education

Department of Education
FREE STATE PROVINCE

PHYSICAL SCIENCES
EXAMINABLE CONTENT
GRADE 10
CAPS
2020 ONWARDS

Dear Grade 10 physical sciences learner

1. **You must have your own copy of this document.**
2. **Use this document to ensure that all the content is covered in class.**
3. **Read this document on a daily basis to acquaint yourself with what is expected. Use a pencil/pen to tick off as aspects are completed in class.**
4. **You must complete a minimum of 5 examination type questions on each topic in your homework book. Ensure that these tasks are present in your homework book and that you do corrections of mistakes made. To help you to control that you do enough homework, the contents are divided into topics.**
5. **Make sure that you know all the definitions described in this document. Most of the definitions are printed in bold so that it is easier to recognise them.**
6. **When preparing for a test or an examination, ensure that you study all concepts described in this document that are applicable to the test/examination.**
7. **Also study the formulae of positive and negative ions, as well as formulae of common compounds, given in Appendix B and Appendix C.**

This document consists of 31 pages.

Minimum number of formal and informal assessment tasks for this year

Grade 10			
Term	**Month**	**Formal Assessment Tasks**	**Informal Assessment Tasks**
1	February	Practical Task 1	Homework/Classwork: 26 Experiments: 4 Informal tests: 6
	March	Control Test 1	
2	June	June Examination	Homework/Classwork: 19 Experiments: 9 Informal tests: 4
3	August	Practical Task 2	Homework/Classwork: 25 Experiments: 3 Informal tests: 4
	September	Control Test 2	
4	November	November Examination	Homework/Classwork: 9 Experiments: 2 Informal tests: 2

What must I prepare for each control test / examination?

Refer to **Appendix D** at the end of this document.

What is the format of the question papers?

Control Tests			
	Grade 10	**Grade 11**	**Grade 12**
Multiple-choice questions	7 x 2 each = 14 marks	10 x 2 each = 20 marks	10 x 2 each = 20 marks
Structured questions	61 marks	80 marks	80 marks
Duration	1,5 hours	2 hours	2 hours
Total of paper	**75 marks**	**100 marks**	**100 marks**

Examinations	
	All grades (10–12)
Multiple-choice questions	10 x 2 each = 20 marks
Structured questions	130 marks
Duration	3 hours
Total of paper	**150 marks**

What is the weighting of cognitive levels in control tests and examinations?

	Percentage of marks per paper allocated to each level			
Control test/examination	**Level 1**	**Level 2**	**Level 3**	**Level 4**
March control tests (10–12)	15%	35%	40%	10%
June examination (10 & 11) One paper each	15%	35%	40%	10%
June, September & November examination (12 P1)	15%	35%	40%	10%
June, September & November examination (12 P2)	15%	40%	35%	10%
September control tests (10 & 11)	15%	35%	40%	10%
November examination (10P1 & 11P1)	15%	35%	40%	10%
November examination (10P2 & 11P2)	15%	40%	35%	10%

SKILLS IN PHYSICAL SCIENCES

- **Identify and question phenomena:**
  - Formulate an investigative question.
  - List all possible variables.
  - Formulate a testable hypothesis.

- **Design/Plan of an investigation:**
  - Identify variables (dependent, independent and controlled variables).
  - List appropriate apparatus.
  - Plan the sequence of steps which should include, amongst others:
    - The need for more than one trial to minimise experimental errors.
    - Identify safety precautions that need to be taken.
    - Identify conditions that ensure a fair test.
    - Set an appropriate control.

- **Graphs:**
  - Draw accurate graphs from given data/information.
  - Interpret graphs.
  - Draw sketch graphs from given information.

- **Results:**
  - Identify patterns/relationships in data.
  - Interpret results.

- **Conclusions:**
  - Draw conclusions from given information, e.g. tables, graphs.
  - Evaluate the validity of conclusions.

- **Calculations:**
  - Solve problems using two or more different calculations (multistep calculations).

- **Descriptions:**
  - Explain/Describe/Argue the validity of a statement/event using scientific principles.

FIRST TERM

Topic 1: Matter and classification

The material(s) of which an object is composed

- Describe matter as being made up of particles whose properties determine the observable characteristics of matter and its reactivity.
- Define properties of materials:
  - Strength
  - **Brittle: Hard but likely to break easy.**
    Malleable: Ability to be hammered or pressed into shape without breaking or cracking.
    Ductile: Ability to be stretched into a wire.
  - **Density: The mass per unit volume of a substance.**
  - Melting points and boiling points
    Boiling point: The temperature of a liquid at which its vapour pressure equals the external (atmospheric) pressure.
    Melting point: The temperature at which a solid, given sufficient heat, becomes a liquid.

Mixtures: heterogeneous and homogeneous

- Define a **homogeneous mixture** as **a mixture of uniform composition and in which all components are in the same phase** e.g. a solution of salt and water.
- Define a **heterogeneous mixture** as **a mixture of non-uniform composition and of which the components can be easily identified** e.g. sand and water.
- Give examples of heterogeneous and homogeneous mixtures.
- Classify given mixtures as homogenous and heterogeneous.

Pure substances: elements and compounds

- Use symbols to represent elements and compounds.
- Define an **element** as **a pure substance consisting of one type of atom**.
- Define a **compound** as **a pure substance consisting of two or more different elements**.
- Define a **pure substance** as **a substance that cannot be separated into simpler components by physical methods.**
- Classify given substances as pure or impure and as compounds or elements.

Names and formulae of substances

- Write names of compounds from given formulae or write down formulae of compounds from given names.
- Write names of ions from given formulae or formulae from given names.
- Write names of substances or ions ending on -ide, -ite and –ate.
- Write names of substances using the prefixes di-, tri-, etc.

Metals, metalloids and non-metals

- Classify substances as metals, metalloids and non-metals using their properties.
- Identify the metals, their position on the periodic table and their number in comparison to the number of non-metals.
- Identify the non-metals and their position on the periodic table.
- Describe metalloids as having properties of metals and non-metals.
- Describe the characteristic property of metalloids that show increasing conductivity with increasing temperature (the reverse of metals) e.g. silicon and graphite.
- Identify the metalloids and their position on the periodic table.

Electrical conductors, semiconductors and insulators

- Define the terms electrical conductor, semiconductor and electrical insulator:
  - **Electrical conductor: A material that allows the flow of charge.**
  - **Semiconductor: A substance that can conduct electricity under some conditions but not others, making it a good medium for the control of electrical current.**
  - **Electrical insulator: A material that prevents the flow of charge.**
- Classify materials as electrical conductors, semiconductors and insulators.
- Give examples of electrical conductors, semiconductors and insulators.

Thermal conductors and insulators

- Define the terms thermal conductor and thermal insulator. A **thermal conductor** is a **material that allows heat to pass through easily, whilst a thermal insulator does not allow heat to pass through it.**
- Describe a test to classify materials as thermal conductors and insulators.
- Give examples of materials that are thermal conductors and insulators.

Magnetic and nonmagnetic materials

- Describe how to test and classify materials as magnetic and non-magnetic.
- Give examples of materials that are magnetic and non-magnetic.
- Give examples of the use we make of magnets in daily life (in speakers, telephones, electric motors and as compasses).

Topic 2: States of Matter and the Kinetic Molecular Theory

Three states of matter

- Describe the particle nature of matter by referring to diffusion and Brownian motion.
  Diffusion: The movement of atoms or molecules from an area of higher concentration to an area of lower concentration.
  Brownian motion: The random movement of microscopic particles suspended in a liquid or gas, caused by collisions between these particles and the molecules of the liquid or gas.
- List and characterise the three states of matter.
- Define freezing point, melting point and boiling point.
  Boiling point: The temperature of a liquid at which its vapour pressure equals the external (atmospheric) pressure.
  Melting point: The temperature at which a solid, given sufficient heat, becomes a liquid. Freezing point: The temperature at which a liquid changes to a solid by the removal of heat.
- Interpret/Draw heating and cooling curves and interpret data given on heating and cooling curves.
- Identify the physical state of a substance at a specific temperature, given the melting point and the boiling point of the substance.
- Define melting, evaporation, freezing, sublimation and condensation as changes in state.
  Melting: The process during which a solid changes to a liquid by the application of heat.
  Evaporation: The change of a liquid into a vapour at any temperature below the boiling point. (Note: Evaporation takes place at the surface of a liquid, where molecules with the highest kinetic energy are able to escape. When this happens, the average kinetic energy of the liquid is lowered, and its temperature decreases.
  Freezing: The process during which a liquid changes to a solid by the removal of heat.
  Sublimation: The process during which a solid changes directly into a gas without passing through an intermediate liquid phase.
  Condensation: The process during which a gas or vapour changes to a liquid, either by cooling or by being subjected to increased pressure.

