PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL

SENIOR CERTIFICATE

GRADE 12



PHYSICAL SCIENCES

CONTROL TEST 1

17 MARCH 2025

MARKS : 100

TIME : 2 HOURS

This question paper consists of 19 pages including data sheets.

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INSTRUCTIONS AND INFORMATION

1. Write your name on the top of your ANSWER SCRIPT.
2. This question paper consists of 7 questions. Answer ALL the questions on your ANSWER SCRIPT.
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. Give brief motivations, discussions, et cetera where required.
8. Round off your final numerical answers to a minimum of TWO decimal places.

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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 – 1.10) in the ANSWER BOOK, e.g. 1.11 D.

1.1 Which one of the following physical quantities is a vector?

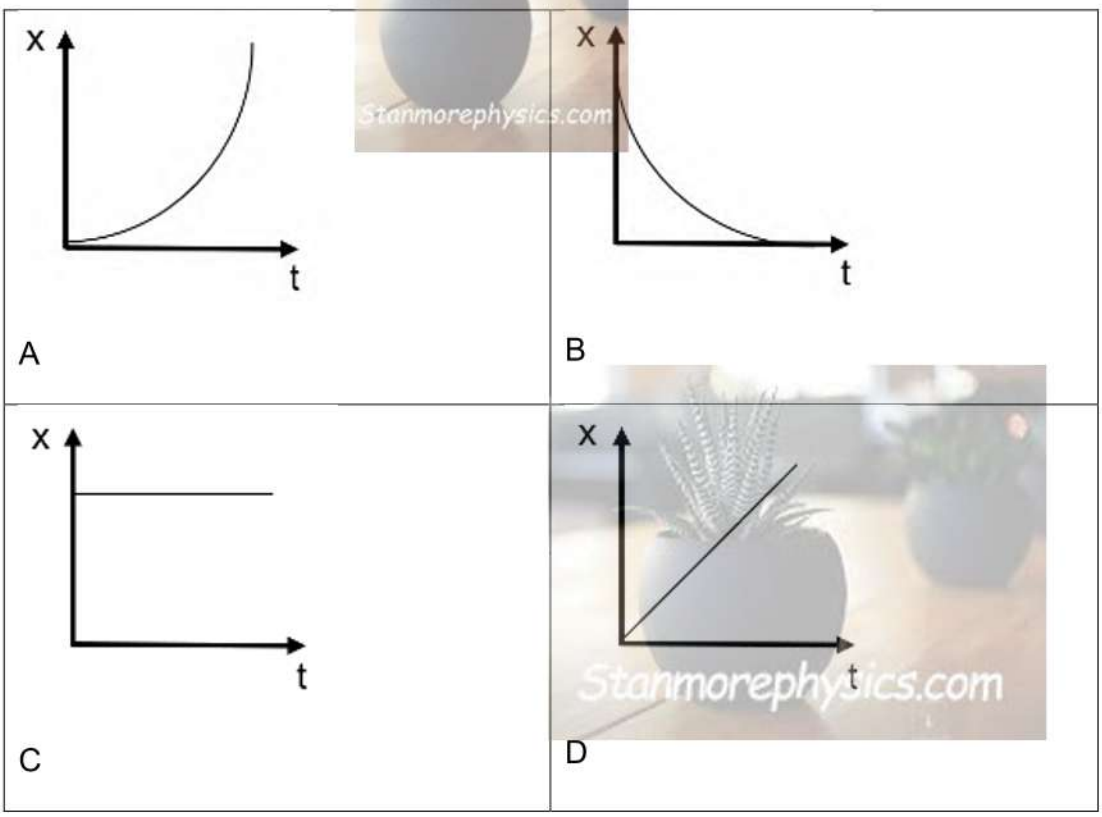
A Impulse

B Kinetic energy

C Time

D Mass (2)

1.2 Which of the following position-time graphs represent the motion of an object moving with constant, non-zero velocity?



