basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES: PHYSICS (P1)

NOVEMBER 2019

MARKS: 150

TIME: 2 hours

This question paper consists of 13 pages and 2 data sheets.

* X P S C E 1 *

EASTERN CAPE

INSTRUCTIONS AND INFORMATION

1. Write your name and class (e.g. 10A) in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of 11 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 subquestions, e.g. between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEETS.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your FINAL numerical answers to a minimum of TWO decimal places.
11. Give brief motivations, discussions, etc. where required.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various 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, e.g. 1.11 E. Each question has only ONE correct answer.

1.1 Which ONE of the following physical quantities is a scalar quantity?

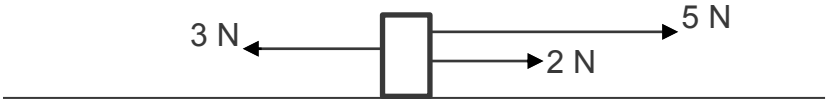
A A weight of 5 N

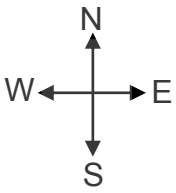
B A velocity of 10 $m \cdot s^{-1}$ east

C A current of 2 A

D A negative acceleration of 0,4 $m \cdot s^{-2}$ (2)

1.2 Three forces act simultaneously on an object, as shown below.





The resultant (net) force acting on the object is …

A 10 N west.

B 4 N west.

C 10 N east.

D 4 N east. (2)

1.3 An object accelerates uniformly when the … of the object changes with the same amount in equal time intervals.

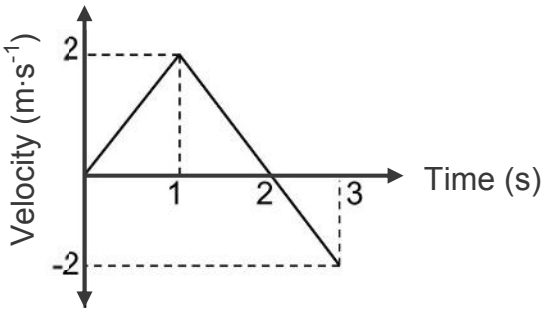
A velocity

B displacement

C speed

D mechanical energy (2)

1.4 The velocity-time graph for the motion of an object is shown below.



The object changes direction at …

A 0,5 s

B 1 s

C 2 s

D 3 s (2)

1.5 An object moving at speed **v** has a kinetic energy **E**. The kinetic energy now changes to ¼**E**.

The speed of the object is now …

A ½v.

B 2v.

C ¼v.

D 4v. (2)

1.6 The frequency of a wave is defined as the …

A lowest point on a wave.

B time taken for one complete wave.

C number of complete waves per second.

D number of points in phase in a wavelength. (2)

1.7 When two wave crests overlap, the increase in amplitude is due to …

A cancellation.

B two waves in phase.

C destructive interference.

D constructive interference. (2)

1.8 Which ONE of the following materials is a ferromagnetic material?

A Chromium

B Carbon

C Cobalt

D Calcium (2)

1.9 The SI unit for charge is the …

A ampere.

B volt.

C ohm.

D coulomb. (2)

1.10 The maximum work done per unit charge by a battery is the …

A emf.