Kinetic Molecular Theory

- Describe a solid, a liquid, and a gas according to the Kinetic Molecular Theory in terms of particles of matter. According to the Kinetic Molecular Theory:
  - Matter consists of small particles
  - The particles are in constant motion
  - There are forces of attraction between the particles
  - Particles collide (with the sides of the container and each other) and exert pressure
  - The temperature of a substance is a measure of the average kinetic energy of the particles
  - A phase change may occur when the energy of particles changes

Topic 3: The atom

Models of the atom

- Describe the major contributions (Dalton, Thomson, Rutherford, Bohr, Chadwick) to the atomic model used today.

Structure of the atom: protons, neutrons, electrons

- Define the **atomic number** as **the number of protons in an atom of an element**.
- Given a periodic table or suitable data, determine for an atom / ion the:
  - Atomic number
  - Number of protons
  - Number of electrons
  - Number of neutrons
  - Mass number
- Show that by removing electrons from an atom the neutrality of the atom is changed.
- Determine the charge on an ion after removing electrons from or adding electrons to an atom.

Isotope

- Define **isotopes** as **atoms of the same element having the same number of protons, but different numbers of neutrons**.
- Define **relative atomic mass** as **the mass of a particle on a scale where an atom of carbon-12 has a mass of 12.**
- Calculate the relative atomic mass of naturally occurring elements from the percentage of each isotope in a sample of the naturally occurring element and the relative atomic mass of each of the isotopes.
- Represent atoms using the notation ${}^{A}_{Z}E$ where E is the symbol of the element, Z is the atomic number and A is the mass number.

Electron configuration

- Use Aufbau diagrams (orbital box diagrams) and the electron configuration notation (sp notation) to give electronic arrangements of atoms up to Z = 20.
- Know that every orbital corresponds to a specific energy value that electrons have when occupying it. Describe atomic orbitals as the most probable regions in space where electrons that have the specific energy corresponding to the orbital are found.
- Describe the shape of s-orbitals as spherical and that of p-orbitals as pairs of dumb-bells aligned along the x, y and z axis at 90° to each other.
- State **Hund's rule**: **No pairing in p orbitals before there is not at least one electron in each of them.**
- State **Pauli's Exclusion Principle**: **Maximum of two electrons per orbital provided that they spin in opposite directions.**

Topic 4: Periodic Table

The position of the elements in the periodic table related to their electronic arrangements

- Describe the periodic table as displaying the elements in order of increasing atomic number and showing how periodicity of the physical and chemical properties of the elements relates to atomic structure.
- Define the group number and the period number of an element in the periodic table.
  Groups are the vertical columns in the periodic table. Some groups have names e.g. alkali metals (group I), alkaline earth metals (group II), halogens (group 17 or VII) and noble gases (group18 or VIII).
  Periods are the horizontal rows in the periodic table.
- Relate the position of an element in the periodic table to its electronic structure and vice versa.
- Describe periodicity from Li to Ar in terms of atomic radius, ionisation energy, electron-affinity and electronegativity. Describe the changes in terms of change in charge of the nucleus and distance between the nucleus and the electron. Periodicity is the repetition of similar properties in chemical elements, as indicated by their positioning in the periodic table.
- Define atomic radius, ionisation energy, electron affinity and electronegativity.
  Atomic radius: Radius of an atom i.e. the mean distance from the nucleus to the border of the outer orbital.
  Ionisation energy: Energy needed per mole to remove an electron(s) from an atom in the gaseous phase.
  First ionisation energy: Energy needed per mole to remove the first electron from an atom in the gaseous phase.
  Electron affinity: The energy released when an electron is attached to an atom or molecule to form a negative ion.
  Electronegativity: A measure of the tendency of an atom in a molecule to attract bonding electrons.

Similarities in chemical properties among elements in Groups 1, 2, 17 and 18

- Relate the electronic arrangements to the chemical properties of group 1, 2, 17 and 18 elements.
- Describe the trend in reactivity of elements in groups 1, 2 and 17.
  Groups 1 and 2: Chemical reactivity increases from top to bottom.
  Group 17: Chemical reactivity decreases from top to bottom.
- Predict chemical properties of unfamiliar elements in groups 1, 2, 17 and 18 of the periodic table.
- Indicate that metals are found on the left hand side of the periodic table.
- Indicate that non-metals are found on the right hand side of the periodic table.
- Indicate where transition metals are to be found on the periodic table.

Topic 5: Chemical bonding

Covalent bonding, ionic bonding and metallic bonding

- Define a **chemical bond** as **a mutual attraction between two atoms resulting from the simultaneous attraction between their nuclei and the outer electrons.** (The energy of the combined atoms is lower than that of the individual atoms resulting in higher stability.)
- Draw Lewis dot diagrams of elements.
  A Lewis dot diagram is a structural formula in which valence electrons are represented by dots or crosses. It is also known as an electron dot formula or a Lewis formula or an electron diagram.
- Define a **covalent bond** as the **sharing of electrons between atoms to form molecules**.
  Molecule: A group of two or more atoms that are covalently bonded and that functions as a unit.

- Draw Lewis dot diagrams of simple covalent molecules containing single, double and triple covalent bonds: H_2; F_2, $C\ell_2$, O_2, N_2, HF, $HC\ell$, CH_4, NH_3, H_2O
  In a Lewis dot diagram, two dots between atoms represent a covalent bond. These two electrons are referred to as a bonding pair, whilst non-bonding electron pairs are called lone pairs.
- Write names and formulae of covalent compounds.
- Define **ionic bonding** as **the transfer of electrons to form cations (positive ions) and anions (negative ions) that attract each other to form a formula-unit.**
  A formula-unit is the most simple empirical formula that represents the compound.
  An ion is a charged particle made from an atom by the loss or gain of electrons.
  An anion (negative ion) is a charged particle made from an atom by the gain of electrons
  A cation (positive ion) is a charged particle made from an atom by the loss of electrons.
- Draw Lewis dot diagrams of cations and anions.
- Draw Lewis dot diagrams to show the formation of simple ionic compounds such as $NaC\ell$, $KC\ell$, KBr, $CaC\ell_2$ and $MgBr_2$.
- Predict the ions formed by atoms of metals and non-metals by using information in the periodic table. Metals occur on the left hand side of the periodic table and form positive ions, whilst non-metals occur on the right hand side of the periodic table and form negative ions.
- Name ionic compounds based on the component ions.
- Describe the structure of the sodium chloride crystal. In the crystal, each sodium ion is surrounded by six chloride ions to form a cubic structure. Each chloride ion is also surrounded by six sodium ions.
  A **crystal lattice** is an **orderly three-dimensional arrangement of particles (ions, molecules or atoms) in a solid structure**.
- Define **metallic bonding** as **the bond between positive ions and delocalised valence electrons in a metal.**
  Valence electrons or outer electrons are the electrons in the highest energy level, of an atom, in which there are electrons.
- Calculate relative molecular masses for covalent molecules e.g. $M_r(HC\ell) = 35,5$.
- Calculate relative formula masses for ionic compounds e.g. $M_r(NaC\ell) = 57,5$.

Topic 6: Transverse pulses in a string or spring

Pulse, amplitude

- Define a **pulse** as **a single disturbance in a medium**.
- Define a **transverse pulse** as **a pulse in which the particles of the medium move at right angles to the direction of motion of the pulse.**
- Define **amplitude** as the **maximum disturbance of a particle from its rest (equilibrium) position.**

Superposition of pulses

- Define the **principle of superposition** as **the algebraic sum of the amplitudes of two pulses that occupy the same space at the same time**.
- Define **constructive interference** as **the phenomenon where the crest of one pulse overlaps with the crest of another to produce a pulse of increased amplitude**.
- Define **destructive interference** as **the phenomenon where the crest of one pulse overlaps with the trough of another, resulting in a pulse of reduced amplitude**.
- Apply the principle of superposition to pulses to explain, using diagrams, how two pulses that reach the same point in the same medium superpose constructively and destructively and then continue in the original direction of motion.