(2)

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1.3 A person stands on a bathroom scale in a stationary elevator. The reading on the scale is 490 N. When the elevator is in motion, the reading on the scale changes to 470 N.

Which ONE of the following combinations best describes the DIRECTION OF THE MOTION and the DIRECTION OF THE ACCELERATION of the elevator during the motion?

	Direction of motion	**Direction of acceleration**
A	Upwards	Upwards
B	Downwards	Downwards
C	Upwards	Downwards
D	Downwards	Upwards

(2)

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1.4 The gravitational acceleration, g, on or near the surface of the earth depends on the…

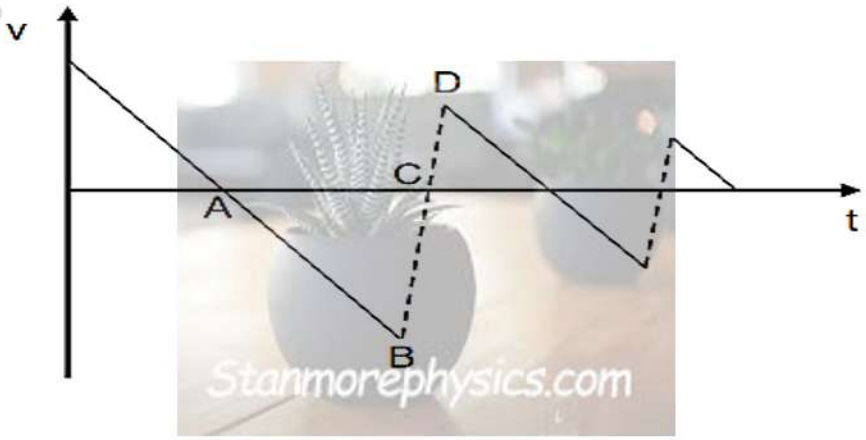
A mass of the earth and the diameter of the earth

B mass of the earth and the distance from its centre

C mass of the earth only

D distance from its centre (2)

1.5 An object is thrown upwards with unknown velocity. The velocity time graph below shows the entire motion of the object.



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At which point **A – D** will the object have the greatest momentum.

A. A

B. B

C. C

D. D

(2)

1.6 A ball is dropped downwards from the height, **h** and hits the ground with a speed v. The speed of the ball when it reaches half its initial height is…

A v

B $\frac{v}{\sqrt{2}}$

C $\frac{v}{2}$

D $\frac{v}{4}$

(2)

1.7 Consider the compound below:

$(CH_3)_3CCCCH(CH_3)_2$

The IUPAC name for the above compound is…

A 2,2,5-trimetielhex-3-yn

B 2,5,5-trimetielhex-3-yn

C 2,2-dimetiel hept-3-yn

D 2,5- dimetielhept-3-yn (2)

1.8 Which one of the following reactions will produce an alkene?

A Esterification reaction

B Substitution reaction

C Elimination reaction

D Addition reaction (2)

1.9 Which one of the following compounds has the lowest vapour pressure?

A Propane

B Propan-1-ol

C Propanoic acid

D Propanone (2)

1.10 List of reactants and reaction conditions are given below for a learner to use so that he/she can produce a primary alcohol from **3-ethyl-3-iodo-2-methylpentane**.

Concentrated H_2SO_4, water, heat, concentrated KOH and dilute H_2SO_4

How will the learner use the above reactants and reaction condition to produce a primary alcohol in 4 steps?

