Province of the
EASTERN CAPE
EDUCATION

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Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE

GRADE 12

JUNE 2026

PHYSICAL SCIENCES P1

MARKS: **150**

TIME: **3 hours**

This question paper consists of 15 pages, including 2 data sheets.

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INSTRUCTIONS AND INFORMATION

1. Write your full NAME and SURNAME in the appropriate space in the ANSWER BOOK.
2. Answer ALL the questions in the ANSWER BOOK.
3. You may use a non-programmable calculator.
4. You may use appropriate mathematical instruments.
5. Number the answers correctly according to the numbering system used in this question paper.
6. You are advised to use the attached DATA SHEETS.
7. The formulae and substitutions must be shown in ALL calculations.
8. Give brief motivations, discussions, et cetera where required.
9. Round off your final numerical answers to a minimum of TWO decimal places.
10. Start EACH question on a NEW page in the ANSWER BOOK.
11. All diagrams are NOT necessarily drawn according to scale.
12. Write neatly and legibly.

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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as 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 B.

1.1 Which ONE of the following forces always acts perpendicular to the surface on which a body is placed?

A Applied force

B Frictional force

C Normal force

D Gravitational force (2)

1.2 An astronaut has a weight **W** on Earth. He lands on a planet with mass three times greater than that of the earth and a radius twice that of the earth. What is the weight of the astronaut on this planet? Take the radius of the earth as R.

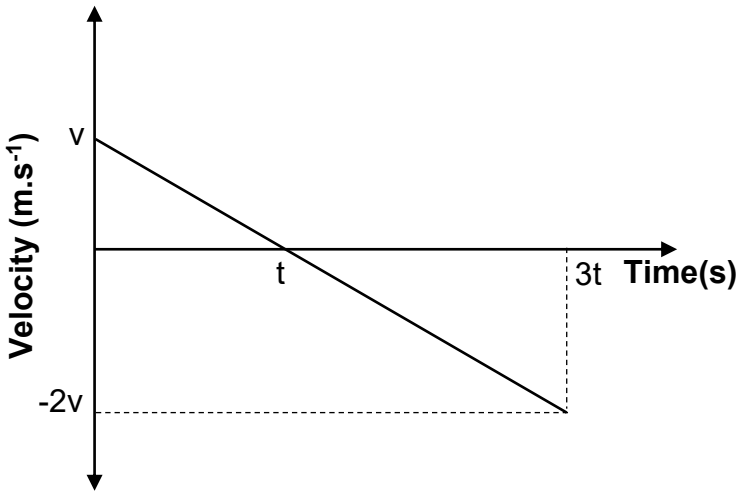
A ¾ W

B ¼ W

C 3W

D ⅔ W (2)

1.3 The velocity-time graph below represents the motion of an object under the influence of gravitational force only.



A learner makes the following statements about the graph:

(i) The object was thrown from a certain height above the ground with velocity, v.

(ii) The object was dropped from a certain height.

(iii) The object reached it maximum height at time, t.

(iv) The acceleration of the object at time t is equal to zero.

(v) The object's velocity is a maximum at time 3t.

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Which of the statements on the previous page (page 3) are TRUE about the object's motion?

A (i), (ii) and (iv)

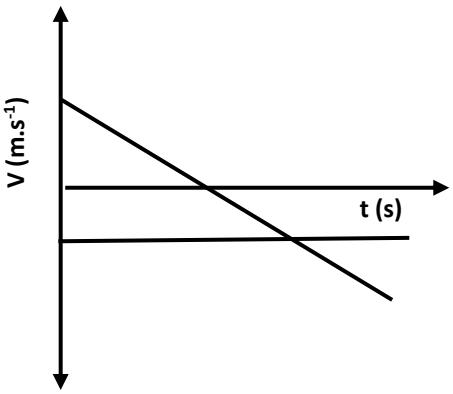
B (i), (iii), (iv) and (v)

C (i), (ii), (iii), (iv) and (v)