Topic 7: Transverse waves

Wavelength, frequency, amplitude, period, wave speed

- Define a **transverse wave** as **a wave in which the particles of the medium vibrate at right angles to the direction of motion of the wave**. A transverse wave is a succession of transverse pulses.
- Define the terms wavelength, frequency, period, amplitude, crest and trough of a wave.
  Wavelength: The distance between two successive points in phase.
  Frequency: The number of wave pulses per second.
  Period: The time taken for one complete wave pulse.
  Amplitude: The maximum displacement of a particle from its equilibrium position.
  Crest: Highest point (peak) on a wave.
  Trough: Lowest point on a wave.
- Explain the wave concepts in phase and out of phase.
  In phase: Two points in phase are separated by a whole number (1; 2; 3; …) multiple of complete wavelengths.
  Out of phase: Points that are not separated by a whole number multiple of complete wavelengths.
- Identify the wavelength, amplitude, crests, troughs, points in phase and points out of phase on a drawing of a transverse wave.
- Use the relationship between frequency and period, i.e. $f = \frac{1}{T}$ and $T = \frac{1}{f}$, to solve problems.
- Define **wave speed** as **the distance travelled by a point on a wave per unit time**.
- Use the **wave equation** $v = f\lambda$ to solve problems involving waves.

Topic 8: Longitudinal waves

On a spring

- Define a **longitudinal wave** as **a wave in which the particles of the medium vibrate parallel to the direction of motion of the wave**.
- Draw a diagram to represent a longitudinal wave in a spring, showing the direction of motion of the wave relative to the direction in which the particles move.

Wavelength, frequency, amplitude, period, wave speed

- Define the wavelength and amplitude of a longitudinal wave.
  Wavelength: The distance between two successive points in phase.
  Amplitude: The maximum displacement of a particle from its equilibrium position.
- Define a **compression** as **a region of high pressure in a longitudinal wave**.
- Define a **rarefaction** as **a region of low pressure in a longitudinal wave**.
- Differentiate between longitudinal and transverse waves.
- Define the period and frequency of a longitudinal wave.
  Frequency: The number of wave pulses per second.
  Period: The time taken for one complete wave pulse.
- Use the relationship between frequency and period, i.e. $f = \frac{1}{T}$ and $T = \frac{1}{f}$, to solve problems.
- Use the wave equation, $v = f\lambda$ to solve problems involving longitudinal waves.

Topic 9: Sound

Sound waves

- Explain that sound waves are created by vibrations in a medium in the direction of propagation. The vibrations cause a regular variation in pressure in the medium.
- Describe a sound wave as a longitudinal wave.
- Explain the relationship between wave speed and the properties of the medium in which the wave travels (gas, liquid or solid).
- Describe **echoes** as **reflections of sound waves**.
- Use the wave equation, $v = f\lambda$ to solve problems involving sound waves that also include echoes e.g. sonar, bats and dolphins.

Pitch, loudness, quality (tone)

- Relate the **pitch of a sound to the frequency of a sound wave**. Pitch is the effect produced in the ear due to the sound of a particular frequency. Pitch is directly proportional to frequency.
- Relate the **loudness of a sound to both the amplitude of a sound wave and the sensitivity of the human ear.** Loudness is a subjective term describing the strength of the ear's perception of a sound. Loudness is directly proportional to amplitude.
- Relate **quality of sound to the waveform as it appears to the listener**. Two notes of the same pitch and loudness, played on different instruments do not sound the same because the waveforms are different and therefore differ in quality or tone.
- Distinguish between the shape of a pure note and the shape of a noise.

Ultrasound

- Describe sound with frequencies higher than 20 kHz up to about 100 kHz as ultrasound
- Explain how an image can be created using ultrasound based on the fact that when a wave encounters a boundary between two media, part of the wave is reflected, part is absorbed and part is transmitted.
- Describe some of the medical benefits and uses of ultrasound, e.g. safety, diagnosis, treatment and pregnancy.

Topic 10: Electromagnetic radiation

Dual (particle/wave) nature of electromagnetic radiation

Explain that some aspects of the behaviour of electromagnetic radiation can best be explained using a wave model and some aspects can best be explained using a particle model.

Nature of electromagnetic radiation

- Describe the **source of electromagnetic waves** as **an accelerating charge**.
- Describe how an electromagnetic wave propagates when an electric field oscillating in one plane produces a magnetic field oscillating in a plane at right angles to it, which produces an oscillating electric field, and so on.
- State that these mutually regenerating fields travel through space at a constant speed of 3 x 10^8 m·s^{-1}, represented by c.
- **List properties of electromagnetic waves:**
  - **Originate from accelerating electric charges**
  - **Propagate as electric and magnetic fields that are perpendicular to each other**
  - **Can travel through a vacuum**
  - **Have a speed of 3 x 10^8 m·s^{-1}**

Electromagnetic spectrum

- Given a list of different types of electromagnetic radiation, arrange them in order of frequency or wavelength.
- Given the wavelength of electromagnetic waves, calculate the frequency and vice versa, using the equation $c = f\lambda$.
- Give an example of the use of each type of electromagnetic radiation, i.e. gamma rays, X-rays, ultraviolet light, visible light, infrared, microwave and radio and TV waves.
- Indicate the penetrating ability of the different kinds of electromagnetic radiation and relate it to energy of the radiation.
- Describe the dangers of gamma rays, X-rays and the damaging effect of ultra-violet radiation on the skin.

Nature of electromagnetic as particle

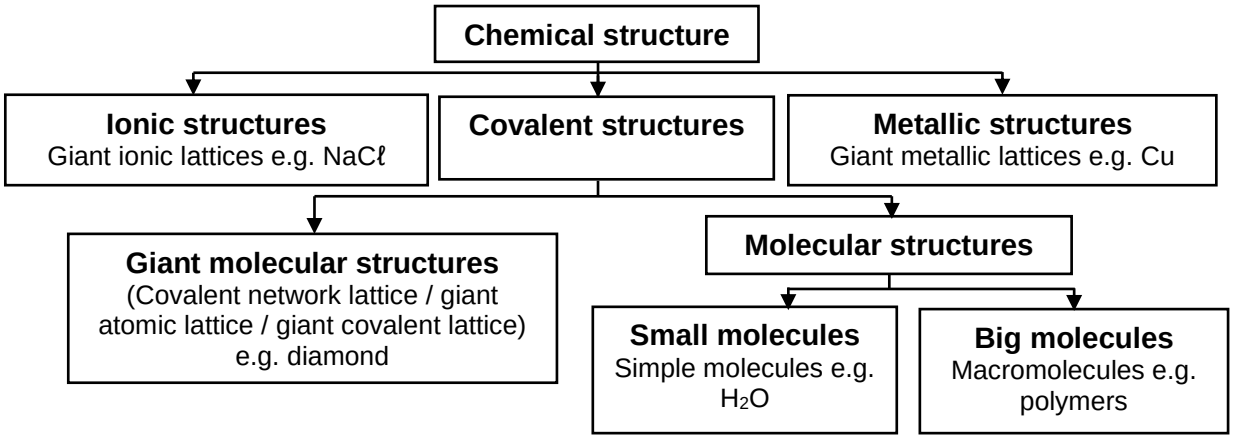
- Define a **photon** as a **packet of energy found in light**.
- Relate the energy of a photon to the frequency and wavelength of the light.
- Calculate the energy of a photon using $E = hf = \frac{hc}{\lambda}$ where h = 6,63 x10^{-34} J·s is Planck's constant, c = 3 x 10^8 m·s^{-1} is the speed of light in a vacuum and λ is the wavelength.