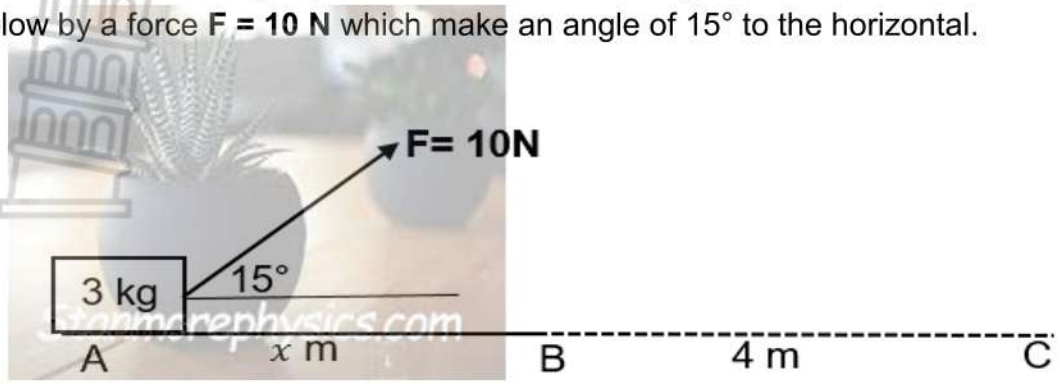
	STEP 1	**STEP 2**	**STEP 3**	**STEP 4**
A	Heat and concentrated KOH	Water and dilute H_2SO_4	Heat and concentrated H_2SO_4	Water and dilute H_2SO_4
B	Heat and Concentrated H_2SO_4	Water and dilute H_2SO_4	Heat and concentrated KOH	Water and dilute H_2SO_4
C	Water and dilute H_2SO_4	Heat and concentrated KOH	Heat and concentrated H_2SO_4	Water and dilute H_2SO_4
D	Water and dilute H_2SO_4	Heat and concentrated KOH	Water and dilute H_2SO_4	Heat and concentrated H_2SO_4

(2)
[20]

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QUESTION 2

A block of mass 3 kg is pulled from rest on a straight horizontal surface as shown below by a force **F = 10 N** which make an angle of 15° to the horizontal.



Path **AB** is x m and is frictionless and path **BC** is 4 m and is rough. The coefficient of kinetic friction between the block and the surface **BC** is 0,53. The block comes to rest at point **C**.

2.1 Draw a force diagram showing all the forces acting on the body as it slides on path **AB**. (3)

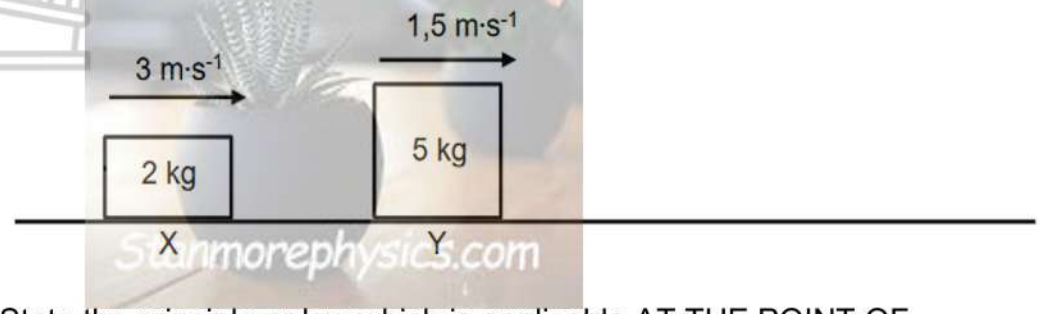
2.2 Calculate the speed of the block at point **B**. (5)

2.3 How will the speed calculated in 2.2 be affected if the angel between the surface and the force (F) was reduced to 10°?
Write INCREASE, DECREASE or REMAIN THE SAME. Give a reason for your answer. (2)

2.4 Draw the graph of $\mathbf{F_{net}}$ vs **time** for the entire motion of the block.
No numerical values are required. (3)
[13]

QUESTION 3

Two blocks are moving to the right along a frictionless surface. Block **X** has a mass of 2 kg and is moving at 3 $m.s^{-1}$. Block **Y** has a mass of 5 kg and is travelling at 1, 5 $m.s^{-1}$. The blocks collide and block **Y** continues in its original direction with a speed of 2, 5 $m.s^{-1}$ after their collision.



