 Ω, R_2 = 12 Ω and R_3 = 14 Ω, an ammeter of negligible resistance, a voltmeter, and a battery with an internal resistance of 1,8 Ω. The conductors are ohmic.



When both switches are closed, the voltmeter reads 38 V.

8.1 Explain the meaning of the term *ohmic conductor*. (2)

8.2 Calculate the:

8.2.1 Total external resistance of the circuit (4)

8.2.2 Current passing through ammeter A (3)

8.2.3 Emf of the battery (4)

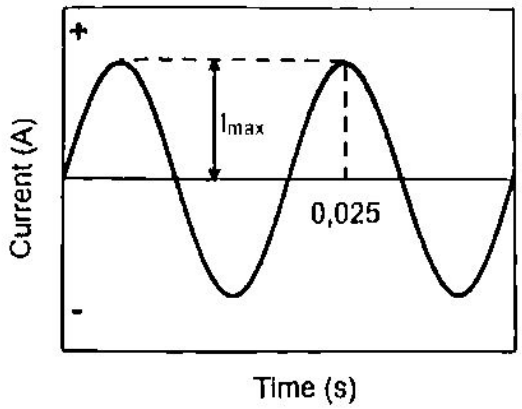
Switch S_1 is now OPENED and S_2 remains closed.

8.3 How will the reading on the voltmeter change? Choose from INCREASE, DECREASE or REMAIN THE SAME. (1)
[14]

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QUESTION 9 (Start on a new page.)

The graph below was drawn using data from an AC generator.



9.1 State the energy conversion that takes place in this generator. (2)

9.2 Calculate the frequency of this generator. (3)

9.3 Define the term *root mean square voltage.* (2)

In investigating the electrodynamic properties of a toaster, a designer measures the maximum value of the current supplied to this toaster by the above generator as 12,4 A. The toaster has an average power rating of 900 W.

9.4 Calculate the:

9.4.1 Root mean square current of this generator (3)

9.4.2 Maximum voltage supplied to the toaster (4)

[14]

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QUESTION 10 (Start on a new page.)

A photon of red light with 2,1 x 10^{-12} J is shone onto a metal surface to eject an electron. The maximum kinetic energy of the ejected photoelectron is 1,1 x 10^{-12} J.

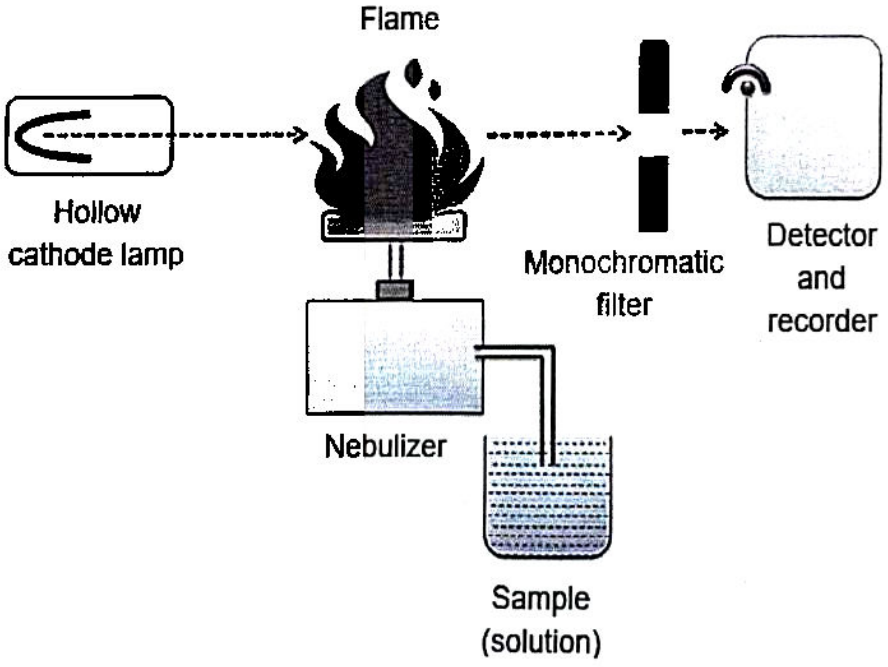
10.1 Define the term *photon*. (2)

10.2 Calculate the:

10.2.1 Maximum speed of the ejected photoelectron (3)

10.2.2 Threshold wavelength of the metal surface upon which the red light is shone (5)

10.3 In the laboratory, a teacher demonstrates how different types of spectra are formed. The teacher uses a light source, hot gas, diffraction grating and a detector in the demonstration.