SECOND TERM

Topic 11: Particles substances are made of

Atoms and compounds

- Describe **atoms** as **the smallest particles of which all substances are made.**
- Identify noble gases as the only substances found in atomic form at ambient conditions.
- Describe a **compound** as **a group of two or more atoms that attract each other by relatively strong forces or bonds. The atoms combine in definite proportions.**
- Classify substances as covalent, ionic or metallic structures.
- Describe covalent structures as consisting of molecular structures and giant molecular structures.
- Describe **molecular structures**. They:
  - Consist of molecules formed when atoms share electrons
  - Are due to intermolecular forces between molecules, e.g. oxygen, water, petrol, CO_2, S_8, C_{60} (buckminsterfullerene or buckyballs), consisting of non-metallic atoms which are covalently bonded
  - Are represented using molecular formula e.g. H_2O, C_8H_{18}
- Describe **giant molecular structures or covalent network structures**. They:
  - Consist of atoms
  - Are due to **covalent bonds (sharing of electrons)** between atoms to form giant repeating lattices of covalently bonded atoms
  - Are e.g. diamond and graphite, both with empirical formula C and quartz, glass or sand, all with empirical formula SiO_2
- Describe **ionic structures**. They:
  - Consist of positive and negative ions
  - Are formed when the electrons of atoms are transferred from one atom to another atom to form positive and negative ions
  - Are due to ionic bonding between positive and negative ions
  - Are usually composed of both metallic elements (usually forming positive ions) and non-metallic elements (usually forming negative ions).
  - Are also called ionic substances or ionic solids or ionic compounds e.g. a sodium chloride crystal and a potassium permanganate crystal
- Describe **metallic structures**. They:
  - Consist of positive ions and delocalised valence electrons
  - Are formed when metal atoms lose their outer electrons (valence electrons) to form a lattice of regularly spaced positive ions and the outer electrons form a delocalised pool of electrons that surround the positive ions
  - Are due to metallic bonding between positive ions and delocalised valance electrons
  - Are e.g. metal crystals like a piece of copper, or zinc, or iron.
- Classify all chemical structures as one of ionic structures, giant molecular structures, molecular structures or metallic structures, as illustrated in the flow diagram below.



Topic 12: Physical and Chemical Change

Separation of particles in physical and chemical change

- Define a **physical change** as a change in which:
  - No new substances are formed
  - Energy changes are small in relation to chemical changes
  - Mass, numbers of atoms and molecules as being conserved
- Describe the rearrangement of molecules during physical changes e.g.
  - Molecules separate when water evaporates to form water vapour
  - When ice melts molecules become disorderly arranged due to breaking of intermolecular forces
- Define a **chemical change** as a change in which:
  - New chemical substances are formed
  - Energy changes are much larger than those of the physical change
    Endothermic reaction: Energy is absorbed during the reaction
    Exothermic reaction: Energy is released during the reaction
  - Mass and atoms are conserved, but the number of molecules is not
- Describe examples of a chemical change that include the:
  - Decomposition of hydrogen peroxide to form water and oxygen
  - Synthesis reaction that occurs when hydrogen burns in oxygen to form water
  - Heating of iron and sulphur
  - Reaction of lead(II) nitrate and potassium iodide (in solid phase and/or as solutions)
  - Titration of hydrochloric acid with sodium hydroxide to measure the change in temperature

Conservation of atoms and mass

- Calculate relative molecular masses of reactants and products in balanced equations to illustrate that atoms are conserved during chemical reactions, but not molecules.

Topic 13: Representing Chemical Change

Balanced chemical equations

- Write and balance chemical equations. Use formulae with subscripts to represent phases viz. (s), (ℓ), (g) and (aq).
- Interpret balanced reaction equations in terms of:
  - Conservation of atoms
  - Conservation of mass (use relative atomic masses)

Topic 14: Magnetism

Magnetic field of permanent magnets

- Explain that a **magnetic field** is **a region in space where a magnet or ferromagnetic material will experience a force (non-contact).**
  Ferromagnetic materials: Materials that are strongly attracted by magnets and are easily magnetised. Examples are iron, cobalt, nickel and their alloys.
  Non-contact force: A force exerted on an object without touching the object.
- Compare magnetic fields with electric and gravitational fields. An electric field is a region in space where an electric charge will experience an electric force. A gravitational field is a region in space where a mass will experience a gravitational force.

Poles of permanent magnets, attraction and repulsion, magnetic field lines

- Describe a **magnet** as **an object that has a pair of opposite poles, called north and south (or north-seeking and south-seeking).** Even if the object is cut into tiny pieces, each piece will still have both a north and a south pole.
- Apply the fact that like magnetic poles repel and opposite poles attract to predict the behaviour of magnets when they are brought close together.

- Sketch magnetic field lines to show the shape, size and direction of the magnetic field of different arrangements of bar magnets.
- Describe properties of magnetic field lines:
  - The more closely spaced the field lines are at a point the greater the field at that point.
  - Arrows drawn on the field lines indicate the direction of the field.
  - The direction of a magnetic field points from the north to the south pole.
  - Magnetic field lines never cross.

Earth's magnetic field, compass

- Explain how a compass indicates the direction of a magnetic field.
- Compare the magnetic field of the earth to the magnetic field of a bar magnet.
- Explain the difference between the geographical north pole and the magnetic north pole of the Earth.
  Geographic north pole: Point in the northern hemisphere where the rotation axis of the earth meets the surface.
  Magnetic north pole: The point where the magnetic field lines of the earth enters the Earth. It is the direction in which the north pole of a compass points.
  Magnetic south pole: The point where the magnetic field lines of the earth leaves the earth.
- Give examples of phenomena that are affected by Earth's magnetic field e.g. Aurora Borealis (Northern Lights) and magnetic storms.
  Aurora Borealis (Northern Lights): An atmospheric phenomenon consisting of bands of light at the north pole caused by charged solar particles following the earth's magnetic lines of force.
  Magnetic storm: A disturbance in the earth's outer magnetosphere, usually caused by streams of charged particles given off by solar flares.
  Magnetosphere: A region surrounding the earth (extending from about one hundred to several thousand kilometres above the surface) **in which charged particles are trapped and their behaviour is dominated by the earth's magnetic field.**
- Discuss qualitatively how the earth's magnetic field provides protection from solar winds.
  Solar wind: A stream of radioactive and charged particles sent into space at high speeds due to reactions on the sun.

Topic 15: Electrostatics

Two kinds of charge

- State that:
  - All materials contain positive charges (protons) and negative charges (electrons)
  - An object that has an equal number of electrons and protons is neutral (no net charge)
  - Positively charged objects are electron deficient and negatively charged objects have an excess of electrons
- Describe how objects (insulators) can be charged by contact (or rubbing) - tribo-electric charging.
  Tribo-electric charging: A type of contact electrification in which certain materials become electrically charged after they come into contact with different materials and are then separated (such as through rubbing). The polarity and strength of the charges produced differ according to the materials.

Charge conservation

- State that the SI unit for electric charge is the coulomb (C).
- State the **principle of conservation of charge**: **The net charge of an isolated system remains constant during any physical process** e.g. two charges making contact and then separating.
- Apply the principle of conservation of charge.
  When two identical conducting objects having charges Q_1 and Q_2 on insulating stands t ouch, each object has the same final charge on separation.
  Final charge after separation: $Q = \frac{Q_1 + Q_2}{2}$
  NOTE: This equation is only true for identically sized conductors on insulated stands.

Charge quantization

- State the **principle of charge quanti**zation: **All charges in the universe consist of an integer multiple of the charge on one electron i.e. 1,6 x 10^{-19} C.**
- Apply the principle of charge quantization: $Q = nq_e$, where $q_e = 1,6 \times 10^{-19}$ C and n is an integer.

Force exerted by charges on each other (descriptive)

- State that like charges repel and opposite charges attract.
- Explain how charged objects can attract uncharged insulators because of the polarisation of molecules inside insulators.
  Polarisation: The partial or complete polar separation of positive and negative electric charge in a system.

Topic 16: Electric Circuits

Terminal potential difference and emf

- Define **potential difference across the ends of a conductor as the energy transferred per unit electric charge flowing through it.** In symbols: $V = \frac{W}{Q}$
  Potential difference is measured in volts (V).
- Define **emf** as **the work done per unit charge by the source** (battery). It is equal to the potential difference measured across the terminals of a battery when no charges are flowing in the circuit.
- Define **terminal potential difference** as **the voltage measured across the terminals of a battery when charges are flowing in the circuit**.
- Do calculations using $V = \frac{W}{Q}$.

Current

- Define **current strength**, I, as **the rate of flow of charge**. It is measured in ampere (A), which is the same as coulomb per second.
- Calculate current strength in a conductor using the equation $I = \frac{Q}{\Delta t}$.
  Q is the symbol for electric charge measured in coulomb (C). **One coulomb is defined as the charge transferred in a conductor in one second if the current is one ampere.**
- Indicate the direction of conventional current (from positive to negative) in circuit diagrams using arrows.