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3.1 State the principle or law which is applicable AT THE POINT OF COLLISION. (2)

3.2 Give a reason why the speed of the 5 kg block increases after collision. (1)

3.3 Calculate the impulse experienced by the 5 kg block. (3)

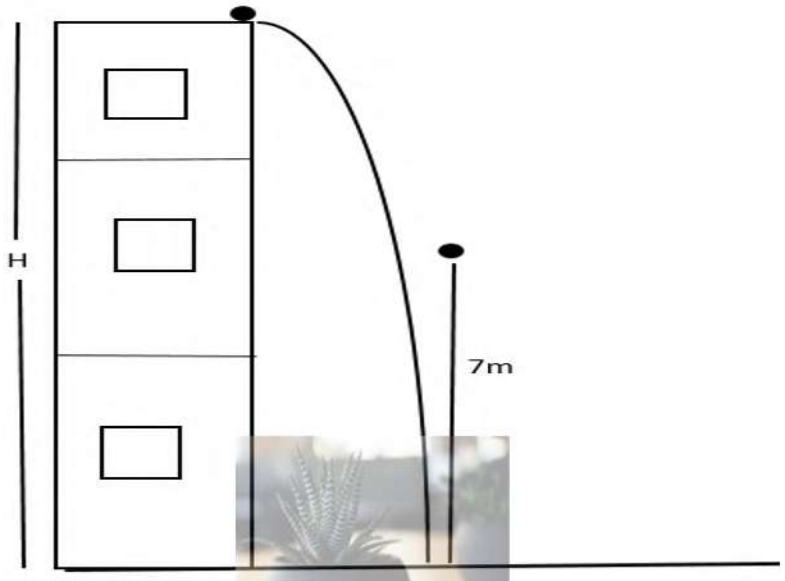
3.4 Determine the magnitude of the velocity of block **X** after collision. (4)

[10]

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QUESTION 4

A ball of mass 1.5 kg is thrown down from the top of the building with a velocity of 12 $m.s^{-1}$. The ball hit the ground and bounces off to the maximum height of 7 m. Ignore the effect of air resistance.



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4.1 Define the term *free fall* in words. (2)

4.2 Calculate the velocity which the ball leaves (bounces) the ground with. (4)

4.3 When the ball was in contact with the ground, 344,1 J of its kinetic energy was converted into the other forms of energy.

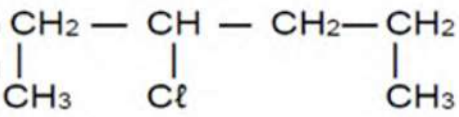
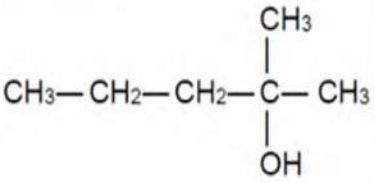
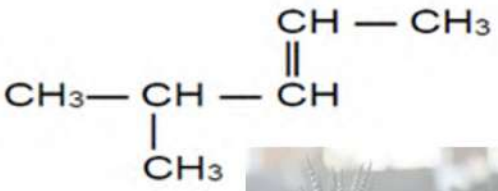
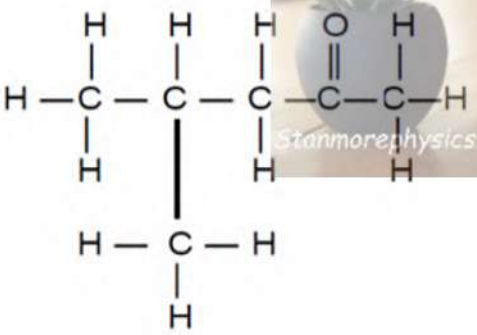
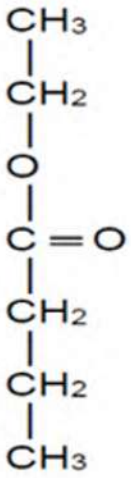
Calculate the:

4.3.1 speed that the ball hit the ground with. HINT: Use ENERGY FORMULAE. (4)

4.3.2 time the ball will take to travel distance **H**. (3)
[13]

QUESTION 5

The letters **A** to **F** in the table below represent six organic compounds.