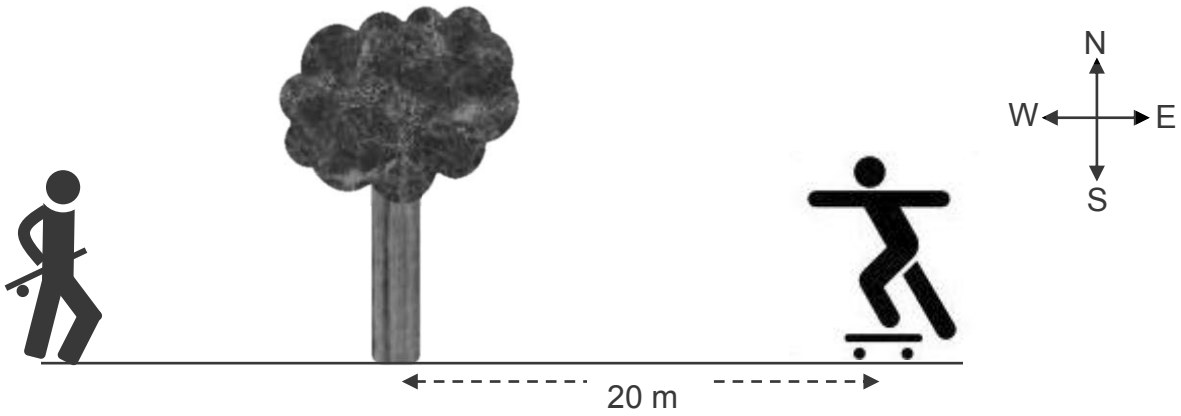
B current.

C resistance.

D terminal potential difference. (2)
[20]

QUESTION 2 (Start on a new page.)

A boy walks in an EASTERLY direction, as shown below. After he passes a tree, he continues in the same direction for another 20 m. He then stops, climbs on his skateboard and rides in a WESTERLY direction for 25 m before he finally stops.



The resultant displacement of the boy when he finally stops is 10 m EAST of his initial position.

2.1 Define the term *distance*. (2)

2.2 Determine the initial position of the boy relative to the tree. (2)

2.3 Calculate the total distance that the boy moved. (2)

2.4 When the boy is on the skateboard, he skates at an average speed of 5 $m \cdot s^{-1}$.

Calculate how long, in seconds, the boy is on the skateboard during the motion. (3)

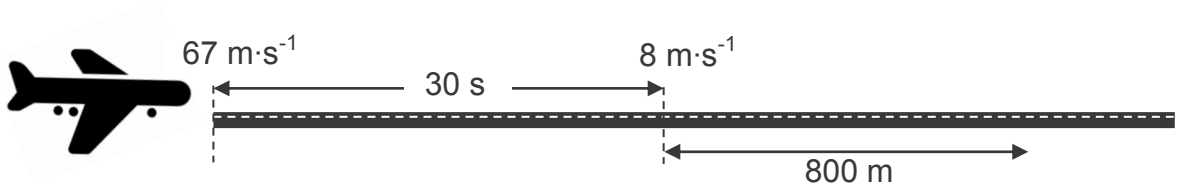
2.5 The total time for the motion of the boy from his initial position until he finally stops is 40 s. Calculate his average velocity. (3)

[12]

QUESTION 3 (Start on a new page.)

An aeroplane touches down on a runway at a velocity of 67 $m \cdot s^{-1}$, as illustrated below. After 30 seconds the velocity of the aeroplane is 8 $m \cdot s^{-1}$.

The aeroplane then continues at a CONSTANT VELOCITY for a further 800 m before leaving the runway. The length of the runway is 2 000 m.