Measurement of potential difference and current

- Draw a diagram to show how to correctly connect an ammeter to measure the current through a given circuit element. An ammeter is connected in series and has a very low resistance.
- Draw a diagram to show how to correctly connect a voltmeter to measure the potential difference across a given circuit element. A voltmeter is connected in parallel and has a very high resistance.

Resistance

- Define **resistance** as **the ratio of the potential difference across a resistor to the current in the resistor.**
- Explain that resistance is the opposition to the flow of electric charges.
- Define the **unit of resistance**: **One ohm (Ω) is equal to one volt per ampere**.
- Give a microscopic description of resistance in terms of electrons moving through a conductor colliding with the particles of which the conductor (metal) is made and transferring kinetic energy.
- State and explain factors that affect the resistance of a given material i.e. temperature, length and thickness.
- Explain why a battery in a circuit goes flat eventually by referring to the energy transformations that take place in the battery and the resistors in a circuit.

Resistors in series

- Know that current is the same through each resistor in a series circuit.
- Describe **series circuits** as **potential difference dividers** because the total potential difference is equal to the sum of the potential differences across all the individual components.
- Calculate the equivalent (total) resistance of resistors connected in series using $R_s = R_1 + R_2 + \ldots$

Resistors in parallel

- Know that potential difference is the same across resistors connected in parallel.
- Describe **parallel circuits** as **current dividers** because the total current in the circuit is equal to the sum of the branch currents.
- Calculate the equivalent (total) resistance of resistors connected in parallel using $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$

THIRD TERM

Topic 17: Vectors and scalars

Introduction to vectors & scalars

- List physical quantities for example time, mass, weight, force, charge, etc.
- Define a vector and a scalar quantity.
  A vector is a physical quantity with magnitude and direction. A scalar is a physical quantity with magnitude only.
- Know that $\vec{F}$ represents the force vector, whereas F represents the magnitude of the force vector. Represent vectors graphically with an arrow. The length of the arrow represents the magnitude and the arrow head the direction of the vector.
- Use the force vector as an example to show equality of vectors, negative vectors and addition of vectors in one dimension only.
- Define a **resultant** as **the single vector having the same effect as two or more vectors together.**
- Determine a resultant graphically using the tail-to-head method as well as by calculation for a maximum of four force vectors in one dimension only i.e. along a straight line.

Topic 18: Motion in one dimension

Reference frame, position, displacement and distance

- Describe the concept of a frame of reference as a coordinate system used to represent and measure properties of objects, such as position.
- Explain that a frame of reference has an origin and a set of directions e.g. East and West or up and down.
- Define **one dimensional motion** as **motion along a straight line**. The object may move forward or backward along this line.
- Define position relative to a reference point and understand that position can be positive or negative.
- Define **distance** as **the total path length travelled**. Know that distance is a scalar quantity.
- Define **displacement** as **the difference in position in space**. Know that displacement is a vector quantity that points from the initial to the final position.
- Describe and illustrate the difference between displacement and distance.
- Calculate distance and displacement for one dimensional motion.

Average speed, average velocity, acceleration

- Define **average speed** as **the total distance travelled per total time**. Know that average speed is a scalar quantity.
- Define **average velocity** as **the rate of change of position**.
  In symbols: $v = \frac{\Delta x}{\Delta t}$
  Know that average velocity is a vector quantity.
- Calculate average speed and average velocity for one dimensional motion.
- Convert between different units of speed and velocity, e.g. $m \cdot s^{-1}$ and $km \cdot h^{-1}$.
- Define **acceleration** as **the rate of change of velocity.** In practice we will mostly encounter situations in which the acceleration is constant , and therefore be working with the average acceleration which we define as: $a_{ave} = \frac{\Delta v}{\Delta t}$
- Know that acceleration is a vector quantity. Differentiate between positive acceleration, negative acceleration and deceleration.
  Positive acceleration: An object moving in the positive direction is experiencing an increase in speed and an object moving in the negative direction is experiencing a decrease in speed.
  Negative acceleration: An object moving in the positive direction is experiencing a decrease in speed and an object moving in the negative direction is experiencing an

increase in speed
Deceleration: An object is experiencing a decrease in speed.

Topic 19: Instantaneous speed and velocity and the equations of motion

Instantaneous velocity and instantaneous speed

- Define **instantaneous velocity** as **the rate of change in positio**n i.e. the displacement divided by a very small time interval or the velocity at a particular time. Know that instantaneous velocity is a vector quantity.
- Define **instantaneous speed** as the **magnitude of the instantaneous velocity**. Know that instantaneous speed is a scalar quantity.

Description of motion in words, diagrams, graphs and equations

- Describe in words and distinguish between motion with uniform velocity and uniformly accelerated motion.
  Uniform velocity: Motion at constant velocity i.e. no acceleration
  Uniform accelerated motion: The velocity of an object changes with the same amount during each time interval.
- Describe the motion of an object given its position versus time, velocity versus time and acceleration versus time graph.
- Determine the velocity of an object from the gradient of the position versus time graph.
- Determine the instantaneous velocity at a particular time using the gradient of a tangent to a position versus time graph.
- Determine the acceleration of an object from the gradient of the velocity vs time graph.
- Determine the displacement of an object by finding the area between the time axis and the graph of a velocity vs time graph.
- Use the equations of motion, listed below, to solve problems involving motion in one dimension in the horizontal plane only.

$$v_f = v_i + a\Delta t \qquad \Delta x = v_i\Delta t + \tfrac{1}{2}a\Delta t^2$$

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

- Solve problems for the motion of a vehicle including safety issues such as the relationship between speed and stopping distance.

Topic 20: Reactions in aqueous solutions

Ions in aqueous solution: their interaction and effects

- Explain, using diagrams, the polar nature of the water molecule and how water is able to dissolve ions.
- Define a **polar molecule** as having **two oppositely charged poles and that it is also known as a dipole.**
- Represent the dissolution process using balanced reaction equations with the abbreviation (s) for the solid phase and (aq) for substances dissolved in water e.g. when salt is dissolved in water ions form according to the equation:
  $NaC\ell(s) \rightarrow Na^+(aq) + C\ell^-(aq)$
- Define an **aqueous solution** as **a solution in which the solvent is water**.
- Define **dissociation** as **the process in which solid ionic crystals are broken up into ions when dissolved in water.**
- Define terms such as:
  Hydration: The process in which ions are surrounded with water molecules
  Solubility: The maximum amount of a substance (the solute) that may be dissolved in another (the solvent).
  Solute: The dissolved substance in a solution - usually the substance present in lesser amount
  Solution: A homogenous mixture of two or more substances.
  Solvent: The substance in a solution in which the solute is dissolved - usually

the substance present in greater amount

Electrolytes and extent of ionization as measured by conductivity

- Describe / interpret a simple circuit to measure conductivity of solutions.
- Define **conductivity** as **the ability of a material to conduct electricity**.
- Define an **electrolyte** as **a solution that conducts electricity through the movement of ions.**
- Relate conductivity to the:
  - Concentration of ions in solution and this in turn to the solubility of ionic substances
    Define concentration as the amount of substance present per volume of a solution.
  - Type of substance, since some substances, like sugar, dissolve but this does not affect conductivity

Precipitation reactions

- Write balanced equations to describe precipitation of insoluble salts.
- Explain how to test for the presence of the following anions in solution and write chemical equations:
  - Chlorides - using silver nitrate and nitric acid
  - Bromides - using silver nitrate and nitric acid
  - Iodides - using silver nitrate and nitric acid
  - Sulphates - using barium nitrate and nitric acid
  - Carbonates - using barium nitrate and nitric acid (precipitate dissolves in nitric acid) or acid and calcium hydroxide (clear lime water)
- Identify an ion or ions in a solution from a description of the reactants mixed and the observations of the products.