A 	**B** 
C 	**D** 4-methylpentanoic acid
E 	**F** 

5.1 Write down the letter(s) that represent(s) each of the following:

5.1.1 compounds that can **PRODUCE** unsaturated hydrocarbon (2)

5.1.2 compound that uses platinum/palladium/nickel as a catalyst when it reacts. (1)

5.2 Write the IUPAC name of the following:

5.2.1 compound **A.** (2)

5.2.2 compound **E.** (3)

5.3 Draw the structural formula of functional group of compound **D.** (2)

5.4 Write the general formula of compound **C.** (1)

5.5 Consider compound **F.**

5.5.1 Write down the NAME of the catalyst used during preparation of compound **F.** (1)

5.5.2 Is the reaction for preparation of compound **F** ENDOTHERMIC or EXOTHERMIC? (1)

[13]

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QUESTION 6

The relationship between strength of intermolecular forces and the boiling point is investigated using five organic compounds. The compounds and their boiling points are given in the table below.

Experiment	Compound/Molecular Formulae		Boiling point (°C)
1	A	C_5H_{12}	36
	B	C_5H_{12}	28
	C	C_5H_{12}	10
2	D	C_4H_8O	54
	E	C_4H_8O	68

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6.1 Define the term *boiling point*. (2)

6.2 Consider experiment 2.

6.2.1 To which homologous series does compound **D** and **E** belong? (1)

6.2.2 Name the type of intermolecular force found in compound **D** and **E**. (1)

6.2.3 Write down the IUPAC name of compound **D**. (2)

6.3 Fully explain the difference in boiling point between compound **A** and compound **B** in experiment 1. (3)

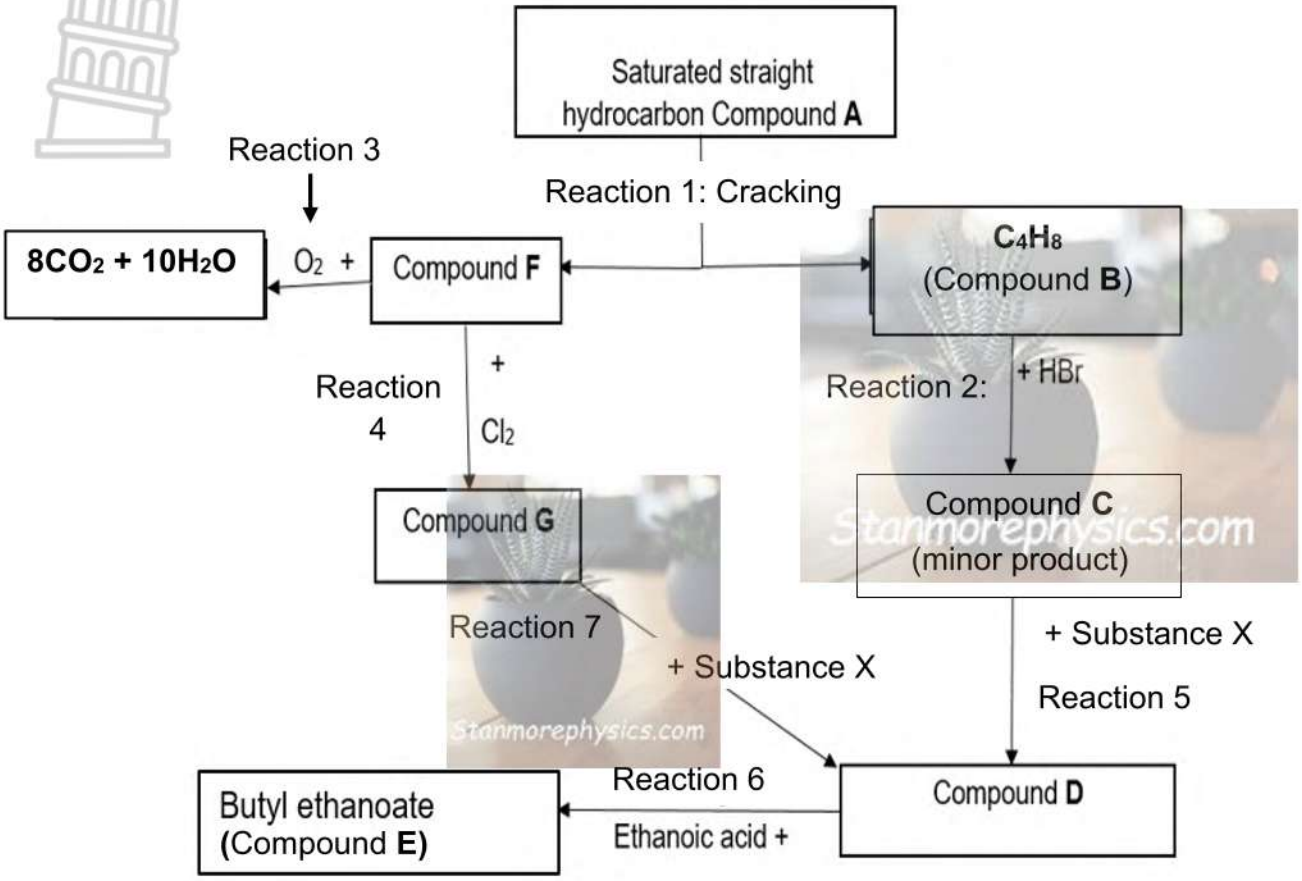
6.4 Draw the structural formula of compound **C**. (2)