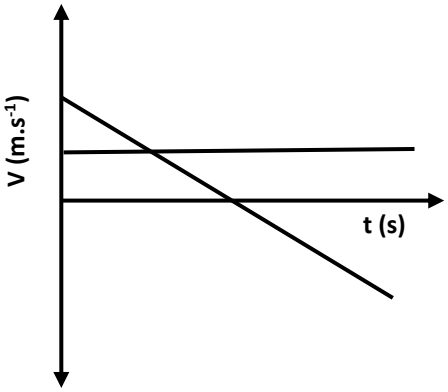
D (i), (iii) and (v) (2)

1.4 A ball is dropped from a hot air balloon that is ascending at a constant velocity. Take UPWARDS as the POSITVE direction. The CORRECT velocity versus time graph for the motion of the ball and the balloon is:

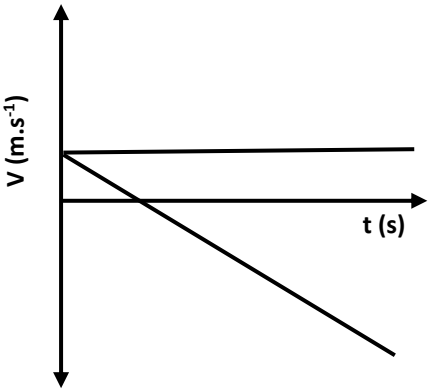
A



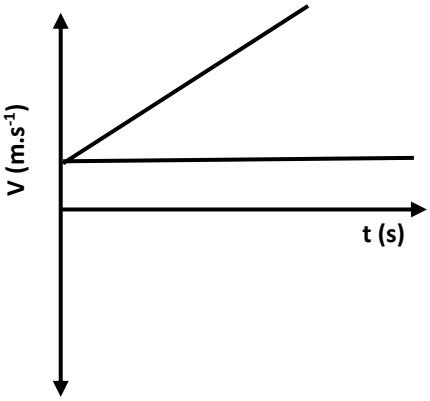
B



C



D



(2)

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1.5 Airbags can protect passengers from serious injury during a collision. Which ONE of the following best describes why this is possible?

	CONTACT TIME	NET FORCE
A	Increase	Increase
B	Increase	Decrease
C	Decrease	Increase
D	Decrease	Decrease

(2)

1.6 An object moving with a constant speed **v** has a kinetic energy K. Which ONE of the following will be TRUE for the change in kinetic energy if the object has a constant velocity of **2v**?

A 2K

B 3K

C 4K

D ¼K (2)

1.7 A bird flies directly away from a stationary birdwatcher at constant velocity. The bird constantly emits sound waves at a certain frequency. Which ONE of the following combinations of properties of the sound heard by the birdwatcher, as the bird flies away is CORRECT?

	VELOCITY	FREQUENCY
A	Remain the same	Decrease
B	Increase	Decrease
C	Decrease	Increase
D	Remains the same	Remains the same

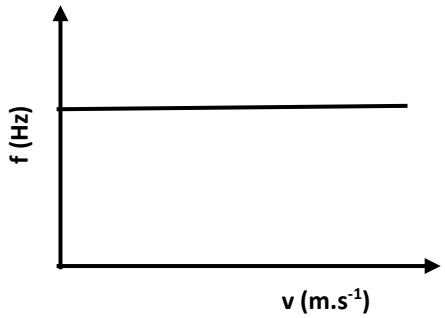
(2)

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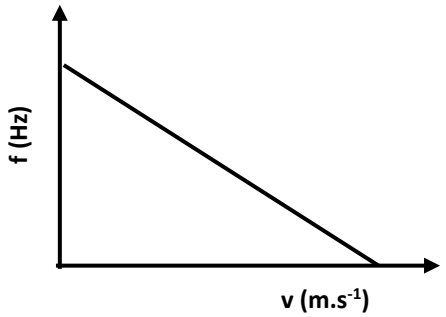
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1.8 A star moving away from the earth produces a spectrum that is red-shifted. Which ONE of the following graphs represents the red-shift?