Other chemical reaction types in water solution

- Classify different ion exchange reactions as:
  - **Precipitation reactions – reactions in which an insoluble product forms when solutions are mixed**
  - **Gas forming reactions - reactions in which the driving force is the formation of a gas as one of the products**
  - **Acid-base reactions - reactions in which a hydrogen ion (H^+ ion) is transferred from one of the reactants to another**
- Classify reactions as **redox reactions** i.e. **reactions in which an electron transfer takes place.** One reactant gains electrons and another loses electrons. Use the charge of the atom to determine whether electrons are transferred in the following reactions:
  - Reactions of acids ($HC\ell$ & H_2SO_4) with metals to form metallic salts e.g.
    $2HC\ell(aq) + Zn(s) \rightarrow ZnC\ell_2(aq) + H_2(g)$
  - $Fe(s) + S(s) \rightarrow FeS(s)$
  - $2H_2(g) + O_2(g) \rightarrow 2H_2O(\ell)$

  Use examples of reactions done that are not redox reactions e.g. precipitation reactions, to show that there is no change in charge of atoms.

Topic 21: Quantitative Aspects of Chemical Change

Atomic mass and the mole concept

- Describe the mole as the SI unit for amount of substance.
- Define **one mole** as **the amount of substance having the same number of particles as there are atoms in 12 g carbon-12.**
- Define **relative atomic mass** as **the mass of a particle on a scale where an atom of carbon-12 has a mass of 12.**
- Describe **Avogadro's number**, N_A, as **the number of particles (atoms, molecules, formula-units) present in mole** ($N_A = 6{,}023 \times 10^{23}$ mol^{-1}).
- Define **molar mass** as **the mass of one mole of a substance measured in g·mol^{-1}.**
- Describe the relationship between molar mass and relative molecular mass and relative formula mass.
- Calculate the molar mass of a substance given its formula.

Molecular and formula masses

- Calculate mass, molar mass and number of moles according to the relationship $n = \frac{m}{M}$.
- Determine the empirical formula for a given substance from percentage composition.
  Define an **empirical formula** as **the simplest whole-number ratio of atoms in a compound.**
- Determine the molecular formula of a compound from percentage composition.
  Define a **molecular formula as a chemical formula that indicates the type of atoms and the correct number of each in a molecule.**
- Determine the number of moles of water of crystallisation in salts like $A\ell C\ell_3 \cdot nH_2O$.
  Define **water of crystallisation** as **water that is stoichiometrically bound into a crystal** e.g. the H_2O in $CuSO_4 \cdot 5H_2O$.

Determining the composition of substances

- Determine percentage composition of an element in a compound.
  Percentage composition is the mass of each atom present in a compound expressed as a percentage of the total mass of the compound.
- Define **concentration** as the **number of moles of solute per cubic decimetre (or litre) of solution**.
- Calculate concentration in mol·dm^{-3} using $c = \frac{n}{V}$.

Molar volume of gases

- State **Avogadro's law i.e. one mole of any gas occupies the same volume at the same temperature and pressure.**
- At STP: 1 mole of any gas occupies 22,4 dm^3 at 0 °C (273 K) and 1 atmosphere (101,3 kPa). Thus the molar gas volume, V_M, at STP = 22,4 dm^3·mol^{-1}.
- Interpret balanced equations in terms of volume relationships for gases, i.e. under the same conditions of temperature and pressure, equal number of moles of all gases occupy the same volume.

Basic stoichiometric calculations

- Perform stoichiometric calculations based on balanced equations. These may include calculations based on concentration, mass, moles, molar mass, number of particles and volume.
- Determine the theoretical yield of a product in a chemical reaction, when you start with a known mass of reactant. **The theoretical yield is the calculated yield of a product in a chemical reaction. Actual yield is the quantity physically obtained from a chemical reaction.**

- Determine the percentage yield of a chemical reaction: $\%yield = \frac{\text{actual yield}}{\text{theoretical yield}} x100$

FOURTH TERM

Topic 22: Energy

Gravitational potential energy

- Define **gravitational potential energy** of an object as **the energy it has because of its position in the gravitational field relative to some reference point**.
- Calculate the gravitational potential energy of an object using $E_p = mgh$ OR $U = mgh$.

Kinetic energy

- Define **kinetic energy** as **the energy an object possesses as a result of its motion**.
- Calculate the kinetic energy of an object using $E_k = ½mv^2$ OR $K = ½mv^2$.

Mechanical energy

- Define **mechanical energy** as **the sum of the gravitational potential energy and kinetic energy.**
- Calculate mechanical energy using $E_M = E_k + E_p$. OR $E_M = K + U$

Conservation of mechanical energy

- State the **law of the conservation of energy**: **The total energy of an isolated system remains constant.**
  Isolated system: A system that does not interact with its surroundings i.e. there is no transfer of energy or mass between the system and the surroundings.
- State the **principle of conservation of mechanical energy**: **The total mechanical energy in an isolated system / in the absence of dissipative forces e.g. friction, remains constant**.
  In symbols: $E_{k1} + E_{p1} = E_{k2} + E_{p2}$
- Apply the principle of conservation of mechanical energy to various contexts viz. objects dropped or thrown vertically upwards, the motion of a pendulum bob, roller coasters and inclined plane problems. In the absence of friction, the mechanical energy of an object moving in the earth's gravitational field is constant (conserved).

Topic 23: The hydrosphere

Its composition and interaction with other global systems

- Describe the **hydrosphere** as **the water of the earth and is found as liquid water (surface and underground), ice (polar ice, icebergs and ice frozen in the soil called permafrost) and water vapour in the atmosphere.**
- Describe the interaction of the hydrosphere with the atmosphere, the lithosphere and the biosphere.
  Atmosphere: The body of air surrounding the earth.
  Lithosphere: The solid, rocky crust covering the entire planet.
  Biosphere: All the living organisms i.e. plants and animals.
- Describe the water cycle and interpret diagrams of the water cycle.
- Explain how the building of dams affect the lives of the people and the ecology in the region.

APPENDIX A: DATA SHEETS

DATA SHEETS – PAPER 1 (PHYSICS)

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 x 10^{8} $m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	6,63 x 10^{-34} J·s
Charge on electron *Lading op elektron*	e	-1,6 x 10^{-19} C
Electron mass *Elektronmassa*	m_e	9,11 x 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* $E_k = \frac{1}{2} mv^2$

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

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

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

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

DATA SHEETS – PAPER 2 (CHEMISTRY)

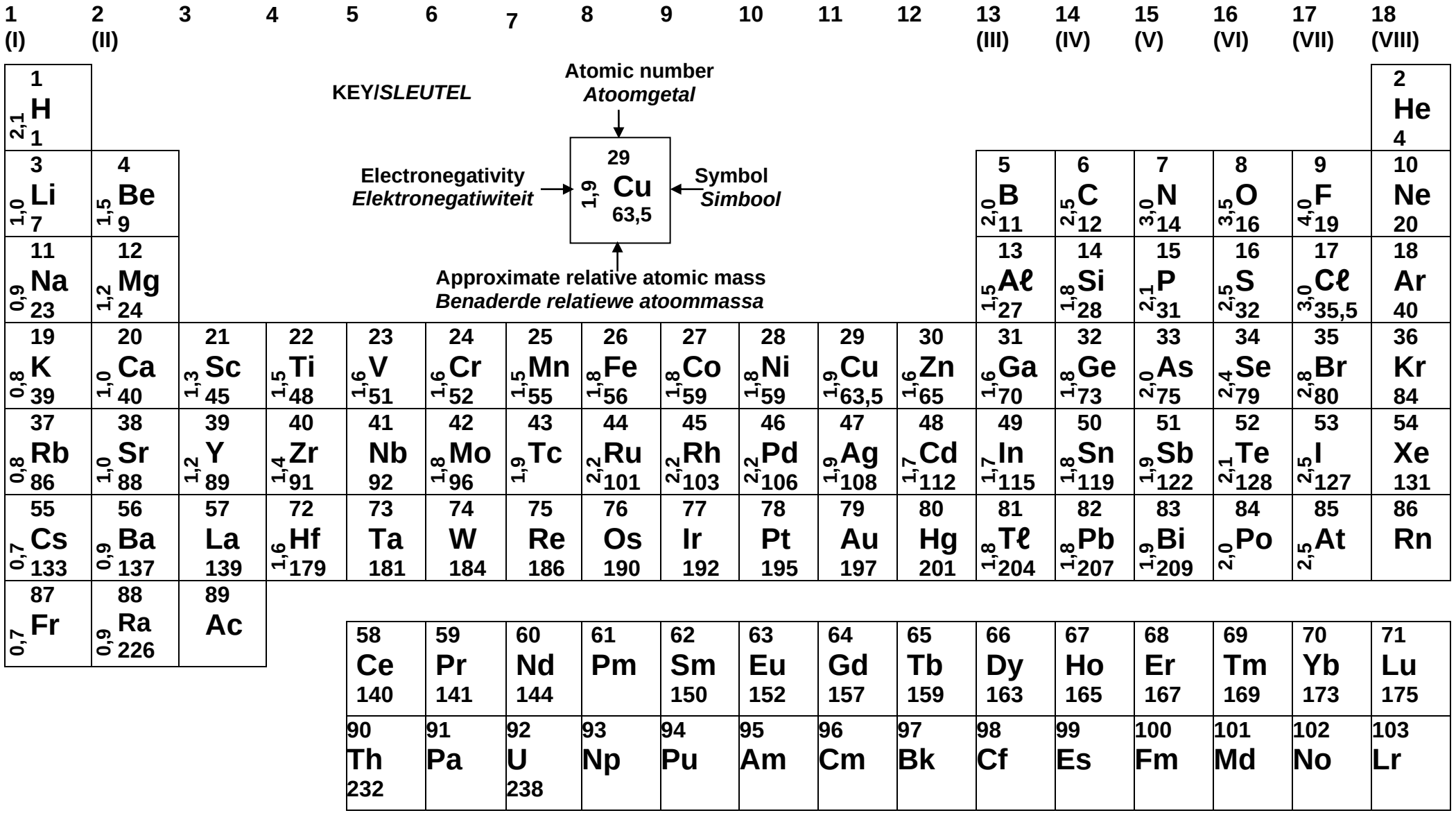
TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	**SYMBOL/*SIMBOOL***	**VALUE/*WAARDE***
Standard pressure *Standaarddruk*	p^{θ}	1,013 x 10^5 Pa
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	22,4 $dm^3 \cdot mol^{-1}$
Standard temperature *Standaardtemperatuur*	T^{θ}	273 K
Charge on electron *Lading op elektron*	e	-1,6 x 10^{-19} C
Avogadro's constant *Avogadro-konstante*	N_A	6,02 x 10^{23} mol^{-1}