3.1 Define the term *vector*. (2)

3.2 Convert 67 $m \cdot s^{-1}$ to $km \cdot h^{-1}$. (1)

3.3 Calculate the:

3.3.1 Acceleration of the aeroplane during the first 30 seconds (4)

3.3.2 Distance travelled by the aeroplane during the first 30 seconds (4)

3.3.3 Time taken by the aeroplane to travel the 800 m (3)

3.3.4 Length of the runway NOT USED when the aeroplane leaves the runway (2)

3.4 Pilots should take weather conditions, such as wind and rain, into account when they calculate landing speed.

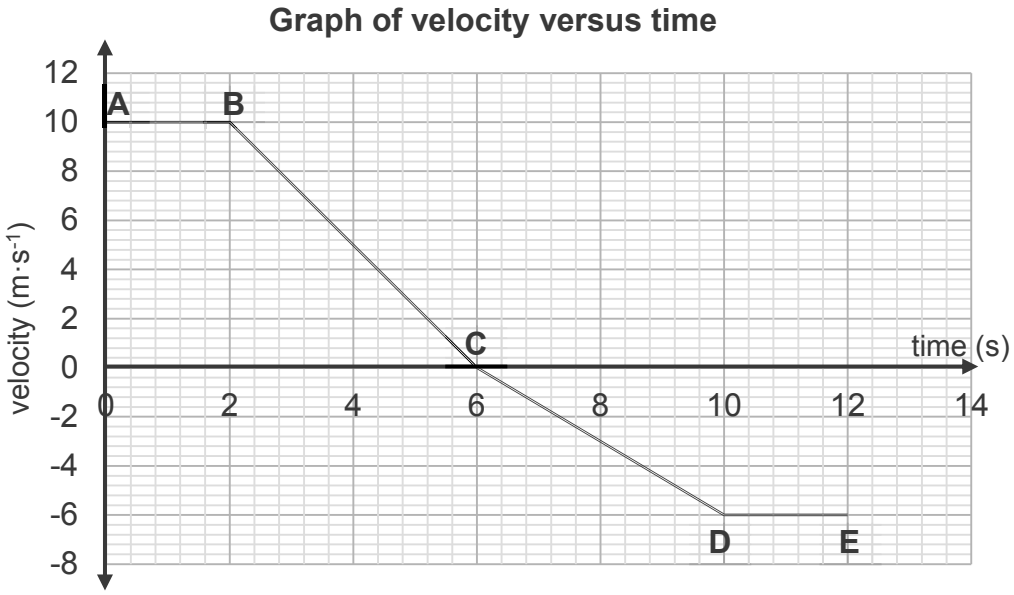
3.4.1 How should a pilot adapt the landing speed if the surface of the runway is wet? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

3.4.2 Explain the answer to QUESTION 3.4.1 by referring to the stopping distance in relation to the landing speed. (2)

[19]

QUESTION 4 (Start on a new page.)

The velocity-time graph below represents the motion of a car over a time period of 12 seconds. The car initially moves NORTH.



4.1 Define the term *velocity*. (2)

4.2 Describe the motion of the car from **C** to **E**. (3)

4.3 WITHOUT USING EQUATIONS OF MOTION, calculate the:

4.3.1 Distance that the car travels from **A** to **C** (4)

4.3.2 Acceleration of the car between **B** and **C** (4)

4.4 How does the magnitude of the acceleration of the car between **B** and **C** compare to the magnitude of its acceleration between **C** and **D**? Choose from GREATER THAN, SMALLER THAN or EQUAL TO. (1)

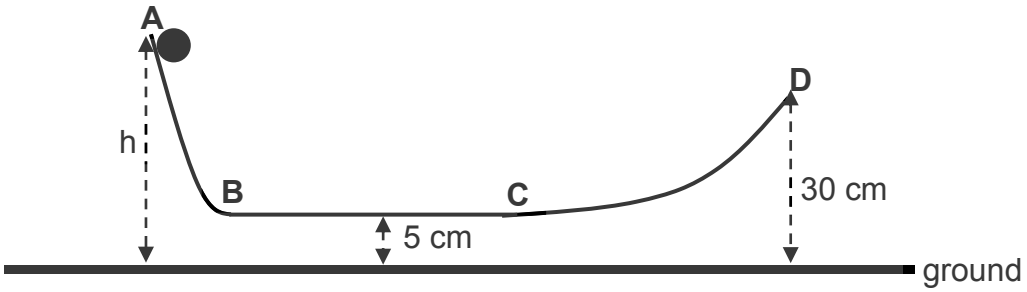
4.5 Refer to the graph and give a reason for the answer to QUESTION 4.4. (1)

4.6 Write down the direction of the resultant displacement of the car. (1)

4.7 Use an equation of motion to calculate the instantaneous velocity of the car at t = 5 s. (4)
[20]

QUESTION 5 (Start on a new page.)

A 2 kg ball rolls from rest from point **A** on a frictionless track **ABCD**, as shown below. The horizontal section, **BC**, of the track is 5 cm above the ground. The ball reaches point **D**, 30 cm above the ground, at a speed of 1,71 $m \cdot s^{-1}$.