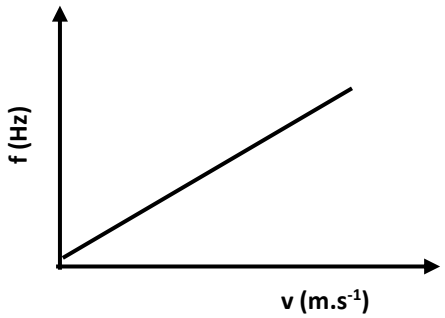
A



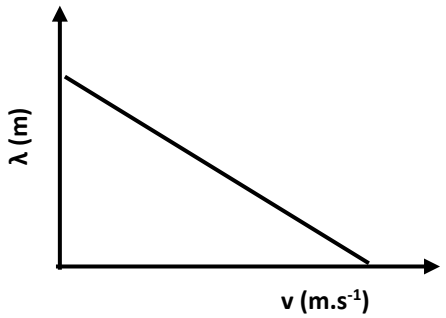
B



C



D



(2)

1.9 Two charges, **X** and **Y**, on insulting stands exerts a force **F** on each other when placed **r** m apart. When the charges are moved to new positions the force they exert on each other changes to **16F**. What is the new distance between the charges?

A 2r

B ½r

C 4r

D ¼r (2)

1.10 Two identical positively charged spheres, which are free to move, are placed near each other on a frictionless surface. Which ONE of the following CORRECTLY describes the motion of the two spheres?

A They move away from each other with increasing acceleration.

B They move away from each other with decreasing acceleration.

C They move away from each other with constant acceleration.

D They move away from each other with zero acceleration. (2)

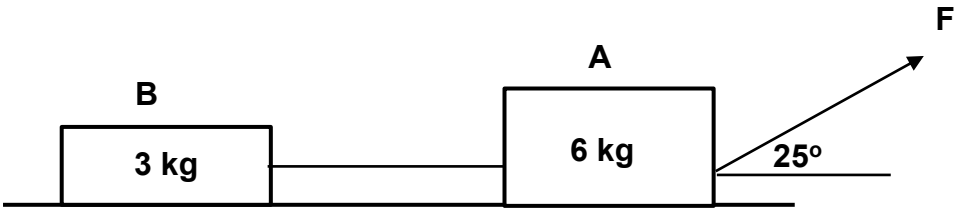
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QUESTION 2 (Start on a new page.)

Two IDENTICAL boxes with different masses **A** and **B**, resting on a rough horizontal surface, are connected by a light inextensible string. The boxes have masses 6 kg and 3 kg respectively. A constant force F, acting at an angle of 25° to the horizontal, is applied to the 6 kg box and the boxes accelerate to the right, as shown below.



The surface exerts a perpendicular force with a magnitude of 33,43 N on the 6 kg box.

2.1 Draw a labelled free-body diagram of all forces acting on the 6 kg box. (5)

2.2 Calculate the applied force **F**. (4)

The coefficient of kinetic friction between the surface and the 6 kg block is 0,15.

2.3 Give a reason why the coefficient of kinetic friction has no unit. (1)

2.4 State Newton's Second Law of Motion in words. (2)

2.5 Calculate the:

2.5.1 Frictional force exerted on the 3 kg box (3)

2.5.2 Acceleration of the boxes (5)

2.6 Suddenly the string between the two boxes breaks. In which direction will the 3 kg box move at the instant the string breaks? Write down, TO THE LEFT or TO THE RIGHT. Explain your answer using a relevant LAW OF PHYSICS. (3)

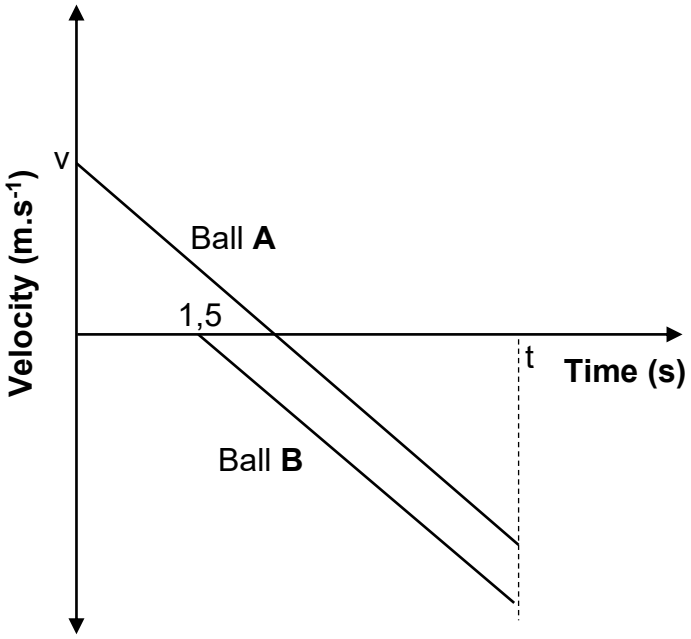
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QUESTION 3 (Start on a new page.)