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ OR $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$

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



APPENDIX B: TABLES OF POSITIVE AND NEGATIVE IONS

POSITIVE IONS					
+ 1		+ 2		+ 3	
Symbol	**Name**	**Symbol**	**Name**	**Symbol**	**Name**
H^+	hydrogen	Be^{2+}	beryllium	Al^{3+}	aluminium
Li^+	lithium	Mg^{2+}	magnesium	Fe^{3+}	iron(III)
Na^+	sodium	Ca^{2+}	calcium	Cr^{3+}	chromium(III)
K^+	potassium	Sr^{2+}	strontium	As^{3+}	arsenic(III)
Ag^+	silver	Ba^{2+}	barium	Sb^{3+}	antimony(III)
Hg^+	mercury(I)	Sn^{2+}	tin(II)	Bi^{3+}	bismuth(III)
Cu^+	copper(I)	Pb^{2+}	lead(II)		
NH_4^+	ammonium	Zn^{2+}	zinc		
H_3O^+	hydronium (oxonium)	Fe^{2+}	iron(II)		
		Hg^{2+}	mercury(II)		
		Mn^{2+}	manganese(II)		
		Ni^{2+}	nickel		
		Cd^{2+}	cadmium		
		Cr^{2+}	chromium(II)		
		Cu^{2+}	copper(II)		

NEGATIVE IONS					
– 1		– 2		– 3	
Symbol	**Name**	**Symbol**	**Name**	**Symbol**	**Name**
F^-	fluoride	O^{2-}	oxide	N^{3-}	nitride
Cl^-	chloride	S^{2-}	sulphide	PO_4^{3-}	phosphate
Br^-	bromide	CO_3^{2-}	carbonate		
I^-	iodide	SO_4^{2-}	sulphate		
OH^-	hydroxide	SO_3^{2-}	sulphite		
NO_3^-	nitrate	CrO_4^{2-}	chromate		
NO_2^-	nitrite	$Cr_2O_7^{2-}$	dichromate		
CN^-	cyanide	$S_2O_3^{2-}$	thiosulphate		
HCO_3^-	hydrogen carbonate	MnO_4^{2-}	manganate		
HSO_4^-	hydrogen sulphate				
ClO_3^-	chlorate				
ClO_4^-	perchlorate				
MnO_4^-	permanganate				
IO_3^-	iodate				
CNS^-	thiocyanate				
CH_3COO^-	ethanoate (acetate)				

APPENDIX C: CHEMICAL AND EVERYDAY NAMES OF WELL-KNOWN COMPOUNDS

Chemical name	Everyday name	Formula
ammonium carbonate	smelling salts	$(NH_4)_2CO_3$
ammonium nitrate	fertiliser	NH_4NO_3
ammonium sulphate	fertiliser	$(NH_4)_2SO_4$
calcium carbonate	marble	$CaCO_3$
calcium sulphate	plaster of Paris	$CaSO_4$
magnesium sulphate	Epsom salts	$MgSO_4$
sodium chloride	table salt	$NaC\ell$
calcium hydroxide	slaked lime	$Ca(OH)_2$
sodium hydrogen carbonate	baking soda	$NaHCO_3$
sodium hydroxide	caustic soda	NaOH
sodium carbonate	washing soda	Na_2CO_3
potassium hydroxide	caustic potash	KOH
carbon disulphide	carbon bisulphide	CS_2
hydrogen oxide	water	H_2O
hydrogen chloride	hydrochloric acid	$HC\ell$
hydrogen sulphate	sulphuric acid	H_2SO_4
hydrogen nitrate	nitric acid	HNO_3
ethanoic acid	acetic acid	CH_3COOH
hydrogen carbonate	carbonic acid	H_2CO_3
hydrogen sulphite	sulphurous acid	H_2SO_3
hydrogen nitrite	nitrous acid	HNO_2
copper(II)sulphate	blue vitriol	$CuSO_4$
calcium oxide	quicklime	CaO
carbon dioxide	carbonic acid gas	CO_2

APPENDIX D: What must I prepare for each control test / examination?

GRADE 10 MARCH CONTROL TEST (ONE PAPER: 75 MARKS)

KNOWLEDGE AREA (KA) & Topic (The numbers in front of the KA and topic are the numbers in the annual teaching plan)	**Approximate mark per topic**	**Approximate mark per KA**
1. MATTER AND MATERIAL: Revise matter and classification • The material(s) of which an object is composed of. • Mixtures: heterogeneous and homogeneous • Pure substances: elements and compounds • Names and formulae of substances • Metals, metalloids and non-metals • Electrical conductors, semiconductors and insulators • Thermal conductors and insulators • Magnetic and nonmagnetic materials	11	53
2. MATTER AND MATERIAL: States of matter and the kinetic molecular theory • Three states of matter • Kinetic molecular theory	10	
3. MATTER AND MATERIAL: The atom • Models of the atom • Atomic mass and diameter • Structure of the atom: protons, neutrons and electrons • Isotope • Electron configuration	11	
4. MATTER AND MATERIAL: Periodic Table • The position of the elements in the periodic table related to their electronic arrangements • Similarities in chemical properties among elements in groups 1, 2, 17 and 18	11	
5. MATTER AND MATERIAL: Chemical bonding • Covalent bonding, ionic bonding and metallic bonding	10	
6. WAVES, SOUND AND LIGHT: Transverse pulses on a string or spring • Pulse, amplitude • Superposition of pulses **7. WAVES, SOUND AND LIGHT: Transverse waves** • Wavelength, frequency, amplitude, period and wave speed	11	22
8. WAVES, SOUND AND LIGHT: Longitudinal waves • in a spring • Wavelength, frequency, amplitude, period and wave speed • Sound waves **9. WAVES, SOUND AND LIGHT: Sound** • Pitch, loudness, quality (tone) • Infra- and ultrasound	11	
TOTAL OF PAPER	**75**	**75**

GRADE 10 JUNE EXAMINATION (ONE PAPER: 150 MARKS)