5.1 Write down ONE term for the following statement:

The sum of gravitational potential energy and kinetic energy (1)

5.2 Calculate the:

5.2.1 Mechanical energy of the ball at point **D** (4)

5.2.2 Initial height **h** of the ball at point **A** (3)

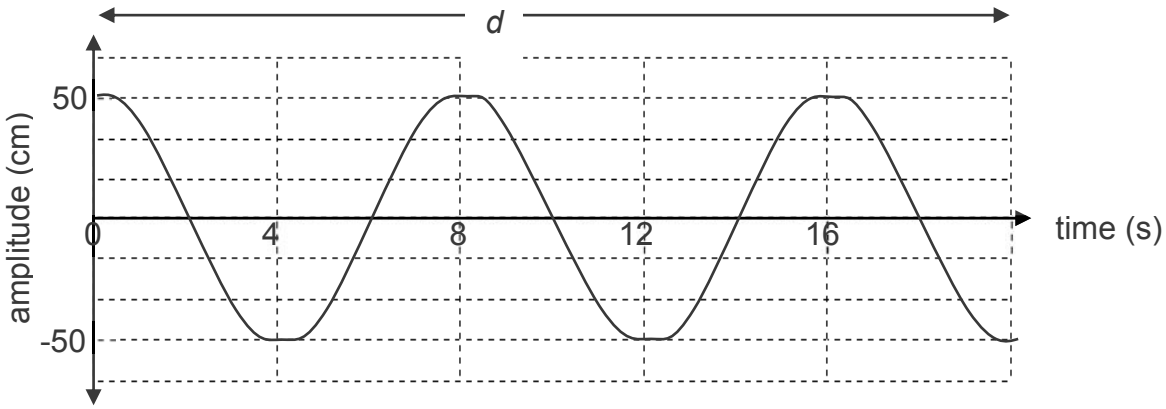
5.2.3 Speed of the ball while it moves between point **B** and point **C** (3)

5.3 The 2 kg ball is now replaced with a 4 kg ball.

How will the speed of the 4 kg ball compare to the speed of the 2 kg ball at point **D**? Choose from GREATER THAN, SMALLER THAN or EQUAL TO. Give a reason for the answer. (2)
[13]

QUESTION 6 (Start on a new page.)

The diagram below represents a transverse wave produced by source **A**.



6.1 Define the term *amplitude of a wave*. (2)

6.2 Write down the amplitude, in metres, of this wave. (1)

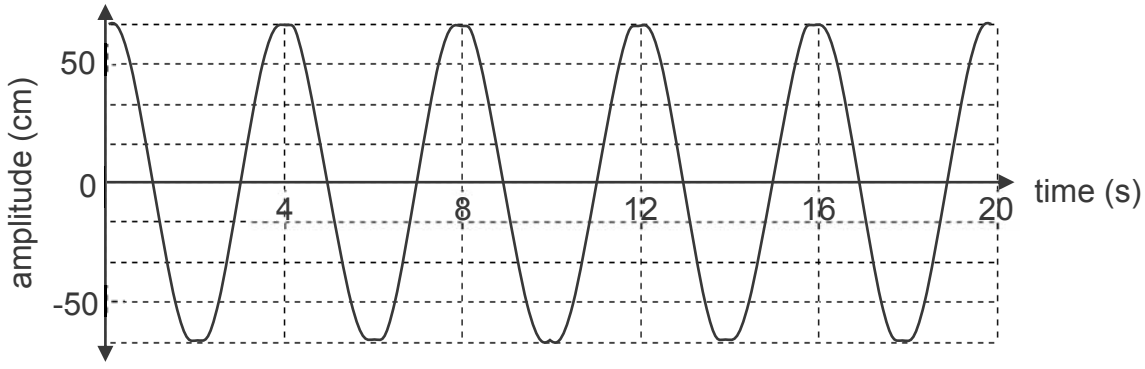
6.3 Determine the period of this wave. (1)

6.4 Calculate the:

6.4.1 Speed of the wave if the wavelength is 0,8 m (5)

6.4.2 Distance ***d*** on the diagram (2)

The diagram below represents the transverse wave produced by source **B**.