The velocity-time graph below represents the motion of two balls projected from a height of 50 m above the ground.



Use the information on the graph to answer the following questions.

3.1 Define the term *projectile*. (2)

3.2 Write down the rate of change of velocity of the balls. (2)

3.3 Calculate the:

3.3.1 Time, t, indicated on the graph (5)

3.3.2 Velocity with which ball **B** hits the ground (3)

3.3.3 Velocity, v, indicated on the graph (4)

3.3.4 Maximum height reached by ball **A** above the ground (4)

3.4 Sketch a position versus time graph for the full duration of the motion of the two balls.

Indicate the following on your graph:

- The position of the balls from which it was projected
- The maximum height reached by ball **A** above the ground
- The time when the balls hit the ground (4)

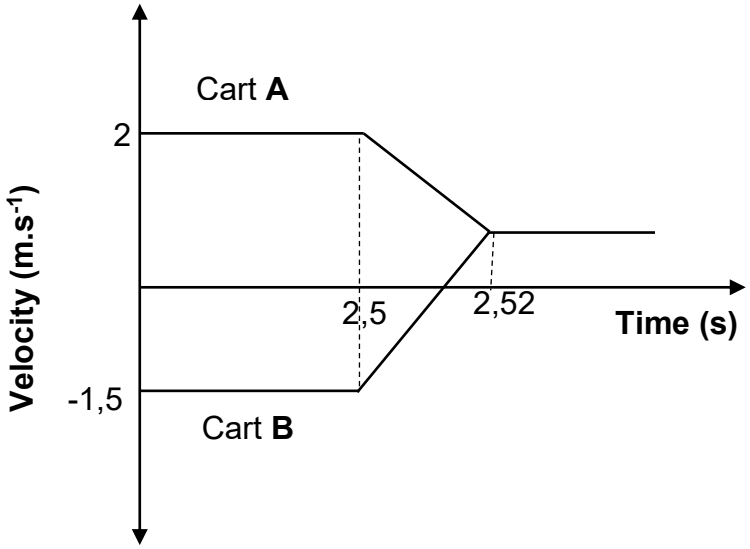
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QUESTION 4 (Start on a new page.)

The graph below represents the motion of two toy carts, **A** and **B**, of mass 1 kg and 2 kg respectively. Cart **A** is traveling eastwards.



4.1 Define the term *linear momentum* in words. (2)

4.2 Write down the initial speed of each cart. (2)

4.3 Calculate the:

4.3.1 Velocity of the carts after the collision (4)

4.3.2 Net force that the carts **A** exert on cart **B** (4)

4.4 What is the acceleration of the carts after the collision? (1)

4.5 Use a relevant calculation to determine whether the collision is ELASTIC or INELASTIC. (5)

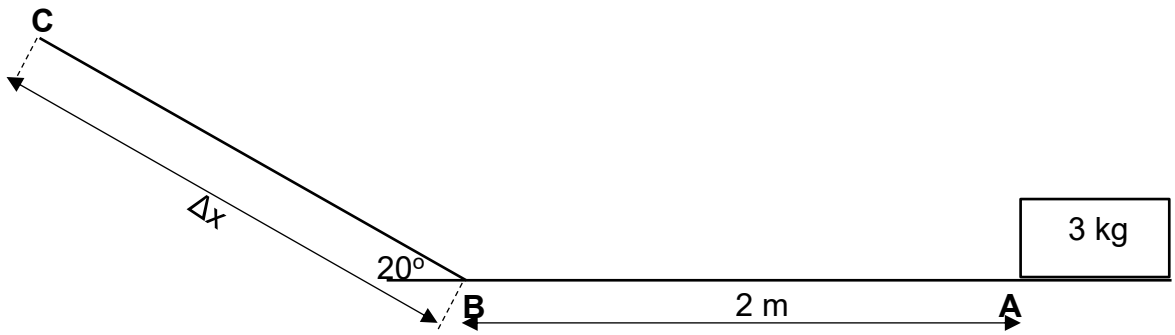
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QUESTION 5 (Start on a new page.)