6.5 From the table above, which compound is a gas at room temperature? Write only the letter (A – E). (1)

[12]

QUESTION 7

The flow diagram below has reactions 1 – 7. Compounds **A – G** represent organic compounds. Study the flow diagram and answer the questions that follow.



7.1 Write down the **type** of:

7.1.1 reaction 3. (1)

7.1.2 reaction 4. (1)

7.2 Write down the **name/formula** of:

7.2.1 substance X. (1)

7.2.2 inorganic product of reaction 4. (1)

7.3 <u>Compound **C** and compound **G** are structural isomers.</u>

Is the above UNDERLINED statement TRUE or FALSE?
Write TRUE or FALSE and give a reason for your answer. (2)

7.4 Write down the IUPAC name of compound **D**. (2)

7.5 Using structural formula write down a balance chemical reaction for reaction 1. (5)

7.6 Write down the structural formula of the positional isomer of the organic PRODUCT of reaction 4. (2)

7.7 Compound **G** can be converted to compound **B**.
Write down TWO reaction conditions required to convert compound **G** to compound **B.** (2)

7.8 Draw the structural formula of the functional isomer of compound **E.** (2)
[19]

TOTAL: 100



DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9,8 $m \cdot s^{-2}$
Universal gravitational constant	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Speed of light in a vacuum	c	3,0 x 10^8 $m \cdot s^{-1}$
Planck's constant	h	6,63 x 10^{-34} J·s
Coulomb's constant	k	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Charge on electron	e	1,6 x 10^{-19} C
Electron mass	m_e	9,11 x 10^{-31} kg
Mass of the Earth	M	5,98 x 10^{24} kg
Radius of the Earth	R_E	6,38 x 10^6 m

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TABLE 2: FORMULAE

MOTION

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

FORCE

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

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

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

WAVES, SOUND AND LIGHT

$v = f\lambda$	$T = \frac{1}{f}$
$f_L = \frac{v \pm v_L}{v \pm v_s}f_s$	$E = hf$ OR $E = h\frac{c}{\lambda}$
$E = W_o + E_{k(max)}$ OR $E = W_o + K_{max}$ where $E = hf$ and $W_0 = hf_0$ and $E_{k(max)} = \frac{1}{2}mv_{max}^2$ OR $K_{max} = \frac{1}{2}mv_{max}^2$	