Name and describe the type of spectrum formed during this demonstration. (3)

[13]

TOTAL: 150

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DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 1 (FISIKA)

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

NAME/NAAM	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9{,}8\ m{\cdot}s^{-2}$
Universal gravitational constant *Universele gravitasiekonstante*	G	$6{,}67 \times 10^{-11}\ N{\cdot}m^2{\cdot}kg^{-2}$
Radius of the Earth *Radius van die Aarde*	R_E	$6{,}38 \times 10^{6}\ m$
Mass of the Earth *Massa van die Aarde*	M_E	$5{,}98 \times 10^{24}\ kg$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3{,}0 \times 10^{8}\ m{\cdot}s^{-1}$
Planck's constant *Planck se konstante*	h	$6{,}63 \times 10^{-34}\ J{\cdot}s$
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	$9{,}11 \times 10^{-31}\ kg$

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MOTION/*BEWEGING*

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

FORCE/KRAG

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = G\frac{m_1 m_2}{d^2}$ or/*of* $F = G\frac{m_1 m_2}{r^2}$	$g = G\frac{M}{d^2}$ or/*of* $g = G\frac{M}{r^2}$

WORK, ENERGY AND POWER/*ARBEID, ENERGIE EN DRYWING*

$W = F\Delta x\cos\theta$	$U = mgh$ or/*of* $E_p = mgh$
$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$	$W_{net} = \Delta K$ or/*of* $W_{net} = \Delta E_k$ $\Delta K = K_f - K_i$ or/*of* $\Delta E_k = E_{kf} - E_{ki}$
$W_{nc} = \Delta K + \Delta U$ or/*of* $W_{nc} = \Delta E_k + \Delta E_p$	$P = \frac{W}{\Delta t}$
$P_{ave} = Fv_{ave}$ / $P_{gem} = Fv_{gem}$	

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

$v = f\lambda$	$T = \frac{1}{f}$
$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ / $f_L = \frac{v \pm v_L}{v \pm v_b} f_b$	$E = hf$ or/*of* $E = \frac{hc}{\lambda}$
$E = W_0 + E_{k(max/maks)}$ or/*of* $E = W_0 + K_{(max/maks)}$ where/*waar* $E = hf$ and/*en* $W_0 = hf_0$ and/*en* $E_{k(max/maks)} = \frac{1}{2}mv^2_{max/maks}$ or/*of* $K_{max/maks} = \frac{1}{2}mv^2_{max/maks}$	

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ELECTROSTATICS/*ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$	$E = \frac{kQ}{r^2}$
$V = \frac{W}{q}$	$E = \frac{F}{q}$
$n = \frac{Q}{e}$ or/*of* $n = \frac{Q}{q_e}$	

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$R = \frac{V}{I}$	emf (ε) = I(R + r) emk (ε) = I(R + r)
$R_s = R_1 + R_2 + \ldots$ $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$	$q = I\Delta t$
$W = Vq$ $W = V\,I\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = V\,I$ $P = I^2R$ $P = \frac{V^2}{R}$

ALTERNATING CURRENT/*WISSELSTROOM*

$I_{rms} = \frac{I_{max}}{\sqrt{2}}$	/	$I_{wgk} = \frac{I_{maks}}{\sqrt{2}}$
$V_{rms} = \frac{V_{max}}{\sqrt{2}}$	/	$V_{wgk} = \frac{V_{maks}}{\sqrt{2}}$

$P_{ave} = V_{rms}\,I_{rms}$ / $P_{gem} = V_{wgk}\,I_{wgk}$
$P_{ave} = I^2_{rms}R$ / $P_{gem} = I^2_{wgk}R$
$P_{ave} = \frac{V^2_{rms}}{R}$ / $P_{gem} = \frac{V^2_{wgk}}{R}$