A 3 kg block slides at a constant velocity of 7 m·s^{-1} along a horizontal surface. It then strikes a rough surface causing it to experience a constant frictional force of 30 N. The block slides 2 m under the influence of this frictional force before it moves up a frictionless ramp inclined at an angle of 20° to the horizontal, as shown in the diagram below.



The block moves a distance **d** up the ramp, before it comes to rest.

5.1 Define the term *non-conservative force* in words. (2)

5.2 Write down the NAME of a non-conservative force acting on the block, while it slides on the horizontal surface. (1)

5.3 Is mechanical energy conserved between points **A** and **B**? Answer YES or NO and give a reason for your answer. (2)

5.4 Show by means of a calculation that the speed of the block at the bottom of the ramp is 3 m.s^{-1}. (3)

5.5 Draw a free-body diagram to show all the forces acting on the block, whilst the block is sliding up the ramp. (3)

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

5.7 Use ENERGY PRINCIPLES ONLY, to calculate the distance, **d**, the block slides up the ramp. (5)

[18]

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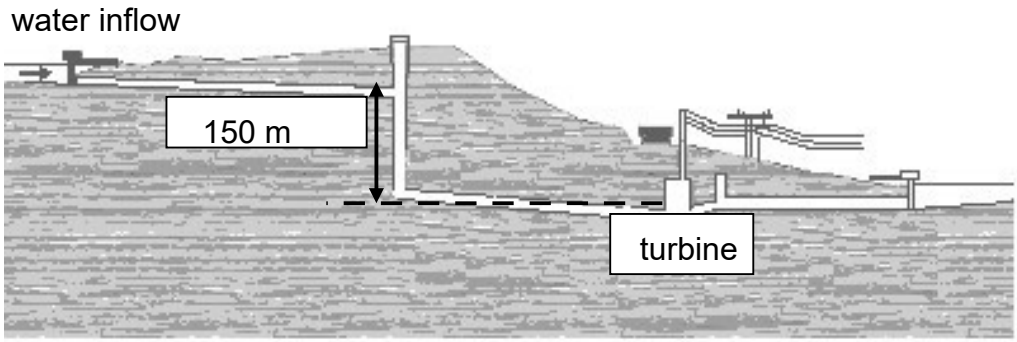
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QUESTION 6 (Start on a new page.)

The diagram below represents how water is funnelled into a pipe and directed to a turbine at a hydro-electric power plant. The force of the falling water rotates the turbine.

Each second, 200 m^3 of water is funnelled down a vertical shaft to the turbine below. The vertical height through which the water falls upon reaching the turbine is 150 m. Ignore the effects of friction.

NOTE: 1 m^3 of water has a mass of 1 000 kg.



6.1 Calculate the mass of water that enters the turbine each second. (1)

6.2 Use energy principles to calculate the kinetic energy of this mass of water when entering the turbine. (4)

6.3 Calculate the maximum speed at which this mass of water enters the turbine. (3)
[8]

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QUESTION 7 (Start on a new page.)

A siren of a stationary police van emits sound waves at a certain frequency. A learner is moving while measuring the detected frequency and recorded the results as shown in a table below.