6.5 How does EACH of the following properties of the wave produced by source **B** compare to that of the wave produced by source **A**? Choose from GREATER THAN, SMALLER THAN or EQUAL TO.

6.5.1 Amplitude (1)

6.5.2 Frequency (1)

6.6 Calculate the frequency of the wave produced by source **B**. (3)

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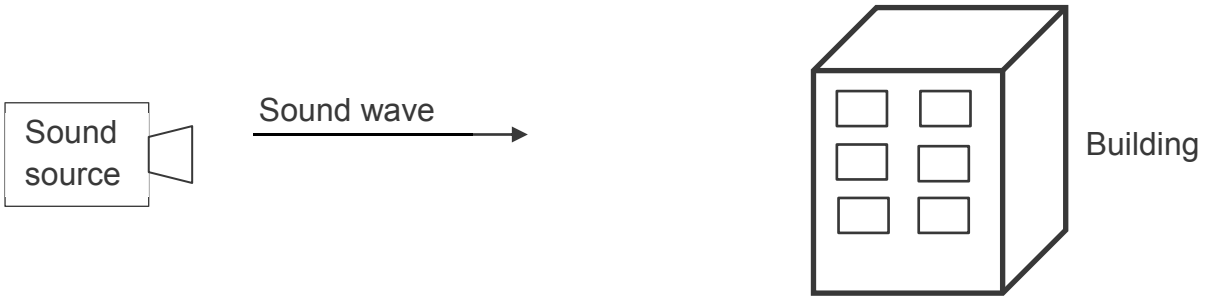
QUESTION 7 (Start on a new page.)

A sound wave is produced by a source placed a certain distance from a building as shown below. The echo reaches the source after 8 seconds. The speed of sound in air is 340 $m \cdot s^{-1}$.



7.1 Define the term *longitudinal wave*. (2)

7.2 Calculate the distance between the sound source and the building. (4)

7.3 Name the property of a sound wave that influences its pitch. (1)

7.4 Above which frequency is a sound wave classified as ultrasound? (1)

7.5 Name ONE use of ultrasound in the medical treatment of patients. (1)
[9]

QUESTION 8 (Start on a new page.)

The frequency and corresponding energy of electromagnetic waves are given in the table below.

WAVE	FREQUENCY (Hz)	ENERGY (J)
A	2×10^{9}	$1{,}33 \times 10^{-24}$
B	4×10^{12}	$2{,}65 \times 10^{-21}$
C	$3{,}5 \times 10^{15}$	$2{,}32 \times 10^{-18}$
D	$1{,}8 \times 10^{18}$	$1{,}19 \times 10^{-15}$
E	**f**	$4{,}97 \times 10^{-14}$

8.1 Describe how an electromagnetic wave propagates. (2)

8.2 What is the relationship between frequency and energy of an electromagnetic wave, as shown in the table above? (2)

8.3 Calculate the:

8.3.1 Frequency of wave **E** (3)

8.3.2 Wavelength of wave **D** (3)

8.4 Which wave, **A** or **B**, has the HIGHER penetrating ability? Give a reason for the answer. (2)
[12]

QUESTION 9 (Start on a new page.)

A compass is used to determine the poles of a magnet. The compass is placed in different positions around the magnet, as shown below. The dark arrow indicates the north pole of the compass.