KNOWLEDGE AREA (KA) & Topic (The numbers in front of the KA and topic are the numbers in the annual teaching plan)	Approximate mark per topic	Approximate mark per KA
1. MATTER AND MATERIAL: Revise matter and classification • The material(s) of which an object is composed of. • Mixtures: heterogeneous and homogeneous • Pure substances: elements and compounds • Names and formulae of substances • Metals, metalloids and non-metals • Electrical conductors, semiconductors and insulators • Thermal conductors and insulators • Magnetic and nonmagnetic materials	10	70
2. MATTER AND MATERIAL: States of matter and the kinetic molecular theory • Three states of matter • Kinetic molecular theory	10	
3. MATTER AND MATERIAL: The atom • Models of the atom • Atomic mass and diameter • Structure of the atom: protons, neutrons and electrons • Isotope • Electron configuration	10	
4. MATTER AND MATERIAL: Periodic Table • The position of the elements in the periodic table related to their electronic arrangements • Similarities in chemical properties among elements in groups 1, 2, 17 and 18	10	
5. MATTER AND MATERIAL: Chemical bonding • Covalent bonding, ionic bonding and metallic bonding	10	
11. MATTER AND MATERIAL: Particles substances are made of • Atoms and compounds >Molecules (molecular substances) are due to covalent bonding. • Atoms and compounds >Ionic bonding is due to ionic bonding.	20	
6. WAVES, SOUND AND LIGHT: Transverse pulses on a string or spring • Pulse, amplitude • Superposition of pulses **7. WAVES, SOUND AND LIGHT: Transverse waves** • Wavelength, frequency, amplitude, period and wave speed	12	35
8. WAVES, SOUND AND LIGHT: Longitudinal waves • In a spring • Wavelength, frequency, amplitude, period and wave speed • Sound waves **9. WAVES, SOUND AND LIGHT: Sound** • Pitch, loudness, quality (tone) • Infra- and ultrasound	11	
10. WAVES, SOUND AND LIGHT: Electromagnetic radiation • Dual (particle/wave) nature of EM radiation • EM spectrum & nature of EM radiation • Energy of a photon related to frequency and wavelength • Detection of waves associated with natural disasters)	12	
12. CHEMICAL CHANGE: Physical and chemical change • Separation of particles in physical change and chemical change • Conservation of atoms and mass • Law of constant composition	10	20
13. CHEMICAL CHANGE: Representing chemical change • Balanced chemical equations	10	
14. ELECTRICITY AND MAGNETISM: Magnetism • Magnetic field of permanent magnets • Poles of permanent magnets, attraction and repulsion, magnetic field lines • Earth's magnetic field, compass	12	25
15. ELECTRICITY AND MAGNETISM: Electrostatics • Two kinds of charge • Forces exerted by charges on each other (descriptive), attraction by charged and uncharged objects (polarisation) • Charge conservation • Charge quantisation	13	
TOTAL OF PAPER	**150**	**150**

GRADE 10 SEPTEMBER CONTROL TEST (ONE PAPER: 75 MARKS)

KNOWLEDGE AREA (KA) & Topic (The numbers in front of the KA and topic are the numbers in the annual teaching plan)	**Approximate mark per topic**	**Approximate mark per KA**
16. ELECTRICITY AND MAGNETISM: Electric circuits • Emf, potential difference (pd) • Current • Measurement of voltage (potential difference) and current • Resistance • Resistors in series • Resistors in parallel	22	22
17. MECHANICS: Vectors and scalars • Introduction to vectors and scalars	6	34
18. MECHANICS: Motion in one dimension • Reference frame, position, displacement and distance • Average speed, average velocity and acceleration	14	
19. MECHANICS: Instantaneous speed and velocity and the equations of motion • Instantaneous velocity, instantaneous speed • Description of motion in words, diagrams, graphs and equations	14	
20. CHEMICAL CHANGE: Reactions in aqueous solutions • Ions in aqueous solution: their interaction and effects • Electrolytes and extent of ionisation as measured by conductivity • Precipitation reactions • Other chemical reaction types. In water solution.	19	19
TOTAL OF PAPER	**75**	**75**

GRADE 10 NOVEMBER EXAMINATION (PAPER 1: 150 MARKS)

KNOWLEDGE AREA (KA) & Topic (The numbers in front of the KA and topic are the numbers in the annual teaching plan)	**Approximate mark per topic**	**Approximate mark per KA**
17. MECHANICS: Vectors and scalars • Introduction to vectors and scalars	10	75
18. MECHANICS: Motion in one dimension • Reference frame, position, displacement and distance • Average speed, average velocity and acceleration	20	
19. MECHANICS: Instantaneous speed and velocity and the equations of motion • Instantaneous velocity, instantaneous speed • Description of motion in words, diagrams, graphs and equations	23	
22. MECHANICS: Energy • Gravitational potential energy • Kinetic energy • Mechanical energy (E_M) • Conservation of mechanical energy (in the absence of dissipative forces)	22	
6. WAVES, SOUND AND LIGHT: Transverse pulses on a string or spring • Pulse, amplitude • Superposition of pulses	14	40
7. WAVES, SOUND AND LIGHT: Transverse waves • Wavelength, frequency, amplitude, period and wave speed		
8. WAVES, SOUND AND LIGHT: Longitudinal waves • On a spring • Wavelength, frequency, amplitude, period and wave speed • Sound waves	13	
9. WAVES, SOUND AND LIGHT: Sound • Pitch, loudness, quality (tone) • Infra- and ultrasound		
10. WAVES, SOUND AND LIGHT: Electromagnetic radiation • Dual (particle/wave) nature of EM radiation • EM spectrum & nature of EM radiation • Energy of a photon related to frequency and wavelength • Detection of waves associated with natural disasters	13	
14. ELECTRICITY AND MAGNETISM: Magnetism • Magnetic field of permanent magnets • Poles of permanent magnets, attraction and repulsion, magnetic field lines • Earth's magnetic field, compass	9	35
15. ELECTRICITY AND MAGNETISM: Electrostatics • Two kinds of charge • Forces exerted by charges on each other (descriptive), attraction by charged and uncharged objects (polarisation) • Charge conservation • Charge quantisation	9	
16. ELECTRICITY AND MAGNETISM: Electric circuits • Emf, potential difference (pd) • Current • Measurement of voltage (pd) and current • Resistance • Resistors in series • Resistors in parallel	17	
TOTAL OF PAPER	**150**	**150**

GRADE 10 **NOVEMBER EXAMINATION (PAPER 2: 150 MARKS)**

KNOWLEDGE AREA (KA) & Topic (The numbers in front of the KA and topic are the numbers in the annual teaching plan)	**Approximate mark per topic**	**Approximate mark per KA**
1. MATTER AND MATERIAL: Revise matter and classification • The material(s) of which an object is composed of. • Mixtures: heterogeneous and homogeneous • Pure substances: elements and compounds • Names and formulae of substances • Metals, metalloids and non-metals • Electrical conductors, semiconductors and insulators • Thermal conductors and insulators • Magnetic and nonmagnetic materials	10	70
2. MATTER AND MATERIAL: States of matter and the kinetic molecular theory • Three states of matter • Kinetic molecular theory	10	
3. MATTER AND MATERIAL: The atom • Models of the atom • Atomic mass and diameter • Structure of the atom: protons, neutrons and electrons • Isotope • Electron configuration	10	
4. MATTER AND MATERIAL: Periodic Table • The position of the elements in the periodic table related to their electronic arrangements • Similarities in chemical properties among elements in groups 1, 2, 17 and 18	10	
5. MATTER AND MATERIAL: Chemical bonding • Covalent bonding, ionic bonding and metallic bonding	10	
11. MATTER AND MATERIAL: Particles substances are made of • Atoms and compounds >Molecules (molecular substances) are due to covalent bonding. • Atoms and compounds >Ionic bonding is due to ionic bonding.	20	
12. CHEMICAL CHANGE: Physical and chemical change • Separation of particles in physical change and chemical change • Conservation of atoms and mass • Law of constant composition	12	70
13. CHEMICAL CHANGE: Representing chemical change • Balanced chemical equations	12	
20. CHEMICAL CHANGE: Reactions in aqueous solutions • Ions in aqueous solution: their interaction and effects • Electrolytes and extent of ionisation as measured by conductivity (1 h) • Precipitation reactions • Other chemical reaction types. In water solution	22	
21. CHEMICAL CHANGE: Quantitative aspects of chemical change • Atomic mass and the mole concept • Molecular and formula masses • Determine the composition of substances • Amount of substance (mole), molar volume of gases, concentration of solutions • Basic stoichiometric calculations	24	
23. CHEMICAL SYSTEMS: The hydrosphere • Its composition and interaction with other global systems	10	10
TOTAL OF PAPER	**150**	**150**