Velocity of learner ($m.s^{-1}$)	0	5	10	15	20	25
Frequency (Hz)	780	791,47	802,94	814,41	825,88	837,35

7.1 State Doppler effect in words. (2)

7.2 Is the learner moving TOWARDS or AWAY from the police van? Give a reason for your answer. (2)

7.3 Write down the frequency of sound emitted by the siren of the police van. (2)

7.4 Using the recorded data in the table. Calculate the:

7.4.1 Speed of sound in the air (5)

7.4.2 Wavelength of the sound waves emitted by the siren of the police van (3)

7.5 Give TWO applications of the Doppler effect in medicine. (2)

7.6 Spectral lines of a certain gas observed from a distant star appear to be experiencing red shift. Explain this observation by referring to MOTION OF THE STAR and FREQUENCY of the spectral line. (2)

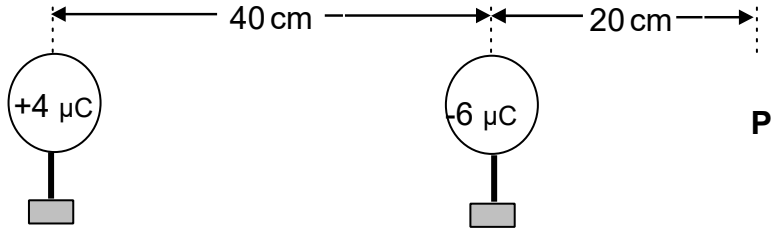
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QUESTION 8 (Start on a new page.)

Two metal spheres on insulated stands carry charges of +4 µC and -6 µC respectively. The spheres are arranged with their centres 40 cm apart, as shown below.



8.1 State Coulomb's law in words. (2)

8.2 Calculate the:

8.3.1 Number of electrons that the -6 µC charge gained (3)

8.2.2 Magnitude of the force exerted by each sphere on the other (4)

8.2.3 Net electric field at point **P** as shown in the diagram above (5)

8.3 The spheres are now brought into contact with each other and then returned to their original positions.

8.3.1 Define *electric field* around a charged object. (2)

8.3.2 Draw the electric field pattern between the two charges. (3)
[19]

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•s^{-2}
Universal gravitational constant/ *Universelegravitasiekonstant*	G	6,67 × 10^{-11} N•m^2•kg^{-2}
Speed of light in a vacuum/*Spoed van lig in 'n vakuum*	c	3,0 × 10^8 m•s^{-1}
Planck's constant/*Planck se konstante*	h	6,63 × 10^{-34} J•s
Coulomb's constant/*Coulomb se konstante*	k	9,0 × 10^9 N•m^2•C^{-2}
Charge on electron/*Lading op elektron*	e	-1,6 × 10^{-19} C
Electron mass/*Elektronmassa*	m_e	9,11 × 10^{-31} kg
Mass of earth/*Massa op aarde*	M	5,98 × 10^{24} kg
Radius of earth/*Radius van aarde*	R_E	6,38 × 10^6 m

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

$v_f = v_i + a\Delta t$	$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ 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*

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = \frac{Gm_1m_2}{d^2}$	$g = G\frac{M}{d^2}$

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* $W_{nc} = \Delta E_k + \Delta E_p$	$P = \frac{W}{\Delta t}$
$P_{av} = Fv$	

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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* $E = h\frac{c}{\lambda}$
$E = W_o + E_k$ where/*waar* $E = hf$ and/*en* $W_0 = hf_0$ and/*en* $E_k = \frac{1}{2}mv^2$ or/*of* $K_{max} = \frac{1}{2}mv_{max}^2$	

ELECTROSTATICS/*ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$	$E = \frac{kQ}{r^2}$
$E = \frac{V}{d}$	$E = \frac{F}{q}$
$V = \frac{W}{q}$	$n = \frac{Q}{q_e}$

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 = VIΔt W= $I^2R\Delta t$ W= $\frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ P = VI P = I^2R P = $\frac{V^2}{R}$

ALTERNATING CURRENT/*WISSELSTROOM*

$I_{rms} = \frac{I_{max}}{\sqrt{2}}$ / $I_{wgk} = \frac{I_{maks}}{\sqrt{2}}$	$P_{average} = V_{rms}I_{rms}$ / $P_{gemiddeld} = V_{wgk}I_{wgk}$
$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ / $V_{wgk} = \frac{V_{maks}}{\sqrt{2}}$	$P_{average} = I_{rms}^2R$ / $P_{gemiddeld} = I_{wgk}^2R$ $P_{average} = \frac{V_{rms}^2}{R}$ / $P_{gemiddeld} = \frac{V_{wgk}^2}{R}$

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