9.1 Explain the term *ferromagnetic materials*. (2)

9.2 Is **X** a NORTH pole or a SOUTH pole? (1)

9.3 At which position, **1** or **2**, will the compass experience the strongest magnetic force? Give a reason for the answer. (2)

9.4 What is the direction of a magnetic field? Choose from NORTH TO SOUTH or from SOUTH TO NORTH. (1)

9.5 Give ONE term for each of the following descriptions:

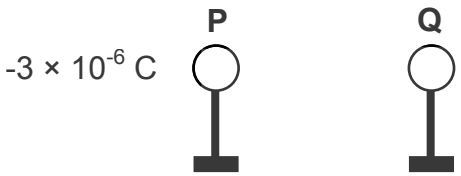
9.5.1 The point in the Northern Hemisphere where the rotation axis of the Earth meets the surface (1)

9.5.2 The point where the magnetic field lines of the Earth enters the Earth (1)

9.6 State ONE advantage of the Earth's magnetosphere for life on Earth. (1)
[9]

QUESTION 10 (Start on a new page.)

The diagram below shows two small identical spheres, **P** and **Q**, on insulated stands. The charge on sphere **P** is -3×10^{-6} C and the charge on sphere **Q** is unknown.



10.1 Calculate the number of electrons in excess on sphere **P**. (3)

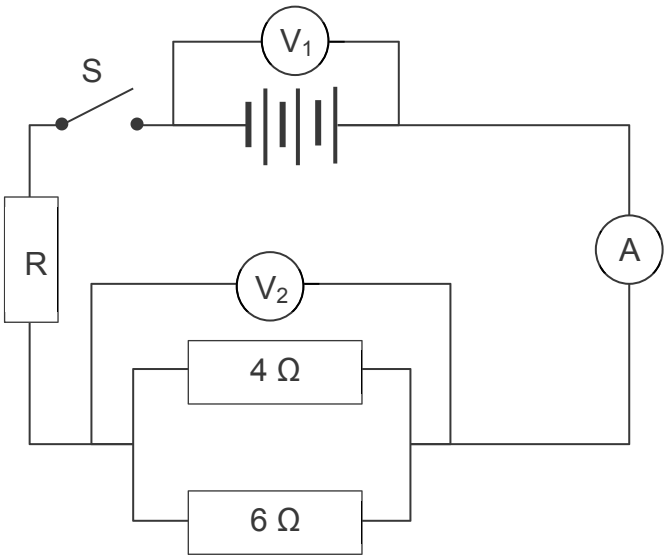
The two spheres are brought into contact and are then returned to their original positions. Each sphere now carries a charge of -1×10^{-6} C.

10.2 Calculate the original charge on sphere **Q** before the spheres were brought into contact. (3)

10.3 Were electrons transferred from P TO Q or from Q TO P during contact? (1)
[7]

QUESTION 11 (Start on a new page.)

In the circuit diagram below, the resistance of the battery, ammeter and connecting wires are negligible.



11.1 Explain the meaning of the following:

A current of 5 A (2)

11.2 Calculate the effective resistance of the parallel resistors. (3)

11.3 Which one of the voltmeters, V_1 or V_2, will show a reading if the switch is open? (1)

Switch **S** is now CLOSED.

11.4 How does the reading on voltmeter V_2 compare to that on voltmeter V_1? Choose from HIGHER THAN, SMALLER THAN or EQUAL TO. (1)

11.5 Calculate the current in the circuit if 0,3 C passes through the ammeter in 2 s. (3)

11.6 The potential difference across resistor R is 5 V when a charge of 0,3 C flows through it. Calculate the energy transferred in resistor R. (3)

[13]

TOTAL: 150

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 1 (PHYSICS)
GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
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 $m \cdot s^{-2}$
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·s
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}$ C
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}$ kg

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

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

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

$U = mgh$ or/*of* $E_P = mgh$	$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$
$E_M = E_k + E_p$ or/*of* $E_M = K + U$	

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

$v = f\lambda$	$T = \frac{1}{f}$
$E = hf$ or/*of* $E = h\frac{c}{\lambda}$	

ELECTROSTATICS/*ELEKTROSTATIKA*

$n = \frac{Q}{e}$ or/*of* $n = \frac{Q}{q_e}$	$Q = \frac{Q_1 + Q_2}{2}$

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$Q = I\Delta t$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$
$R_s = R_1 + R_2 + \ldots$	$V = \frac{W}{Q}$