ELECTROSTATICS

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

ELECTRIC CIRCUITS

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

ALTERNATING CURRENT

$I_{rms} = \frac{I_{max}}{\sqrt{2}}$ $V_{rms} = \frac{V_{max}}{\sqrt{2}}$	$P_{ave} = V_{rms}I_{rms}$ $P_{ave} = I_{rms}^2R$ $P_{ave} = \frac{V_{rms}^2}{R}$

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TABLE 3: THE PERIODIC TABLE OF ELEMENTS
TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE



1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
1 2,1 **H** 1																	2 **He** 4
3 1,0 **Li** 7	4 1,5 **Be** 9											5 2,0 **B** 11	6 2,5 **C** 12	7 3,0 **N** 14	8 3,5 **O** 16	9 4,0 **F** 19	10 **Ne** 20
11 0,9 **Na** 23	12 1,2 **Mg** 24											13 1,5 **Aℓ** 27	14 1,8 **Si** 28	15 2,1 **P** 31	16 2,5 **S** 32	17 3,0 **Cℓ** 35,5	18 **Ar** 40
19 0,8 **K** 39	20 1,0 **Ca** 40	21 1,3 **Sc** 45	22 1,5 **Ti** 48	23 1,6 **V** 51	24 1,6 **Cr** 52	25 1,5 **Mn** 55	26 1,8 **Fe** 56	27 1,8 **Co** 59	28 1,8 **Ni** 59	29 1,9 **Cu** 63,5	30 1,6 **Zn** 65	31 1,6 **Ga** 70	32 1,8 **Ge** 73	33 2,0 **As** 75	34 2,4 **Se** 79	35 2,8 **Br** 80	36 **Kr** 84
37 0,8 **Rb** 86	38 1,0 **Sr** 88	39 1,2 **Y** 89	40 1,4 **Zr** 91	41 **Nb** 92	42 1,8 **Mo** 96	43 1,9 **Tc**	44 2,2 **Ru** 101	45 2,2 **Rh** 103	46 2,2 **Pd** 106	47 1,9 **Ag** 108	48 1,7 **Cd** 112	49 1,7 **In** 115	50 1,8 **Sn** 119	51 1,9 **Sb** 122	52 2,1 **Te** 128	53 2,5 **I** 127	54 **Xe** 131
55 0,7 **Cs** 133	56 0,9 **Ba** 137	57 **La** 139	72 1,6 **Hf** 179	73 **Ta** 181	74 **W** 184	75 **Re** 186	76 **Os** 190	77 **Ir** 192	78 **Pt** 195	79 **Au** 197	80 **Hg** 201	81 1,8 **Tℓ** 204	82 1,8 **Pb** 207	83 1,9 **Bi** 209	84 2,0 **Po**	85 2,5 **At**	86 **Rn**
87 0,7 **Fr**	88 0,9 **Ra** 226	89 **Ac**															

												58 **Ce** 140	59 **Pr** 141	60 **Nd** 144	61 **Pm**	62 **Sm** 150	63 **Eu** 152
64 **Gd** 157	65 **Tb** 159	66 **Dy** 163	67 **Ho** 165	68 **Er** 167	69 **Tm** 169	70 **Yb** 173	71 **Lu** 175										
90 **Th** 232	91 **Pa**	92 **U** 238	93 **Np**	94 **Pu**	95 **Am**	96 **Cm**	97 **Bk**	98 **Cf**	99 **Es**	100 **Fm**	101 **Md**	102 **No**	103 **Lr**				

Electronegativity *Elektronegatiwiteit* → 1,9 **Cu** 63,5 ← Symbol *Simbool*

Atomic number *Atoomgetal* → 29

Approximate relative atomic mass *Benaderde relatiewe atoommassa* → 63,5

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